Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1

May/June 2005

2 hours

Candidates answer on the Question Paper.
Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 80.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

For Examiner's Use

This document consists of **16** printed pages.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 **(a)** Express $\frac{13}{20}$ as a decimal.

(b) In a test, Rose scored 56 marks out of 70.
Express this score as a percentage.

Answer *(a)* ..... [1]

(b) .....% [1]

---

2 Evaluate

(a) $2\frac{2}{3} \times \frac{1}{7}$,

(b) $\frac{2}{5} \div \frac{7}{12}$.

Answer *(a)* ..... [1]

(b) ..... [1]

---

3 **(a)** Evaluate $\begin{pmatrix} 4 & 2 \\ 1 & 1 \end{pmatrix}\begin{pmatrix} 1 & -2 \\ -1 & 4 \end{pmatrix}$.

(b) **Write down** the inverse of $\begin{pmatrix} 1 & -2 \\ -1 & 4 \end{pmatrix}$.

Answer *(a)* $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

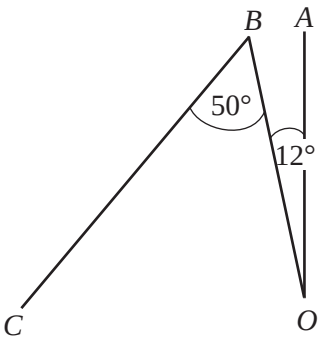
(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

---

4 *A* is due North of *O*.

(a) A ship sailed from *O* to *B*, where $A\hat{O}B = 12°$.
Write down the bearing of *B* from *O*.

(b) At *B*, the ship turned and sailed to *C*, where $O\hat{B}C = 50°$.
Calculate the bearing of *C* from *B*.



Answer *(a)* .....[1]

(b) ..... [1]

---

5 **(a)** When Peter went to Hong Kong, he changed £50 into $616.
Calculate what one British pound (£) was worth in Hong Kong dollars ($).

(b) It takes 8 hours for 5 people to paint a room.
How long would it take 4 people?

Answer *(a)* £1 = $.....[1]

(b) .....h [1]

---

6 **(a)** The population of a city is given as 280 000, correct to the nearest ten thousand.
State the greatest possible error in the given value.

(b) The dimensions of a rectangular card are 7 cm by 4 cm, correct to the nearest centimetre.
Calculate the smallest possible perimeter of the card.

Answer *(a)* ..... [1]

(b) .....cm [1]

---

7 The number of hours worked each day by Adam and Brenda is shown in the table.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Adam	7	5	8	9	8	0
Brenda	0	8	9	9	7	5

The number of hours for which they are paid is calculated in the following way.
On each of days 1 to 5, every hour worked after the first 7 hours is counted as $1\frac{1}{2}$ hours.
On day 6, every hour worked is counted as 2 hours.

(a) Calculate the **total** number of hours for which Adam was paid.

(b) The rate of pay is \$14.50 per hour.
How much did Brenda earn on day 6?

Answer (a) .....h [1]

(b) \$..... [1]

---

8 $f(x) = \frac{2x - 1}{3}$.

Find an expression for $f^{-1}(x)$.

Answer $f^{-1}(x)$ = ...[2]

9 Solve the simultaneous equations

$$3x + y = 95,$$
$$x + y = 29.$$

Answer $x =$ .....

$y =$ .....[2]

---

10 Green Line buses run every 10 minutes.
Red Line buses run every 20 minutes.
Purple Line buses run every 35 minutes.
One bus from each Line leaves the city centre at 09 00.
After how many minutes will buses from all three Lines next leave the city centre at the same time?

Answer ..... [2]

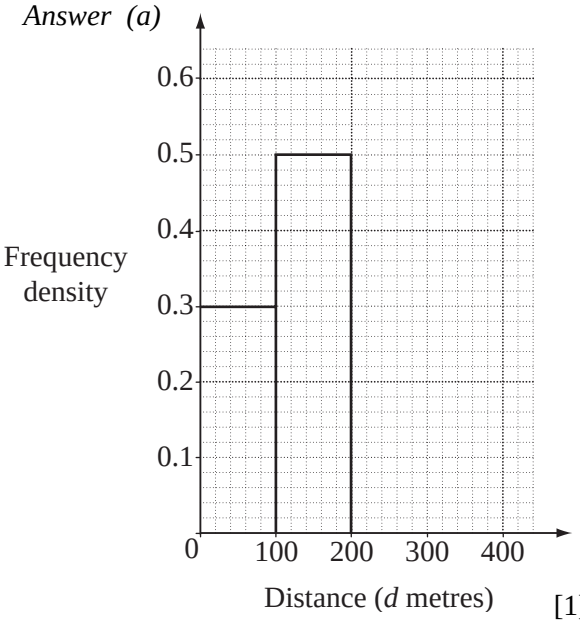
---

11 One hundred children were asked how far they could swim.
The results are summarised in the table.

Distance (d metres)	$0 < d \leqslant 100$	$100 < d \leqslant 200$	$200 < d \leqslant 400$
Number of children	30	50	20

(a) The histogram in the answer space represents part of this information.
Complete the histogram.

Answer (a)



[1]

(b) A pie chart is drawn to represent the three groups of children.
Calculate the angle of the sector that represents the group of 20 children.

Answer (b) ..... [1]

12 **(a)** A TV programme list shows that a film begins at 21 55.
The film lasts for 100 minutes.
At what time will it end?
Express your answer using the 24 hour clock.

(b) The times taken by an athlete to run three races were 3 minutes 59.1 seconds, 4 minutes 3.8 seconds and 4 minutes 1.6 seconds.
Calculate the mean time.

Answer (a) ..... [1]

(b) ..... minutes ..... seconds [2]

---

13 **(a)** P is the point (–3, 3) and Q is the point (13, –2).
Find the coordinates of the midpoint of PQ.

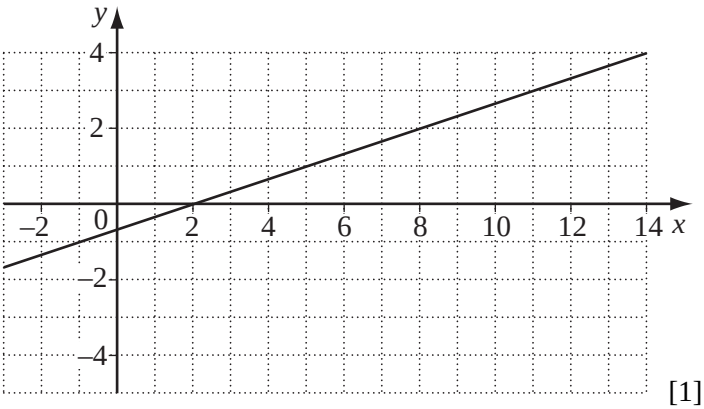
Answer (a) (..... , ...) [1]

(b) The line $x - 3y = 2$ is shown on the diagram in the answer space.
The line $x - 3y = k$ cuts the y-axis at the point (0, –4).

(i) Draw the line $x - 3y = k$ on the diagram.

(ii) Calculate the value of k.

Answer (b)(i)



[1]

(ii) k = ... [1]

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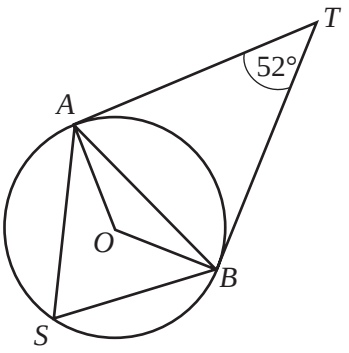
14 *A*, *B* and *S* are points on a circle, centre *O*.
TA and *TB* are tangents.
$A\hat{T}B = 52°$.



Calculate

(a) $A\hat{O}B$,

(b) $O\hat{B}A$,

(c) $A\hat{S}B$.

Answer *(a)* $A\hat{O}B$ = ... [1]

(b) $O\hat{B}A$ = ... [1]

(c) $A\hat{S}B$ = ... [1]

---

15 It is given that $N = 87 \times 132$.

(a) Complete the statements in the answer space.

Answer *(a)* $88 \times 132 = N +$ ..... [1]

$87 \times 131 = N -$ ..... [1]

(b) Hence evaluate $88 \times 132 - 87 \times 131$.

Answer *(b)* ..... [1]

---

16 **(a)** The number 222.222 is written in the answer space.
Circle the digit which represents the value 2×10^0.

(b) Write 5×10^{-2} as a fraction in its simplest form.

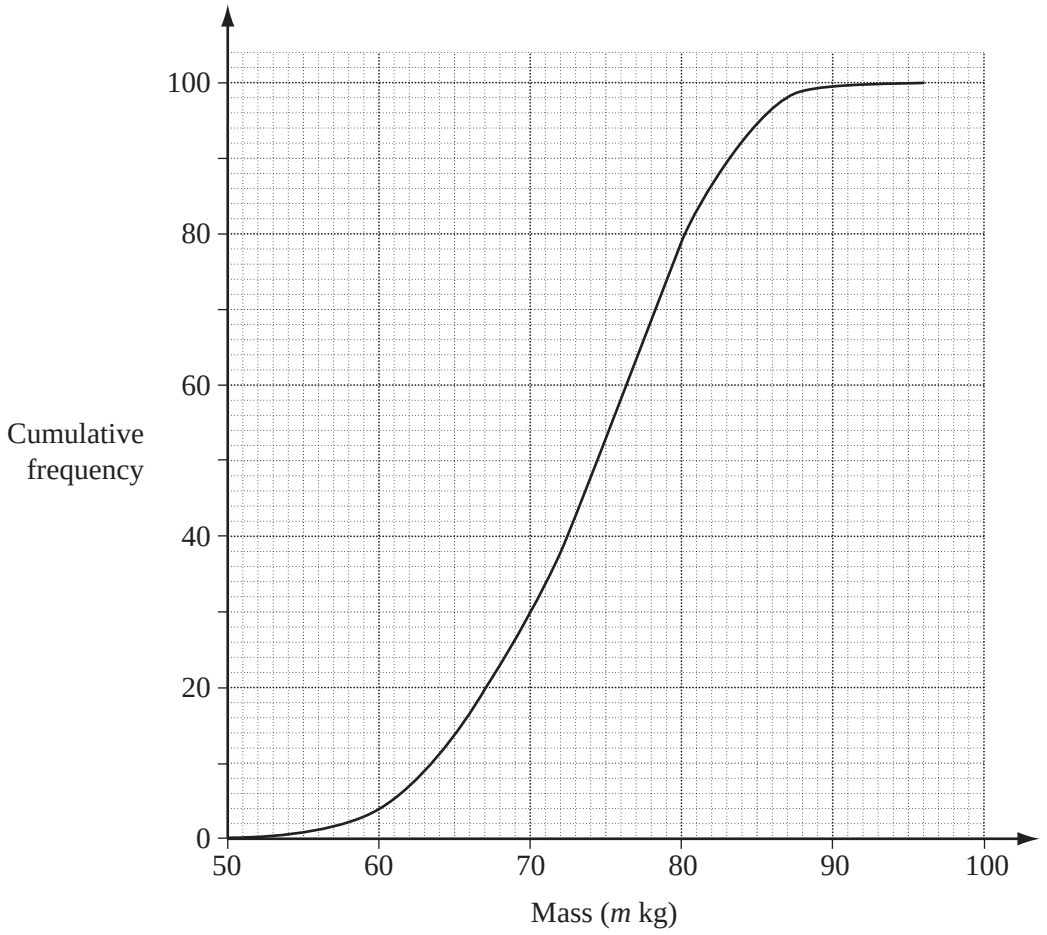
(c) Evaluate $8^{\frac{2}{3}}$.

Answer *(a)* 222.222 [1]

(b) .....[1]

(c) ..... [1]

17 The cumulative frequency curve shows the distribution of the masses of 100 people.



Find

(a) the median,

(b) the upper quartile,

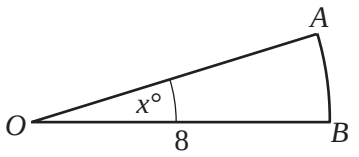
(c) the number of people with masses in the range $65 < m \leqslant 72$.

Answer *(a)* .....kg [1]

(b) .....kg [1]

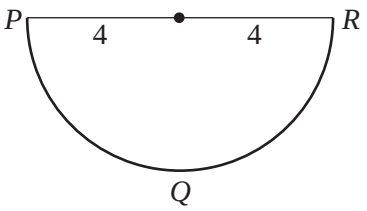
(c) ..... [1]

18 OAB is a sector of a circle with centre O and radius 8 cm.
$A\hat{O}B = x°$.



(a) Write down an expression, in terms of x and π, for the area of the sector OAB.

(b) PQR is a semicircle of radius 4 cm.
The area of the sector OAB is $\frac{1}{3}$ of the area of this semicircle.
Calculate the value of x.

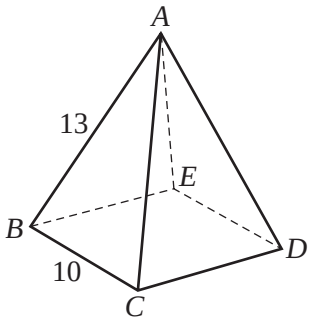


Answer (a) .....cm^2 [1]

(b) x = ... [2]

---

19 $ABCDE$ is a pyramid.
The base $BCDE$ is a square of side 10 cm.
The sloping faces are isosceles triangles.
$AB = AC = AD = AE = 13$ cm.

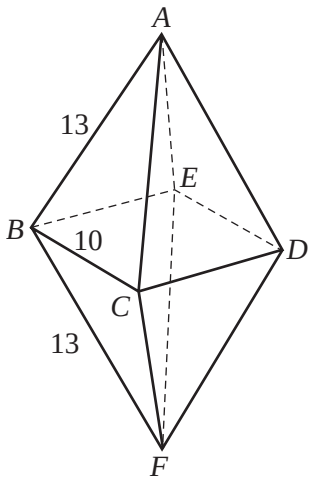


(a) Calculate the area of the sloping face ABC.

(b) The pyramid $ABCDE$ is joined to an identical pyramid $BCDEF$ to form the solid $ABCDEF$.

(i) Calculate the surface area of the solid $ABCDEF$.

(ii) Describe fully the locus of all points which are equidistant from A and F.



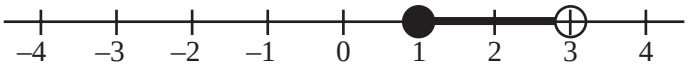
Answer (a) .....cm^2 [2]

(b)(i).....cm^2 [1]

(ii) .....

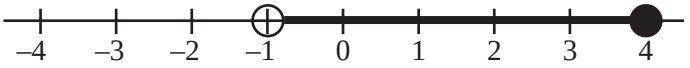
..... [1]

20 **(a)**



The set $A = \{x : 1 \leqslant x < 3\}$ is shown on the number line above.

(i) Set B is shown on the number line below.

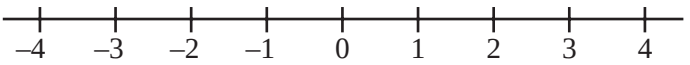


Complete the description in the answer space.

Answer (a)(i) $B = \{x :$ ..... x .....$\}$ [1]

(ii) The set $C = \{x : x \leqslant -3\}$.
Illustrate the set C' using the number line in the answer space.

Answer (a)(ii)

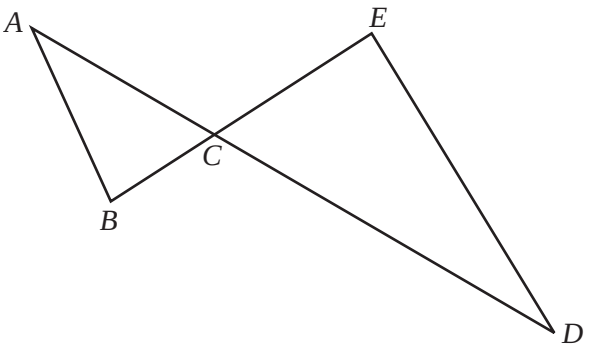


[1]

(b) $X = \{1, 3, 5\}$, $Y = \{3, 5\}$, $Z = \{(x, y) : x \in X, y \in Y, x \neq y\}$.
List the members of Z.

Answer (b) $Z = \{$ .....$\}$ [2]

21



In the diagram, ACD and BCE are straight lines.

$\frac{CB}{CE} = \frac{CA}{CD} = \frac{1}{2}$.

(a) Describe fully the **single** transformation that maps ΔCAB onto ΔCDE.

(b) It is given that $\overrightarrow{ED} = \begin{pmatrix} 6 \\ -8 \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$.
Calculate $\overrightarrow{AE}$.

Answer (a) ..... [2]

(b) $\overrightarrow{AE} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

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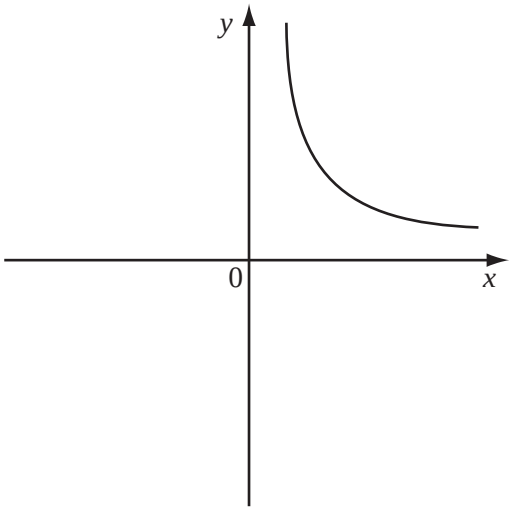
22 **(a)** The diagram in the answer space is a sketch of the graph of $y = \frac{3}{x}$ for $x > 0$. Complete the sketch for $x < 0$.

(b) Sketch the graph of $y = x$ on the diagram in the answer space.

(c) The graphs of $y = \frac{3}{x}$ and $y = x$ meet at $x = k$.
Find the values of k.

Answer (a) (b)



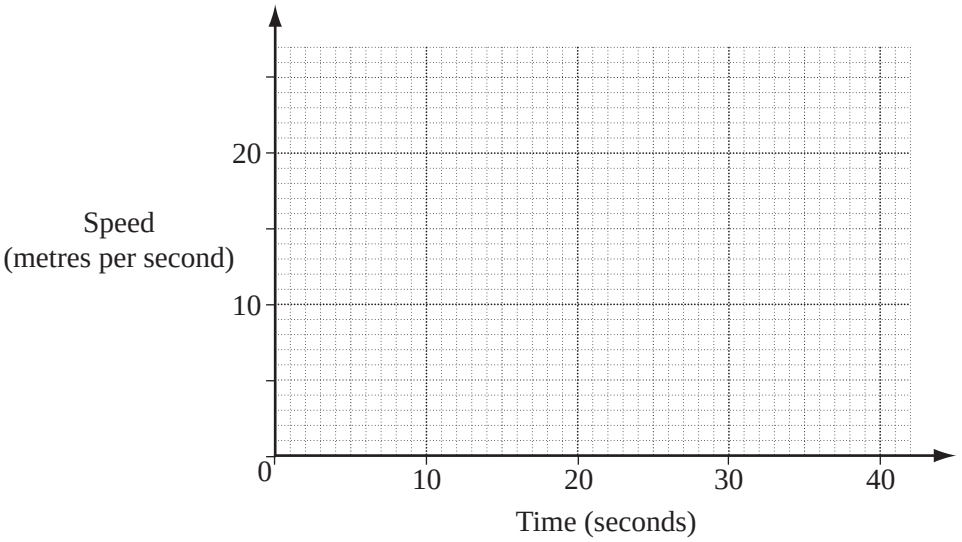
[2]

(c) ..... [2]

23 A car accelerates uniformly from rest for 30 seconds.
Its speed after 30 seconds is 18 m/s.
The speed remains constant for the next 10 seconds.

(a) Draw the speed-time graph for the first 40 seconds of the journey.

Answer (a)



[1]

(b) Calculate

(i) the car's acceleration during the first 30 seconds,

(ii) its average speed for the first 40 seconds.

Answer (b)(i) .....m/s^2 [1]

(ii) .....m/s [2]

24 In triangle PLQ, $PL = 14$ cm, $PQ = 10$ cm and $LQ = 7$ cm.
The line PL is drawn in the answer space.

(a) Using ruler and compasses only, complete triangle PLQ where Q is above PL.

(b) Measure and write down $P\hat{Q}L$.

(c) Draw a semicircle with PL as diameter.
The line LQ produced meets the semicircle at M.
Measure and write down the length of QM.

(d) **(i)** Explain why PM is perpendicular to LM.

(ii) Hence write down the value of cos $P\hat{Q}L$.

Answer (a)

P L [1]

Answer (b) $P\hat{Q}L =$ ..... [1]

(c) $QM =$ .....cm [1]

(d)(i) ..... [1]

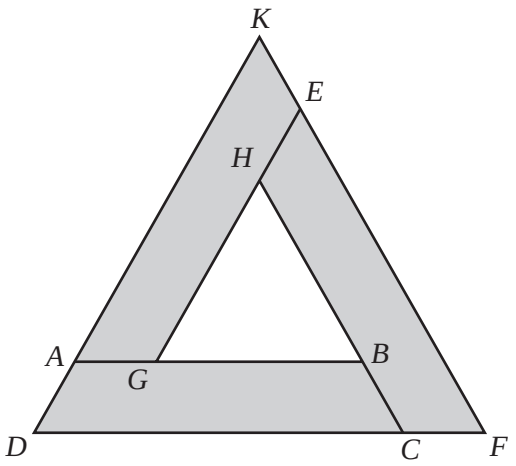
(ii) cos $P\hat{Q}L =$ ..... [1]

25 The trapezium $PQRS$ has one line of symmetry. $S\hat{P}Q = 120°$.

(a) Explain why $P\hat{S}R = 60°$.

Answer (a) ..... [1]

(b) Three trapezia, each congruent to $PQRS$, are placed together as shown.



Show that KDF is an equilateral triangle.

Answer (b) .....

..... [1]

(c) Given also that $BC = 1$ m, $AB = 4$ m and $DC = 5$ m, find

(i) the length of GB,

(ii) the ratio Area ΔKDF : Area ΔHGB,

(iii) the shaded area as a fraction of the area of ΔKDF.

Answer (c)(i) .....m [1]

(ii) ..... : ..... [2]

(iii) ..... [1]

26 **(a)** Factorise $3tx - 2sx + 15ty - 10sy$.

(b) Solve the equation $\frac{x-2}{4} + \frac{x+1}{3} = 1$.

(c) Factorise $2y^2 - 3y - 2$.

Answer *(a)* ..... [2]

(b) $x =$ ..... [2]

(c) ..... [2]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Ordinary Level

MARK SCHEME for the June 2005 question paper

4024 MATHEMATICS

4024/02 **Paper 2, maximum raw mark 100**

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2005 question papers for most IGCSE and GCE Advanced Level syllabuses.

Mark Scheme Notes

Marks are of the following three types:

M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

B Mark for a correct result or statement independent of method marks.

- When a part of a question has two or more "method" steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly when there are several B marks allocated. The notation DM or DB (or dep*) is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.

- The symbol √ implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only. A and B marks are not given for fortuitously "correct" answers or results obtained from incorrect working.

- Note: B2 or A2 means that the candidate can earn 2 or 0.
  B2/1/0 means that the candidate can earn anything from 0 to 2.

The following abbreviations may be used in a mark scheme or used on the scripts:

A.G.	Answer given
b.o.d.	Benefit of doubt
c.a.o	Correct answer only
(in)dep	(In) dependent
Ex.Q.	Extra question
	Follow through
	Further error made
I.S.W.	Ignore subsequent working
M.R.	Misread
o.e.	Or equivalent
O.W.	Omission of essential working
P.A.	Premature approximation
S.C.	Special case
s.o.i	Seen or implied
S.O.S.	See other solution
t.&e.	Trial and error
W.W.	Without working (i.e. answer only seen)
W.W.W.	Without wrong working
(£) or (°)	Condone the omission of the £ or degree sign etc.

JUNE 2005

GCE O LEVEL

MARK SCHEME

MAXIMUM MARK: 100

SYLLABUS/COMPONENT: 4024/02

MATHEMATICS
PAPER 2

1	**(a)**	**(i)**	$9 - 5p$	**B1**			1	
		(ii)	$3q^2 - 2r^2$	**B1**	+5qr	**B1**	2	
	(b)		$2(3t + 1)(3t - 1)$	**B2**			2	SC1 for any incomplete (correct) factorisation
	(c)	**(i)**	30	**B1**			1	
		(ii)	$3x^2 = 75$	**M1**	$x = \pm 5$	**A1**	2	x = 5 (or –5) implies M1
		(iii)	$y - 18 = 3x^2$	**M1**	$x = \sqrt{\frac{1}{3}(y - 18)}$	**A1**	2	
							10	
2	**(a)**	**(i)**	150 (g)	**B1**			1	
		(ii)	450 : 550 or better	**M1**	9 : 11	**A1**	2	Accept $\frac{9}{11}$ etc. SC1 for 11 : 9
		(iii)	$\frac{\text{'}their\text{'}\ 150 + 450}{1250\ (figs)}$	**M1**	48%	**A1**	2	
	(b)	**(i)**	($) 3.60	**B1**			1	
		(ii)	Idea that \$6.20 ≡ 80%	**M1**	\$7.75	**A1**	2	
							8	
3	**(a)**	**(i)**	$t = 69$	**B1**			1	
		(ii)	$u = 57$	**B1**			1	
		(iii)	$x = 72$	**B1**			1	
		(iv)	$y = 15$	**B1**			1	
	(b)		$3z + 3 \times 105$	**M1**	$z = 135$	**A1**	2	N.B. Alt. method using pentagon.
	(c)	**(i)**	12 (cm)	**B1**			1	
		(ii)	$\frac{18}{PS} = \frac{14}{18}$ (or $\frac{his\ 12}{18}$)	**M1**	15 (cm)	**A1**	2	
							9	
4	**(a)**	**(i)**	$\frac{20}{\cos 55}$	**M1**	34.8 – 35 (cm)	**A1**	2	
		(ii)	'their' 34.9 + 20 = 54.8 – 35 (cm)	**B1** ✓			1 ✓	
		(iii)	20 sin 55	**M1**	16.3 – 16.4	**A1**	2	
	(b)		Arc of circle	**B1**	Centre C or 125° or $r = 20$	**B1**	2	
	(c)		$\frac{125}{360}$	**M1**	43.6 – 43.66	**A1**	2	
							9	

5	**(a)**	**(i)**	Mode = 0	**B1**			1	If 0 and 8 mentioned, 0 must clearly be the intended answer
		(ii)	Median = 1	**B1**			1	
		(iii)	Mean = $\frac{(0\times 8)+(1\times 5)+.....}{8+5+.....}$	**M1**	= 1.6	**A1**	2	Accept $\frac{8}{5}$, $1\frac{3}{5}$, $1\frac{6}{10}$
	(b)	**(i)**	$p = \frac{1}{5}$, $q = 1$, $r = 0$ o.e	**B2**			2	Allow **B1** for any 1 correct.
		(ii)(a)	$\frac{2}{7}$	**B1**			1	
		(b)	$\frac{4}{21}$	**B1**			1	
		(c)	$\frac{4}{7}$ or 'their' $\frac{4}{21}$ x 3	**B2**			2	**SC1** for 3 x their $\frac{4}{21}$ or for $\frac{8}{21}$
							10	
6	**(a)**		73 – 37 = 36	**B1**			1	
	(b)		Any other 3 pairs	**B1**			1	
	(c)		Multiples of 9, digits add up to 9	**B1**			1	
	(d)	**(i)**	$10x + y$	**B1**			1	
		(ii)	$10x + y - (10y - x)$	**M1**	$= 9x - 9y$	**A1**	2	
							6	
7	**(a)**		$2x^2 = 500$	**M1**	15.8 – 15.82 (cm)	**A1**	2	
	(b)		$\frac{1}{3}$ x 150 x h = 500	**M1**	10 (cm)	**A1**	2	
	(c)		$\frac{4}{3}\pi r^3 = 500$	**M1**	4.9 – 4.925 (cm)	**A1**	2	
	(d)		Use of R and R + 1.5 o.e	**M1**	**or** Use of $R+\frac{1.5}{2}$	**M1**		
			Area of x section = $\pi\left[(R+1.5)^2 - R^2\right]$	**A1**	Area of x section = $2\pi\left[R+\frac{1.5}{2}\right]\times 1.5$	**A1**		
			Area of x section = $\frac{500}{6}$	**B1**				
			R = 8 – 8.1 (cm)	**B1**			4	
	(e)		$\left(\frac{2}{5}\right)^3$	**M1**	32 (cm^3)	**A1**	2	
							12	

8	**(a)**		Scales	**S1**				
			All 10 points correctly plotted (within 1 mm)	**P1**				
			Smooth curve through points (allow marginally incorrect points)	**C1**			3	Lost for straight lines, incomplete, grossly thick
	(b)	**(i)**	Negative value	**T1**				
			0.32 to 0.45	**T1**				
		(ii)	Rate at which water level is changing or fall of water level per hour o.e	**R1**			3	
	(c)	**(i)**	4 (m)	**B1**				
		(ii)	Straight line through (0,4) and (6,2)	**L2**				Allow (**L1**) for any st. line through (0,4) with *–ve* gradient
		(iii)	Their 2 – their 1.2	**M1**	75 – 85	**A1**		
		(iv)	5.7 – 5.9	**B1**			6	
							12	
9	**(a)**	**(i)**	$\frac{\sin D}{600} = \frac{\sin 118}{950}$	**M1**	$\Rightarrow \sin D = \frac{600 \sin 118}{950}$	**M1**		All **M** and **A** marks available for any COMPLETE alternative methods.
			$\hat{D} = 33.89 - 33.9 \Rightarrow$	**A1**				
			$B = 28.1 - 28.11$ (62 – their 33.9)	**A1**			✓4	
		(ii)	(CD^2=) $1040^2 + 950^2$ – (or+)(2) 1040.950. cos42			**M1**		N.B. $\cos 42 = \frac{1040^2 + 950^2 - CD^2}{2 \times 1040 \times 950}$ gets the first **M1**
			$CD^2 = 1040^2 + 950^2 - 2.1040.950 \cos 42$	**M1**				
			= 515000 – 516000	**A1**				
			CD = 716 – 719 (m)	**A1**			4	
		(iii)	CN = 1040 sin 42 o.e	**M1**				
			=695 – 696 (m)	**A1**			2	
	(b)		Angle of Dep. = $\tan^{-1} \frac{500}{\textit{their } 696}$	**M1**				
			= 35.6 – 35.75	**A1**			2	
							12	

10	**(a)**		$\frac{20}{x}$	**B1**				
	(b)		$\frac{25}{x+2}$	**B1**				
	(c)		$\frac{20}{x}-\frac{25}{x+2}=(\pm)1\frac{1}{2}$	**M1**				
			$40(x+2)-50x=3x(x+2)$	**M1**				
			$\Rightarrow 3x^2+16x-80=0$	**A1**			5	N.B. A.G
	(d)		For numerical $p\pm(\text{or}+\text{or}-)\sqrt{q}$					If 'completing the square' used $\left(x+\frac{8}{3}\right)^2$ **B1**
			p = – 16 and r = 6	**B1**				33.7… **B1**
			q = 1216 or $\sqrt{q}$ = 34.8 – 34.9	**B1**				
			x = 3.145	**B1**	–8.479	**B1**	4	**SC1** for 3.1 – 3.2 **and** –8.4 to –8.5
	(e)		Time up $\frac{20}{3.145}$	**M1**	$\frac{25}{5.145}$	**M1**		Implied by 6.3… and 4.8…
			11 h 13 min or 673 min	**A1**			3	
							12	
11	**(a)**	**(i)**	Reflection	**B1**	y = – x	**B1**		
		(ii)	$\begin{pmatrix}0 & -1\\ -1 & 0\end{pmatrix}$	**B1**			3	
	(b)	**(i)**	(–1,3)	**B1**				
		(ii)	$\begin{pmatrix}0 & -1\\ 1 & 0\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix}=\begin{pmatrix}1\\ 2\end{pmatrix}$	**M1**				
			K is (2, –1)	**A1**			3	
		(iii)	Rotation	**B1**				
			90° Anticlockwise (or 270° CW)	**B1**			2	
		(iv)	$\begin{pmatrix}1 & 0\\ 0 & -1\end{pmatrix}$	**B2**			2	**SC1** for Reflection in x axis
	(c)	**(i)**	1 : 9	**B1**				Accept $\frac{2}{18}$ etc.
		(ii)	27	**B1**			2	
							12	

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Ordinary Level

MARK SCHEME for the June 2005 question paper

4024 MATHEMATICS

4024/01 **Paper 1, maximum raw mark 80**

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Mark Scheme Notes

Marks are of the following three types:

M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

C Consolation mark, sometimes awarded for an incorrect answer. In some places it may be earned in the working.

- When a part of a question has two or more "method" steps, the M marks are generally independent unless the scheme specifically says otherwise.

- FT implies that the candidate has continued correctly after an error.

The following abbreviations may be used in a mark scheme or used on the scripts:

AG Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)

BOD Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)

CAO Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)

CWO Correct Working Only – often written by a 'fortuitous' answer

FT Follow through

ISW Ignore Subsequent Working

MR Misread

PA Premature Approximation (resulting in basically correct work that is insufficiently accurate)

SOI Seen or implied

SOS See Other Solution (the candidate makes a better attempt at the same question)

June 2005

GCE O LEVEL

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 4024/01

MATHEMATICS
PAPER 1

1	**(a)** **(b)**		0.65 c.a.o. 80(%)	**1** **1**			**2**
2	**(a)** **(b)**		$\frac{8}{21}$ c.a.o. $\frac{24}{35}$ c.a.o.	**1** **1**	If answer decimal, accept in working. If answer decimal, accept in working. After 0+0, answers 0.3805 to 0.381 and 0.6855 to 0.686.	 **C1**	 **2**
3	**(a)** **(b)**		$\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ $\frac{1}{2}\begin{pmatrix} 4 & 2 \\ 1 & 1 \end{pmatrix}$ o.e.	**1** **1**			 **2**
4	**(a)** **(b)**		348(°) 218(°)	**1** **1**			**2**
5	**(a)** **(b)**		($) 12.32 10 (h)	**1** **1**	Not $12\frac{8}{25}$ After 12.3, accept 12.32 in working.		**2**
6	**(a)** **(b)**		(±) 5000 20 (cm)	**1** **1**			**2**
7	**(a)** **(b)**		39 (h) ($) 145(.00)	**1** **1**			**2**
8			$\frac{3x+1}{2}$ o.e.	**2**	After clear MR, M1 available. $ax + b$ with $a = \frac{3}{2}$ $b \neq 0$ **or** $a \neq 0$ $b = \frac{1}{2}$ Use of letter other than x, -1 if possible.	**C1**	**2**
9			(x) = 33 (y =) -4	**2**	One correct **with supporting working**. **Or** correct method for one variable reaching such as $2x = 95 - 29$ **or** $2y = 3 \times 29 - 95$	**C1** **M1**	 **2**
10			140 (minutes) Accept 2 h 20 (min) **or** 11.20 (a.m.)	**2**	140 seen, or prime factors 2 x 5, 2^2 x 5, 5 x 7 Answer 280, 4h 40, 13.40 or 1.40 p.m.	**M1** **C1**	**2**
11	**(a)** **(b)**		Rectangle from 200 to 400, height 0.1 72(°)	**1** **1**	Accept freehand		 **2**
12	**(a)** **(b)**		23 35 4 (min) 1.5 (s)	**1** **2**	Ignore embellishments $\frac{4.5}{3}$ seen, **or** accept at $\frac{\sum times}{3}$ when ∑times is in seconds, **or** minutes/seconds and with seconds < 60.	**M1**	 **3**

13	**(a)**		(5,½) or (5,0.5)	**1**			
	(b)	**(i)**	Parallel line through (0,-4)	**1**	Ruled or good freehand, > 4 cm long. Cutting *x* axis between (11,0) and (13,0), produced if necessary.		
		(ii)	12 c.a.o.	**1**			**3**
14	**(a)**		$128^{(\circ)}$	**1**	Accept on diagram if necessary		
	(b)		$26^{(\circ)}$ **or** ½(180 – *a*) ° f.t.	**1**	Accept on diagram if necessary		
	(c)		$64^{(\circ)}$ **or** ½ their **(a)** f.t. **or** 90- their **(b)** f.t.	**1**	Accept on diagram if necessary		**3**
15	**(a)**		132	**1**	Condone -87		
			87 f.t.	**1**			
	(b)		219 **or** $\{\lvert\text{their}132\rvert + \lvert\text{their}87\rvert\}$	**1**			**3**
16	**(a)**		Units digit ranged	**1**			
	(b)		$\frac{1}{20}$ c.a.o.	**1**			
	(c)		4	**1**			**3**
17	**(a)**		74.4 to 74.7 (kg)	**1**			
	(b)		79.1 to 79.4 (kg)	**1**			
	(c)		23 to 25	**1**			**3**
18	**(a)**		$\frac{x}{360}\pi 8^2$ or better **seen** (cm^2)	**1**	Accept $\frac{22}{7}$ for π.		
	(b)		$15^{(\circ)}$ (accept 14.9 to 15.1)	**2**	Their **(a)** = $\frac{1}{3}$ x $\frac{\pi 4^2}{2}$ o.e. seen	**M1**	**3**
19	**(a)**		60 (cm^2)	**2**	$\sqrt{13^2 - 5^2}$ s.o.i.	**M1**	
	(b)	**(i)**	480 **or** 8 x their **(a)** f.t. (cm^2)	**1**			
		(ii)	**Plane** BCDE	**1**	Accept clear indication of correct **plane**		**4**
20	**(a)**	**(i)**	$-1 < x \leq 4$	**1**	Accept in other form if equivalent		
		(ii)	O——— -3	**1**	Line must go to $x = 3$ **or** further **or** show an indication it continues		
	(b)		(1,3) (1,5) (3,5) (5,3) Accept without brackets if pairs clear	**2**	At least two pairs correct. Any extra pairs or terms, -1.	**C1**	**4**
21	**(a)**		Enlargement	**1**	No other transformation stated or implied		
			Scale factor -2 dep	**1**	Ignore references to centre		
	(b)		$\begin{pmatrix}12\\-1\end{pmatrix}$	**2**	$\begin{pmatrix}3\\-4\end{pmatrix}+k\begin{pmatrix}3\\1\end{pmatrix}$, $\begin{pmatrix}6\\-3\end{pmatrix}+k\begin{pmatrix}3\\1\end{pmatrix}$, $\begin{pmatrix}-6\\8\end{pmatrix}+k\begin{pmatrix}6\\-3\end{pmatrix}$ **or** $k\begin{pmatrix}6\\-8\end{pmatrix}+\begin{pmatrix}3\\1\end{pmatrix}+k'\begin{pmatrix}6\\-3\end{pmatrix}+\begin{pmatrix}-6\\1\end{pmatrix}$	**M1**	**4**

22	**(a)**		Correct sketch for $x = 0$	**1**	No incorrect lines for **(a)** or **(b)** through (0,0) with gradient 1, by eye. Long enough to cut both branches		
	(b)		Line $y = x$ sketched	**1**			
	(c)		$\sqrt{3}$ $\quad -\sqrt{3}$	**1**	Accept clear attempts, e.g. 1.7. After 0+0, $x^2 = 3$ or $k^2 = 3$ seen	**M1**	**4**
23	**(a)**		Ruled straight lines (0,0) to (30,18) and (30,18) to (40,18)	**1**			
	(b)	**(i)**	$\frac{3k}{5k}$ or 0.6 (m/s^2) f.t.	**1**	Follow through from their graph ($\neq 0$)		
		(ii)	11.25, 11¼ or $\frac{45k}{4k}$ (m/s)	**2**	Accept 11.2 or 11.3 ½ 30 x their 18 s.o.i. **and** division by 40	**M1**	**4**
24	**(a)**		Triangle drawn, with arcs visible	**1**	Sides 10 ± 0.4cm, 7 ± 0.4cm		
	(b)		$108^{(\circ)}$ to $111^{(\circ)}$	**1**			
	(c)		3.2 to 3.5 (cm)	**1**	Dep on semicircle		
	(d)	**(i)**	Angle in semicircle	**1**	No incorrect reason. Diameter alone not enough.		
		(ii)	$-\frac{\textbf{\textit{their}}(c)}{10}$ f.t.	**1**	Accept for example $-\frac{3.5}{10}$ Accept $-\frac{47}{140}$		**5**
25	**(a)**		Interior angle (parallel lines) or angle sum of quad	**1**	Accept clear equivalents provided symmetry correctly quoted.		
	(b)		$D = F = K$ (= 60) **Or** $DC + CF = FE + EK = KA + AD$	**1**	Be generous if intention clear but $DF = FK = KD$ alone not enough.		
	(c)	**(i)**	3 (m)	**1**			
		(ii)	$4k$:$1k$	**2**	Accept $\frac{4}{1}$ **or** 4. $25k$:$9k$ **or** k:$4k$ **Or** attempt at $(DF:GB)^2$	**C1** **M1**	
		(iii)	$\frac{3k}{4k}$ f.t. (k integer)	**1**	Follow through from **(ii)** But not for ½ after 2:1		**6**

26					**(a), (c)** Condone missing outside brackets, "= 0" and use of wrong letter if clear. If only solutions (even incorrect) in answer space, give marks if factors seen.		
	(a)		$(3t – 2s)(x + 5y)$ o.e.	**2**	Complete correct extraction of one factor such as $3tx - 2sx + 5t(3y – 2s)$	**M1**	
	(b)		2	**2**	$3(x – 2) + 4(x + 1) = 12$ or better s.o.i. (condone missing brackets for M1)	**M1**	
	(c)		$(2y + 1)(y – 2)$ o.e.	**2**	$(2y – 1)(y + 2)$ o.e.	**C1**	
					or $\frac{3 \pm \sqrt{25}}{4}$ **or** better seen	**M1**	**6**

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/02**

Paper 2

May/June 2004

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (2 sheets)
Mathematical tables (optional)

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate Answer Booklet/Paper provided.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 100.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

This document consists of **11** printed pages and **1** blank page.

Section A [52 marks]

Answer **all** the questions in this section.

1 Two villages, *P* and *Q*, are joined by a straight road 6000 m long.

(a) Ann left *P* and ran to *Q* at a steady speed of 3 m/s.
At the same instant that Ann left *P*, Ben left *Q* and cycled to *P* at a steady speed of 7 m/s.

(i) **(a)** How far, in metres, did Ann travel in the first 2 minutes? [1]

(b) Calculate the distance between Ann and Ben at the end of the first 2 minutes. [1]

(ii) Ann and Ben passed each other at *M*.

Calculate the distance *PM*. [2]

(iii) Calculate the time that Ben took to cycle from *Q* to *P*.
Give your answer in minutes and seconds, correct to the nearest second. [2]

(b) The villages appear on a map which has a scale of 2 cm to 5 km.

(i) Express this scale in the form 1 : *n*. [1]

(ii) Calculate the length of the road joining *P* and *Q* on the map. [2]

---

2 **(a)** Factorise completely $2tv + t - 10v - 5$. [2]

(b) Make *k* the subject of the formula

$$\sqrt{\frac{h}{k}} = 3.$$

[2]

(c) Solve the equation $x^2 - 23x + 81 = 0$, giving both answers correct to two decimal places. [4]

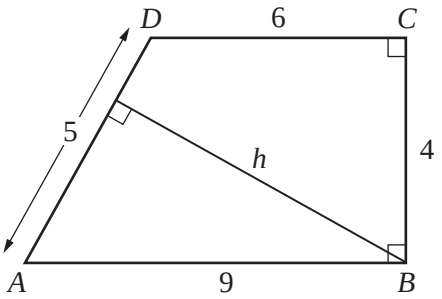
(d) The matrix **Y** satisfies the equation

$$4\mathbf{Y} - 2\begin{pmatrix} 12 & 6 \\ -9 & 0 \end{pmatrix} = \mathbf{Y}.$$

Find **Y**, expressing it in the form $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$. [2]

---

3 **(a)** The diagram shows a trapezium $ABCD$.



Angle ABC and angle BCD are right angles.

$AB = 9$ cm, $BC = 4$ cm, $CD = 6$ cm and $DA = 5$ cm.

The perpendicular distance from B to AD is h centimetres.

Calculate

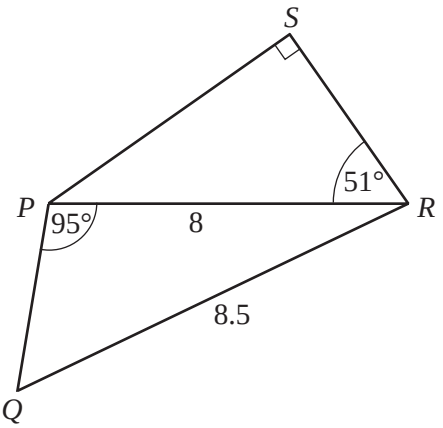
(i) the area of the trapezium, [1]

(ii) the value of h, [2]

(iii) angle DAB. [2]

(b) The diagram shows two triangles, PRS and PRQ.

$PR = 8$ cm, $QR = 8.5$ cm, $P\hat{S}R = 90°$, $P\hat{R}S = 51°$ and $R\hat{P}Q = 95°$.



(i) Calculate RS. [2]

(ii) Calculate $P\hat{Q}R$. [3]

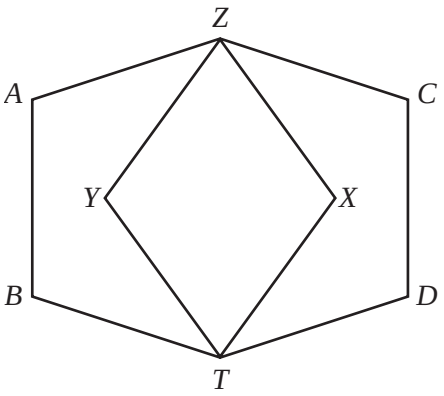
(iii) A circle is drawn through P, R and S.

(a) Does this circle pass through Q?
Give a reason for your answer. [1]

(b) Where is the centre of this circle? [1]

4 **(a)** Show that the interior angle of a regular pentagon is 108°. [2]

(b)



The diagram shows two congruent, regular pentagons, *ZABTX* and *ZCDTY*.

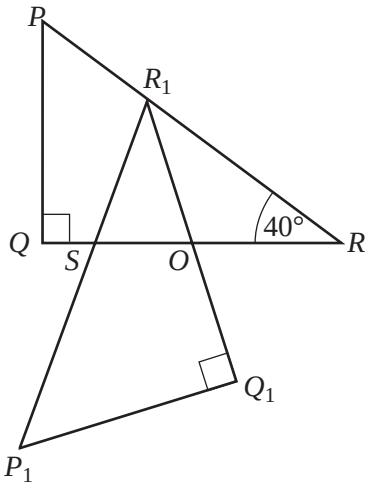
(i) Describe fully all the symmetries of this diagram. [2]

(ii) What is the special name given to the quadrilateral *ZXTY*? [1]

(iii) Calculate **reflex** angle *ZYT*. [1]

(iv) Calculate angle *AZY*. [1]

(c)



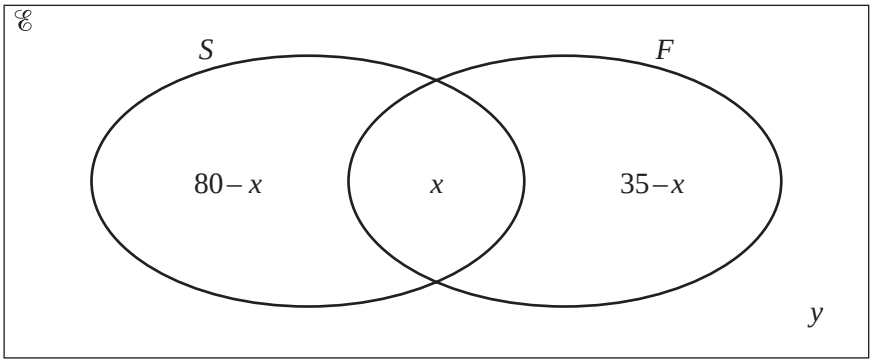
In the diagram, *PQR* is a triangle with $P\hat{Q}R = 90°$ and $Q\hat{R}P = 40°$.
The point *O* is the midpoint of *QR*.
Triangle $P_1Q_1R_1$ is the image of triangle *PQR* under an anticlockwise rotation about the point *O*.
The point R_1 lies on *PR*.
The line *QR* intersects the line P_1R_1 at the point *S*.
Find

(i) $R\hat{R}_1Q_1$, [1]

(ii) the angle of rotation , [1]

(iii) $O\hat{S}P_1$. [1]

5 In a group of 100 students, 80 study Spanish and 35 study French.
x students study Spanish and French.
y students study neither Spanish nor French.
The Venn diagram illustrates this information.



(a) Expressed in set notation, the value of x is $n(S \cap F)$.
Express the value of y in set notation. [1]

(b) Find, in its simplest form, an expression for y in terms of x. [2]

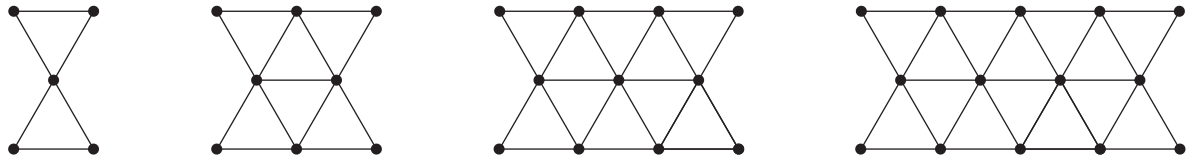
(c) Find

(i) the least possible value of x, [1]

(ii) the greatest possible value of y. [1]

6 Bob makes fences using identical metal rods one metre long.
The rods are bolted together at their ends.

Some fences, with different lengths, are shown below.



Length = 1 m Length = 2 m Length = 3 m Length = 4 m

- shows the position of a bolt.

The table shows the numbers of bolts and rods used for various lengths of fence.

Length (metres)	1	2	3	4	.....	*n*
Number of bolts	5	8	11	*p*	.....	*B*
Number of rods	6	13	20	*q*	.....	*R*

(a) Write down the values of p and q. [1]

(b) Given that $B = 3n + k$, where k is a constant, find the value of k. [1]

(c) Find an expression for R in terms of n. [2]

(d) Bob has 200 bolts and 400 rods.

How many complete fences can he make which have a length of 6 m? [2]

Section B [48 marks]

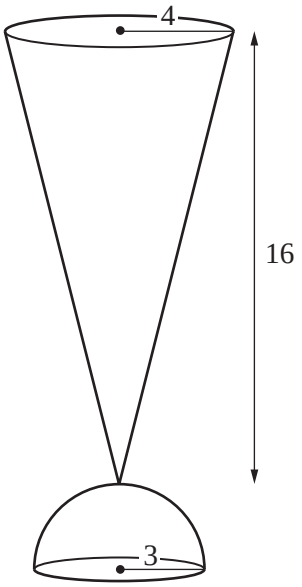
Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 [The surface area of a sphere is $4\pi r^2$.]

[The volume of a cone is $\frac{1}{3} \times$ base area $\times$ height.]

[The area of the curved surface of a cone of radius r and slant height l is πrl.]



A drinking glass consists of a hollow cone attached to a solid hemispherical base as shown in the diagram.
The hemisphere has a radius of 3 cm.
The radius of the top of the cone is 4 cm and the height of the cone is 16 cm.

(a) Calculate the **total** surface area of the solid hemispherical base. [3]

(b) Calculate the curved surface area of the outside of the cone. [3]

(c) **(i)** The cone contains liquid to a depth of d centimetres.

Giving your reasons, show that the radius of the surface of the liquid is $\frac{1}{4}d$ centimetres. [1]

(ii) The cone is completely filled with liquid.

Calculate the volume of the liquid. [2]

(iii) Half of the volume of the liquid from the full cone is now poured out.

Using the answers to parts **(i)** and **(ii)**, find the depth of the liquid that remains in the cone. [3]

8 Answer the whole of this question on a sheet of graph paper.

The table gives the x and y coordinates of some points which lie on a curve.

x	1	1.5	2	2.5	3	4	5	6
y	140	110	100	98	100	110	124	140

(a) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $0 \leqslant x \leqslant 6$.

Using a scale of 2 cm to represent 10 units, draw a vertical y-axis for $90 \leqslant y \leqslant 150$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(b) Use your graph to find

(i) the value of y when $x = 4.5$, [1]

(ii) the values of x for which $y = 128$. [1]

(c) By drawing a tangent, find the gradient of the curve at the point where $x = 1.5$. [2]

(d) The line $y = k$ is a tangent to the curve.

Find the value of k. [1]

(e) The values of x and y are related by the equation

$$y = \frac{A}{x} + Bx.$$

(i) Use the fact that the point (2, 100) lies on the curve to show that

$$200 = A + 4B.$$ [1]

(ii) Obtain a second equation connecting A and B.

Hence calculate the value of A and the value of B. [3]

9

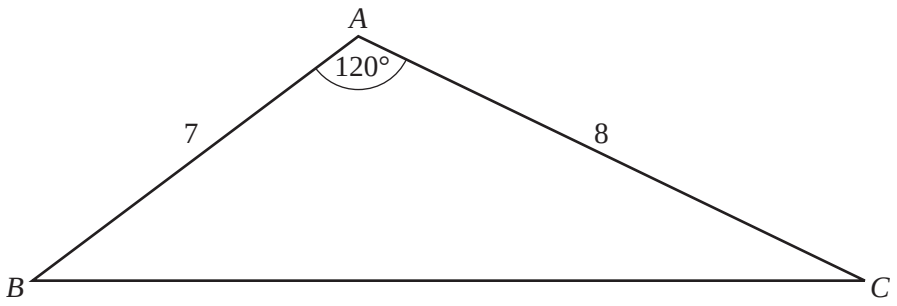


Diagram I

Diagram I shows a triangle ABC in which $AB = 7$ cm, $AC = 8$ cm and $B\hat{A}C = 120°$.

(a) Show that $BC = 13$ cm. [2]

(b) Calculate the area of triangle ABC. [2]

(c)

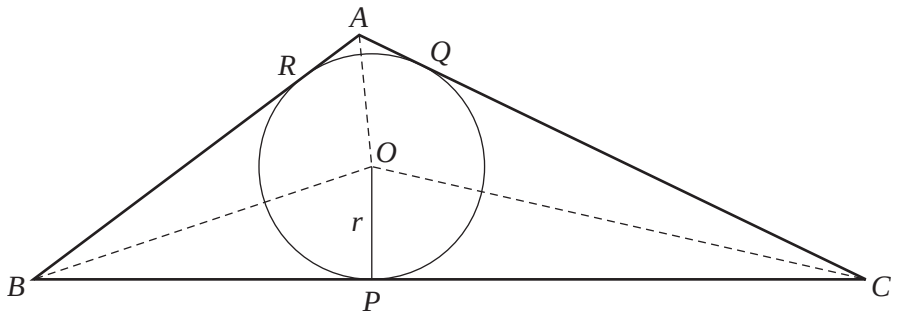


Diagram II

The sides of the triangle ABC, shown in Diagram I, are tangents to a circle with centre O and radius r centimetres.
The circle touches the sides BC, CA and AB at P, Q and R respectively, as shown in Diagram II.

(i) Find an expression, in terms of r, for the area of triangle OBC. [1]

(ii) By similarly considering the areas of triangles OAB and OAC, find an expression, in terms of r, for the area of triangle ABC. [2]

(iii) Hence find the value of r. [2]

(d) Calculate the percentage of the area of triangle ABC that is **not** occupied by the circle. [3]

10 Answer the whole of this question on a sheet of graph paper.

The ages of a sample of 40 students were recorded.
The results are given in the table below.

Age (x years)	$8 < x \leqslant 10$	$10 < x \leqslant 11$	$11 < x \leqslant 12$	$12 < x \leqslant 14$	$14 < x \leqslant 16$	$16 < x \leqslant 19$
Frequency	7	8	6	10	3	6

(a) Using a scale of 1 cm to represent 1 year, draw a horizontal axis for ages from 8 to 19 years.
Using a scale of 1 cm to represent 1 unit, draw a vertical axis for frequency densities from 0 to 8 units.
On your axes, draw a histogram to illustrate the distribution of ages. [3]

(b) In which interval does the median lie? [1]

(c) Calculate an estimate of the mean age of the students. [3]

(d) Calculate an estimate of the number of students who were under 13 years old. [1]

(e) One student is chosen at random from this sample of 40 students.

Write down the probability that this student is

(i) under 8, [1]

(ii) over 16. [1]

(f) A second student is now chosen at random from the remaining 39 students.

Calculate the probability that one student is over 16 and the other is not over 16.
Give your answer as a fraction in its lowest terms. [2]

11 **(a)** In a swimming match between two schools, *C* and *D*, two students from each school took part in each event.
The number of places each school gained in each position is shown in the table.

	First	Second	Third	Fourth
School *C*	6	3	5	6
School *D*	4	7	5	4

The points awarded for First, Second, Third and Fourth places were 5, 3, 1 and 0 respectively.

Matrices related to this information are defined below.

$$\mathbf{A} = \begin{pmatrix} 6 & 3 & 5 & 6 \\ 4 & 7 & 5 & 4 \end{pmatrix} \quad \text{and} \quad \mathbf{B} = \begin{pmatrix} 5 \\ 3 \\ 1 \\ 0 \end{pmatrix}$$

(i) What does the sum of the elements in each column of **A** represent? [1]

(ii) **(a)** Find **AB**. [2]

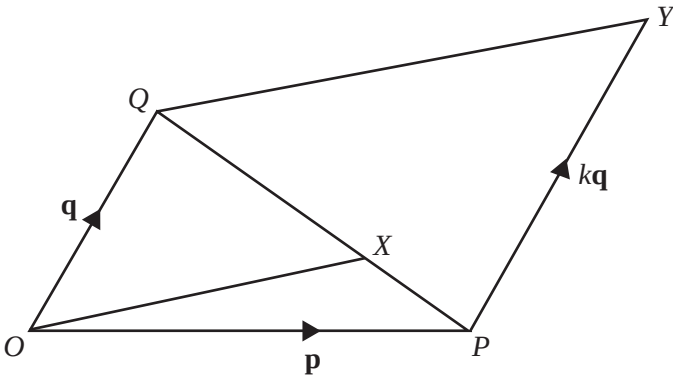
(b) What information is shown by **AB**? [1]

(iii) It was suggested that the points awarded for First, Second, Third and Fourth places should have been 5, 3, 2 and 1 respectively.

Would this suggestion have made any difference to which school won this match?
Show clear working to justify your answer. [1]

(b) In the diagram,

$\overrightarrow{OP} = \mathbf{p}$,
$\overrightarrow{OQ} = \mathbf{q}$,
$\overrightarrow{PY} = k\mathbf{q}$,
$\overrightarrow{PX} = \frac{1}{3}\overrightarrow{PQ}$.



(i) Express $\overrightarrow{PX}$ in terms of **p** and **q**. [1]

(ii) Express $\overrightarrow{OX}$ in terms of **p** and **q**. [1]

(iii) Express $\overrightarrow{QY}$ in terms of *k*, **p** and **q**. [1]

(iv) Given that *OX* is parallel to *QY*, find the value of *k*. [2]

(v) The line *OX*, when produced, meets *PY* at *Z*.

Express $\overrightarrow{PZ}$ in terms of **q**. [2]

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Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1

May/June 2004

2 hours

Candidates answer on the Question Paper.
Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 80.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use

This document consists of **16** printed pages.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 **(a)** Express $\frac{7}{100}$ as a decimal.

(b) Express 0.08 as a percentage.

Answer (*a*) ..... [1]

(*b*) ..... % [1]

---

2 **(a)** Express $\frac{72}{108}$ as a fraction in its lowest terms.

(b) Evaluate $\frac{1}{3} + \frac{4}{7}$.

Answer (*a*) ..... [1]

(*b*) ..... [1]

---

3 **(a)** Evaluate $63 \div 0.9$.

Answer (*a*) ..... [1]

(b) Add brackets to the expression in the answer space to make it correct.

Answer (*b*) 1 + 72 ÷ 4 × 2 = 10 [1]

---

4 **(a)** Simplify $(3x^3)^2$.

(b) Given that $(16)^{-\frac{1}{2}} \times k = 1$, evaluate k.

Answer (*a*) ..... [1]

(*b*) k = ... [1]

---

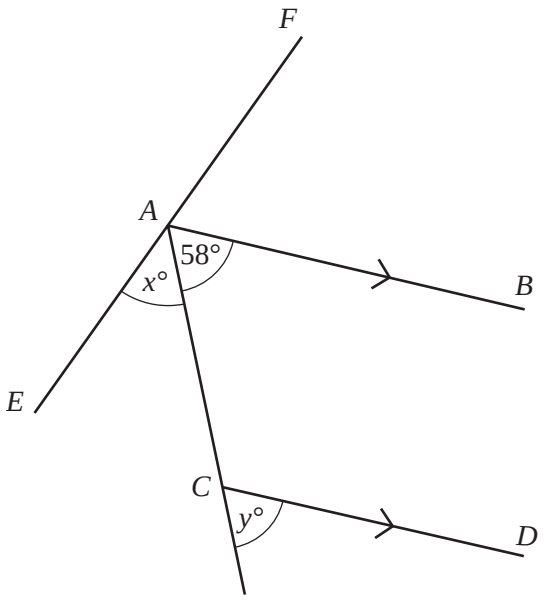
5 In the diagram, EAF is a straight line and AB is parallel to CD.

AB bisects $F\hat{A}C$ and $C\hat{A}B = 58°$.

Find the value of

(a) x,

(b) y.



Answer (*a*) x = ... [1]

(*b*) y = ... [1]

---

6 Given that $\mathbf{A} = \begin{pmatrix} 3 & -1 \\ 4 & 2 \end{pmatrix}$,

find

(a) the determinant of **A**,

(b) $\mathbf{A}^{-1}$.

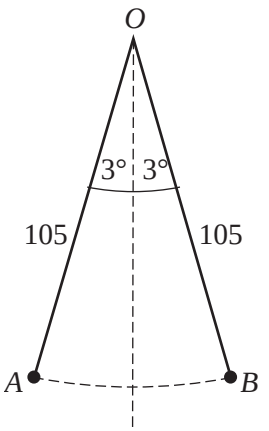
Answer (*a*) ..... [1]

(*b*) ..... [1]

7 A pendulum of length 105 cm is suspended from O.

Its end swings 3° on either side of the vertical from A to B.

Taking $\pi = \frac{22}{7}$, calculate the length of the arc AB.



Answer ..... cm [2]

---

8 Express as a single fraction in its simplest form $\frac{2}{x-3} - \frac{1}{x+2}$.

Answer ..... [2]

---

9 Some children were asked how many television programmes they had watched on the previous day. The table shows the results.

Number of programmes watched	0	1	2	3
Number of children	7	3	1	y

(a) If the median is 2, find the value of y.

(b) If the median is 1, find the greatest possible value of y.

Answer (*a*) ..... [1]

(*b*) ..... [1]

---

10 **(a)** Express 217.3×10^2 in standard form.

Answer (*a*) ..... [1]

(b) Arrange the following numbers in order starting with the smallest.

$$217.3 \times 10^2 \ , \quad 22.6 \times 10^3 \ , \quad 0.031 \times 10^5 \ , \quad 2.5 \times 10^4 \ .$$

Answer (*b*) ..... , ... , ... , ... [2]

---

11 A function f is defined by $\mathrm{f} : x \mapsto \dfrac{x + 5}{3}$.

(a) Given that $\mathrm{f} : 1 \mapsto k$, find the value of k.

(b) Given also that $\mathrm{f}^{-1} : x \mapsto cx + d$, find the value of c and the value of d.

Answer (*a*) k = ... [1]

(*b*) c = ... d = ... [2]

---

12 It is given that $x = -3.5$, $y = 1.5$ and $z = 4.5$.

(a) Find the value of $x - z$.

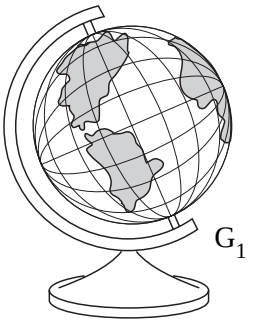
(b) Given also that $(y + z) : t = 4 : 15$, find the value of t.

Answer (*a*) $x - z$ = ... [1]

(*b*) t = ... [2]

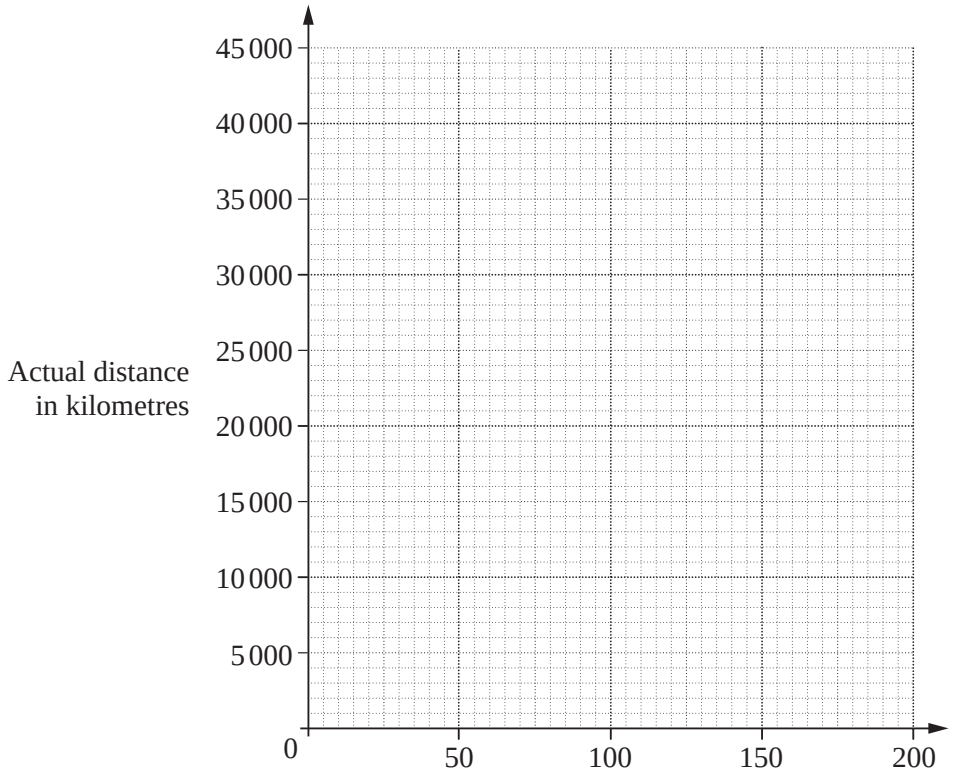
---

13 String is used to measure distances on two globes, G_1 and G_2.



(a) The length of string required to go around the equator on globe G_1 is 157.5 cm.
The actual length of the equator is 40 000 km.
On the axes below, draw a graph which will enable you to convert lengths of string on the globe G_1 to actual distances.

Answer (*a*)



[1]

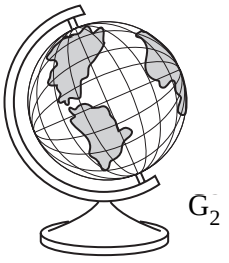
(b) The flight path between two places, *A* and *B*, on globe G_1 requires 35 cm of string.

(i) Use your graph to estimate the actual distance between *A* and *B*.

Answer (*b*) (i) ..... km [1]

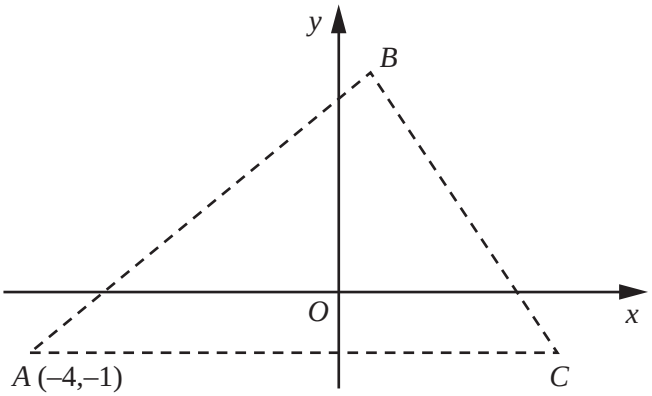
(ii) On the other globe G_2, the same flight path between *A* and *B* requires 17.5 cm of string.

Write down the value of $\dfrac{\text{volume of globe } G_2}{\text{volume of globe } G_1}$.



Answer (*b*)(ii) ..... [1]

14



In the diagram, A is the point $(-4, -1)$ and AC is parallel to the x-axis.

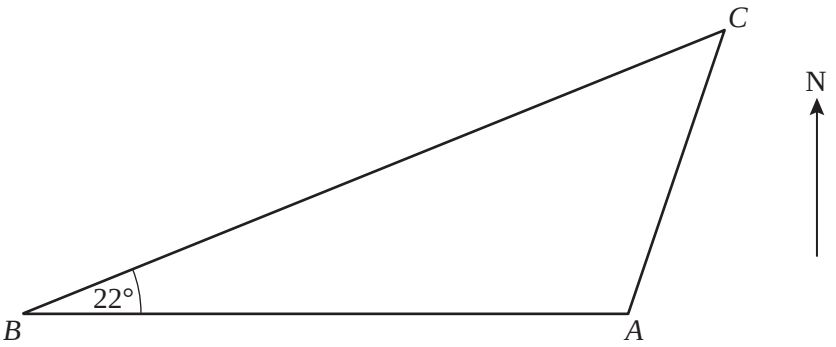
(a) The equation of BC is $y + 2x = 4$.
Find the x-coordinate of C.

(b) The equation of AB is $y = x + 3$.
Write down the inequalities which describe the region **inside** the triangle ABC.

Answer (*a*) ..... [1]

(*b*) ..... [2]

15



A, B and C are three ships.
B is due West of A.

(a) Given that $A\hat{B}C = 22°$, write down the bearing of C from B.

(b) By using your protractor, find the bearing of A from C.

Answer (*a*) ..... [1]

(*b*) ..... [2]

---

16 **(a)** Maryam's height is 1.52 m correct to the nearest centimetre.
State the lower bound of her height.

(b) The length of each of Maryam's paces is 0.55 m.
She walks at a constant speed of 2 paces per second.
Calculate the distance, in kilometres, that she walks in one hour.

Answer (*a*) ..... [1]

(*b*) ..... km [2]

---

17 Solve the equation $\frac{4}{x+3} = \frac{x-1}{3}$.

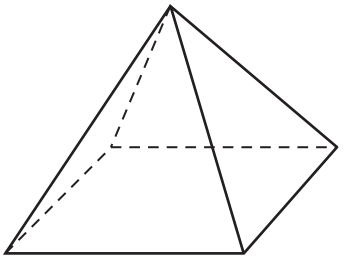
Answer ..... [3]

---

18 The base of a pyramid is a square with diagonals of length 6 cm.

The sloping faces are isosceles triangles with equal sides of length 7 cm.
The height of the pyramid is $\sqrt{l}$ cm.

Calculate *l*.



Answer *l* = ... [3]

---

19 (a)

Calculate the percentage reduction in the price of the camera.

Answer (*a*) ..... % [2]

(b) Matthew invested $500 at 6% simple interest per year.
Calculate how much interest had been earned after 8 months.

Answer (*b*) $ ..... [2]

20 The diagram in the answer space is a map showing a section of coastline and a beacon on land. Fishing boats can only operate when they are

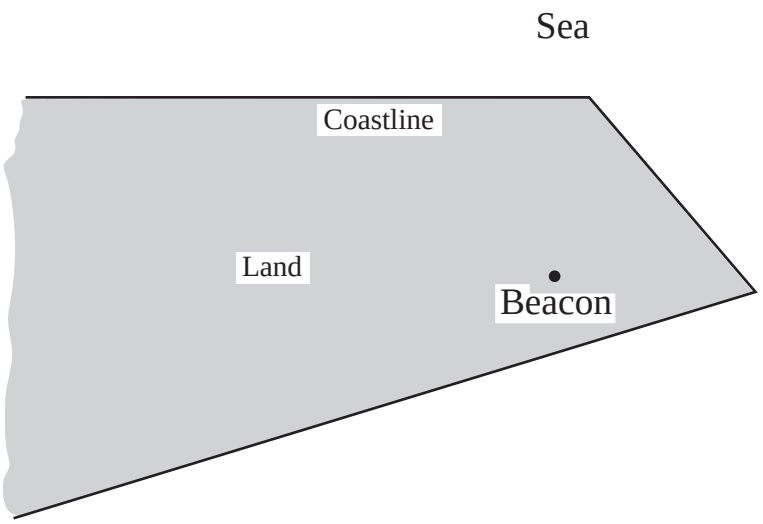
I not more than 6.5 km from the beacon,

II at least 2 km from the coastline.

The scale of the map is 1 cm to 1 km.

Construct the boundaries of the region where fishing can take place.
Label this region *F*.

Answer



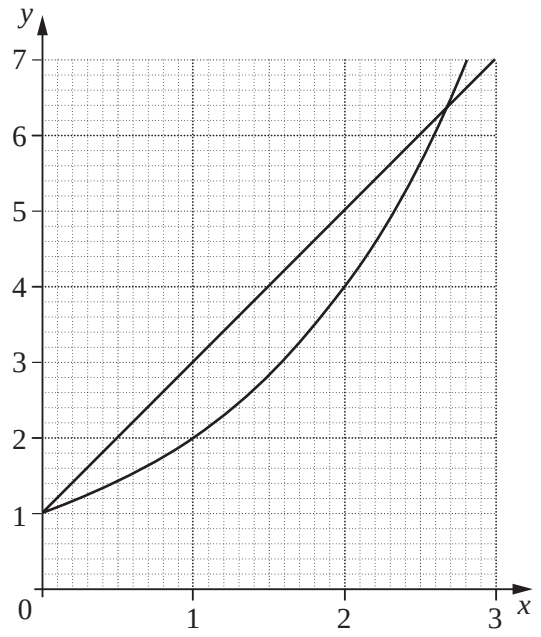
[4]

21 **(a)** The diagram shows the graphs of

$y = 2^x$ and
$y = 2x + 1$.

(i) State the gradient of the line $y = 2x + 1$.

(ii) Find the value of x such that $x > 0$ and $2x + 1 = 2^x$.



Answer (*a*)(i) ..... [1]

(ii) $x =$ ..... [1]

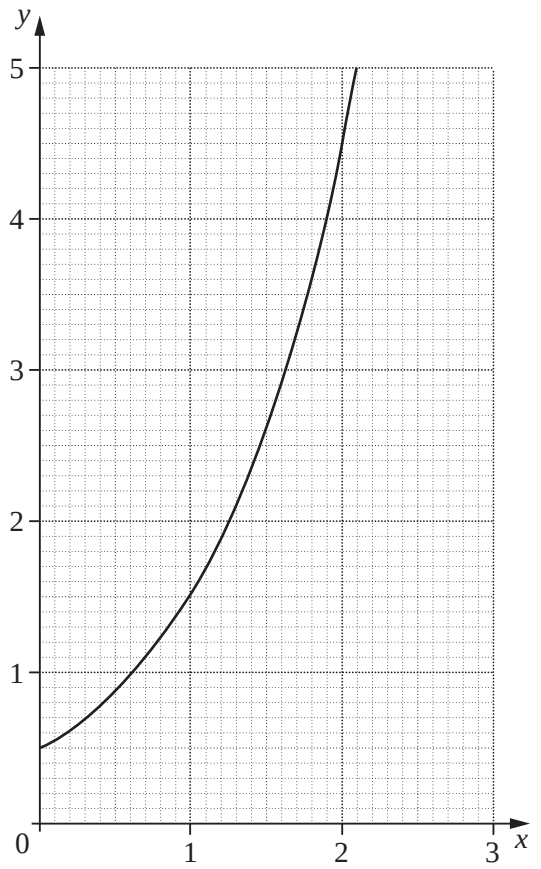
(b) The diagram shows the graph of

$y = ka^x$.

State the value of

(i) k ,

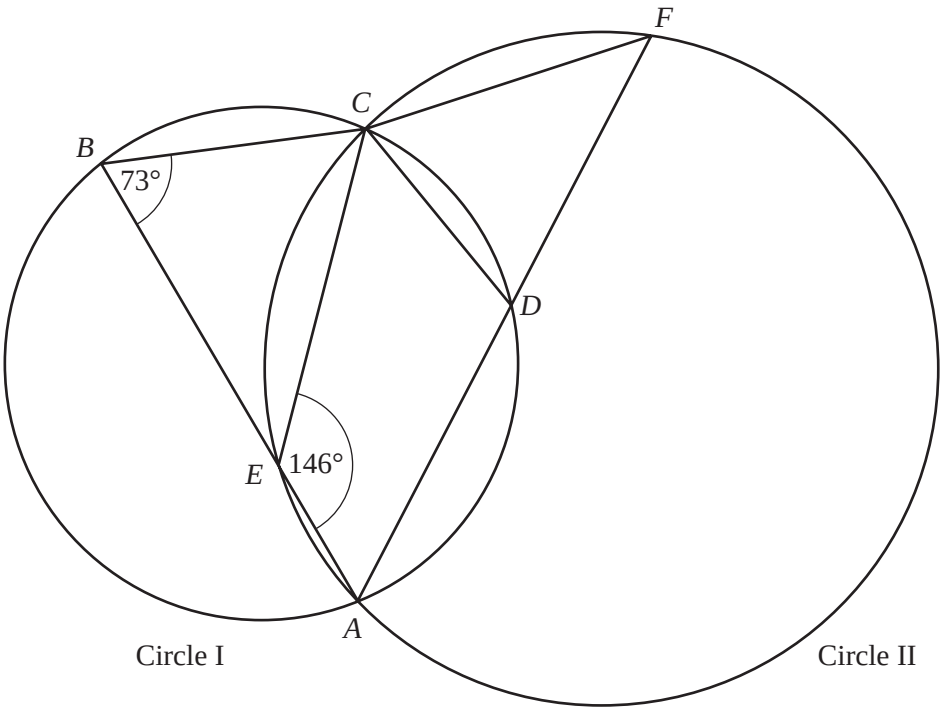
(ii) a.



Answer (*b*)(i) $k =$ ..... [1]

(ii) $a =$ ..... [1]

22



In the diagram, the points *A*, *B*, *C* and *D* lie on circle I.
The points *A*, *E*, *C* and *F* lie on circle II.
AEB and *ADF* are straight lines.
$E\hat{B}C = 73°$ and $A\hat{E}C = 146°$.

(a) Calculate

(i) $A\hat{D}C$,

(ii) $C\hat{F}A$.

(b) Explain why the centre of circle I lies on circle II.

Answer (*a*)(i) ..... [1]

(ii) ..... [1]

(*b*) .....

..... [2]

23 **(a)** Factorise completely $5a^2 - 20$.

Answer (*a*) ..... [2]

(b) A formula connecting x and y is $y = \frac{k}{x^3}$, where k is a constant.

Given that $y = -1$ when $x = 2$, calculate the value of

(i) k,

(ii) x when $y = 64$.

Answer (*b*)(i) $k =$ ..... [1]

(ii) $x =$ ..... [1]

24 A man who is 1.8 m tall stands on horizontal ground 50 m from a vertical tree.
The angle of elevation of the top of the tree from his eyes is 30°.
Use as much of the information below as is necessary to calculate an estimate of the height of the tree.
Give the answer to a reasonable degree of accuracy.

[sin 30° = 0.5 , cos 30° = 0.866 , tan 30° = 0.577]

Answer ..... m [4]

25 **(a)** **(i)** Express 7056 as the product of its prime factors.

(ii) Hence evaluate $\sqrt{7056}$.

Answer (*a*)(i) ..... [2]

(ii) ..... [1]

(b) $\sqrt{5\frac{1}{16}}$ can be expressed as the rational number $\frac{p}{q}$ where p and q are integers.

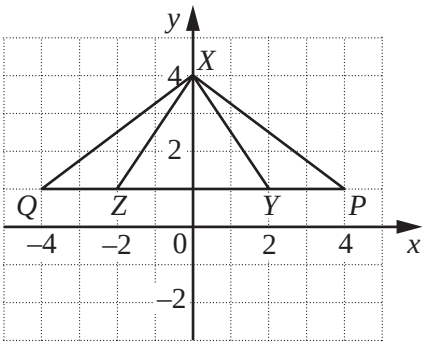
Find the value of p and the value of q.

Answer (*b*) p = ... , q = ... [1]

(c) Write down an example of an irrational number.

Answer (*c*) ..... [1]

26 **(a)** Describe fully the single transformation that maps ΔXYZ onto ΔXPQ.



Answer (*a*) .....

..... [2]

(b) The diagram in the answer space shows ΔABC and the point B' (9 , 2).

(i) A translation maps B onto B'.
Write down the column vector that represents this translation.

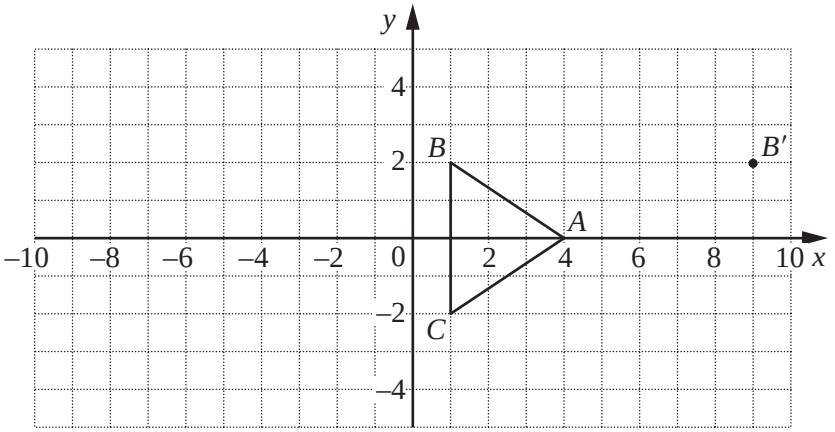
Answer (*b*)(i) ..... [1]

(ii) A shear in which the x-axis is invariant maps ΔABC onto $\Delta A'B'C'$.

(a) Draw $\Delta A'B'C'$ on the diagram in the answer space.

(b) State the shear factor.

Answer (*b*)(ii)*(a)*



[2]

Answer (*b*)(ii)*(b)* ..... [1]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Ordinary Level

MARK SCHEME for the June 2004 question papers

4024 MATHEMATICS (Syllabus D)

4024/01	**Paper 1, maximum raw mark 80**
4024/02	**Paper 2, maximum raw mark 100**

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.

TYPES OF MARK

Most of the marks (those without prefixes, and 'B' marks) are given for accurate results, drawings or statements.

- **M** marks are given for a correct method.
- **B** marks are given for a correct statement or step.
- **A** marks are given for an accurate answer following a correct method.

ABBREVIATIONS

a.r.t. Anything rounding to
b.o.d. Benefit of the doubt has been given to the candidate
c.a.o. Correct answer **only** (i.e. no 'follow through')
e.e.o. Each error or omission
f.t. Follow through
o.e. Or equivalent
SC Special case
s.o.i. Seen or implied
ww Without working
www Without wrong working
* Indicates that it is necessary to look in the working following a wrong answer

June 2004

GCE ORDINARY LEVEL

MARKING SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 4024/01

MATHEMATICS (Syllabus D)
Paper 1

1 (a)	(0).07 cao	1				
(b)	8(.00....) (%)	1			2	
2 (a)	$\frac{2}{3}$ cao	1				
(b)	$\frac{19k}{21k}$ cao	1	Allow decimal in range (0).904 to (0).905		2	
3 (a)	70 cao	1	(Not 70/1)			
(b)	1 + 72 + (4 x 2) = 10	1	Both brackets needed. Ignore extra <u>pairs</u> if not wrong		2	
4 (a)	$9x^6$	1				
(b)	4	1	Accept ± 4, but not - 4 or $16^{½}$	2		
5 (a)	64	1				
(b)	58	1			2	
6 (a)	10	1				
(b)	$\frac{1}{\text{their (a)}}$ $\begin{pmatrix} 2 & 1 \\ -4 & 3 \end{pmatrix}$ or correct answer	1	Accept equivalents Both brackets essential		2	12
7	11 Accept 10.99 (from = 3.14)	2	11/2 , 5½ or 5.5 **or** Figs $\left(\frac{3+3}{360}\times 2\times\pi\times 105\right)$ seen	C1 M1	2	
8	Condone missing outside brackets and **Final answer** $\frac{x+7}{(x-3)(x+2)}$ *or* $\frac{x+7}{x^2-x-6}$	us 2	e of wrong letter if clear Correct num, but brackets missing in denom ***or*** $\frac{2(x+2)-(x-3)}{(x-3)(x+2)}$ oe soi [Condone **all** missing brackets] [Only available if some working seen]	C1 M1	2	

9 (a)	10	1				
(b)	8	1			2	
10(a)	2.173 x 10^4 cao	1	Accept . for x Do not accept calculator form			
(b)	0.031 x 10^5, 217.3 x 10^2, 22.6 x 10^3, 2.5 x 10^4 or equivalents	2	Order reversed **or** Least or greatest identified Condone minor slips if intention clear	C1 C1	3	
11(a)	2	1				
(b)	(c =) 3 (x) (d =) - 5	1 1	One correct **or** (f^{-1} : x) 3x - 5 seen in working	C1 M1	3	
12(a)	-8(.0)	1				
(b)	22½ **or** 22.5 cao	2	$\frac{6}{t} = \frac{4}{15}$ oe or better seen (not just in ratio form)	M1	3	15
13(a)	Ruled straight line through (0 , 0) and (157.5 , 40 000)	1	Allow tolerance of ½ small square at points			
(b)	(i) 8500 to 9000	1				
	(ii) $\frac{1}{8}$ or (0).125 cao	1	Condone 1: 8		3	
14(a)	2½, 2.5 or 5/2	1	Ignore reference to y coordinate if it is -1			
(b)	$y > -1$, $y < x + 3$ and $y + 2x < 4$ oe Accept ≥ for > etc throughout	2	**All** inequalities reversed **or** Two inequalities correct	C1 C1	3	
15(a)	(0)68$^{(0)}$	1	Ignore embellishments (eg N 68 E)			
(b)	199 to 201 $^{(0)}$	2	Ignore embellishments such as S 199 W Other value in range 196 to 204 **or** (BAC =) 109 to 111 **or** (BCA =) 47 to 49 **or**(ACS =) 19 to 21 or for S 19 to 21 W seen or implied, possibly on diagram	C1 M1	3	9

16(a)	1.515 m oe	1	**Unit essential** in this case			
(b)	3.96	2	Figs 396 **or** Figs $\frac{2 \times 0.55 \times 60 \times 60}{1000}$	C1 M1	3	
17	Both 3 and -5	3	$3 \times 4 = x^2 + 3x - x \pm 3$ or better seen **and** $(x + 5)(x - 3)$ oe seen, condoning missing outside brackets **or** $\frac{-2 + \sqrt{64}}{2}$ obtained	M1 M1	 3	
18	40	3	$7^2 = 3^2 + \ell^{(2)}$ seen or implied, eg by $\sqrt{40}$ **or** $7^2 = 3^2 + 3^2 + \ell^{(2)}$ soi eg by 31 or $\sqrt{31}$ **or** 6, 7 used correctly	M2 M1 M1	 3	
19(a)	30 (%)	2	70 (%) **or** Figs $\left(\frac{400-280}{400} \times 100\right)$	C1 M1		
(b)	($) 20	2	($) 520 **or** Figs $\left(\frac{500 \times 6 \times 8}{100 \times 12}\right)$ seen, if intention clear	C1 M1	4	13
20	Circular arc, centre B, radius 6.5 ± 0.5 cm One line parallel to one coast One arc of circle linking two of these Region clearly identified	1 1 1 1	Subtending at least 90° at B Parallel by eye, 2 ± 0.5 cm from coasts as long as relevant coast or till it cuts circle Dep on large circular arc and 3 parallel lines, but not lost for wrong measurements Ignore superfluous lines		 4	
21(a)	(i) 2 cao (ii) 2.65 to 2.7(0)	1 1	Not 2/1 Ignore any attempt at $x = 0$			
(b)	(i) 0.5 (ii) 3	1 1	Do not accept $x < 2.65$ Condone intrusion of y value of about 6.4 Accept ½		4	8

22(a)	(i)107(°)	1	Accept on diagram if necessary			
	(ii) 34(°)	1	Accept on diagram if necessary			
(b)	Completely correct solution	2	Any reference to angle at centre, 146 = 2 x 73 or CEA=2xCBA **or** reference to angles in same segment soi	1 1	4	
23(a)	Condone missing outside brackets, "=0", and use of wrong letter if clear If only "solutions" (even incorrect) in answer space, award marks in working space					
	5(a - 2)(a + 2) oe	2	Incomplete factorisation seen e.g. $5(a^2 - 4)$, *(5a - 10)(a* + 2) etc	M1		
(b)	(i) - 8	1				
	(ii) $-\frac{k}{2k}$ or - (0).5 cao	1	No follow through. Not ± .		4	8
24	31 (m)	4	30.6 , 30.7, 30.65 or 30.8 **or** Appropriate diagram or attempt to add 1.8 **and** 50 tan 30 oe or 50 x 0.577 **and** Rounding finally to the nearest integer provided some rounding has taken place Accept a reasonable eye level used	C3 M1 M1 M1	4	
25(a)	(i) $2^4 \times 3^2 \times 7^2$ oe	2	Attempted division by same prime at least twice, soi	M1		
	(ii) (±) 84 cao	1	Not just - 84			
(b)	*(p* =) (±) *9, (q* =) (±) 4	1	Any combination of + and - acceptable			
(c)	Any irrational, with no rationals given	1	= 3.142 does not score		5	9

26(a)	(One way) stretch Factor 2 dep	1 1	Ignore reference to invariant line No other transformation to be stated			
(b)	(i) $\begin{pmatrix} 8 \\ 0 \end{pmatrix}$	1	Brackets essential. Not (8 , 0)			
	(ii)(a) *A*' at *A*, (4 , 0) *C*' at (-7 , -2)	1 1	Labels not essential if triangle drawn Labels essential if triangle not drawn Accept (good) freehand triangle			
	(b) 4	1	Indep		6	6

June 2004

GCE ORDINARY LEVEL

MARKING SCHEME

MAXIMUM MARK: 100

SYLLABUS/COMPONENT: 4024/02

MATHEMATICS (Syllabus D)
Paper 2

1	(a)	(i)	(a) 360 (m) (b) 4800 (m)		B1 B1	2	f.t. 5160 – their 360
		(ii)	$\frac{6000 \times 3}{10}$ o.e.	M1 = 1800 (m)	A1	2	sc1 for 4200 or 600s or 10min seen.
		(iii)	$\frac{6000}{7}$ (s)	M1 = 14m 17s	A1	2	Allow M1 if 857. …seen
	(b)	(i)	1 : 250000		B1	1	Allow n = 250000
		(ii)	$2 \times \frac{6}{5}$ (figs) o.e.	M1 = 2.4 cm	A1	2	e.g. $\frac{6000 \times 100}{250000}$ Accept 0.024m NB: figs 24→M1 immediately
						9	
2	(a)		$(t - 5)(2v + 1)$ o.e.		B2	2	sc1 for any factor e.g. $2(tv - 5v)$ or if solution given.
	(b)		$\frac{h}{k} = 9$ or $\sqrt{h} = 3\sqrt{k}$	M1 → $k = \frac{h}{9}$	A1	2	sc1 for any of: $k = \frac{\sqrt{h}}{3}$, $k = \frac{h}{\sqrt{3}}$ $k = \frac{h}{3^2}$
	(c)		For numerical $\frac{p \pm (or + or-)\sqrt{q}}{r}$				as final answer
			p = 23 and r = 2		B1		
			q = 205 or $\sqrt{q}$ = 14.3		B1 B1		or $\left(x - \frac{23}{2}\right)^2$ B1, 51.25 B1
			x = 18.66		B1	4	
	(d)		4.34				sc1 for 18.6→18.7 and 4.3→4.35 or for any two answers given to 2 dec. places.
			$\begin{pmatrix} 8 & 4 \\ -6 & 0 \end{pmatrix}$ Accept a = 8, b = 4 etc		B2	2	sc1 for 3 elements correct or $3Y = 2\begin{pmatrix} 12 & 6 \\ -9 & 0 \end{pmatrix}$
						10	
3	(a)	(i)	30 (cm^2)		B1	1	
		(ii)	$\frac{1}{2} \times 5h + \frac{1}{2} \times 6 \times 4$ = their 30		M1	2	Possible GRAD answers
			or 9 sin their $D\hat{A}B$	→ 7.18→7.2	A1		
		(iii)	tan $DAB = \frac{4}{3}$ (or sin $DAB = \frac{7.2}{9}$ etc.)		M1	2	(a)(iii) 59.0…
				→ 53→53.14	A1		
	(b)	(i)	cos 51 = $\frac{RS}{8}$ o.e.	M1 → 5 → 5.04	A1	2	(b)(i) 5.56…
		(ii)	$\frac{\sin Q}{8} = \frac{\sin 95}{8.5}$	M1 → $\frac{8\sin 95}{8.5}$ M1 (dep)			(b)(ii) 77.5…
				→ 69.6 → 70	A1	3	
		(iii)	(a) No: $PQR \neq 90$ or equiv		B1		Ignore superfluous reasoning.
			(b) Mid pt of PR		B1	2	
						12	

4	(a)		$180 - \frac{360}{5}$ or $\frac{5-2}{5} \times 180$ o.e.	M1			
			→ 108º	A1	2	AG	
				B1			
	(b)	(i)	2 lines of symmetry	B1			
			Rot. sym. of order 2		2		
				B1			
		(ii)	Rhombus				
				B1		Accept diamond.	
		(iii)	252º				
				B1			
		(iv)	36º		3		
				B1			
	(c)	(i)	40º				
				B1			
		(ii)	100º				
				B1			
		(iii)	120º		3		
					10	f.t. 220 – their 100	f.t.
5	(a)		$n(S \cup F)'$ or $n(S' \cap F')$ or $n(\ ) - n(S \cup F)$	B1	1		
	(b)		$y + 80 + 35 - x = 100$ o.e. M1 → $x - 15$	A1	2		
	(c)	(i)	$x$min = 15	B1			
		(ii)	$y$max = 20	B1	2		
					5		
6	(a)		$p = 14$ $q = 27$	B1	1	both	
	(b)		$k = 2$	B1	1	Accept $3n + 2$	
	(c)		$7n$	B1			
			-1	B1	2	Accept unsimplified	
	(d)		$R = 41$ $B = 20$	B1			
			9 fences with either $\frac{400}{41}$ or $\frac{200}{20}$	B1	2	NB: 9 fences without working sc1	
					6		

7	(a)		2 3^2 (56.5..) + 3^2 (28.2..) = 84.8 – 84.834	M1 M1 A1	3	
	(b)		$I = \sqrt{16^2 + 4^2}$ (16.5) →CSA = x 4 x 16.5 = 207 – 207.5	M1 M1 A1	3	
	(c)	(i)	$\frac{r}{d} = \frac{4}{16}$ or $r = \frac{4d}{16}$	B1	1	A.G Alternatively: 4 and 16 with mention of shape or similarity o.e.
		(ii)	$V = \frac{1}{3}$ x x 4^2 x 16 = 267.9 → 268.2	M1 A1	2	
		(iii)	$\frac{1}{3} r^2 d = \frac{268}{2}$ $\frac{1}{3} \frac{d^3}{16} = \frac{268}{2}$ o.e. → d = 12.69 – 12.7 (cm)	M1 M1	3	
					12	
8	(a)		Scales All 8 points correctly plotted (within 1 mm) Smooth curve through pts (allow marginally incorrect pts)	S1 P1 C1	3	Lost for st. lines, incomplete, grossly thick.
	(b)	(i)	116 – 117	V1		Accept (4.5 , 116)
		(ii)	1.1 – 1.2 and 5.2 to 5.3	V1	2	DiHo Accept (1.1 , 128) , (5.2 , 128)
	(c)		suitable tangent 22 – 40	T1 T1	2	
	(d)		98	K1	1	(2.5 , 98) not accepted
	(e)	(i)	100 = $\frac{A}{2}$ + 2B → 200 = A + 4B	E1		AG
		(ii)	140 = A + B or 100 = $\frac{A}{3}$ + 3B etc. A = 120 B = 20	E1 B2	4	sc1 for attempt to solve 200 = A + 4B and 2nd equation in A and B
					12	

9	(a)		$(BC^2) = 7^2 + 8^2 -$ (or +) (2).7.8.cos 120 (or 60)	B1			
			$BC^2 = 7^2 + 8^2 - 2.7.8 \cos 120 \rightarrow BC = 13$	B1	2	AG	Possible GRAD answers (a) 12.4… (AG) (b) 26.62…
	(b)		Area = $\frac{1}{2}$.7.8.sin 120	M1			
			= 24.2 – 24.25 (cm^2)	A1	2		
	(c)	(i)	$\frac{1}{2}$.13.r	B1			
		(ii)	$+\frac{1}{2}$.7.r + $\frac{1}{2}$.8.r M1 = 14r	A1			f.t. 7.5r + their 6.5r
		(iii)	14r = 24.2	M1			Complete alternative method M1 A1
			r = 1.728 → 1.733	A1	5		
	(d)		24.2 – x 1.73^2 M1 24.2	M1			
			= 61 – 61.2 (%)	A1	3		
					12		
10	(a)		Widths 2, 1, 1, 2, 2, 3	M1			
			Heights 3½, 8, 6, 5, 1½, 2	M1			
			All correct (inc. given scales)	A1	3		
	(b)		11 < x ≤ 12	B1	1		
	(c)		fx (496) M1 f (40) M1 = 12.4 indep	A1	3		Allow any clear indication.
	(d)		26	B1	1		fx = 63 + 84 + 69 + 130 + 45 + 105 = 496 Allow 1 omission or 2 incorr mid pts
	(e)	(i)	0	B1			not $\frac{0}{40}$
		(ii)	$\frac{6}{40}$	B1			isw
	(f)		(2x) $\frac{6}{40}$ x $\frac{34}{39}$ M1 = $\frac{17}{65}$	A1	4		
					12		

11	(a)	(i)	Number of events	B1		
		(ii)	(a) $\begin{pmatrix}44\\46\end{pmatrix}$	B1 + B1		sc1 for (44, 46)
			(b) School scores, totals, no of points o.e.	B1 indep of (a)		
		(iii)	$\begin{pmatrix}55\\55\end{pmatrix}\rightarrow$ Yes, (tie)	B1	5	
	(b)	(i)	$\overline{PX} = -\frac{1}{3}p + \frac{1}{3}q$ o.e	B1		Accept unsimplified answers
		(ii)	$\overline{OX} = \frac{2}{3}p + \frac{1}{3}q$ o.e	B1		Accept unsimplified answers
		(iii)	$\overline{QY} = p + (k-1)q$ o.e	B1	3	Accept unsimplified answers
		(iv)	$\lambda\overline{OX} = \overline{QY}$ M1 $k = \frac{3}{2}$	A1	2	
		(v)	$\overline{PZ} = \frac{1}{2}q$	B2	2 **12**	Accept unsimplified answers

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) 4024/02

Paper 2

May/June 2003

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (1 sheet)
Mathematical tables (optional)

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate Answer Booklet/Paper provided.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 100.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

This document consists of **11** printed pages and **1** blank page.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

Section A [52 marks]

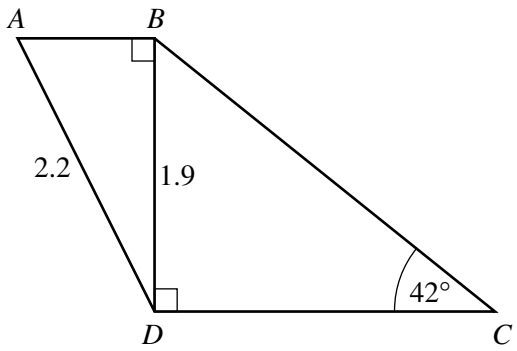
Answer **all** questions in this section.

1 **(a)** **(i)** Evaluate $\dfrac{4.8^2 - 1.7^2}{4.8 \times 1.7}$. [1]

(ii) Find a value of x for which $\sin x° = \tan 12° + \cos 46°$. [1]

(b) The diagram shows a framework $ABCD$.

$AD = 2.2$ m, $BD = 1.9$ m and $B\hat{C}D = 42°$.
$A\hat{B}D = B\hat{D}C = 90°$.



Calculate

(i) $A\hat{D}B$, [2]

(ii) BC. [3]

(c) A vertical flagpole, 18 m high, stands on horizontal ground.

Calculate the angle of elevation of the top of the flagpole from a point, on the ground, 25 m from its base. [2]

---

2 **(a)** Factorise completely $20t^2 - 5$. [2]

(b) Express as a single fraction in its simplest form

$$\frac{7}{2x} - \frac{5}{3x}.$$ [2]

(c) Tickets for a concert were priced at \$5, \$8 and \$12.

The number of \$5 tickets sold was twice the number of \$8 tickets.
The number of \$12 tickets sold was 80 more than the number of \$8 tickets.

The number of \$8 tickets sold was x.

(i) Find an expression, in terms of x, for the total sum of money received from the sale of the tickets. [1]

(ii) Given that \$9360 was received from the sale of the tickets, form an equation in x.

Solve this equation and hence find the **total** number of tickets that were sold. [3]

---

3 In 2001 the price of one litre of petrol was 72 cents.

(a) 65% of this price is 'tax' and the remainder is 'other costs'.

(i) Find, in its simplest form, the ratio of tax to other costs.
Give your answer in the form $m : n$, where m and n are integers. [1]

(ii) Calculate how much tax is paid on one litre of petrol. [1]

(b) Maureen bought as many complete litres of petrol as she could with a \$20 note (\$1 = 100 cents).

(i) Calculate how many litres she bought. [1]

(ii) Calculate how much change she received. [1]

(c) In 2002 the price of one litre of petrol was 81 cents.

Calculate the percentage increase in the price of petrol from 2001 to 2002. [2]

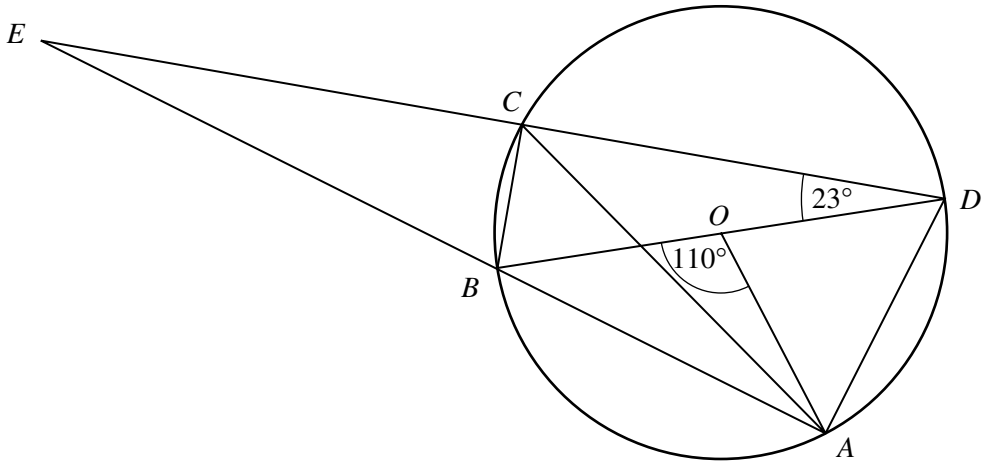
(d) The price of petrol in 2001 was 10% less than the price in 2000.

Calculate the price of one litre of petrol in 2000. [3]

(e) Andrew's car will travel 480 km on a full tank of petrol.
He starts a journey of 620 km with a tank which is **half** full.
He wants to stop only once for petrol.

Between what distances from the start of his journey must he stop for petrol? [2]

4



BD is a diameter of the circle, centre O.
C and A are two points on the circle.
AB and DC, when produced, meet at E.
$A\hat{O}B = 110°$ and $B\hat{D}C = 23°$.

(a) Find

(i) $A\hat{D}O$, [1]

(ii) $B\hat{A}C$, [1]

(iii) $C\hat{B}D$, [1]

(iv) $C\hat{E}B$. [1]

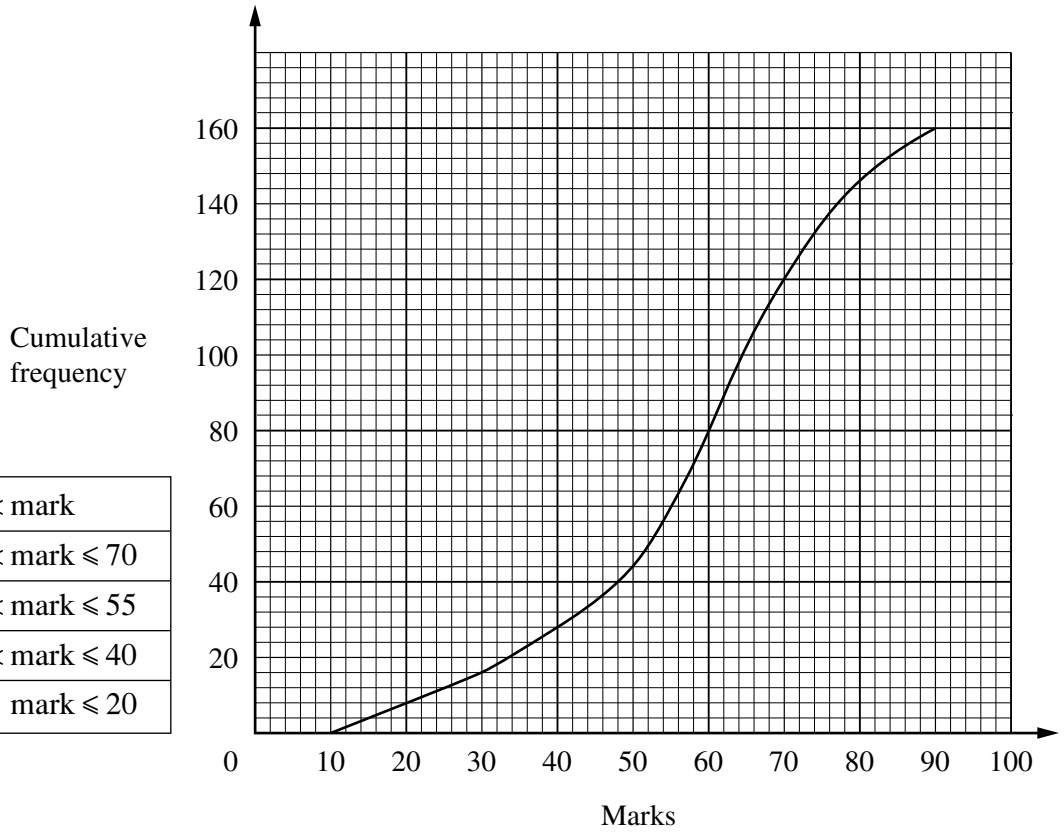
(b) M is the midpoint of CD.

(i) Explain why triangle OMD is similar to triangle BCD. [2]

(ii) Write down the value of $\dfrac{\text{Area of } \triangle OMD}{\text{Area of } \triangle BCD}$. [1]

5 **(a)** One hundred and sixty students took an examination.
The table shows the marks needed for each grade.
The cumulative frequency curve shows the distribution of their marks.

Grade A	70 < mark
Grade B	55 < mark ⩽ 70
Grade C	40 < mark ⩽ 55
Grade D	20 < mark ⩽ 40
Grade U	mark ⩽ 20



(i) Use the graph to estimate

(a) the median, [1]

(b) the interquartile range, [2]

(c) the number of students who were awarded a Grade C. [2]

(ii) A pie chart was drawn to illustrate the grades awarded to the students.

Calculate the angle of the sector which represented the number of students who were awarded a Grade C. [2]

(b) An ordinary unbiased die has faces numbered 1, 2, 3, 4, 5 and 6.
Sarah and Terry each threw this die once.
Expressing each answer as a fraction **in its lowest terms**, find the probability that

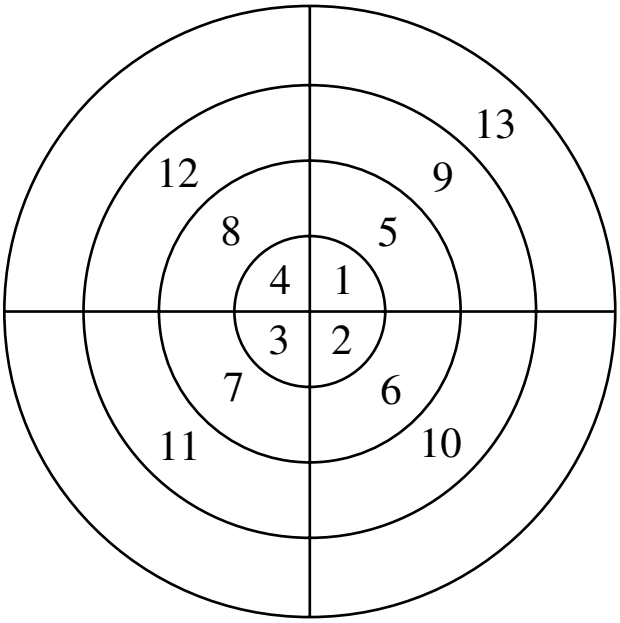
(i) Sarah threw a 7, [1]

(ii) they both threw a 6, [1]

(iii) neither threw an even number, [1]

(iv) Sarah threw exactly four more than Terry. [1]

6



The natural numbers 1, 2, 3, … are written, in a clockwise direction, on a circular grid as shown in the diagram.
There are four numbers in each ring.
The numbers 1, 2, 3, and 4 are in the first ring.
The numbers 5, 6, 7 and 8 are in the second ring.
The following numbers fill up the other rings in the same way.

(a) Write down the numbers in the fourth ring. [1]

(b) Write down the largest number in the tenth ring. [1]

(c) The sum, S_n, of the four numbers in the nth ring, where $n = 1, 2$ and 3, is given in the table below.

n	1	2	3	4
S_n	10	26	42	

(i) Write down the value of S_4. [1]

(ii) Find, in its simplest form, an expression, in terms of r, for S_r. [2]

(iii) In which ring is the sum of the four numbers equal to 1018? [1]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 **[The value of π is 3.142, correct to three decimal places.]**
[The surface area of a sphere is $4\pi r^2$.]
[The volume of a sphere is $\frac{4}{3}\pi r^3$.]

A closed container is made by joining together a cylinder of radius 9 cm and a hemisphere of radius 9 cm as shown in Diagram I. The length of the cylinder is 18 cm. The container rests on a horizontal surface and is exactly half full of water.

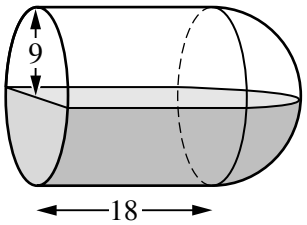


Diagram I

(a) Calculate the surface area of the inside of the container that is in contact with the water. Give your answer correct to the nearest square centimetre. [4]

(b) Show that the volume of the water is 972π cm^3. [2]

(c) The container is held with its axis vertical, the hemisphere being at the bottom, as shown in Diagram II.

Calculate the depth of the water.

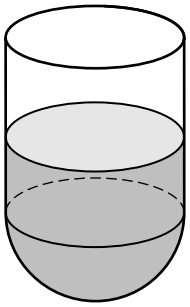


Diagram II [4]

(d) The container is now placed with its circular end on a horizontal surface as shown in Diagram III.

Find the depth of the water.

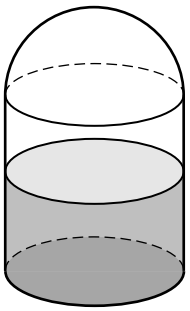


Diagram III [2]

8 Answer the whole of this question on a sheet of graph paper.

Temperatures were recorded over a nine hour period.
The table below shows the temperature, y °C, at various times.

Time (x hours)	0	1	2	3	4	5	6	7	8	9
Temperature (y °C)	2	−1	−2	−1.4	0	2	3.5	3.4	2.4	0.6

(a) Using a scale of 1 cm to represent 1 hour, draw a horizontal x-axis for $0 \leqslant x \leqslant 9$.
Using a scale of 2 cm to represent 1 °C, draw a vertical y-axis for $-2 \leqslant y \leqslant 4$.
On your axes, plot the points given in the table and join them with **a smooth curve**. [3]

(b) Use your graph to find an estimate for

(i) the temperature when $x = 5.5$, [1]

(ii) the difference between the highest and lowest temperatures, [1]

(iii) how long, in hours and minutes, the temperature was above 2 °C. [2]

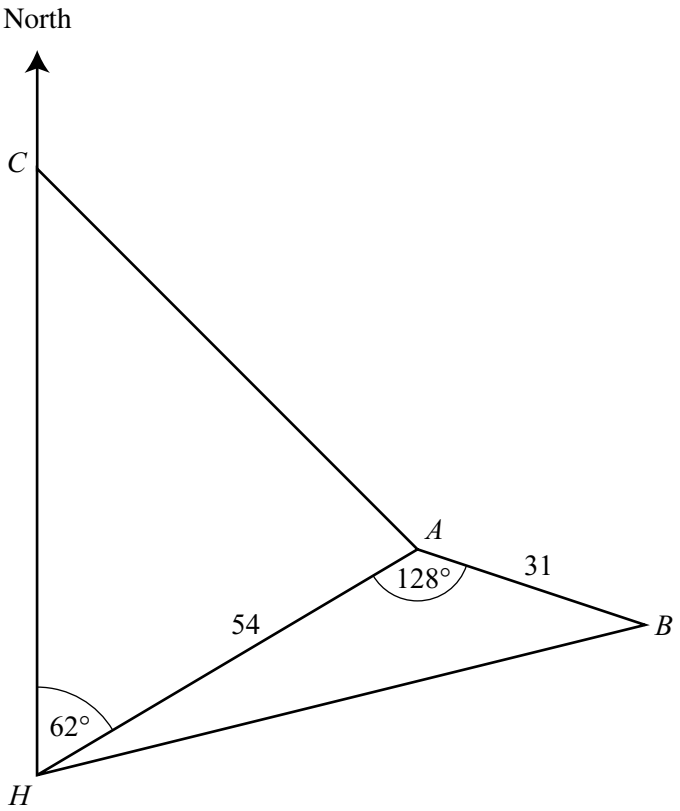
(c) (i) By drawing a tangent, find the gradient of the curve at the point where $x = 8$. [2]

(ii) State **briefly** what this gradient represents. [1]

(d) The curve from $x = 0$ to $x = 2$ has the equation $y = x^2 + Bx + C$.

Find the value of C and the value of B. [2]

9



The diagram shows the position of a harbour, H, and three islands A, B and C.

C is due North of H.

The bearing of A from H is 062° and $H\hat{A}B = 128°$.

$HA = 54$ km and $AB = 31$ km.

(a) Calculate the distance HB. [4]

(b) Find the bearing of B from A. [1]

(c) The bearing of A from C is 133°.
Calculate the distance AC. [4]

(d) A lightship, L, is positioned due North of H and equidistant from A and H.
Calculate the distance HL. [3]

10

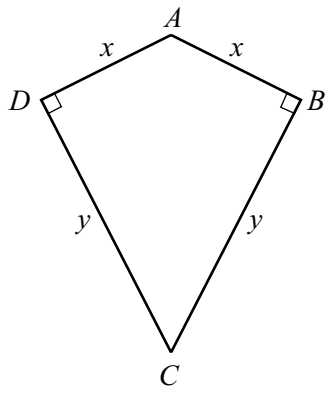


Diagram I

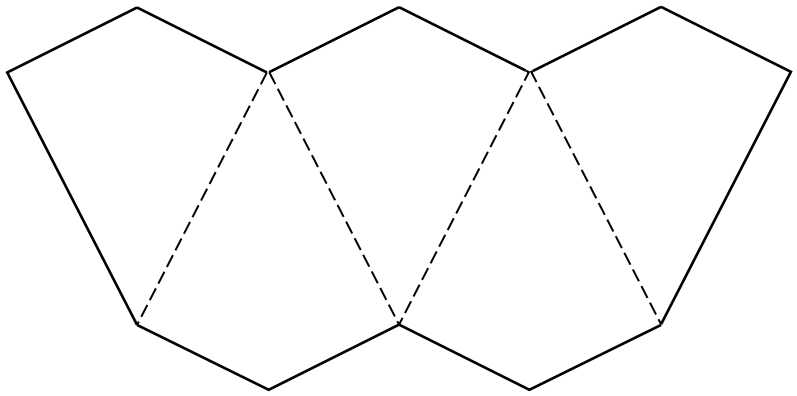


Diagram II

Diagram I shows a quadrilateral, $ABCD$, in which $DA = AB = x$ centimetres and $BC = CD = y$ centimetres.

$A\hat{B}C = C\hat{D}A = 90°$.

(a) Show that the area of this quadrilateral is xy square centimetres. [1]

(b) Five of these quadrilaterals are joined together to make the shape shown in Diagram II. The total area of this shape is 80 cm^2.

(i) Show that the outside perimeter, P centimetres, of this shape is given by

$$P = 10x + \frac{32}{x}.$$ [2]

(ii) **(a)** In the case when $P = 38$, show that $5x^2 - 19x + 16 = 0$. [2]

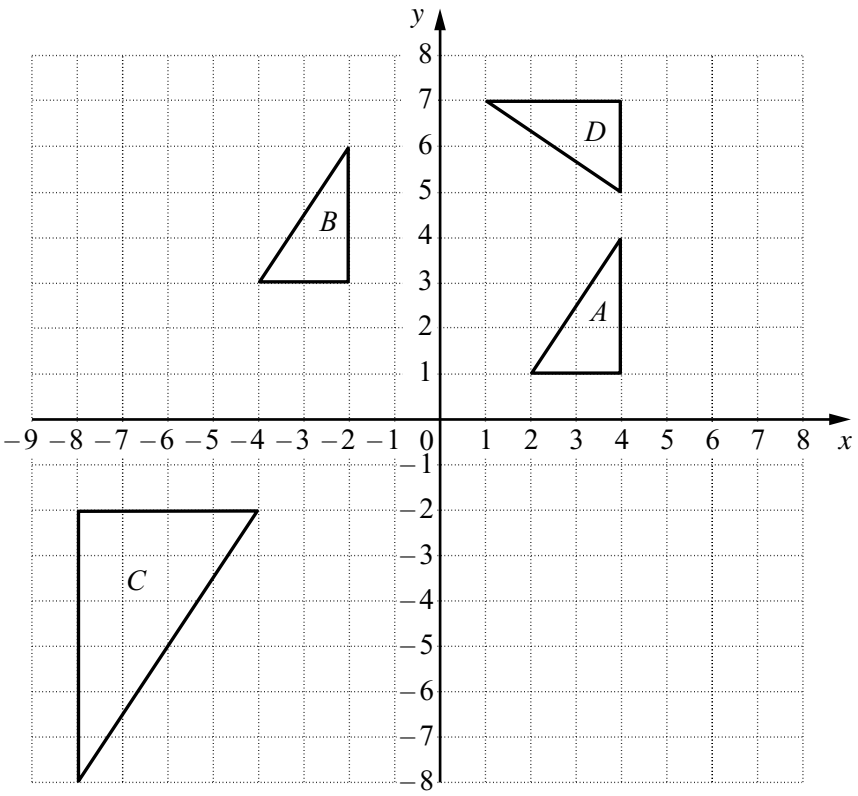
(b) Solve the equation $5x^2 - 19x + 16 = 0$, giving both answers correct to two decimal places. [4]

(c) Find the two possible values of y when $P = 38$. [1]

(iii) **(a)** Calculate the value of P when $x = y$. [1]

(b) What is the special name given to the quadrilateral $ABCD$ when $x = y$? [1]

11



The diagram shows triangles A, B, C and D.

(a) Describe fully the single transformation which maps A onto B. [2]

(b) Find the matrix that represents the single transformation which maps A onto C. [2]

(c) A is mapped onto D by a clockwise rotation.

Find

(i) the angle of this rotation, [1]

(ii) the coordinates of the centre of this rotation. [1]

(d) The matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$ represents the transformation which maps triangle A onto triangle E.

(i) Find the coordinates of the vertices of triangle E. [2]

(ii) Describe fully the transformation that is represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$. [2]

(iii) Find the matrix that represents the single transformation which maps triangle E onto triangle A. [2]

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CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) 4024/02

Paper 2

May/June 2003

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (1 sheet)
Mathematical tables (optional)

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate Answer Booklet/Paper provided.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 100.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

This document consists of **11** printed pages and **1** blank page.

UNIVERSITY of CAMBRIDGE
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[Turn over

Section A [52 marks]

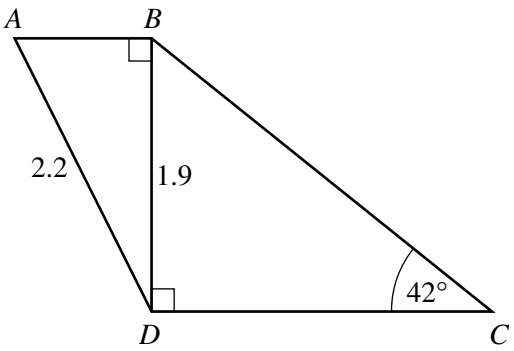
Answer **all** questions in this section.

1 **(a)** **(i)** Evaluate $\dfrac{4.8^2 - 1.7^2}{4.8 \times 1.7}$. [1]

(ii) Find a value of x for which $\sin x° = \tan 12° + \cos 46°$. [1]

(b) The diagram shows a framework $ABCD$.

$AD = 2.2$ m, $BD = 1.9$ m and $B\hat{C}D = 42°$.
$A\hat{B}D = B\hat{D}C = 90°$.



Calculate

(i) $A\hat{D}B$, [2]

(ii) BC. [3]

(c) A vertical flagpole, 18 m high, stands on horizontal ground.

Calculate the angle of elevation of the top of the flagpole from a point, on the ground, 25 m from its base. [2]

---

2 **(a)** Factorise completely $20t^2 - 5$. [2]

(b) Express as a single fraction in its simplest form

$$\frac{7}{2x} - \frac{5}{3x}.$$ [2]

(c) Tickets for a concert were priced at \$5, \$8 and \$12.

The number of \$5 tickets sold was twice the number of \$8 tickets.
The number of \$12 tickets sold was 80 more than the number of \$8 tickets.

The number of \$8 tickets sold was x.

(i) Find an expression, in terms of x, for the total sum of money received from the sale of the tickets. [1]

(ii) Given that \$9360 was received from the sale of the tickets, form an equation in x.

Solve this equation and hence find the **total** number of tickets that were sold. [3]

---

3 In 2001 the price of one litre of petrol was 72 cents.

(a) 65% of this price is 'tax' and the remainder is 'other costs'.

(i) Find, in its simplest form, the ratio of tax to other costs.
Give your answer in the form $m : n$, where m and n are integers. [1]

(ii) Calculate how much tax is paid on one litre of petrol. [1]

(b) Maureen bought as many complete litres of petrol as she could with a \$20 note (\$1 = 100 cents).

(i) Calculate how many litres she bought. [1]

(ii) Calculate how much change she received. [1]

(c) In 2002 the price of one litre of petrol was 81 cents.

Calculate the percentage increase in the price of petrol from 2001 to 2002. [2]

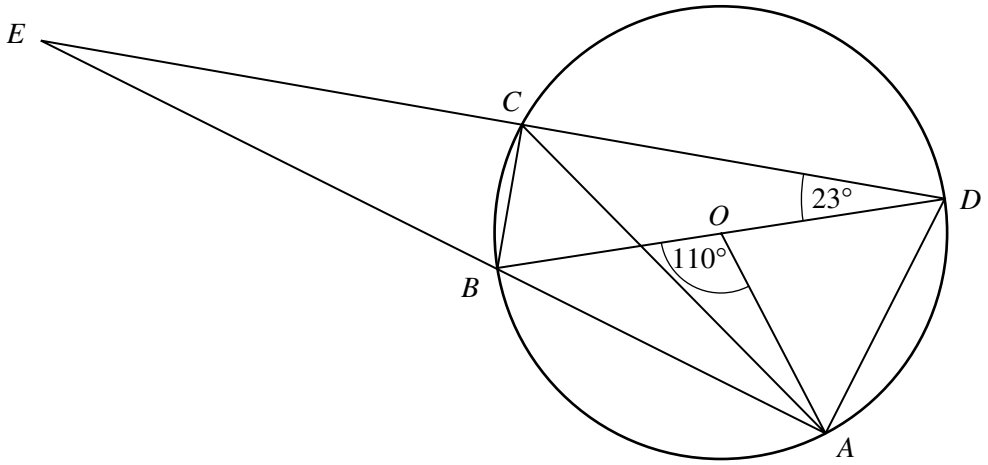
(d) The price of petrol in 2001 was 10% less than the price in 2000.

Calculate the price of one litre of petrol in 2000. [3]

(e) Andrew's car will travel 480 km on a full tank of petrol.
He starts a journey of 620 km with a tank which is **half** full.
He wants to stop only once for petrol.

Between what distances from the start of his journey must he stop for petrol? [2]

4



BD is a diameter of the circle, centre O.
C and A are two points on the circle.
AB and DC, when produced, meet at E.
$A\hat{O}B = 110°$ and $B\hat{D}C = 23°$.

(a) Find

(i) $A\hat{D}O$, [1]

(ii) $B\hat{A}C$, [1]

(iii) $C\hat{B}D$, [1]

(iv) $C\hat{E}B$. [1]

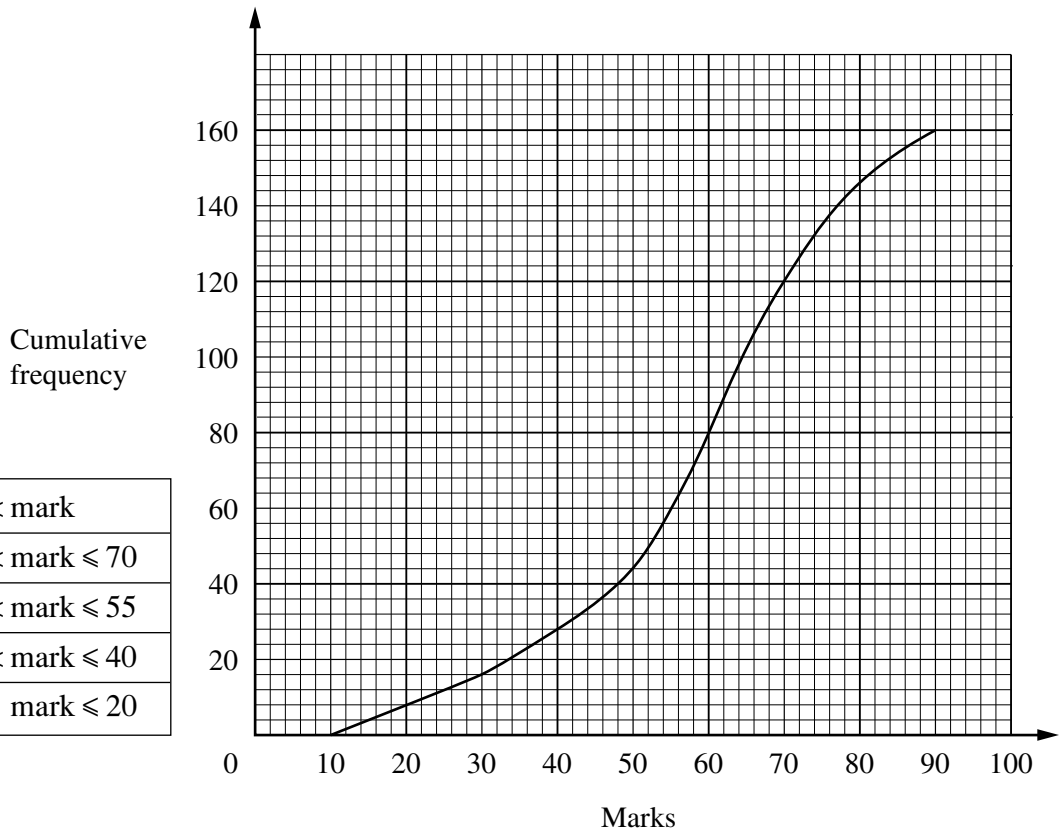
(b) M is the midpoint of CD.

(i) Explain why triangle OMD is similar to triangle BCD. [2]

(ii) Write down the value of $\dfrac{\text{Area of } \triangle OMD}{\text{Area of } \triangle BCD}$. [1]

5 **(a)** One hundred and sixty students took an examination.
The table shows the marks needed for each grade.
The cumulative frequency curve shows the distribution of their marks.

Grade A	70 < mark
Grade B	55 < mark ⩽ 70
Grade C	40 < mark ⩽ 55
Grade D	20 < mark ⩽ 40
Grade U	mark ⩽ 20



(i) Use the graph to estimate

(a) the median, [1]

(b) the interquartile range, [2]

(c) the number of students who were awarded a Grade C. [2]

(ii) A pie chart was drawn to illustrate the grades awarded to the students.

Calculate the angle of the sector which represented the number of students who were awarded a Grade C. [2]

(b) An ordinary unbiased die has faces numbered 1, 2, 3, 4, 5 and 6.
Sarah and Terry each threw this die once.
Expressing each answer as a fraction **in its lowest terms**, find the probability that

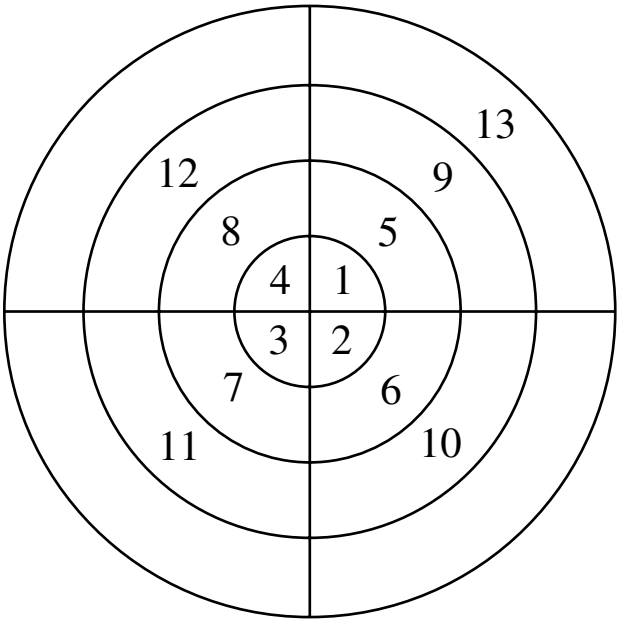
(i) Sarah threw a 7, [1]

(ii) they both threw a 6, [1]

(iii) neither threw an even number, [1]

(iv) Sarah threw exactly four more than Terry. [1]

6



The natural numbers 1, 2, 3, … are written, in a clockwise direction, on a circular grid as shown in the diagram.
There are four numbers in each ring.
The numbers 1, 2, 3, and 4 are in the first ring.
The numbers 5, 6, 7 and 8 are in the second ring.
The following numbers fill up the other rings in the same way.

(a) Write down the numbers in the fourth ring. [1]

(b) Write down the largest number in the tenth ring. [1]

(c) The sum, S_n, of the four numbers in the nth ring, where $n = 1, 2$ and 3, is given in the table below.

n	1	2	3	4
S_n	10	26	42	

(i) Write down the value of S_4. [1]

(ii) Find, in its simplest form, an expression, in terms of r, for S_r. [2]

(iii) In which ring is the sum of the four numbers equal to 1018? [1]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 **[The value of π is 3.142, correct to three decimal places.]**
[The surface area of a sphere is $4\pi r^2$.]
[The volume of a sphere is $\frac{4}{3}\pi r^3$.]

A closed container is made by joining together a cylinder of radius 9 cm and a hemisphere of radius 9 cm as shown in Diagram I. The length of the cylinder is 18 cm. The container rests on a horizontal surface and is exactly half full of water.

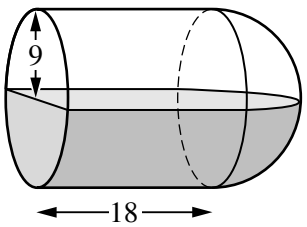


Diagram I

(a) Calculate the surface area of the inside of the container that is in contact with the water. Give your answer correct to the nearest square centimetre. [4]

(b) Show that the volume of the water is 972π cm^3. [2]

(c) The container is held with its axis vertical, the hemisphere being at the bottom, as shown in Diagram II.

Calculate the depth of the water.

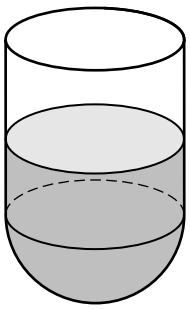


Diagram II [4]

(d) The container is now placed with its circular end on a horizontal surface as shown in Diagram III.

Find the depth of the water.

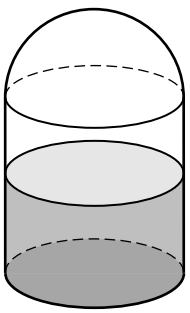


Diagram III [2]

8 **Answer the whole of this question on a sheet of graph paper.**

Temperatures were recorded over a nine hour period.
The table below shows the temperature, y °C, at various times.

Time (x hours)	0	1	2	3	4	5	6	7	8	9
Temperature (y °C)	2	−1	−2	−1.4	0	2	3.5	3.4	2.4	0.6

(a) Using a scale of 1 cm to represent 1 hour, draw a horizontal x-axis for $0 \leqslant x \leqslant 9$.
Using a scale of 2 cm to represent 1 °C, draw a vertical y-axis for $-2 \leqslant y \leqslant 4$.
On your axes, plot the points given in the table and join them with **a smooth curve**. [3]

(b) Use your graph to find an estimate for

(i) the temperature when $x = 5.5$, [1]

(ii) the difference between the highest and lowest temperatures, [1]

(iii) how long, in hours and minutes, the temperature was above 2 °C. [2]

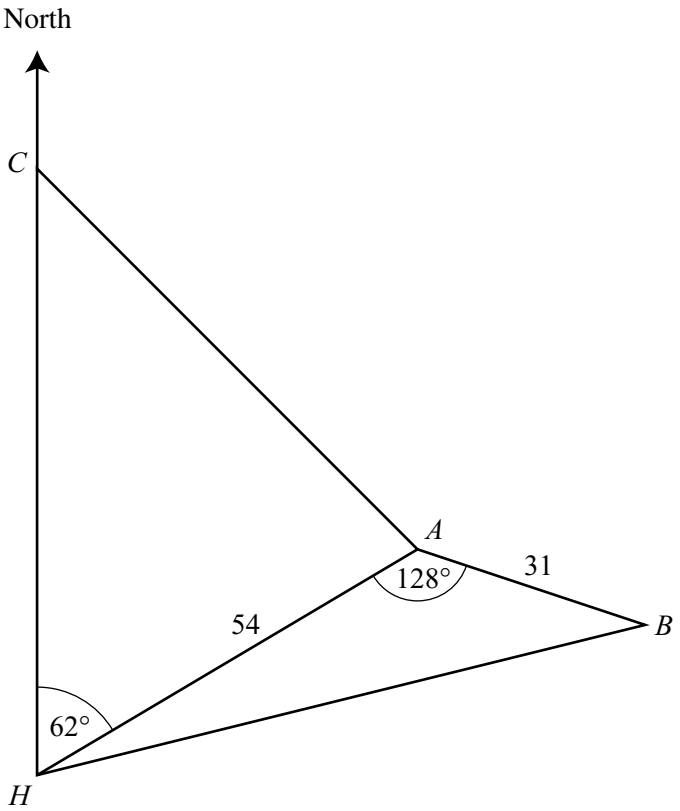
(c) **(i)** By drawing a tangent, find the gradient of the curve at the point where $x = 8$. [2]

(ii) State **briefly** what this gradient represents. [1]

(d) The curve from $x = 0$ to $x = 2$ has the equation $y = x^2 + Bx + C$.

Find the value of C and the value of B. [2]

9



The diagram shows the position of a harbour, H, and three islands A, B and C.

C is due North of H.

The bearing of A from H is 062° and $H\hat{A}B = 128°$.

$HA = 54$ km and $AB = 31$ km.

(a) Calculate the distance HB. [4]

(b) Find the bearing of B from A. [1]

(c) The bearing of A from C is 133°.
Calculate the distance AC. [4]

(d) A lightship, L, is positioned due North of H and equidistant from A and H.
Calculate the distance HL. [3]

10

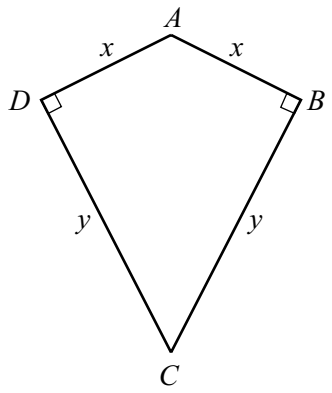


Diagram I

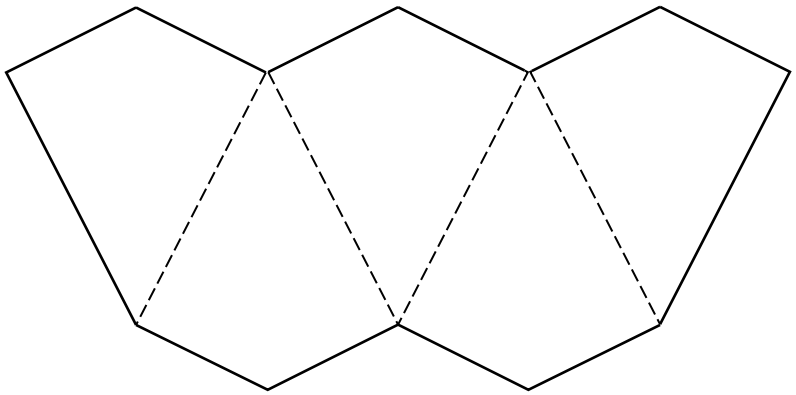


Diagram II

Diagram I shows a quadrilateral, $ABCD$, in which $DA = AB = x$ centimetres and $BC = CD = y$ centimetres.

$A\hat{B}C = C\hat{D}A = 90°$.

(a) Show that the area of this quadrilateral is xy square centimetres. [1]

(b) Five of these quadrilaterals are joined together to make the shape shown in Diagram II. The total area of this shape is 80 cm^2.

(i) Show that the outside perimeter, P centimetres, of this shape is given by

$$P = 10x + \frac{32}{x}.$$ [2]

(ii) **(a)** In the case when $P = 38$, show that $5x^2 - 19x + 16 = 0$. [2]

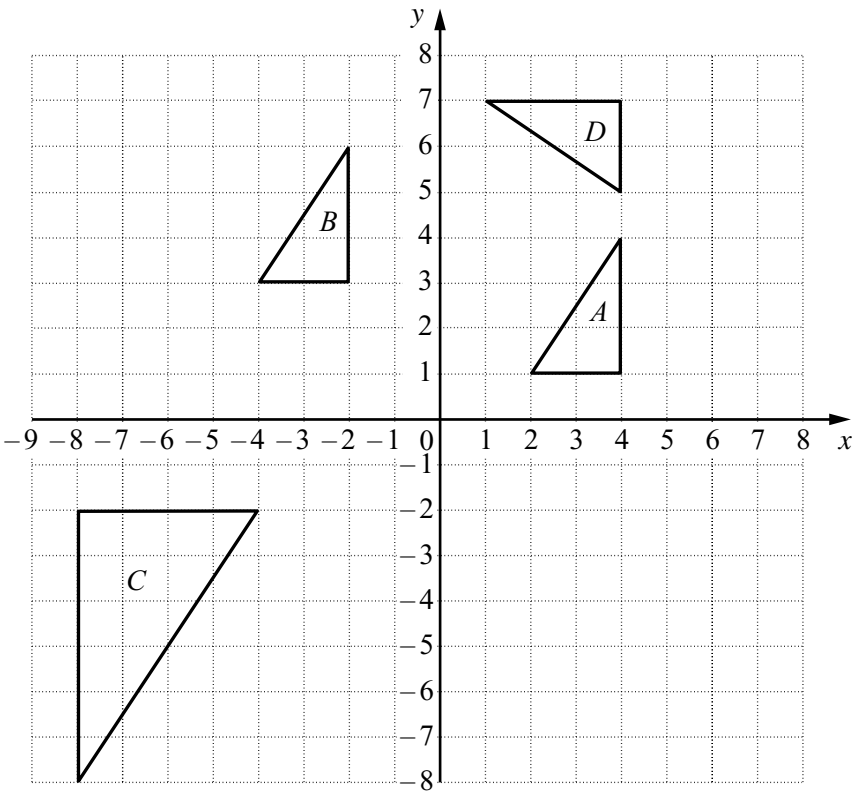
(b) Solve the equation $5x^2 - 19x + 16 = 0$, giving both answers correct to two decimal places. [4]

(c) Find the two possible values of y when $P = 38$. [1]

(iii) **(a)** Calculate the value of P when $x = y$. [1]

(b) What is the special name given to the quadrilateral $ABCD$ when $x = y$? [1]

11



The diagram shows triangles A, B, C and D.

(a) Describe fully the single transformation which maps A onto B. [2]

(b) Find the matrix that represents the single transformation which maps A onto C. [2]

(c) A is mapped onto D by a clockwise rotation.

Find

(i) the angle of this rotation, [1]

(ii) the coordinates of the centre of this rotation. [1]

(d) The matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$ represents the transformation which maps triangle A onto triangle E.

(i) Find the coordinates of the vertices of triangle E. [2]

(ii) Describe fully the transformation that is represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$. [2]

(iii) Find the matrix that represents the single transformation which maps triangle E onto triangle A. [2]

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Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1

May/June 2003

2 hours

Candidates answer on the Question Paper.
Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 80.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

For Examiner's Use

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

This document consists of **16** printed pages.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

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NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 **(a)** Express 0.03 as a fraction.

(b) Express \$150 as a percentage of \$500.

Answer (*a*) ..... [1]

(*b*)..... % [1]

---

2 **(a)** Evaluate $\frac{7}{8} - \frac{7}{10}$, giving your answer as a fraction in its lowest terms.

(b) Evaluate $2\frac{1}{3} \times 3\frac{1}{2}$, giving your answer as a mixed number.

Answer (*a*) ..... [1]

(*b*) ..... [1]

---

3 Evaluate

(a) $24 \div 6 + 2 \times 9$,

(b) 0.4×0.02 .

Answer (*a*) ..... [1]

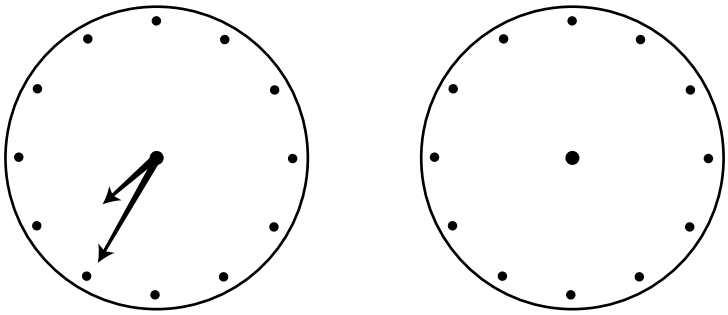
(*b*) ..... [1]

---

4 Local time in Singapore is 11 hours ahead of Trinidad.

(a) Look at the two clocks in the answer space.
One shows the local time in Singapore.
Show the local time in Trinidad on the other clock.

Answer (*a*)



Singapore Trinidad [1]

(b) It is 9.15 a.m. in Trinidad.
Using the 24 hour clock, write down the local time in Singapore.

Answer (*b*)..... [1]

---

5 **(a)** Factorise $x^2 - 7x + 12$.

(b) Solve $(x + 1)(3x - 2) = 0$.

Answer (*a*)..... [1]

(*b*) x = ... or ..... [1]

---

6 **(a)** Express 99 as the product of its prime factors.

(b) Find the smallest possible integer value of n for which $99n$ is a multiple of 24.

Answer (*a*) ..... [1]

(*b*) ..... [1]

---

7 **(a)** It is given that $5^{-2} \times 5^{k} = 1$.
Write down the value of k.

(b) It is given that $\sqrt[3]{7} = 7^{m}$.
Write down the value of m.

Answer (*a*) $k =$ ..... [1]

(*b*) $m =$ ..... [1]

---

8 **(a)** Add together 37 kilograms and 40 grams.
Give your answer in kilograms.

(b) The length of a piece of string is 0.026 metres, correct to the nearest millimetre.
Write down, in millimetres, the lower bound of this length.

Answer (*a*) ..... kg [1]

(*b*) ..... mm [1]

---

9 $p = 3.2 \times 10^{11}$ and $q = 8 \times 10^{-4}$.
Expressing your answers in standard form, evaluate

(a) q^2,

(b) $p \div q$.

Answer (*a*)..... [1]

(*b*)..... [1]

---

10 $\mathbf{a} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$, $\mathbf{c} = \begin{pmatrix} u \\ 10 \end{pmatrix}$.

(a) Express $2\mathbf{a} + \mathbf{b}$ as a column vector.

(b) Given that the vector **c** is parallel to the vector **a**, calculate the value of u.

Answer (*a*) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(*b*) $u =$..... [1]

---

11 Solve the simultaneous equations

$$4x - y = 9,$$
$$2x - 3y = -23.$$

Answer $x =$ .....

$y =$..... [3]

---

12 Five items bought at a shop are shown on the receipt.

The part showing the cost of the apples is missing.

Apples	
Roll	1.35
Mineral water	1.20
Cheese	1.64
Tomatoes	1.20
Total	$ 5.90

(a) How much did the apples cost?

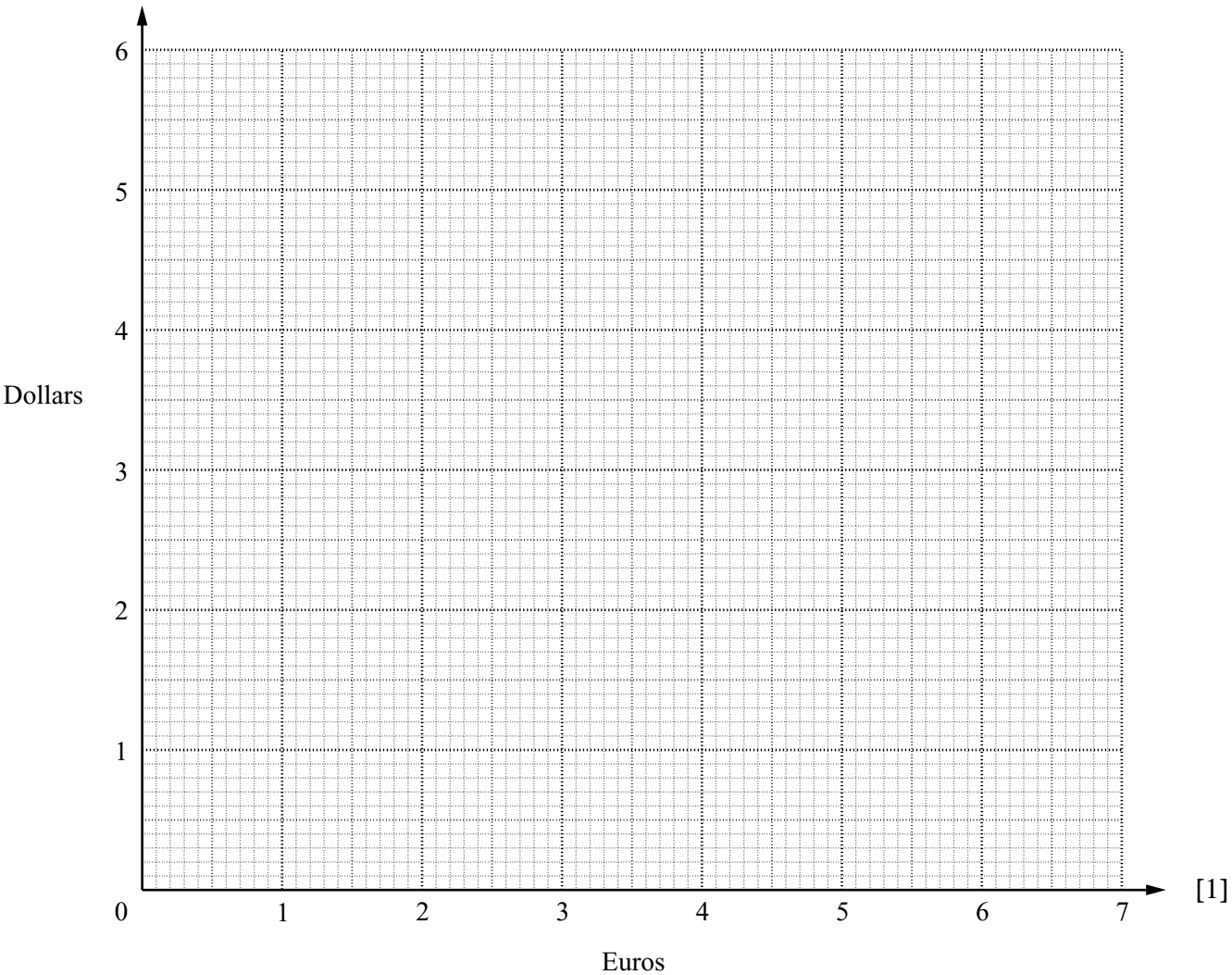
Answer (*a*) $..... [1]

(b) The total cost of $5.90 when converted to euros is 6.80 euros.

(i) Using these totals, draw a graph on the axes in the answer space which will enable you to convert dollars ($) to euros.

(ii) Use your graph to estimate the cost of the mineral water in euros.

Answer (*b*)(i)



[1]

Answer (*b*)(ii) ..... euros [1]

13 **(a)** Solve the equation $\frac{5}{x+1} = 4$.

(b) Solve the inequality $7 - y < 9$.

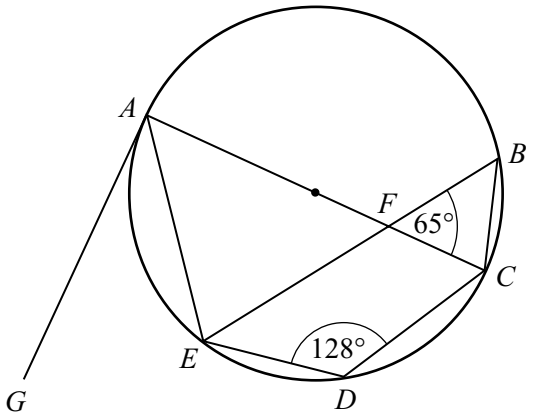
(c) Write down the least integer value of z for which $z > -4$.

Answer (*a*) $x =$ ..... [1]

(*b*) y ..... [1]

(*c*) ..... [1]

14



The points A, B, C, D and E lie on the circle with diameter AC.
EB and AC meet at F.
GA is a tangent to the circle at A.
$C\hat{D}E = 128°$ and $B\hat{F}C = 65°$.
Calculate

(a) $G\hat{A}E$,

(b) $A\hat{E}B$.

Answer (*a*) $G\hat{A}E =$ ..... [2]

(*b*) $A\hat{E}B =$ ..... [1]

---

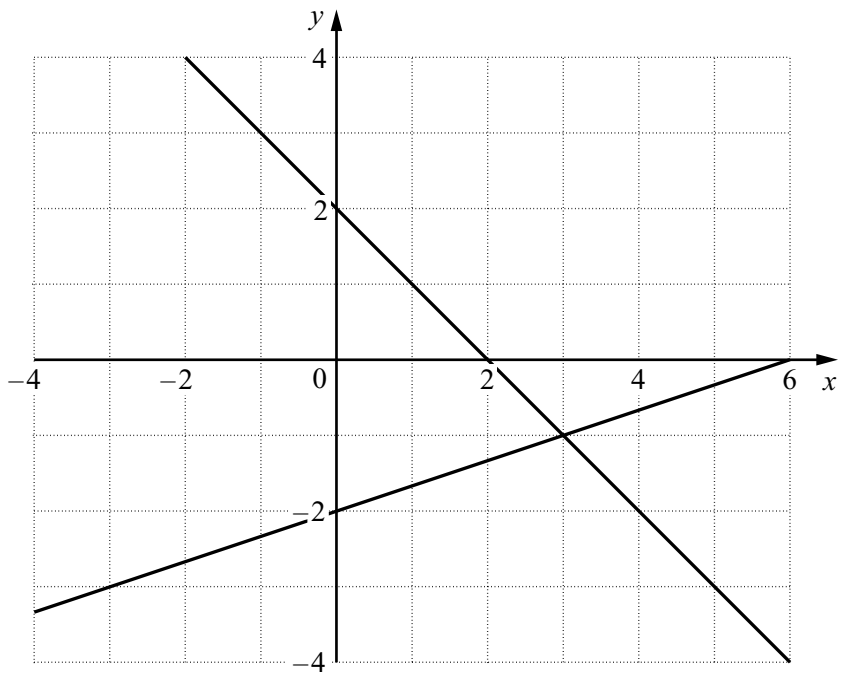
15 The lines $x + y = 2$ and $x - 3y = 6$ are shown on the diagram in the answer space.

(a) Find the gradient of the line $x - 3y = 6$.

Answer (*a*) ..... [1]

(b) On the diagram in the answer space, shade the region defined by the inequalities $x + y \leqslant 2$, $x - 3y \leqslant 6$ and $x + 1 \geqslant 0$.

Answer (*b*)



[2]

16 **(a)** State the order of rotational symmetry of a regular decagon.

Answer (*a*) ..... [1]

(b) Write down those letters of the word AMBULANCE which have a vertical axis of symmetry.

Answer (*b*)..... [1]

(c) *A* and *B* are two points in space which are 10 cm apart.
Describe fully the locus of points in three dimensions that are 3 cm from the line which starts at *A* and ends at *B*.

Answer (*c*).....

.....[2]

---

17 A function is defined by $f(x) = 3x + 4$.

(a) Given that $f(k) = k$, find k.

(b) Find the inverse of f.

Answer (*a*) $k =$ ..... [2]

(*b*) $f^{-1}(x) =$ ..... [2]

---

18 **(a)** In a group of language students,
24 studied Spanish, 23 studied French and 15 studied German,
12 studied Spanish and French,
10 studied German and French,
6 studied Spanish and German,
4 studied all three languages.
By drawing a Venn diagram, or otherwise, calculate the number of students who studied

(i) both Spanish and French, but not German,

(ii) only one language.

Answer (*a*)(i) ..... [1]

(ii) ..... [1]

(b) The set A consists of the points whose coordinates (x, y) are given by $A = \{(x, y) : y = 2x + 1\}$.
The points in set B are given by $B = \{(0, 0), (0, 1), (1, 2), (2, 5), (3, 6)\}$.

Find

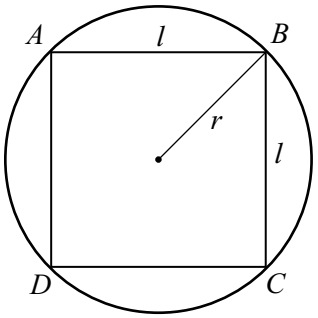
(i) $n(B)$,

(ii) $A \cap B$.

Answer (*b*)(i) $n(B) =$ ..... [1]

(ii) {.....} [1]

19 The vertices of the square *ABCD* lie on a circle of radius *r* cm.



(a) Show that the length, *l* cm, of a side of the square is $r\sqrt{2}$ cm.

(b) By comparing the perimeter of the square and the circumference of the circle, or otherwise, show that $\sqrt{2} < \frac{\pi}{2}$.

(c) What special kind of numbers are $\sqrt{2}$ and π?

Answer (*a*) .....

.....

..... [1]

(*b*).....

.....

..... [2]

(*c*) ..... [1]

---

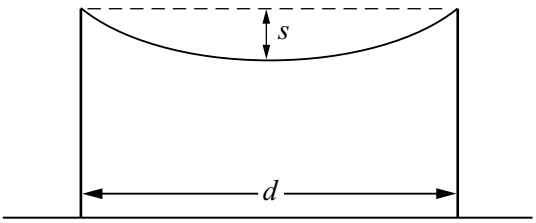
20 **(a)** Expand and simplify $(x - 1)(x^2 + x + 1)$.

(b) Factorise $ax - bx - 3ay + 3by$.

Answer (*a*)..... [2]

(*b*)..... [2]

21



Two vertical posts of the same height stand on horizontal ground.
The distance between the posts is d centimetres.
When a wire of length w centimetres is suspended between the posts, the sag in the middle is s centimetres.
The sag is given by the formula $s = \sqrt{\dfrac{3d(w-d)}{8}}$.

(a) Find s when $d = 800$ and $w = 803$.

(b) Express w in terms of d and s.

Answer (*a*) $s =$ ..... [1]

(*b*) $w =$ ..... [3]

22 It is given that $\sin 30° = 0.5$ and $\cos 30° = 0.866$.

(a) Write down the value of

(i) $\cos 150°$,

(ii) $\cos 60°$.

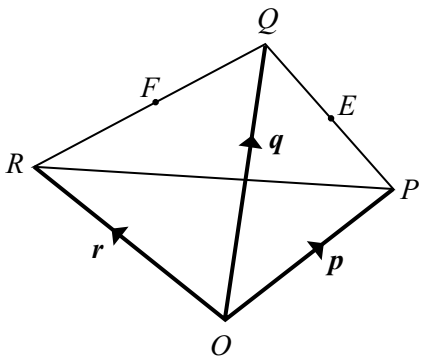
(b) A triangle has sides of length 6 cm and 5 cm.
The angle between these two sides is 150°.
Calculate the area of the triangle.

Answer (*a*)(i) $\cos 150° =$ ..... [1]

(ii) $\cos 60° =$ ..... [1]

(*b*) ..... cm^2 [2]

23



In the diagram,

$\overrightarrow{OP} = \mathbf{p}$, $\overrightarrow{OQ} = \mathbf{q}$ and $\overrightarrow{OR} = \mathbf{r}$.

The midpoints of PQ and QR are E and F, respectively.

(a) Express, as simply as possible, in terms of **p** and/or **q**,

(i) $\overrightarrow{PE}$,

(ii) $\overrightarrow{OE}$.

(b) Hence write down $\overrightarrow{OF}$.

(c) Find $\overrightarrow{EF}$.

(d) Write down two facts about EF and PR.

Answer (*a*)(i) $\overrightarrow{PE}$ = ... [1]

(ii) $\overrightarrow{OE}$ = ... [1]

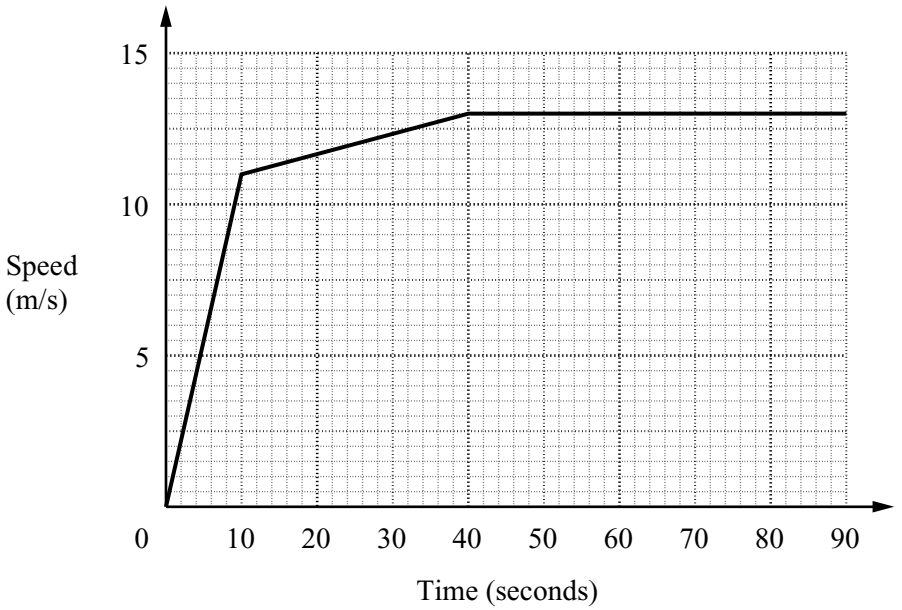
(*b*) $\overrightarrow{OF}$ = ... [1]

(*c*) $\overrightarrow{EF}$ = ... [1]

(*d*) .....

..... [1]

24



The speed–time graph shows the performance of a cyclist during the first 90 seconds of a race.

(a) Calculate the acceleration of the cyclist during the first 10 seconds.

(b) Calculate the distance, in metres, travelled by the cyclist in the first 90 seconds.

(c) Calculate the time taken for the cyclist to travel 1 kilometre.

Answer (*a*)..... m/s^2 [1]

(*b*)..... m [3]

(*c*)..... s [2]

25 The numbers of goals scored in 20 football matches were

5	0	5	4	1	0	5	5	1	3
4	5	0	0	5	5	3	2	5	4

(a) **(i)** Complete the table in the answer space.

(ii) Using the axes in the answer space, represent the information as a bar chart.

(b) State the median.

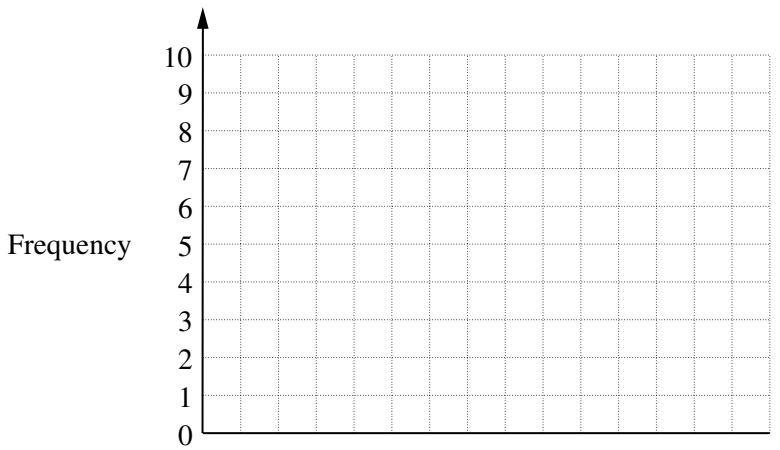
(c) Calculate the mean number of goals.

Answer (*a*)(i)

Number of goals		Frequency
0		
1		
2		
3		
4		
5		

[1]

Answer (*a*)(ii)



[2]

Answer (*b*) ..... [1]

(*c*)..... [2]

Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1

May/June 2003

2 hours

Candidates answer on the Question Paper.
Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 80.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

For Examiner's Use

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

This document consists of **16** printed pages.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

[Turn over

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 **(a)** Express 0.03 as a fraction.

(b) Express \$150 as a percentage of \$500.

Answer (*a*) ..... [1]

(*b*)..... % [1]

---

2 **(a)** Evaluate $\frac{7}{8} - \frac{7}{10}$, giving your answer as a fraction in its lowest terms.

(b) Evaluate $2\frac{1}{3} \times 3\frac{1}{2}$, giving your answer as a mixed number.

Answer (*a*) ..... [1]

(*b*) ..... [1]

---

3 Evaluate

(a) $24 \div 6 + 2 \times 9$,

(b) 0.4×0.02 .

Answer (*a*) ..... [1]

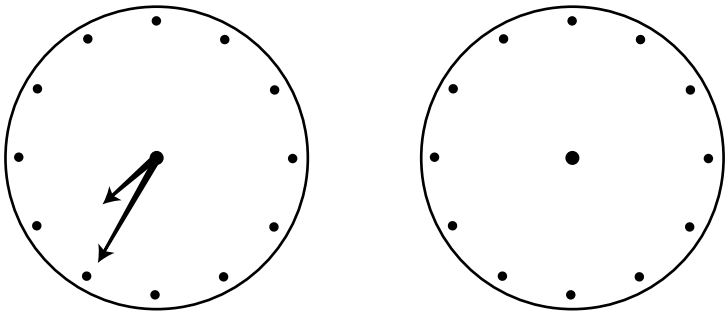
(*b*) ..... [1]

---

4 Local time in Singapore is 11 hours ahead of Trinidad.

(a) Look at the two clocks in the answer space.
One shows the local time in Singapore.
Show the local time in Trinidad on the other clock.

Answer (*a*)



Singapore Trinidad [1]

(b) It is 9.15 a.m. in Trinidad.
Using the 24 hour clock, write down the local time in Singapore.

Answer (*b*)..... [1]

---

5 **(a)** Factorise $x^2 - 7x + 12$.

(b) Solve $(x + 1)(3x - 2) = 0$.

Answer (*a*)..... [1]

(*b*) x = ... or ..... [1]

---

6 **(a)** Express 99 as the product of its prime factors.

(b) Find the smallest possible integer value of n for which $99n$ is a multiple of 24.

Answer (*a*) ..... [1]

(*b*) ..... [1]

---

7 **(a)** It is given that $5^{-2} \times 5^{k} = 1$.
Write down the value of k.

(b) It is given that $\sqrt[3]{7} = 7^{m}$.
Write down the value of m.

Answer (*a*) $k =$ ..... [1]

(*b*) $m =$ ..... [1]

---

8 **(a)** Add together 37 kilograms and 40 grams.
Give your answer in kilograms.

(b) The length of a piece of string is 0.026 metres, correct to the nearest millimetre.
Write down, in millimetres, the lower bound of this length.

Answer (*a*) ..... kg [1]

(*b*) ..... mm [1]

---

9 $p = 3.2 \times 10^{11}$ and $q = 8 \times 10^{-4}$.
Expressing your answers in standard form, evaluate

(a) q^2,

(b) $p \div q$.

Answer (*a*)..... [1]

(*b*)..... [1]

---

10 $\mathbf{a} = \begin{pmatrix} -2 \\ 4 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$, $\mathbf{c} = \begin{pmatrix} u \\ 10 \end{pmatrix}$.

(a) Express $2\mathbf{a} + \mathbf{b}$ as a column vector.

(b) Given that the vector **c** is parallel to the vector **a**, calculate the value of u.

Answer (*a*) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(*b*) $u =$..... [1]

---

11 Solve the simultaneous equations

$$4x - y = 9,$$
$$2x - 3y = -23.$$

Answer $x =$ .....

$y =$..... [3]

---

12 Five items bought at a shop are shown on the receipt.

The part showing the cost of the apples is missing.

Apples	
Roll	1.35
Mineral water	1.20
Cheese	1.64
Tomatoes	1.20
Total	$ 5.90

(a) How much did the apples cost?

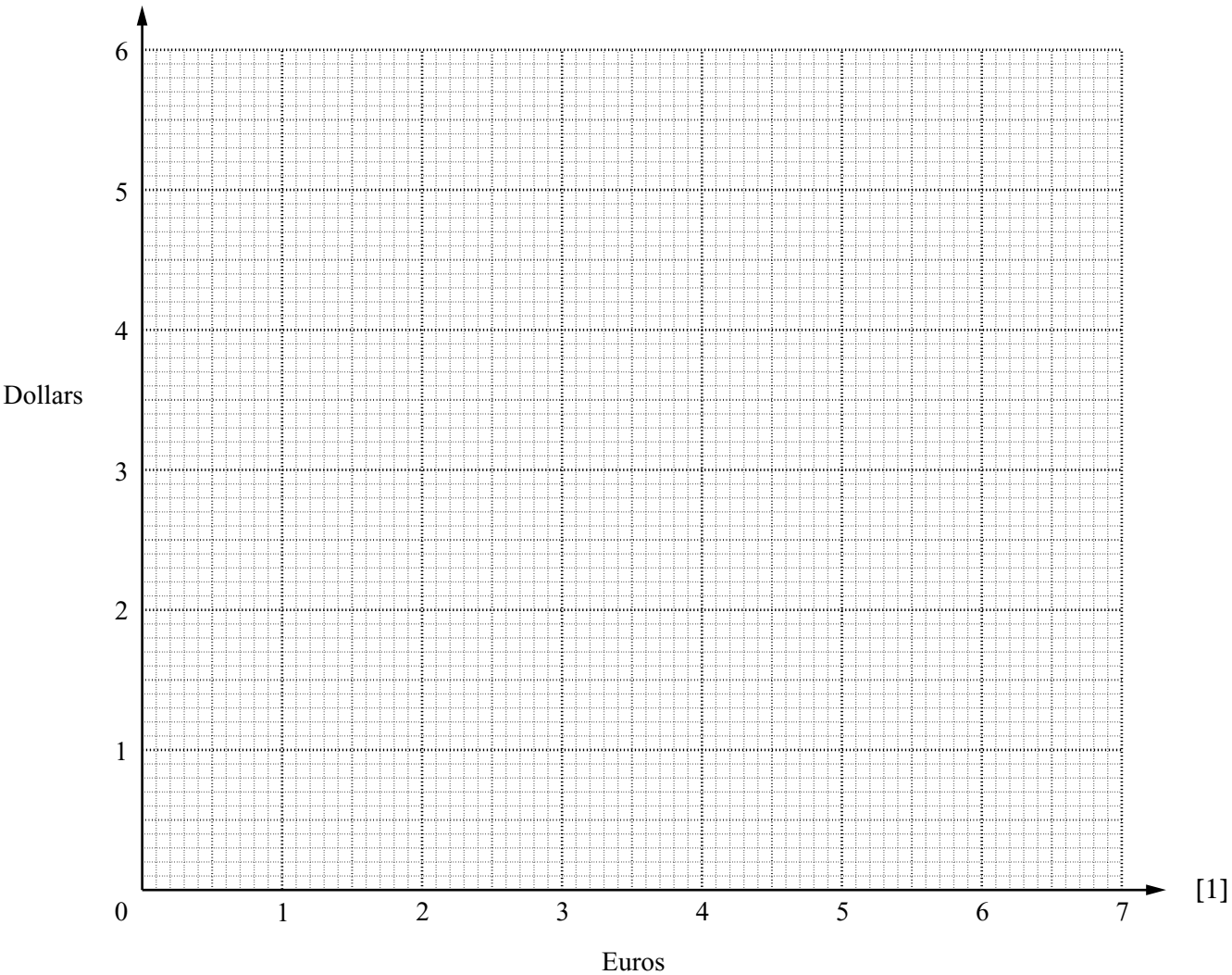
Answer (*a*) $..... [1]

(b) The total cost of $5.90 when converted to euros is 6.80 euros.

(i) Using these totals, draw a graph on the axes in the answer space which will enable you to convert dollars ($) to euros.

(ii) Use your graph to estimate the cost of the mineral water in euros.

Answer (*b*)(i)



[1]

Answer (*b*)(ii) ..... euros [1]

13 **(a)** Solve the equation $\frac{5}{x+1} = 4$.

(b) Solve the inequality $7 - y < 9$.

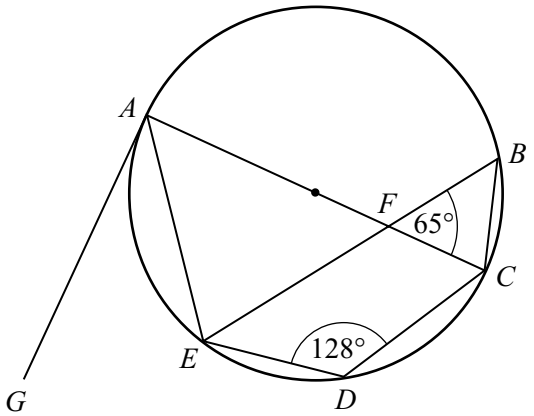
(c) Write down the least integer value of z for which $z > -4$.

Answer (*a*) $x =$ ..... [1]

(*b*) y ..... [1]

(*c*) ..... [1]

14



The points A, B, C, D and E lie on the circle with diameter AC.
EB and AC meet at F.
GA is a tangent to the circle at A.
$C\hat{D}E = 128°$ and $B\hat{F}C = 65°$.
Calculate

(a) $G\hat{A}E$,

(b) $A\hat{E}B$.

Answer (*a*) $G\hat{A}E =$ ..... [2]

(*b*) $A\hat{E}B =$ ..... [1]

---

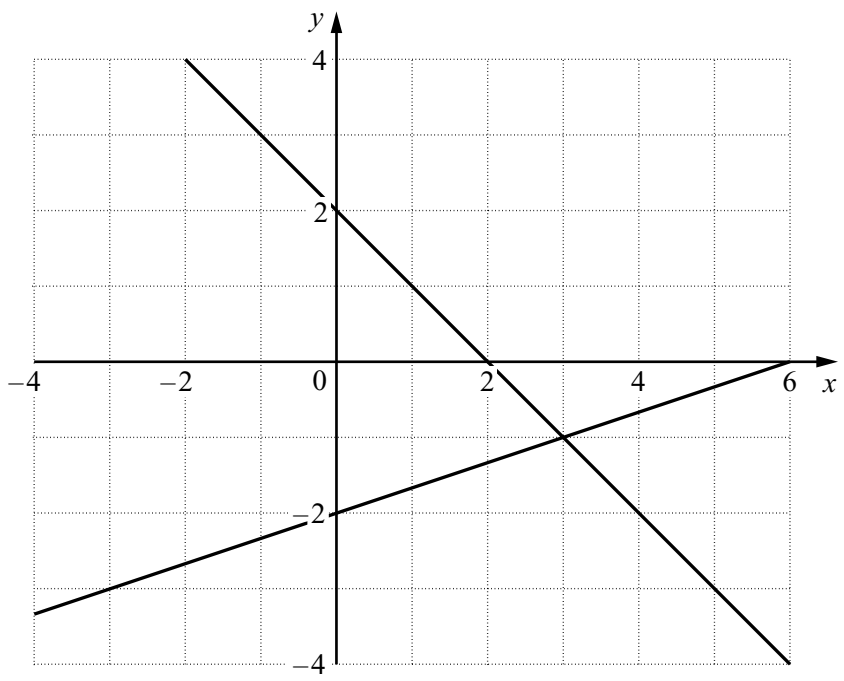
15 The lines $x + y = 2$ and $x - 3y = 6$ are shown on the diagram in the answer space.

(a) Find the gradient of the line $x - 3y = 6$.

Answer (*a*) ..... [1]

(b) On the diagram in the answer space, shade the region defined by the inequalities $x + y \leqslant 2$, $x - 3y \leqslant 6$ and $x + 1 \geqslant 0$.

Answer (*b*)



[2]

16 **(a)** State the order of rotational symmetry of a regular decagon.

Answer (*a*) ..... [1]

(b) Write down those letters of the word AMBULANCE which have a vertical axis of symmetry.

Answer (*b*)..... [1]

(c) *A* and *B* are two points in space which are 10 cm apart.
Describe fully the locus of points in three dimensions that are 3 cm from the line which starts at *A* and ends at *B*.

Answer (*c*).....

.....[2]

---

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(a) Given that $f(k) = k$, find k.

(b) Find the inverse of f.

Answer (*a*) $k =$ ..... [2]

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---

18 **(a)** In a group of language students,
24 studied Spanish, 23 studied French and 15 studied German,
12 studied Spanish and French,
10 studied German and French,
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By drawing a Venn diagram, or otherwise, calculate the number of students who studied

(i) both Spanish and French, but not German,

(ii) only one language.

Answer (*a*)(i) ..... [1]

(ii) ..... [1]

(b) The set A consists of the points whose coordinates (x, y) are given by $A = \{(x, y) : y = 2x + 1\}$.
The points in set B are given by $B = \{(0, 0), (0, 1), (1, 2), (2, 5), (3, 6)\}$.

Find

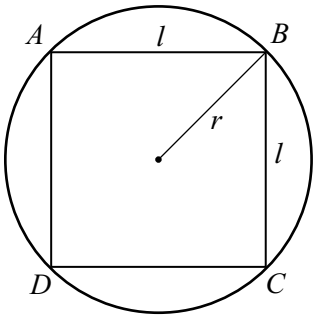
(i) $n(B)$,

(ii) $A \cap B$.

Answer (*b*)(i) $n(B) =$ ..... [1]

(ii) {.....} [1]

19 The vertices of the square *ABCD* lie on a circle of radius *r* cm.



(a) Show that the length, *l* cm, of a side of the square is $r\sqrt{2}$ cm.

(b) By comparing the perimeter of the square and the circumference of the circle, or otherwise, show that $\sqrt{2} < \frac{\pi}{2}$.

(c) What special kind of numbers are $\sqrt{2}$ and π?

Answer (*a*) .....

.....

..... [1]

(*b*).....

.....

..... [2]

(*c*) ..... [1]

---

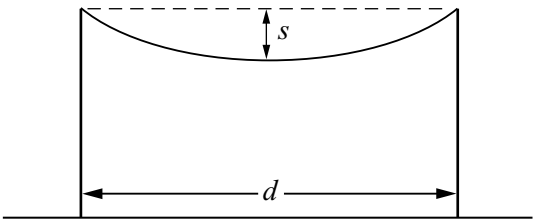
20 **(a)** Expand and simplify $(x - 1)(x^2 + x + 1)$.

(b) Factorise $ax - bx - 3ay + 3by$.

Answer (*a*)..... [2]

(*b*)..... [2]

21



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The distance between the posts is d centimetres.
When a wire of length w centimetres is suspended between the posts, the sag in the middle is s centimetres.
The sag is given by the formula $s = \sqrt{\frac{3d(w-d)}{8}}$.

(a) Find s when $d = 800$ and $w = 803$.

(b) Express w in terms of d and s.

Answer (*a*) $s =$ ..... [1]

(*b*) $w =$ ..... [3]

22 It is given that $\sin 30° = 0.5$ and $\cos 30° = 0.866$.

(a) Write down the value of

(i) $\cos 150°$,

(ii) $\cos 60°$.

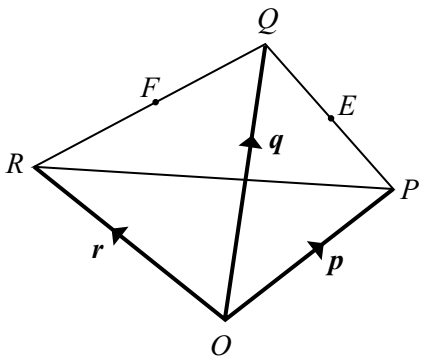
(b) A triangle has sides of length 6 cm and 5 cm.
The angle between these two sides is 150°.
Calculate the area of the triangle.

Answer (*a*)(i) $\cos 150°$ = ... [1]

(ii) $\cos 60°$ = ... [1]

(*b*) ..... cm^2 [2]

23



In the diagram,

$\overrightarrow{OP} = \mathbf{p}$, $\overrightarrow{OQ} = \mathbf{q}$ and $\overrightarrow{OR} = \mathbf{r}$.

The midpoints of PQ and QR are E and F, respectively.

(a) Express, as simply as possible, in terms of **p** and/or **q**,

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(ii) $\overrightarrow{OE}$.

(b) Hence write down $\overrightarrow{OF}$.

(c) Find $\overrightarrow{EF}$.

(d) Write down two facts about EF and PR.

Answer (*a*)(i) $\overrightarrow{PE}$ = ... [1]

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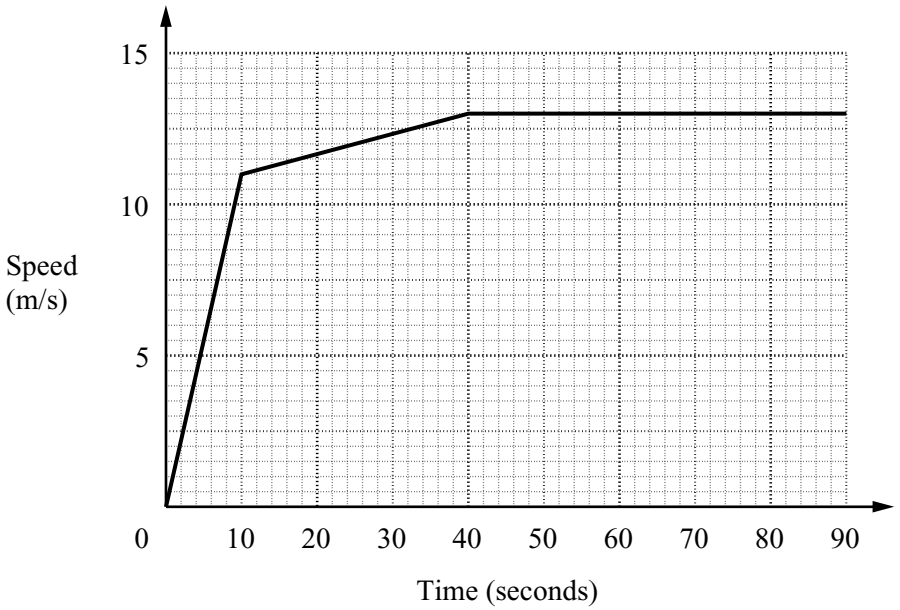
(*b*) $\overrightarrow{OF}$ = ... [1]

(*c*) $\overrightarrow{EF}$ = ... [1]

(*d*) .....

..... [1]

24



The speed–time graph shows the performance of a cyclist during the first 90 seconds of a race.

(a) Calculate the acceleration of the cyclist during the first 10 seconds.

(b) Calculate the distance, in metres, travelled by the cyclist in the first 90 seconds.

(c) Calculate the time taken for the cyclist to travel 1 kilometre.

Answer (*a*)..... m/s^2 [1]

(*b*)..... m [3]

(*c*)..... s [2]

25 The numbers of goals scored in 20 football matches were

5	0	5	4	1	0	5	5	1	3
4	5	0	0	5	5	3	2	5	4

(a) **(i)** Complete the table in the answer space.

(ii) Using the axes in the answer space, represent the information as a bar chart.

(b) State the median.

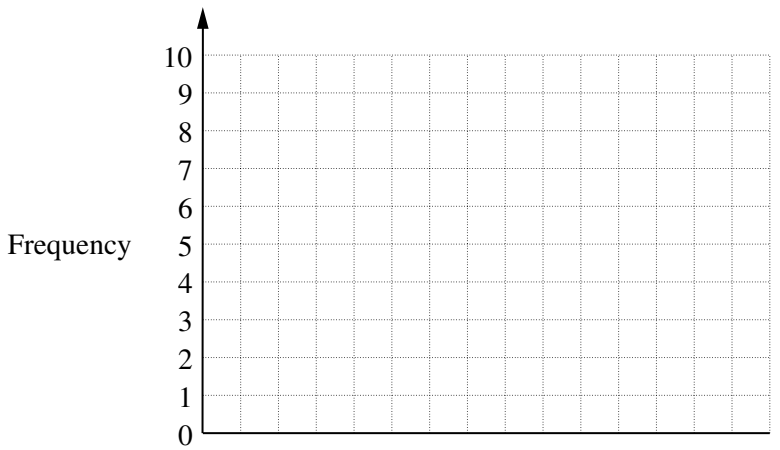
(c) Calculate the mean number of goals.

Answer (*a*)(i)

Number of goals		Frequency
0		
1		
2		
3		
4		
5		

[1]

Answer (*a*)(ii)



[2]

Answer (*b*) ..... [1]

(*c*)..... [2]

CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/2**

PAPER 2 Rupee version

MAY/JUNE SESSION 2002

2 hours 30 minutes

Additional materials:
Answer paper
Electronic calculator
Geometrical instruments
Graph paper (2 sheets)
Mathematical tables (optional)

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Write your answers and working on the separate answer paper provided.

Show all your working on the same page as the rest of the answer.

Omission of essential working will result in loss of marks.

Section A

Answer **all** questions.

Section B

Answer any **four** questions.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is 100.

You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

This question paper consists of 9 printed pages and 3 blank pages.

Section A [52 marks]

Answer **all** questions in this section.

1 Denise, Elaine and Michelle went on holiday to America.

(a) The exchange rate between American dollars ($) and British pounds (£) was $1.60 = £1.
Denise changed £400 into dollars.
Calculate how many dollars she received. [1]

(b) To change the money, the bank charged a fixed amount of £3 plus 2% of the number of pounds changed.

(i) Calculate the amount the bank charged Denise to change her £400. [1]

(ii) The bank then charged Elaine £15 to change her money.
Calculate the number of pounds she changed. [2]

(c) While in America they spent a total of $450 on food.
The amounts spent by Denise, Elaine and Michelle were in the ratio 7 : 6 : 5.
Calculate how much Denise spent on food. [2]

(d) Michelle bought a watch for $135.
This price included a tax of 8%.
Calculate the **tax** that was paid. [3]

---

2 **(a)** Remove the brackets and simplify $(q+3r)(2q-r)$. [2]

(b) Given that $m = -2$ and $n = 4$, evaluate

(i) $5m^3$, [1]

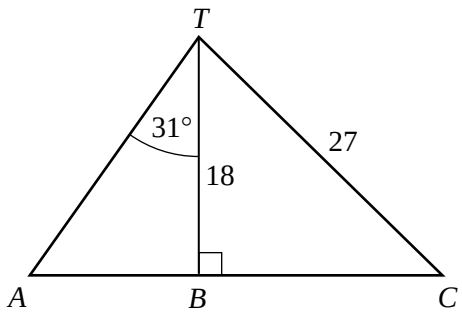
(ii) $\frac{m}{n} + \frac{n}{m}$. [1]

(c) Factorise completely $3y^2 - 3$. [2]

(d) Peter has Rs200 and Paul has Rs2120.
When they are each given Rsx, Paul has 5 times as much as Peter.
Write down an equation in x and solve it. [3]

---

3 The diagram shows a vertical mast, TB, of height 18 m.
A, B and C are three points on horizontal ground.
TA and TC are two straight wires.
TC has length 27 m and $A\hat{T}B = 31°$.



(a) Calculate

(i) $B\hat{C}T$, [2]

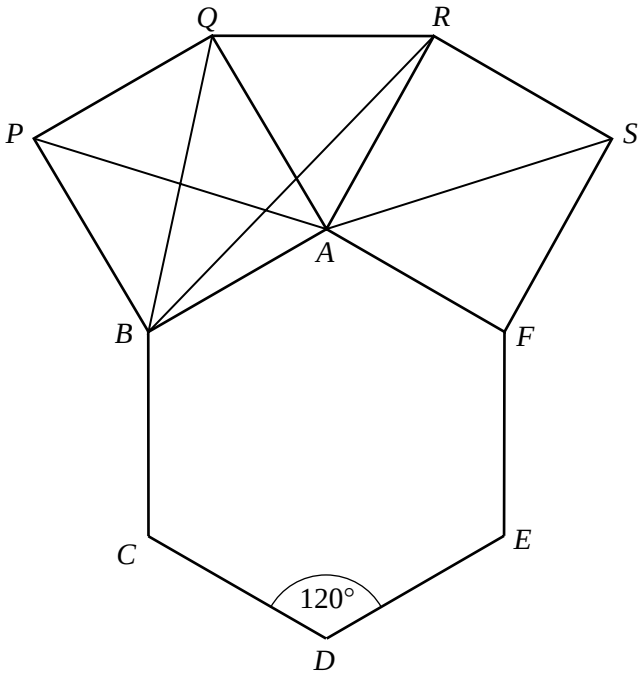
(ii) the length of TA. [3]

(b) A third straight wire, TD, joins T to a point D on the same horizontal ground.
Given that $D\hat{T}B = 51°$, find the angle of elevation of T from D. [1]

---

4 **(a)** Show that the interior angle of a regular hexagon is 120°. [2]

(b) In the diagram, $ABCDEF$ is a regular hexagon.
$ABPQ$ and $FARS$ are two squares.



(i) Calculate

(a) reflex $P\hat{B}C$, [1]

(b) obtuse $P\hat{A}S$, [2]

(c) acute $R\hat{B}A$. [2]

(ii) What is the special name given to triangle AQR? [1]

[Turn over

5 [The value of π is 3.142, correct to three decimal places.]

[The volume of a sphere is $\frac{4}{3}\pi r^3$.]

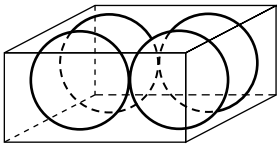


Diagram I

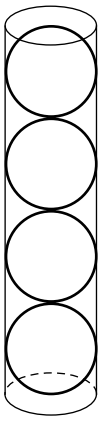


Diagram II

The diagrams show two ways of packaging 4 identical balls.
The radius of each ball is 3 cm.

Diagram I shows a closed rectangular box with a square base.
Each ball touches the top, the bottom and two sides of the box.
Each ball also touches two other balls.

Diagram II shows a closed cylinder.
The balls touch the ends and the side of the cylinder.

(a) (i) Write down the dimensions of the rectangular box. [1]

(ii) Calculate the **total** surface area of the outside of this box. [2]

(b) Calculate the **total** surface area of the outside of the cylinder. [2]

(c) Calculate the **total** volume of the 4 balls. [2]

(d) Calculate, correct to three decimal places, the value of

$$\frac{\text{volume of the cylinder}}{\text{volume of the box}}.$$ [2]

(e) Hence state which of the two containers has more space **not** occupied by the balls. [1]

6 Answer the whole of this question on a sheet of graph paper.

The masses of 80 parcels sent out by a garden centre are given in the table below.

Mass (m kilograms)	$0 < m \leqslant 2$	$2 < m \leqslant 4$	$4 < m \leqslant 6$	$6 < m \leqslant 10$	$10 < m \leqslant 15$
Frequency	12	18	20	20	10

(a) Using a scale of 1 cm to represent 1 kg, draw a horizontal axis for $0 \leqslant m \leqslant 15$.
Choose a suitable scale for the vertical axis and draw a histogram to represent this data. [3]

(b) Estimate the number of parcels which had a mass greater than 9 kg. [1]

(c) Calculate an estimate of the mean mass. [3]

(d) One parcel was chosen at random and not replaced.
A second parcel was chosen at random from the remainder.
Giving each answer as a fraction in its lowest terms, find the probability that

(i) both parcels were chosen from the $6 < m \leqslant 10$ group, [1]

(ii) one parcel was chosen from the $6 < m \leqslant 10$ group and the other parcel was **not** chosen from the $6 < m \leqslant 10$ group. [2]

[Turn over

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 **[The value of π is 3.142, correct to three decimal places.]**

Diagram I shows a sector, *ADB*, of a circle.
The centre of the circle is *C* and its radius is 6 cm.
$A\hat{C}B = 120°$.

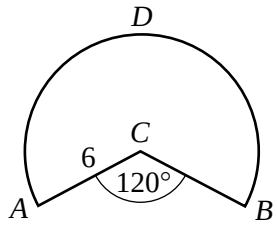


Diagram I

(a) Calculate the length of the major arc *ADB*. [2]

(b) Two tangents are drawn to touch the circle at *A* and *B*. The tangents meet at *T*, to form the shape shown in Diagram II.

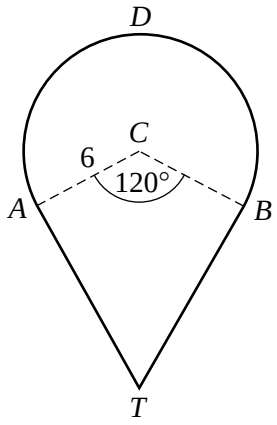


Diagram II

(i) Explain why $A\hat{T}B = 60°$. [1]

(ii) Calculate the length of *AT*. [2]

(iii) Calculate the perimeter of the shape *ADBT*. [2]

(c) Four of the shapes shown in Diagram II are arranged to form the figure shown in Diagram III.

This figure has rotational symmetry of order 4.

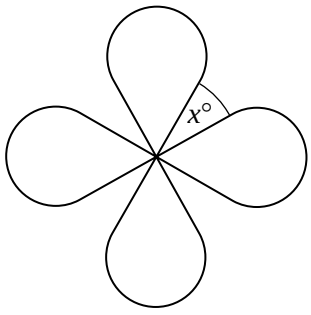


Diagram III

(i) Write down the number of lines of symmetry in this figure. [1]

(ii) Calculate the angle (marked as $x°$ in Diagram III) between each shape. [1]

(iii) Every second, the figure turns through 40° about its centre.
Calculate the time it takes to make 108 revolutions.
Give your answer in minutes and seconds. [3]

8 Answer the whole of this question on a sheet of graph paper.

The table below gives some values of x and the corresponding values of y, where

$$y = 30 - 18x + x^3.$$

x	-4	-3	-2	-1	0	1	2	3	4
y	38	57	58	47	30	13	2	3	22

(a) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $-4 \leqslant x \leqslant 4$.
Using a scale of 2 cm to represent 10 units, draw a vertical y-axis for $0 \leqslant y \leqslant 60$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]

(b) Use your graph to find

(i) the largest value of $30 - 18x + x^3$ in the interval $-4 \leqslant x \leqslant 4$, [1]

(ii) the smallest value of x for which $30 - 18x + x^3 = 50$. [1]

(c) By drawing a tangent, find the gradient of the curve when $x = 1$. [2]

(d) A is the point (0, 27) and B is the point (3, 3).

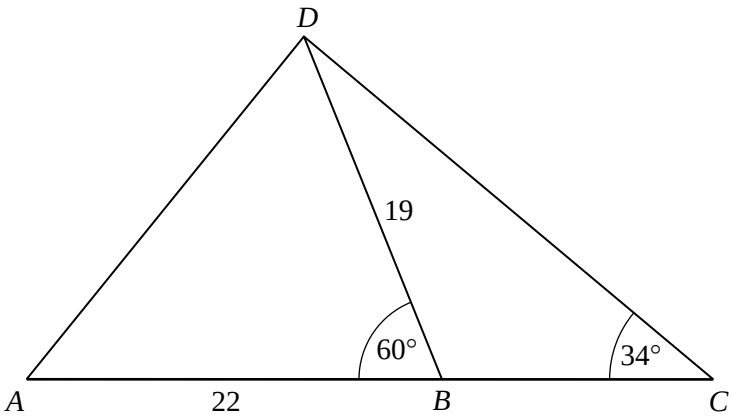
(i) Draw, on the axes used in part **(a)**, the line which passes through A and B. [1]

(ii) Find the equation of AB. [2]

(iii) The x coordinates of the points where the line AB intersects the curve are the solutions of the equation $x^3 + ax + b = 0$.
Find the value of a and the value of b. [2]

[Turn over

9



The diagram shows a straight line ABC and a point D.
$AB = 22$ cm, $BD = 19$ cm, $A\hat{B}D = 60°$ and $B\hat{C}D = 34°$.

Calculate

(a) the length of BC, [4]

(b) the length of AD, [4]

(c) the area of triangle ABD, [2]

(d) the shortest distance from B to AD. [2]

---

10 The distance between two houses, P and Q, is 200 km.
Joe travelled by car from P to Q at an average speed of x km/h.

(a) Write down an expression, in terms of x, for the number of hours he took to travel from P to Q. [1]

(b) He returned from Q to P at an average speed of $(x + 5)$ km/h.
Write down an expression, in terms of x, for the number of hours he took to travel from Q to P. [1]

(c) The **total** time he took to go from P to Q and to return from Q to P was 8 hours.

(i) Write down an equation in x and show that it simplifies to

$$x^2 - 45x - 125 = 0.$$ [4]

(ii) Solve the equation $x^2 - 45x - 125 = 0$, giving each answer correct to 2 decimal places. [4]

(iii) Calculate, correct to the nearest minute, the time he took to travel from P to Q. [2]

---

11 **(a)** $\overrightarrow{OP} = \begin{pmatrix} -9 \\ 40 \end{pmatrix}$ and $\overrightarrow{OQ} = \begin{pmatrix} 3 \\ -16 \end{pmatrix}$.

Find

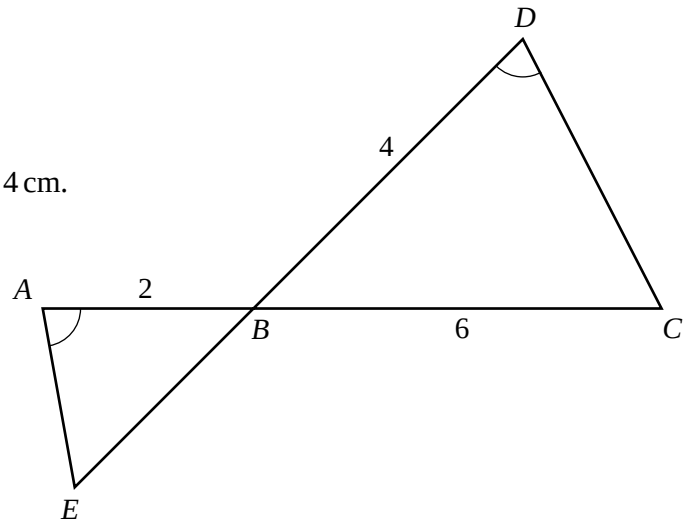
(i) $|\overrightarrow{OP}|$, [2]

(ii) $\overrightarrow{PQ}$. [1]

(b) In the diagram, ABC and EBD are two straight lines.

Angle EAB = angle CDB.

$AB = 2$ cm, $BC = 6$ cm and $BD = 4$ cm.



(i) Explain why triangle ABE is similar to triangle DBC. [1]

(ii) Explaining your working fully, show that $BE = 3$ cm. [2]

(iii) Write down, as a fraction in its lowest terms, the value of

$$\frac{\text{area of triangle } ABE}{\text{area of triangle } DBC}.$$ [1]

(iv) It is given that $\overrightarrow{AB} = \mathbf{p}$ and $\overrightarrow{DB} = \mathbf{q}$.
Express each of the following in terms of **p** and/or **q**

(a) $\overrightarrow{BC}$, [1]

(b) $\overrightarrow{BE}$, [1]

(c) $\overrightarrow{AE}$, [1]

(d) $\overrightarrow{DC}$. [1]

(v) Use your answers to parts **(iv)(c)** and **(d)** to explain why AE is **not** parallel to DC. [1]

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Centre Number	Candidate Number

Candidate Name _____

CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) 4024/1

PAPER 1 Rupee version

MAY/JUNE SESSION 2002

2 hours

Candidates answer on the question paper.
Additional materials:
Geometrical instruments

TIME 2 hours

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

If working is needed for any question it must be shown in the space below that question.

Omission of essential working will result in loss of marks.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is 80.

FOR EXAMINER'S USE

This question paper consists of 16 printed pages.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

[Turn over

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 **(a)** Calculate the value of 0.1×0.06.

(b) Find the decimal number exactly halfway between 1.01 and 1.02.

Answer *(a)* ..... [1]

(b) ..... [1]

---

2 Giving the answer as simply as possible, calculate

(a) $\frac{3}{4} - \frac{1}{3}$,

(b) $\frac{2}{5}$ of $\frac{15}{16}$.

Answer *(a)* ..... [1]

(b) ..... [1]

---

3 **(a)** Calculate the value of $9^{\frac{1}{2}} + 9^0$.

(b) The reciprocal of 2^{-3} is 2^n.
Write down the value of n.

Answer *(a)* ..... [1]

(b) n = ... [1]

---

4 **(a)** Calculate the value of $16 - 8 \div 2$.

(b) Express 0.0032 in standard form.

Answer *(a)* ..... [1]

(b) ..... [1]

---

5 Mr. Smith asked the children in his class 'What is your favourite colour?'
Their replies are given below.

Green	Blue	Green	Yellow	Blue
Green	Red	Blue	Green	Blue
Yellow	Green	Yellow	Blue	Yellow
Blue	Blue	Green	Blue	Yellow
Green	Blue	Green	Yellow	Blue

(a) By making tally marks, or otherwise, obtain the frequency distribution of the colours.

Answer (*a*)

Colour	Frequency
Green	
Blue	
Red	
Yellow	

[1]

(b) State the mode of this distribution. *Answer* *(b)* ..... [1]

---

6 *P* is the point (1, 1) and *Q* is the point (5, –2).

(a) A translation maps *P* onto *Q*.
Write down the column vector which represents this translation.

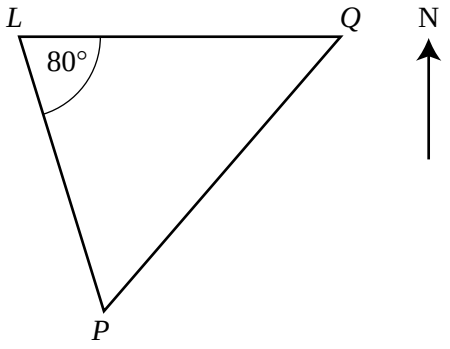
(b) Find the coordinates of the midpoint of *PQ*.

Answer *(a)* $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) (..... , ...) [1]

---

7 The diagram shows a lighthouse, L, and two ports P and Q.
Q is due east of L and $P\hat{L}Q = 80°$.
P and Q are each 10 km from L.



Find

(a) $L\hat{Q}P$,

(b) the bearing of Q from P,

(c) the bearing of L from P.

Answer (*a*) ..... [1]

(*b*) ..... [1]

(*c*) ..... [1]

---

8 Solve the simultaneous equations

$$2y = 3x - 13,$$
$$5x - 6y = 23.$$

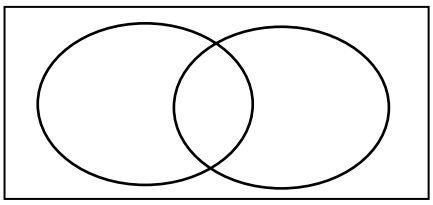
Answer x = ...

y = ... [3]

---

9 There are 50 people on a tour.
One day, 26 people went on the morning cruise and 29 to the evening barbecue.
Using Venn diagrams, or otherwise, answer the following questions.

(a) It was thought that 4 people went to both events and 1 person to neither.
Explain why this was not possible.



Answer (*a*) .....

.....[1]

(b) Find the least number and the greatest number of people who could have gone to both events.

Answer (*b*) Least number ..... [1]

Greatest number ..... [1]

---

10 Consider the sequence $1^3–2$, $2^3–4$, $3^3–6$, $4^3–8$, …. .

(a) Write down the 5^{th} term of the sequence.

(b) Write down, in terms of n, an expression for the nth term of the sequence.

(c) Evaluate the 10^{th} term of the sequence.

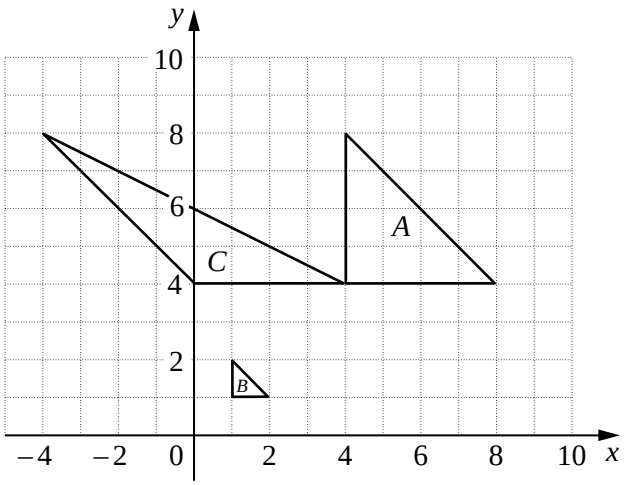
Answer (*a*) ..... [1]

(*b*) ..... [1]

(*c*) ..... [1]

---

11 The diagram shows triangles *A*, *B* and *C*.



(a) An enlargement maps triangle *A* onto triangle *B*.
Write down the scale factor of this enlargement.

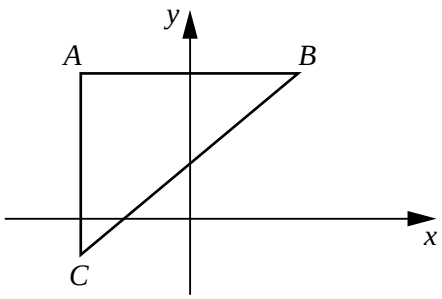
Answer (*a*) ..... [1]

(b) Describe completely the single transformation which will map triangle *A* onto triangle *C*.

Answer (*b*) .....

.....[2]

12



The triangle *ABC* has vertices *A*(–3,5), *B*(3,5) and *C*(–3,–1).
The equation of the line *BC* is $y = x + 2$.
Write down the three inequalities which define the region **inside** the triangle *ABC*.
This region **does not include** points on the boundaries.

Answer .....

.....

..... [3]

---

13 It is given that $f : x \mapsto m + nx$, where m and n are constants.
Given also that $f(0) = 1$ and $f(4) = 21$, find the value of

(a) m,

(b) n,

(c) $f^{-1}(21)$.

Answer (*a*) $m =$ ..... [1]

(*b*) $n =$ ..... [1]

(*c*) $f^{-1}(21) =$ ..... [1]

---

14 In 2000 Esther went to a tennis tournament.
Her ticket cost Rs700.
At the tournament she bought a programme costing Rs60 and an ice cream costing Rs40.

(a) This information is to be shown on a pie chart.
Calculate the angle of the sector which represents the amount she spent on ice cream.

(b) In 2001 the cost of a ticket was Rs735.
Calculate the percentage increase in the cost of a ticket.

Answer (*a*) ..... [2]

(*b*) .....% [2]

---

15 In the diagram in the answer space, *TC*, *TD* and *AB* are straight lines.

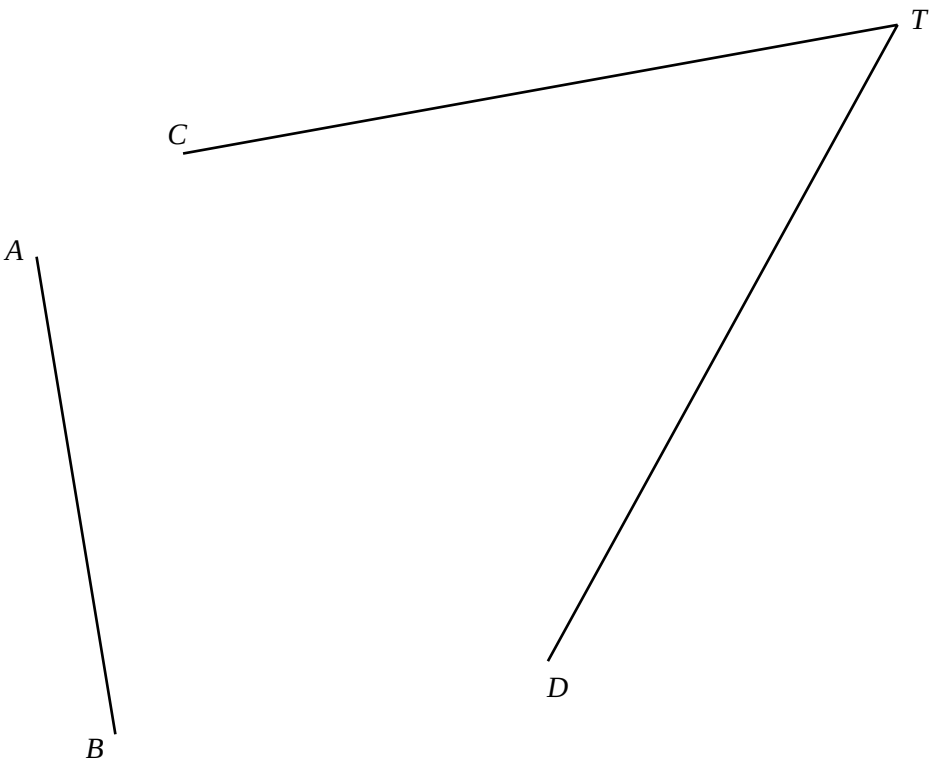
(a) Construct the locus of the points which are equidistant from *TC* and *TD*.

(b) Construct the locus of the points which are equidistant from *A* and *B*.

(c) The two loci meet at *P*.

AB is a chord of a circle, centre *P*.
Draw the circle.

Answer



[4]

16

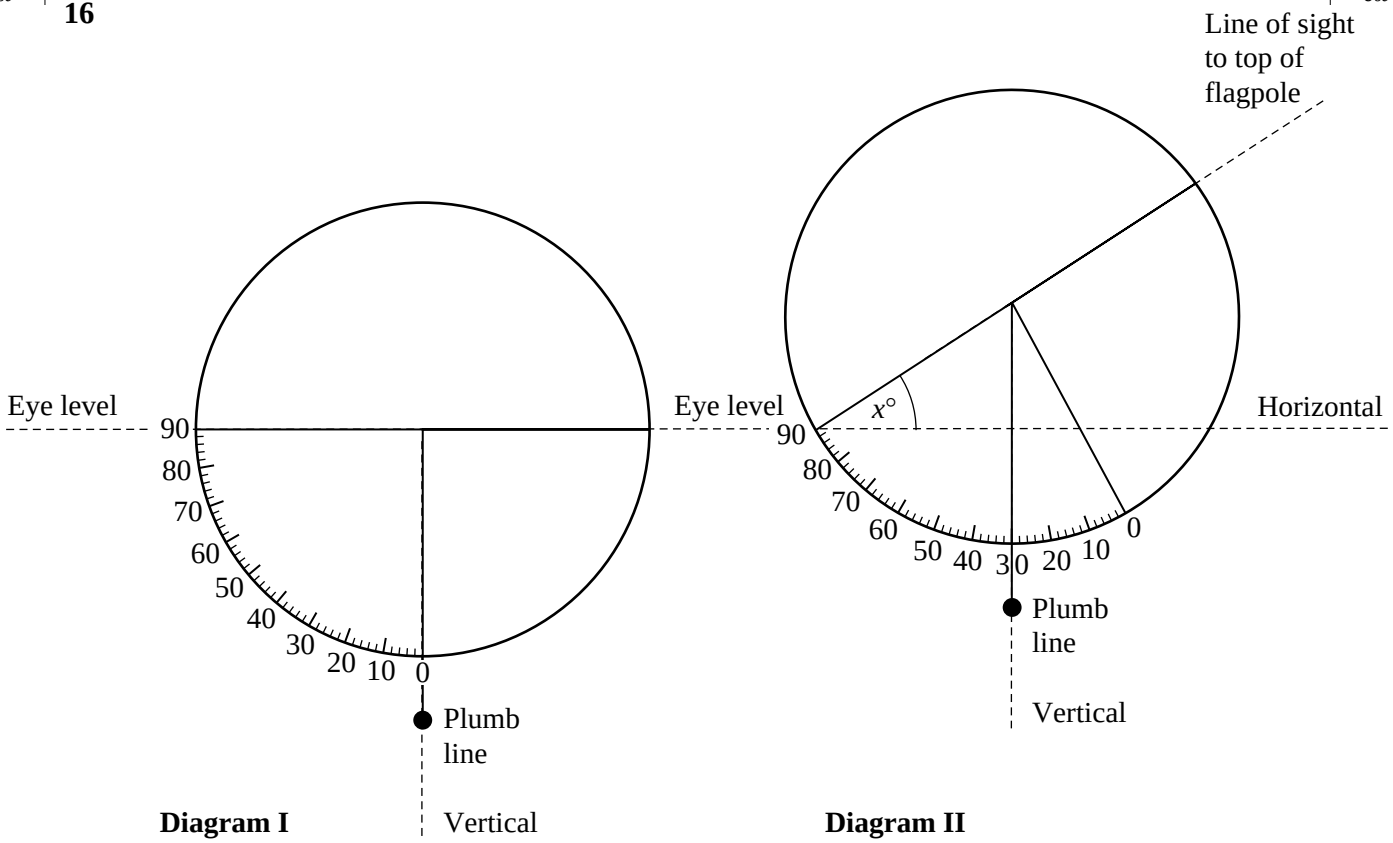


Diagram I shows a device for measuring angles in a vertical plane.
Diagram II shows the device being used by a surveyor.
He views the top of a flagpole at an angle $x°$ to the horizontal.

(a) Write down the value of x.

Answer (*a*) x = ... [1]

(b) The surveyor stands on horizontal ground 50 m from the vertical flagpole.
His eye level is 1.8 m above the ground.
Using a scale of 1 cm to 5 m, make an accurate scale drawing and use it to find the height of the flagpole.

Answer (*b*)

Height of flagpole .....m [3]

17 **(a)** Factorise completely $18rc - 3rd - 6tc + td$.

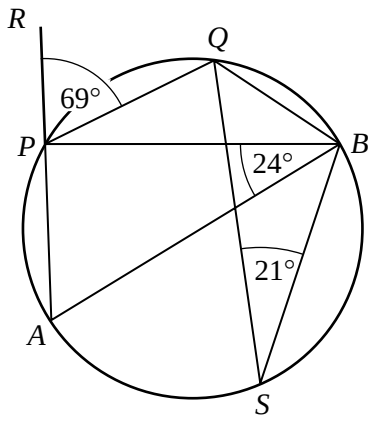
(b) Solve the equation $\frac{4}{x+3} = \frac{3}{2x}$.

Answer (*a*) ..... [2]

(*b*) x = ... [2]

---

18 The points A, P, Q, B and S lie on a circle.
AP is produced to R.
$R\hat{P}Q = 69°$, $P\hat{B}A = 24°$ and $Q\hat{S}B = 21°$.



(a) Find $Q\hat{P}B$, giving your reasons.

(b) Given that M is the midpoint of AB, find $P\hat{M}A$.
Give all your reasons.

Answer (*a*) $Q\hat{P}B$ = ... because .....

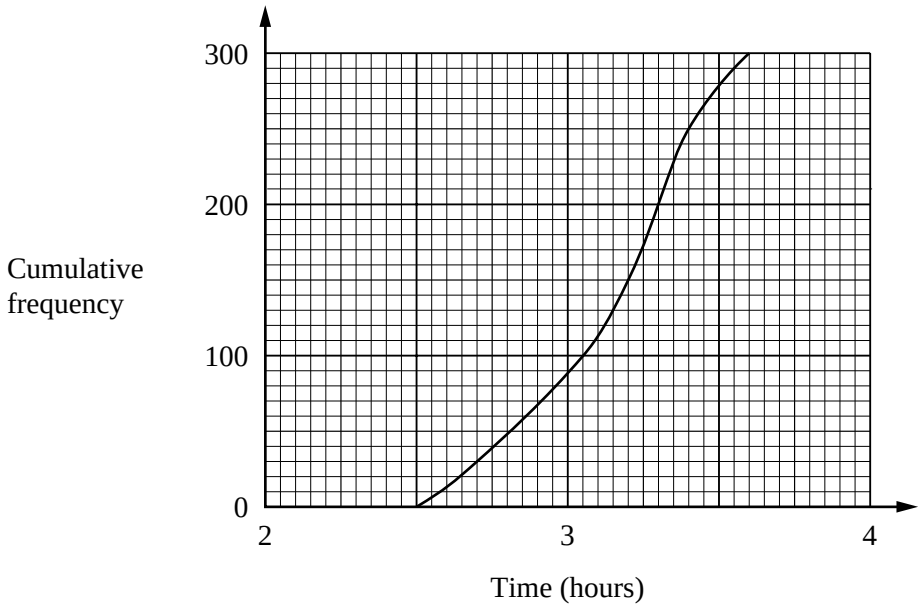
.....[1]

(*b*) $P\hat{M}A$ = ... because .....

.....[3]

---

19 The cumulative frequency curve shows the distribution of the times of 300 competitors in a women's marathon race.



Use the curve to answer the following questions.

(a) The race was won by Tegla.
Find her time, giving your answer in hours **and** minutes.

(b) Find the median time in hours **and** minutes.

(c) The qualifying time for the Olympic Games was achieved by ten percent of the runners.
The race began at 11.30.
At what time did the last qualifying athlete finish the race?
Express your answer using the 24 hour clock.

Answer (*a*) ..... h ..... min [1]

(*b*) ..... h ..... min [1]

(*c*) ..... [2]

20 V varies inversely as P.
When $P = 3$, $V = 1$.

(a) Express V in terms of P.

(b) Complete the table in the answer space.

Answer (*a*) ..... [2]

(*b*)

P	3	5	
V	1		9

[2]

---

21 Given that $S = \dfrac{RV}{3V - 1}$,

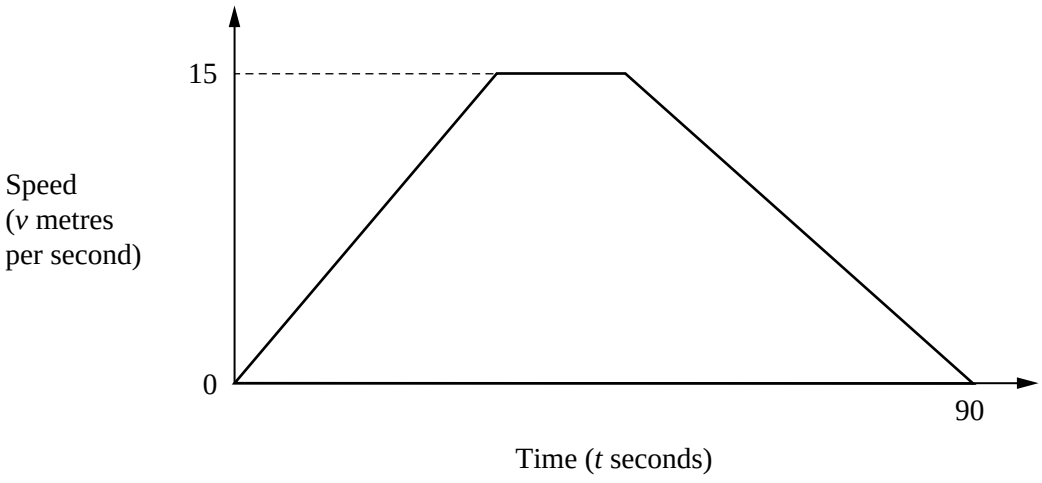
(a) calculate the value of S when $R = 100$ and $V = -13$,

(**b**) express V in terms of R and S.

Answer (*a*) S = ... [1]

(*b*) V = ... [3]

22



The diagram shows the speed – time graph of a bus over a period of 90 seconds.
The bus reaches a maximum speed of 15 metres per second.

(a) Express 15 metres per second in kilometres per hour.

(b) Given that the acceleration was $0.5\,m/s^2$, calculate the time taken, in seconds, to reach its maximum speed.

(c) The total distance travelled during the 90 seconds was 750 metres.
Calculate the length of time that the bus was travelling at its maximum speed.

Answer *(a)* ..... km/h [1]

(b) ..... s [1]

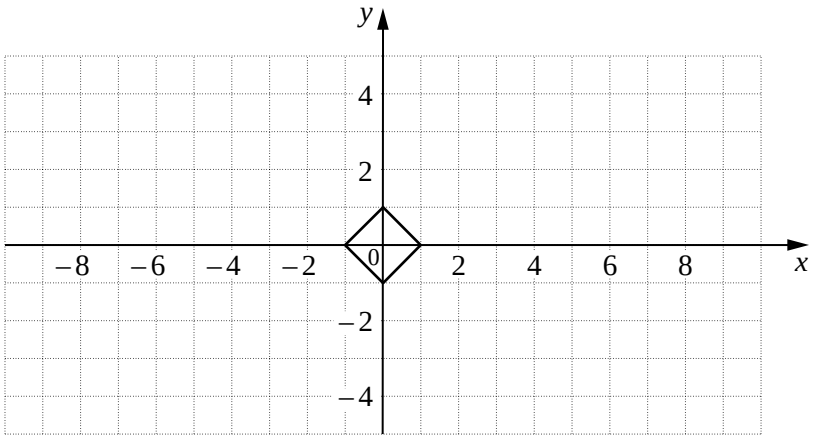
(c) ..... s [2]

23 A transformation S is represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$.

(a) The shape *A* has vertices (1,0), (0,1), (–1,0) and (0,–1).
Shape *A* is shown on the grid in the answer space.

By calculating $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & 0 & -1 \end{pmatrix}$, or otherwise, draw and label the shape S(*A*).

Answer (*a*)



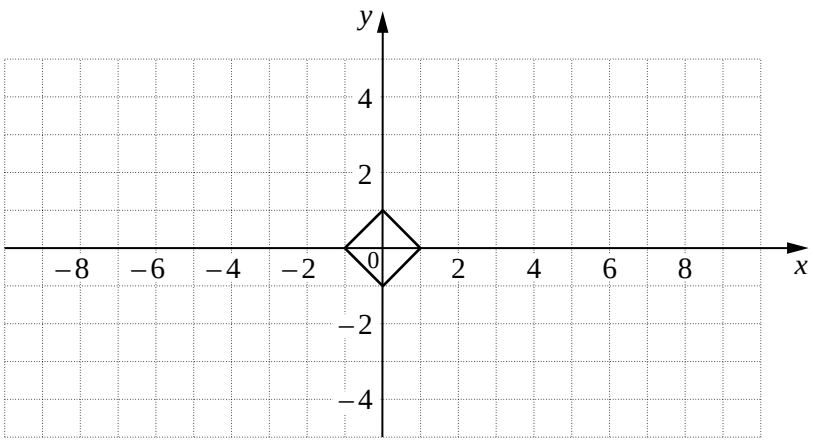
[2]

(b) Find the matrix which represents the transformation S^2.

Answer (*b*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

(c) On the grid below, draw and label $S^2(A)$.

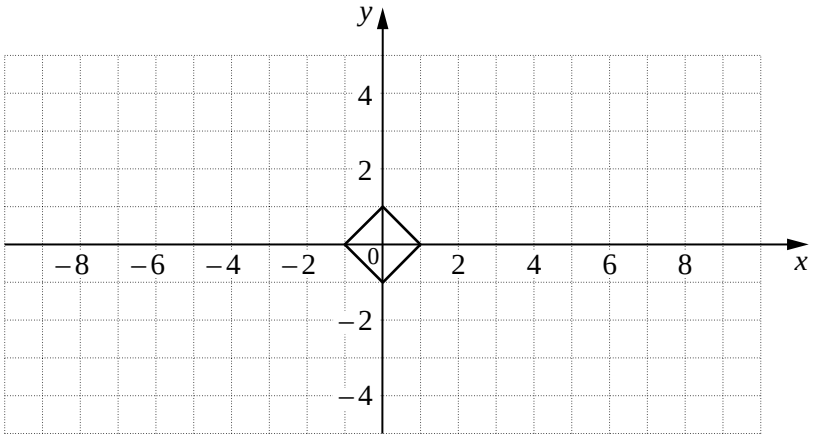
Answer (*c*)



[1]

(d) On the grid below, draw and label $S^3(A)$.

Answer (*d*)

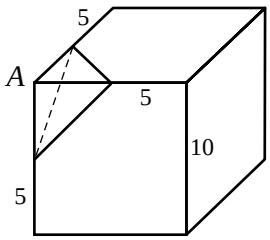


[1]

(e) Write down the matrix which represents S^n.

Answer (*e*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

24 (a)



The diagram shows a 10 cm cube.

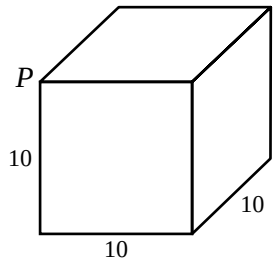
(i) A triangular pyramid is cut from the corner of the cube at *A*.
The cut is made halfway along each of the edges meeting at *A* as shown.
Calculate the volume, in cubic centimetres, of the pyramid.

[The volume of a pyramid = $\frac{1}{3}$ × area of base × height]

(ii) From another 10 cm cube, shown in the answer space, a second similar pyramid is cut from the corner at *P*.
The volume is 8 times the volume of the first pyramid.
On the diagram in the answer space, draw the lines where the cut is made.

Answer *(a)* (i) ..... cm^3 [2]

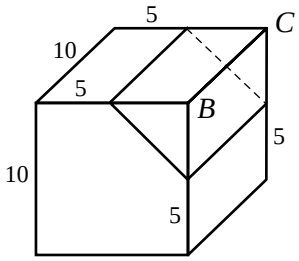
(ii)



[1]

(b) Another 10 cm cube is cut as shown.

A prism containing the corners *B* and *C* is removed.
Calculate the volume which **remains**.



Answer *(b)* ..... cm^3 [2]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/02**

Paper 2 **May/June 2008**

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (1 sheet)
Mathematical tables (optional)

5199141611

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

This document consists of **11** printed pages and **1** blank page.

Section A [52 marks]

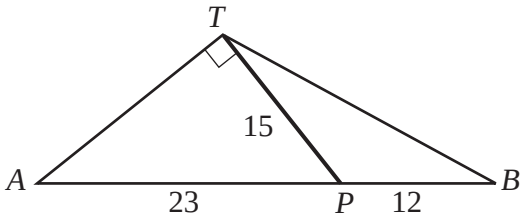
Answer **all** questions in this section.

1 **(a)** A flagpole is a cylinder of length 15 m and diameter 14 cm.

Calculate the volume of the flagpole.
Give your answer in **cubic metres**. [3]

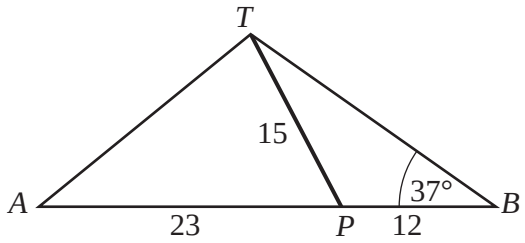
(b) The flagpole, represented by TP in the diagrams below, is hinged at the point P.
It is raised by using two ropes.
Each rope is fastened to the top of the flagpole and the ropes are held at A and B.
The points A, P, B and T are in a vertical plane with A, P and B on horizontal ground.
TP = 15 m, AP = 23 m and BP = 12 m.

(i) When $A\hat{T}P = 90°$, calculate $T\hat{P}A$.



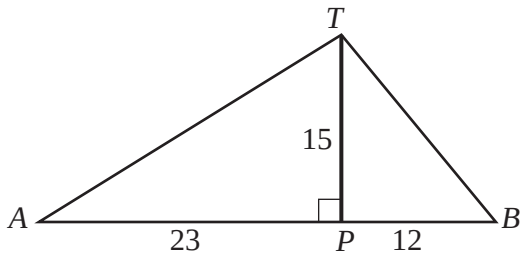
[2]

(ii) When $T\hat{B}P = 37°$, calculate $B\hat{P}T$.



[3]

(iii) When the flagpole is vertical, calculate the angle of elevation of the top of the flagpole from A.



[2]

2 **(a)** Anne's digital camera stores its images on a memory card.
The memory card has 128 units of storage space.
When 50 images were stored, there were 40 units of **unused** storage space on the memory card.

(i) Calculate the percentage of **unused** storage space on the memory card. [1]

(ii) Calculate the average amount of storage space used by each image. [2]

(b) Shop A charged 60 cents for each photograph.
Shop B charged 63 cents for each photograph and gave a discount of $1 on all purchases more than $10.

(i) Anne bought 24 photographs from Shop A and paid with a $20 note.
Calculate the change she received. [1]

(ii) Find how much cheaper it was to buy 24 photographs from Shop B than from Shop A. [2]

(iii) Find the smallest number of photographs for which it was cheaper to use Shop B. [2]

---

3 **(a)** On average, Jim's heart beats 75 times per minute.

Calculate the number of times his heart beats during 50 weeks.
Give your answer in standard form. [2]

(b) After an exercise, Ali and Ben measured their heart rates.
The ratio of their heart rates was 15 : 17.
Ben's heart beat 18 times per minute more than Ali's.

Calculate Ali's heart rate. [2]

(c) The recommended maximum heart rate, H, for a man during exercise, is given by the formula

$$H = \frac{4}{5}(220 - n),$$

where n years is the age of the man.

(i) Calculate H when $n = 25$. [1]

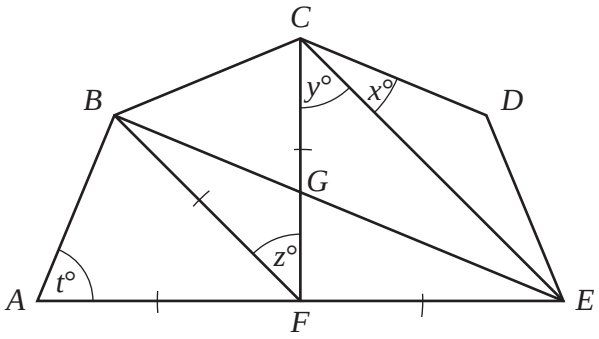
(ii) Calculate n when $H = 144$. [1]

(iii) Make n the subject of this formula. [2]

---

4 **(a)** Show that each interior angle of a regular octagon is 135°. [2]

(b)



In the diagram, *AB*, *BC*, *CD* and *DE* are four adjacent sides of a regular octagon.
FA = *FB* = *FC* = *FE*.
CF meets *BE* at *G*.

(i) Calculate

(a) *x*, [1]

(b) *y*, [1]

(c) *z*, [1]

(d) *t*. [1]

(ii) Write down the special name given to the quadrilateral *BCEF*. [1]

(iii) Given that *FC* = 10 cm, calculate *CE*. [2]

(iv) **(a)** Show that Δ*CGE* is similar to Δ*FGB*. [1]

(b) Find $\frac{\text{the area of } \Delta CGE}{\text{the area of } \Delta FGB}$. [1]

5 **(a)** Mary has 50 counters.
Some of the counters are square, the remainder are round.
There are 11 square counters that are green.
There are 15 square counters that are not green.
Of the round counters, the number that are not green is double the number that are green.

By drawing a Venn diagram, or otherwise, find the number of counters that are

(i) round, [1]

(ii) round and green, [1]

(iii) not green. [1]

(b) Tina has two fair, normal 6-sided dice. One is red and the other is blue.
She throws both of them once.
You may find it helpful to draw a possibility diagram to answer the following questions.

Find, as a fraction in its lowest terms, the probability that

(i) the red die shows a 2 and the blue die does **not** show a 2, [1]

(ii) the sum of the two numbers shown is equal to 5, [1]

(iii) one die shows a 3 and the other shows an even number. [2]

(c) Ann went on a car journey that was split into three stages.
Two relevant matrices are shown below.
The first matrix shows the average speed, in kilometres per hour, of the car during each stage.
The second matrix shows the time, in hours, taken for each stage.

$$\begin{array}{c} \\ \text{Average speed} \end{array} \begin{array}{c} \begin{array}{ccc} \text{First stage} & \text{Second stage} & \text{Third stage} \end{array} \\ \begin{pmatrix} 40 & 30 & 50 \end{pmatrix} \end{array} \qquad \begin{array}{c} \text{Time} \\ \begin{pmatrix} 1\frac{1}{2} \\ 1 \\ 2\frac{1}{2} \end{pmatrix} \end{array} \begin{array}{l} \\ \text{First stage} \\ \text{Second stage} \\ \text{Third stage} \end{array}$$

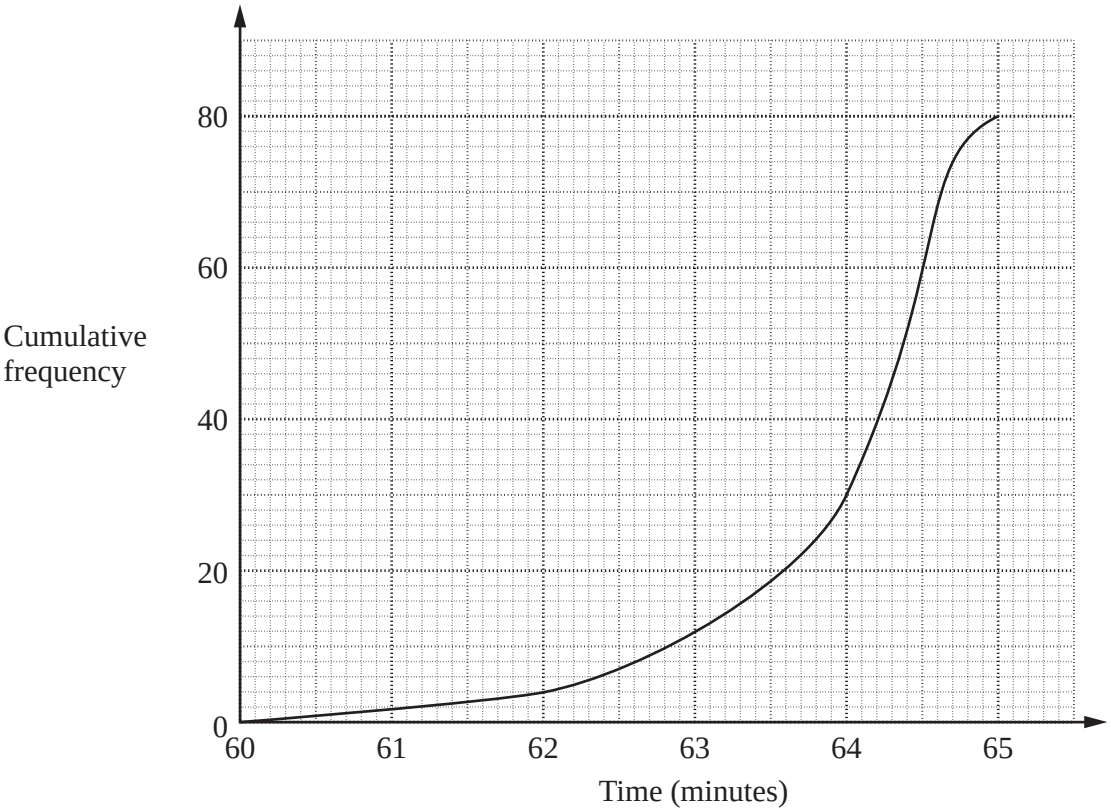
(i) Find $\begin{pmatrix} 40 & 30 & 50 \end{pmatrix} \begin{pmatrix} 1\frac{1}{2} \\ 1 \\ 2\frac{1}{2} \end{pmatrix}$. [1]

(ii) What information is given by the matrix obtained in part **(i)**? [1]

(iii) Calculate the average speed for the whole journey. [1]

6 Paul and Sam are two athletes who have training sessions together.
On 80 sessions during 2007 they ran the same route, and their times were recorded.

(a) The cumulative frequency curve shows the distribution of Paul's times.



Use the curve to estimate

(i) the median, [1]

(ii) the interquartile range, [2]

(iii) how often Paul took more than 64 minutes. [1]

(b) Sam's times had a lower quartile of 62.5 minutes, a median of 63 minutes and an upper quartile of 64 minutes.

State which athlete was the more consistent runner, giving a reason for your answer. [1]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 A, B, C, D and E are five different shaped blocks of ice stored in a refrigerated room.

(a) At 11 p.m. on Monday the cooling system failed, and the blocks started to melt.
At the end of each 24 hour period, the volume of each block was 12% less than its volume at the start of that period.

(i) Block A had a volume of 7500 cm^3 at 11 p.m. on Monday.

Calculate its volume at 11 p.m. on Wednesday. [2]

(ii) Block B had a volume of 6490 cm^3 at 11 p.m. on Tuesday.

Calculate its volume at 11 p.m. on the previous day. [2]

(iii) **Showing your working clearly**, find on which day the volume of Block C was half its volume at 11 p.m. on Monday. [2]

(b) **[The volume of a sphere is $\frac{4}{3}\pi r^3$.]**
[The surface area of a sphere is $4\pi r^2$.]

At 11 p.m. on Monday Block D was a **hemisphere** with radius 18 cm.

Calculate

(i) its volume, [2]

(ii) its **total** surface area. [2]

(c) As Block E melted, its shape was always **geometrically similar** to its original shape.
It had a volume of 5000 cm^3 when its height was 12 cm.

Calculate its height when its volume was 1080 cm^3. [2]

8 Answer the WHOLE of this question on a sheet of graph paper.

The table below shows some values of x and the corresponding values of y, correct to one decimal place, for

$$y = \tfrac{4}{5} \times 2^x.$$

x	–2	–1	0	1	2	2.5	3	3.5	4
y	p	0.4	0.8	1.6	3.2	4.5	6.4	9.1	12.8

(a) Calculate p. [1]

(b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $-2 \leqslant x \leqslant 4$.
Using a scale of 2 cm to represent 2 units, draw a vertical y-axis for $0 \leqslant y \leqslant 14$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) As x decreases, what value does y approach? [1]

(d) By drawing a tangent, find the gradient of the curve at the point (3, 6.4). [2]

(e) (i) On the axes used in part **(b)**, draw the graph of $y = 8 - 2x$. [2]

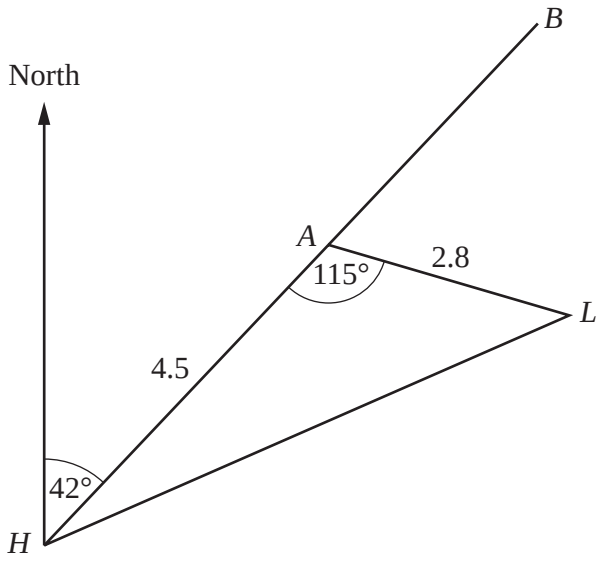
(ii) Write down the coordinates of the point where the line intersects the curve. [1]

(iii) The x coordinate of this point of intersection satisfies the equation

$$2^x = Ax + B.$$

Find the value of A and the value of B. [2]

9



The diagram shows the positions of a harbour, H, a lighthouse, L, and two buoys A and B.
HAB is a straight line.
The bearing of A from H is 042°.
$HA = 4.5$ km, $AL = 2.8$ km and $H\hat{A}L = 115°$.

(a) Find the bearing of

(i) H from A, [1]

(ii) L from A. [1]

(b) Calculate

(i) HL, [4]

(ii) the area of triangle HAL. [2]

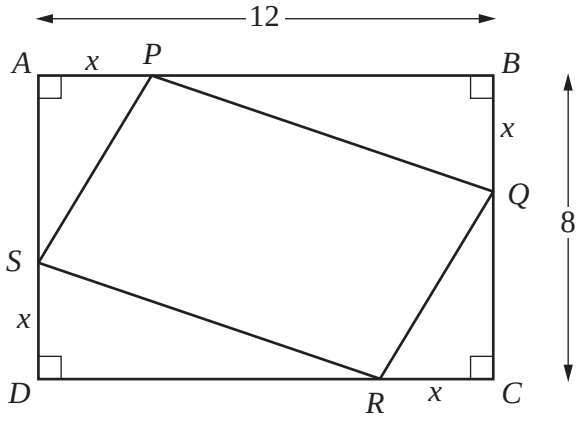
(c) A boat sailed from the harbour along the line HAB.

(i) Calculate the shortest distance between the boat and the lighthouse. [2]

(ii) The boat sailed at a constant speed of 3 m/s.

Given that the boat reached A at 07 15, find at what time it left the harbour. [2]

10



In the diagram, $ABCD$ is a rectangle.
$AB = 12$ cm and $BC = 8$ cm.
$AP = BQ = CR = DS = x$ centimetres.

(a) Find an expression, in terms of x, for

(i) the length of QC, [1]

(ii) the area of triangle CRQ. [1]

(b) Hence show that the area, in square centimetres, of the quadrilateral $PQRS$ is $2x^2 - 20x + 96$. [3]

(c) When the area of quadrilateral $PQRS$ is $60\,\text{cm}^2$, form an equation in x and show that it simplifies to

$$x^2 - 10x + 18 = 0.$$ [1]

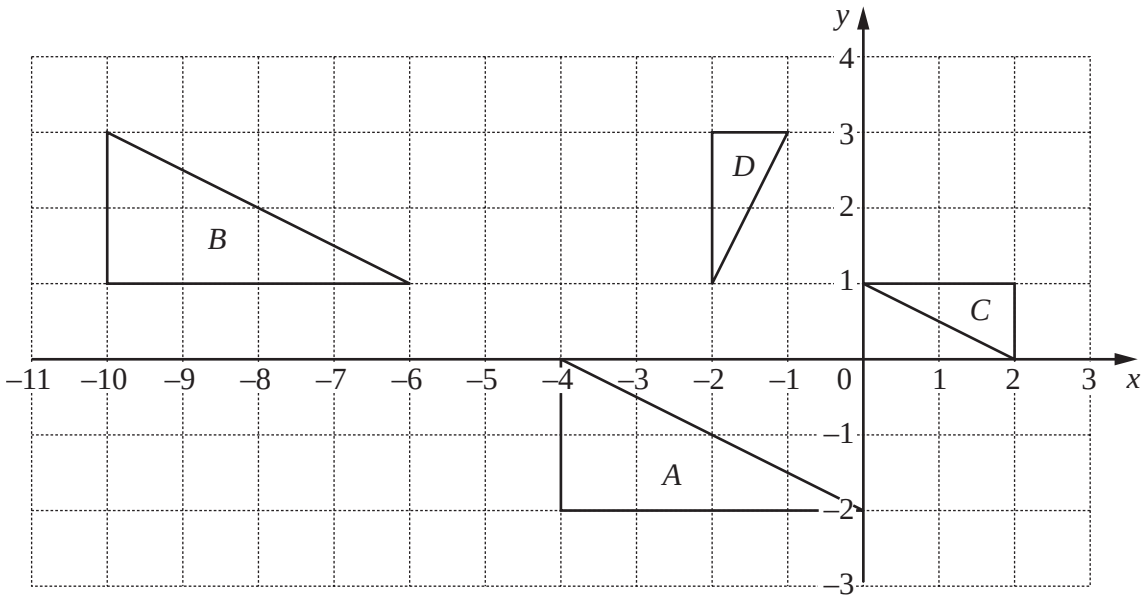
(d) Solve the equation $x^2 - 10x + 18 = 0$, giving each answer correct to 2 decimal places. [3]

(e) It is given that $2x^2 - 20x + 96 = 2(x - 5)^2 + K$.

(i) Find the value of K. [1]

(ii) Hence **write down** the smallest possible area of the quadrilateral $PQRS$ and the value of x at which it occurs. [2]

11 **(a)** The diagram shows triangles *A*, *B*, *C* and *D*.



(i) Describe fully the **single** transformation that maps ΔA onto ΔB. [2]

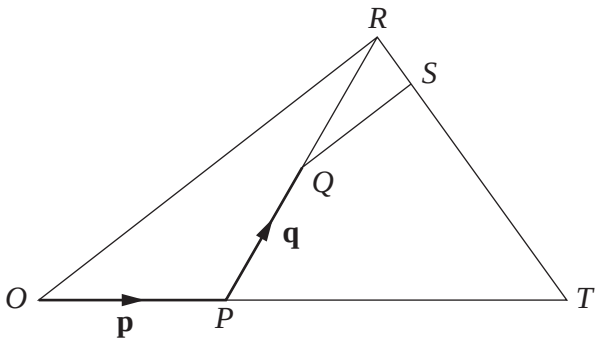
(ii) Describe fully the **single** transformation that maps ΔB onto ΔC. [2]

(iii) Describe fully the **single** transformation that maps ΔC onto ΔD. [2]

(iv) Write down the matrix that represents the transformation which maps ΔC onto ΔA. [1]

(b) In the diagram,

$OT = 3OP$, $RS = \frac{1}{6}RT$ and
Q is the midpoint of PR.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{PQ} = \mathbf{q}$.



(i) Express, as simply as possible, in terms of **p** and **q**,

(a) $\overrightarrow{OR}$, [1]

(b) $\overrightarrow{RT}$, [1]

(c) $\overrightarrow{QS}$. [2]

(ii) Write down the value of $\frac{QS}{OR}$. [1]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2934833602

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1 **May/June 2008**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

For Examiner's Use

This document consists of **14** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 Evaluate

(a) $\frac{1}{2} - \frac{3}{7}$,

(b) $2\frac{2}{3} \times 1\frac{3}{4}$.

Answer (*a*) .....[1]

(*b*) .....[1]

---

2 Evaluate

(a) 25 – 18.3,

(b) 1.7 × 0.03.

Answer (*a*) .....[1]

(*b*) .....[1]

---

3 It is given that $f(x) = 5x + 2$.

Find

(a) $f(-2)$,

(b) $f^{-1}(x)$.

Answer (*a*) .....[1]

(*b*) $f^{-1}(x)$ = ...[1]

---

4 By writing each number correct to 1 significant figure, estimate the value of

$$\frac{8.62 \times 2.04^2}{0.285}.$$

Answer .....[2]

---

5 It is given that $68.2 \times 0.235 = 16.027$.

Hence evaluate

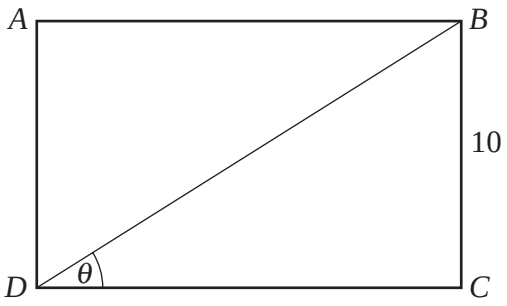
(a) 0.0682×2350,

(b) $160.27 \div 0.0235$.

Answer (*a*) .....[1]

(*b*) .....[1]

6



$\sin\theta$	$\frac{5}{13}$
$\cos\theta$	$\frac{12}{13}$
$\tan\theta$	$\frac{5}{12}$

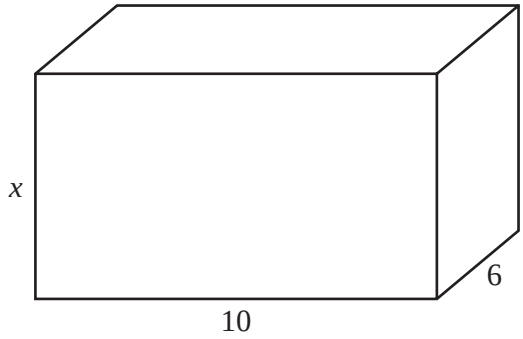
ABCD is a rectangle with *BC* = 10 cm.

Using as much information from the table as is necessary, calculate *BD*.

Answer *BD* = ... cm [2]

---

7 The diagram shows a solid cuboid with base 10 cm by 6 cm.
The height of the cuboid is x centimetres.



(a) Find an expression, in terms of x, for the total surface area of the cuboid.

(b) The total surface area of the cuboid is 376 cm^2.

Form an equation in x and solve it to find the height of the cuboid.

Answer (*a*) ..... cm^2 [1]

(*b*) ..... cm [2]

---

8 Evaluate

(a) 9^0,

(b) 9^{-2},

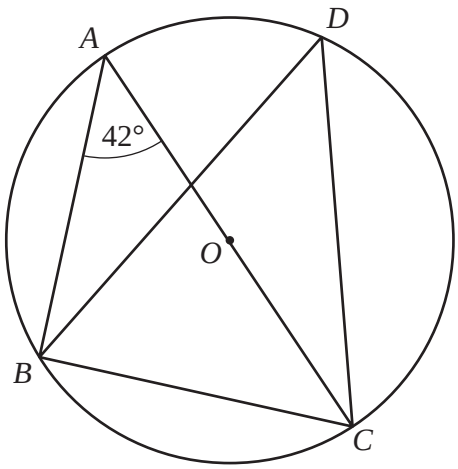
(c) $9^{\frac{3}{2}}$.

Answer (*a*) .....[1]

(*b*) .....[1]

(*c*) .....[1]

9



The diagram shows a circle, centre O, passing through A, B, C and D.
AOC is a straight line and $B\hat{A}C = 42°$.

Find

(a) $B\hat{D}C$,

(b) $A\hat{B}C$,

(c) $A\hat{C}B$.

Answer (*a*) $B\hat{D}C$ = ...[1]

(*b*) $A\hat{B}C$ = ...[1]

(*c*) $A\hat{C}B$ = ...[1]

---

10 It is given that y is directly proportional to the square of x and that $y = 1$ when $x = \frac{1}{2}$.

Find

(a) the formula for y in terms of x,

(b) the values of x when $y = 9$.

Answer (*a*) y = ...[2]

(*b*) x = ...[1]

---

11 The following list gives the names of six shapes.

Square	Rectangle	Equilateral triangle
Kite	Trapezium	Parallelogram

From this list, write down the name of the shape which always has

(a) rotational symmetry of order 3,

(b) rotational symmetry of order 2 and exactly 2 lines of symmetry,

(c) one line of symmetry only.

Answer (*a*) .....[1]

(*b*) .....[1]

(*c*) .....[1]

---

12 Solve the simultaneous equations

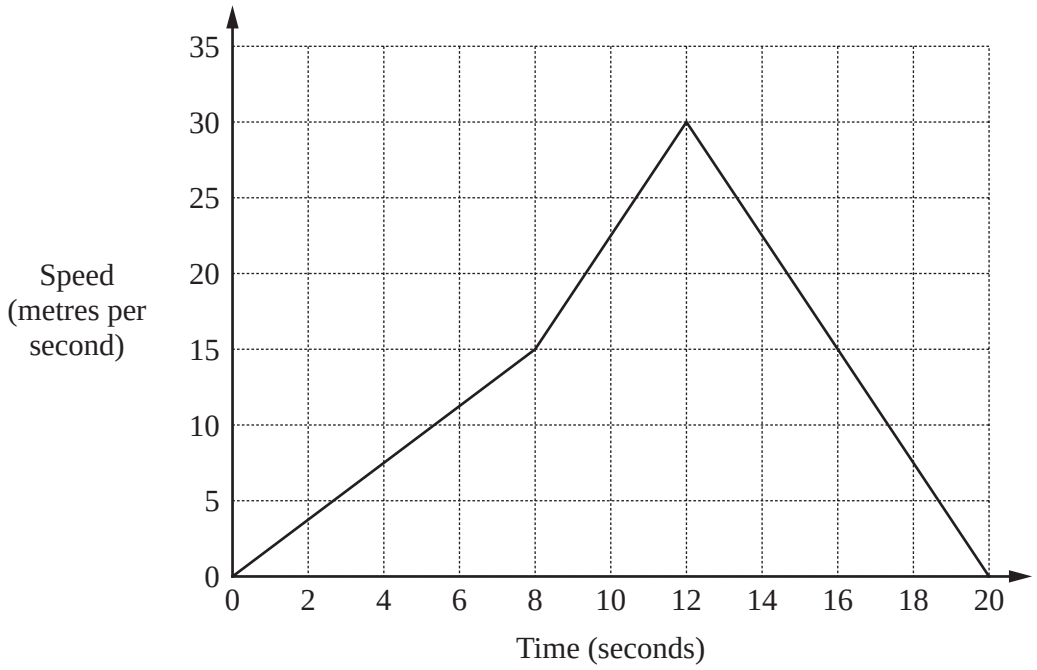
$$2x - 3y = 13,$$
$$3x + y = 3.$$

Answer $x =$ .....

$y =$ .....[3]

---

13 The diagram is the speed-time graph of the first 20 seconds of a motorcyclist's journey.



(a) Calculate the motorcyclist's retardation during the final 8 seconds.

(b) Calculate the distance travelled in the 20 seconds.

Answer (*a*) ..... m/s^2 [1]

(*b*) ..... m [2]

14 **(a)** A jar contained 370 g of jam.
Usman ate 30% of the jam.

What mass of jam remained in the jar?

(b) In 2006 the population of a town was 30 000.
This was 5000 more than the population in 1999.

Calculate the percentage increase in population.

Answer (*a*) ..... g [1]

(*b*) ..... % [2]

---

15 Express as a single fraction in its simplest form

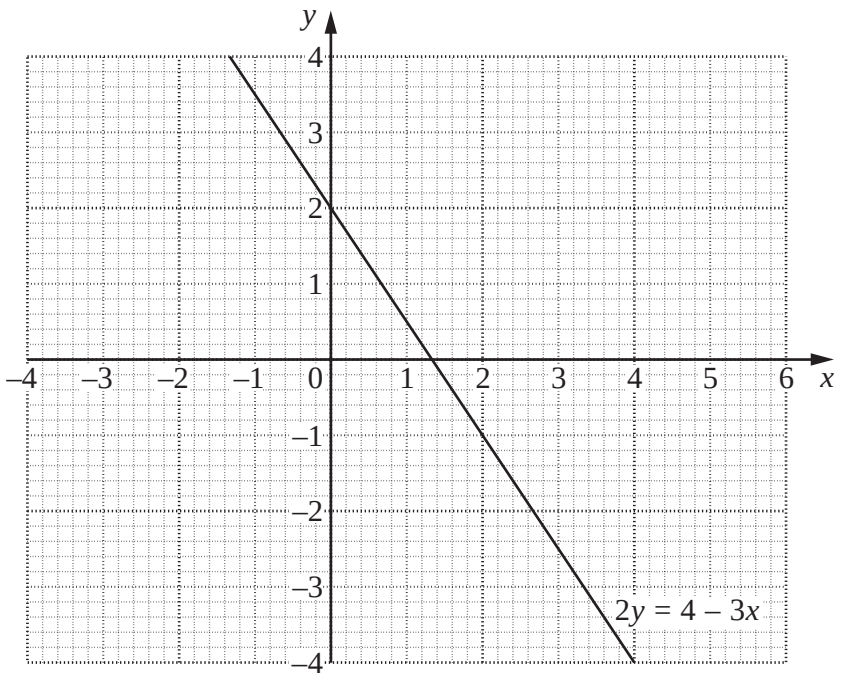
$$\frac{3}{2t-1} - \frac{2}{t+2}.$$

Answer .....[3]

---

16 The diagram below shows the line $2y = 4 - 3x$.

Answer (*a*), (*b*)



On this diagram,

(a) draw the line $y = \frac{1}{2}x - 2$, [1]

(b) shade and label the region, R, defined by the following inequalities.

$$x \geqslant 0 \qquad 2y \leqslant 4 - 3x \qquad y \geqslant \tfrac{1}{2}x - 2$$

[2]

17 A straight line passes through the points P (1, 2) and Q (5, –14).

Find

(a) the coordinates of the midpoint of PQ,

(b) the gradient of PQ,

(c) the equation of PQ.

Answer (*a*) (..... , ...) [1]

(*b*) .....[1]

(*c*) .....[2]

---

18 The Earth is 1.5×10^8 kilometres from the Sun.

(a) Mercury is 5.81×10^7 kilometres from the Sun.

How much nearer is the Sun to Mercury than to the Earth?
Give your answer in standard form.

(b) A terametre is 10^{12} metres.

Find the distance of the Earth from the Sun in terametres.

Answer (*a*) ..... km [2]

(*b*) ..... terametres [2]

---

19 **(a)** Factorise completely

(i) $15x^2 + 10x$,

(ii) $t^2 - 2t - 15$.

(b) Solve $4(x - 0.3) = 3(x - 0.2)$.

Answer (*a*)(i) .....[1]

(ii) .....[1]

(*b*) $x =$ .....[2]

---

20 It is given that

$$\mathbf{A} = \begin{pmatrix} 5 & -1 \\ 2 & 3 \end{pmatrix} \qquad \mathbf{B} = \begin{pmatrix} 2 & -2 \\ 0 & 1 \end{pmatrix} \qquad \mathbf{C} = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}.$$

Find

(a) $\mathbf{A} - 2\mathbf{B}$,

(b) $\mathbf{C}^{-1}$.

Answer (*a*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(*b*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

---

21 **(a)** Solve $8 - 3t > 14 + t$.

(b) Evaluate $x^2 - 6xy + 2y^2$ when $x = 2$ and $y = -3$.

Answer (*a*) t .....[2]

(*b*) .....[2]

---

22 **(a)** The nth term of a sequence is $7 - 2n$.

Write down the 23rd term in this sequence.

Answer (*a*) .....[1]

(b) **(i)** The first five terms of another sequence are

4 7 10 13 16.

Write down an expression, in terms of n, for the nth term of this sequence.

(ii) The first five terms of another sequence are

$$\frac{4}{1} \quad \frac{7}{4} \quad \frac{10}{9} \quad \frac{13}{16} \quad \frac{16}{25}.$$

(a) Write down the next term in this sequence.

(b) Write down an expression, in terms of n, for the nth term of this sequence.

Answer (*b*) (i) .....[1]

(*b*)(ii)(*a*) .....[1]

(*b*)(ii)(*b*) .....[1]

---

23 A map is drawn to a scale of 1 cm to 3 km.
The diagram below shows the positions of two villages *A* and *B* on the map.

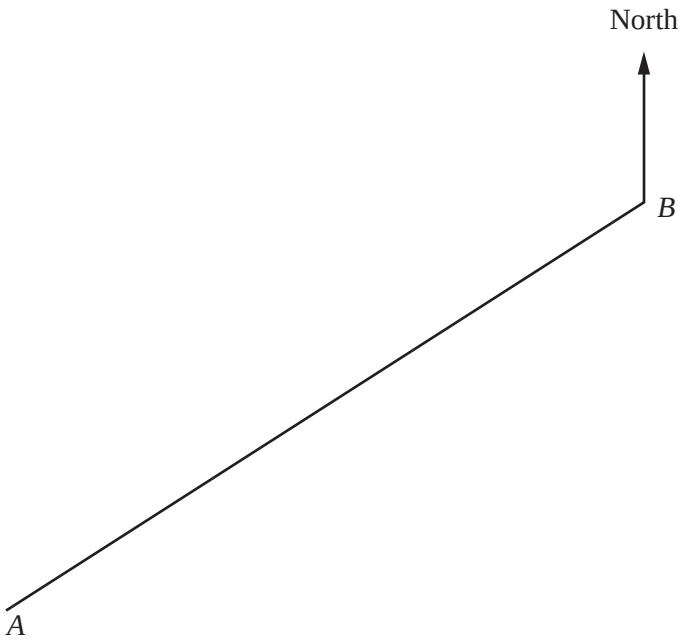
(a) **(i)** Write the scale in the form 1 : *n* .

(ii) Find the actual distance, in kilometres, between the villages *A* and *B*.

Answer (*a*)(i) 1 : .....[1]

(ii) ..... km [1]

Answer (*b*), (*c*), (*d*)



[4]

(b) A third village, *C*, lies north of the line *AB*.
It is 21 km from *A* and 18 km from *B*.

Using ruler and compasses only, construct triangle *ABC*.

(c) Construct the perpendicular bisector of *AB*.

(d) A petrol station is to be built so that it is equidistant from *A* and *B* and 9 km from *C*.

Mark with letters *F* and *G* the two possible positions of the petrol station.

24 **(a)** Fifty students were asked how many books they each took to school on Monday. The results are summarised in the table below.

Number of books	0	1	2	3	4	5	6	7
Frequency	10	11	8	3	6	7	4	1

(i) Write down the median.

(ii) Calculate the mean number of books.

(iii) What is the probability that two students, chosen at random, both took 5 books to school?
Give your answer as a fraction in its simplest form.

Answer (*a*)(i) .....[1]

(ii) .....[3]

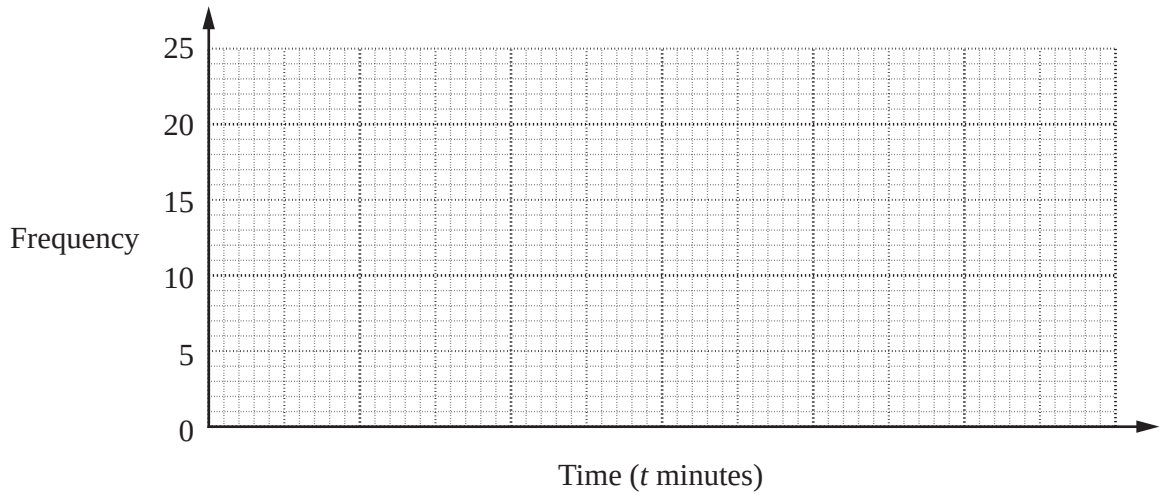
(iii) .....[2]

(b) The fifty students were also asked how long they each took to travel to school. The results are summarised in the table below.

Time of travel (t minutes)	$4 \leqslant t < 6$	$6 \leqslant t < 8$	$8 \leqslant t < 10$	$10 \leqslant t < 12$
Frequency	21	11	13	5

Draw a frequency polygon on the grid below to illustrate this data.

Answer (*b*)



[2]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2008 question paper

4024 MATHEMATICS

4024/02 Paper 2, maximum raw mark 100

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

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Type of mark

In general:

(i) 'M' marks are awarded for any correct method applied to the appropriate numbers, even though a numerical error may be involved.

a) Once earned they cannot be lost.

b) They are earned for a numerical statement which is usually explicit as regards the quantity to be found.

c) e.g. the use of a wrong formula, wrong trigonometrical ratio or misapplication of 'Pythagoras' is wrong method.

(ii) 'A' marks are awarded for a numerically correct stage, for a correct result or for an answer lying within a specified range.

a) They are given only if the relevant 'M' mark has been earned.

b) They are not given for a correct result following an error in working.

(iii) 'B' marks are independent of method and are usually awarded for an accurate result or statement.

(iv) In graph or drawing questions some marks may carry a letter (e.g. G4 for drawing the graph, Q1 for quality, L3 for drawing loci) to make their identification easier.

Abbreviations which may be used in mark schemes or in comments on scripts:

A.G.	Answer given
b.o.d.	Benefit of doubt
c.a.o.	Correct answer only
(in)dep	(In) dependent
Ex.Q.	Extra question
	Follow through
	Further error made
I.S.W.	Ignore subsequent working
M.R.	Misread
o.e.	Or equivalent
O.W.	Omission of essential working
P.A.	Premature approximation
S.C.	Special case
s.o.i.	Seen or implied
S.O.S.	See other solution
t.&e.	Trial and error
W.W.	Without working (i.e. answer only seen)
W.W.W.	Without wrong working
(£) or (°)	Condone the omission of the £ or degree sign etc.

1	**(a)**	$\pi \times (\text{fig } 7)^2 \times 15$ or figs 23 $\pi \times 0.07^2 \times 15$ or $\pi 7^2 \times 1500$ 0.23 to 0.231	**M1** **A1** **A1**	**[3]**	Condone 14/2 for M1 SC1 for $0.92 \rightarrow 0.924$
	(b) **(i)**	$\cos T\hat{P}A = \frac{15}{23}$	**M1**		For any <u>complete</u> methods allow appropriate M+ A marks
		49.29 to 49.3	**A1**	**[2]**	GRAD ANSWERS **(i)** 54.77…
	(ii)	$\frac{12}{\sin T} = \frac{15}{\sin 37}$	**M1**		**(ii)** 28.94…→
		$\sin T = \frac{12\sin 37}{15} = (28.7 - 29)$	**M1**		**(iii)** 33.97
		$B\hat{P}T = 114 - 114.22$	**A1**	**[3]**	
	(iii)	$\tan A = \frac{15}{23}$	**M1**		
		A = 33 to 33.12	**A1**	**[2]**	SC1 for 56.8 to 56.9
2	**(a)** **(i)**	31.2 to 31.3	**B1**	**[1]**	
	(ii)	$\frac{128 - 40}{50}$ o.e.	**M1**		
		1.76	**A1**	**[2]**	
	(b) **(i)**	($)5.6(0)	**B1**	**[1]**	560 (c) ✓
	(ii)	shop B ($)14.1(2) soi	**B1**		
		28(c)	**B1**	**[2]**	($)0.28 ✓
	(iii)	16	**B2**	**[2]**	SC1 for 15
3	**(a)**	$75 \times 60 \times 24 \times 7 \times 50$ or figs 378 or figs 37 or figs38	**M1**		
		3.78×10^7	**A1**	**[2]**	
	(b)	$\frac{18}{2} = \frac{x}{15}$ o.e.	**M1**		e.g. $\frac{x}{15} = \frac{18 + x}{17}$ or $\frac{x}{15} = \frac{2x + 18}{32}$
		135	**A1**	**[2]**	

(c)	**(i)**	156	**B1**		
	(ii)	40	**B1**		
	(iii)	$220-\frac{5H}{4}$ o.e. … isw	**B2**	**[4]**	SC1 for (±) $\frac{5H}{4}$ soi or any correct expression for –n
4	**(a)**	Ext. angle = $\frac{360}{8}$ or			
		Sum of int $\angle = (2.8-4)\times 90$ o.e.	**M1**		
		Correct method → 135	**A1**	**[2]**	AG
	(b) **(i)**	$x = 22\frac{1}{2}$	**B1**		
		$y = 45$	**B1**		
		$z = 45$	**B1**		
		$t = 67\frac{1}{2}$	**B1**	**[4]**	
	(ii)	Trapezium	**B1**	**[1]**	Any recognizable word.
	(iii)	CE = $\sqrt{100+100}$ or $\frac{10}{\sin/\cos 45}$	**M1**		
		= 14.1 → 14.2	**A1**	**[2]**	
	(iv) **(a)**	$y = z,\ B\hat{G}F = E\hat{G}C, (F\hat{B}G = G\hat{E}C)$	**B1**		Accept any 2.
	(b)	1.96 → 2.02	**B1**	**[2]**	Or any equivalent integer fraction.
5	**(a)** **(i)**	24	**B1**		
	(ii)	8	**B1**		
	(iii)	31	**B1**	**[3]**	
	(b) **(i)**	$\frac{5}{36}$	**B1**		
	(ii)	$\frac{1}{9}$ o.e.	**B1**		–1 once for un-simplified answers in **(b)(i), (ii), (iii)**
	(iii)	$\frac{1}{6}$ o.e.	**B2**	**[4]**	SC1 for $\frac{1}{12}$

(c)	**(i)**	(215)	**B1**		Condone 215
	(ii)	(Total) distance (travelled)	**B1**		Dep. on single element in **(c)(i)**.
	(iii)	43(km/h) ♩	**B1**	**[3]**	♩ their 215 ÷ 5, can be from 3 elements in **(c)(i).**
6 **(a)**	**(i)**	64.2	**B1**		} Accept answers correcting to any of these values
	(ii)	Either 64.5 or 63.6 0.9	**M1** **A1**		
	(iii)	50 cao	**B1**	**[4]**	
(b)		Paul – smaller IQR ♩	**B1**	**[1]**	Provided answer to **(a)(ii)** is < 1.5
7 **(a)**	**(i)**	7500×0.88^2 o.e. 5808 or 5810	**M1** **A1**	**[2]**	
	(ii)	$6490 \times \frac{100}{88}$ o.e. 7375 or 7370 or 7380	**M1** **A1**	**[2]**	
	(iii)	100, 88, 77, 68, (60, 53, 46.4) o.e. 6^{th} day or Sunday	**M1** **A1**	**[2]**	
(b)	**(i)**	$\frac{4}{3}\pi.18^3 \times \frac{1}{2}$ $12200 \rightarrow 12220$	**M1** **A1**	**[2]**	SC1 for $24400 \rightarrow 24440$
	(ii)	$2\pi 18^2 + \pi 18^2$ $3050 \rightarrow 3055$	**M1** **A1**	**[2]**	
(c)		Use of $\left(\frac{h}{12}\right)^3$ or $\left(\frac{1080}{5000}\right)^{\frac{1}{3}}$ $7.1 \rightarrow 7.3$	**M1** **A1**	**[2]**	

8	**(a)**	0.2	**B1**	**[1]**	
	(b)	Correct scales	**S1**		Condone reversed axes.
		8 correct plots (within 1mm)	**P1**		Accept if curve goes through correct point(s) [Ignore $x < -1$]
		Smooth increasing curve (not grossly thick) through at least 5 of his plots	**C1**	**[3]**	
	(c)	0	**B1**	**[1]**	
	(d)	Clear attempt at tangent (be generous)	**T1**		
		$4 \rightarrow 5$	**G1**	**[2]**	Accept integer fractions.
	(e) (i)	Straight line thro' (08)	**L1**		Produce if necessary.
		And thro' (4,0)	**L1**	**[2]**	
	(ii)	Approx (2.2, 3.6) [each coord ± 0.1]	**B1**	**[1]**	
	(iii)	$A = -2\frac{1}{2}$	**B1**		SC1 for $\frac{4}{5}2^x = 8 - 2x$ seen
		B = 10	**B1**	**[2]**	
9	**(a) (i)**	222°	**B1**		
		107°	**B1**	**[2]**	
	(b) (i)	Attempt at cosine rule	**M1**		e.g. $4.5^2 + 2.8^2 \pm (2)\ 4.5 + 2.8 \cos 115/65$
		$HL^2 = 4.5^2 + 2.8^2 - 2 \times 4.5 \times 2.8 \cos 115$	**M1**		HL can be implied by later working
		38.7 to 38.74	**A1**		
		6.2 to 6.23	**A1**	**[4]**	
	(ii)	$\frac{1}{2} \times 4.5 \times 2.8 \times \sin 115$	**M1**		Possible GRAD ANSWERS **(b) (i)** 33.77
		5.7 to 5.71	**A1**	**[2]**	5.83 **(ii)** 6.13
	(c) (i)	$\frac{\text{Area}}{2.25}$ or 2.8 sin 65	**M1**		**(c) (i)** 2.39 or 2.72
		2.53 to 2.54	**A1**	**[2]**	
	(ii)	$\frac{\text{DistHA}}{\text{Speed}} = \frac{4.5}{3}$	**M1**		
		0650 (h)	**A1**	**[2]**	6 50 (am)

10	**(a)** **(i)**	$8 - x$	**B1**		
	(ii)	$\frac{1}{2}x(8-x)$	**B1**	**[2]**	Condone omission of brackets.
	(b)	$\frac{1}{2}x(12-x)$	**B1**		Condone omission of brackets.
		$12 \times 8 - x(8-x) - x(12-x)$	**M1**		
		Correct working to $2x^2 - 20x + 96$	**A1**	**[3]**	Must see at least one step. AG
	(c)	$2x^2 - 20x + 96 = 60$ & working	**B1**	**[1]**	AG
	(d)	For numerical $\frac{p \pm \sqrt{q}}{r}$	**B1**		– ⁻10 not far enough but can be implied.
		$p = 10$ and $r = 2$			
		$\sqrt{q} = 5.29$ or $q = 28$	**B1**		
		7.65 and 2.35 or 2.36	**B1**	**[3]**	
	(e) **(i)**	$k = 46$	**B1**		
	(ii)	Area = 46 or his k	**B1**		
		$x = 5$	**B1**	**[3]**	
11	**(a)** **(i)**	Translation	**B1**		
		$\begin{pmatrix} -6 \\ 3 \end{pmatrix}$	**B1**	**[2]**	Accept in words but not (–6, 3) NB: mention of 2nd transf. loses both marks in each part
	(ii)	Enlargement	**B1**		
		SF $-\frac{1}{2}$, Centre (–2, 1)	**B1**	**[2]**	
	(iii)	Rotation	**B1**		
		90° AC o.e. Centre (–1 0)	**B1**	**[2]**	Accept +90°
	(iv)	$\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$	**B1**	**[1]**	
	(b) **(i)** **(a)**	$p + 2q$ o.e.	**B1**		–1 once for unsimplified answers.
	(b)	$2p - 2q$ o.e.	**B1**		
	(c)	$\frac{1}{3}p + \frac{2}{3}q$ o.e.	**B2**	**[4]**	SC1 for $\overrightarrow{QS} = \overrightarrow{QR} + \frac{1}{6}\overrightarrow{RT}$ o.e. soi or ans. of $-\frac{1}{3}p - \frac{2}{3}q$
	(ii)	$\frac{1}{3}$ cao	**B1**	**[1]**	Allow only if correct OR and QS seen

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2008 question paper

4024 MATHEMATICS

4024/01 Paper 1, maximum raw mark 80

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1	**(a)** $\frac{1}{14}$	1		In both parts, if answers decimal, accept fractions in working	
	(b) $4\frac{2k}{3k}$	1	2	After 0 + 0, answers 0.0714(0) to 0.07145 **and** {4.665 to 4.67(0) or $\frac{14k}{3k}$ }	C1
2	**(a)** 6.7 oe	1			
	(b) (0).051 oe	1	2		
3	**(a)** –8	1			
	(b) $\frac{x-2}{5}$ oe	1	2	Must use x	
4	100 or 120	2	2	Answer with more sig figs which rounds to this or figs 1 or 12 **or** at least 2 of 9, 2^2 and 0.3 seen	C1 M1
5	**(a)** 160.27	1		Accept 160 or 160.3	
	(b) 6820	1	2		
6	26 (cm)	2	2	$\frac{10}{\sin\theta}$ or $\frac{10\times13}{5}$ or $\sqrt{\{10^2+24^2\}}$ seen Accept $\frac{10(\sin 90)}{\sin 5/13}$ for M1	M1
			[12]		**[12]**
7	**(a)** $32x + 120$ (cm^2) oe	M1		Accept any equivalent seen anywhere	
	(b) 8 (cm)	2	3	Their **(a)** = 376 oe seen [Their **(a)** must be linear in x]	M1

8	**(a)** 1	1			
	(b) $\frac{1}{81}$	1		Accept (0).0123(0) to (0).01235	
	(c) 27	1	3	Accept ±27	
9	**(a)** (*BDC* =) 42 (°)	1		Accept all answers on the diagram if not seen in answer or working space	
	(b) (*ABC* =) 90 (°)	1			
	(c) (*ACB* =) 48 (°) **or** 138 – their (b) ft√	1	3	ft√ only allowed if $0° < ACB \leqslant 96°$	
10	**(a)** $y = 4x^2$ **or** $y = kx^2$ with $k = 4$ seen anywhere	2		$4x^2$ seen M1 **or** $y = kx^2$ seen M1	
	(b) $\frac{3}{2}$ and $-\frac{3}{2}$ oe www cao	1	3	Both required	
			[12]		**[12]**
11	**(a)** Equilateral triangle	1		Accept either word alone	
	(b) Rectangle	1			
	(c) Kite	1	3		
12	$x = 2$ **and** $y = –3$	3	3	One correct **with supporting working** C2 **or** correct method to eliminate one variable condoning one arithmetic slip M1 [reaching such as $11x = k$, $kx = 22$, $11y = k$ or $ky = (–)33$]	
13	**(a)** 3.75 or $3\frac{3}{4}$ or $\frac{30}{8}$ (m/s^2) oe	1		Accept –3.75 etc.	
	(b) 270 (m)	2	3	Correct method to find complete area under graph M1	
			[9]		**[9]**

14 **(a)** 259 (g) — 1

(b) 20 (%) — 2 — 3 — 120, $16\frac{2}{3}$ or 16.6 to 16.7 oe — C1

or fig ($\frac{5}{25}$ (× 100)) — M1

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15 **Final answer** $\frac{8-t}{(2t-1)(t+2)}$ oe — 3 — 3 — $8 - t$ **and** $(2t - 1)(t + 2)$ or $2t^2 + 3t - 2$ — M2

seen in single fraction, not necessarily together
or $3(t + 2) - 2(2t - 1)$ seen in single fraction with quadratic denominator — M1
[condoning missing brackets]

---

16 **(a)** Ruled line from (0, –2) to (2, –1) drawn — 1 — Allow tolerance of ½ small square

(b) Correct region shaded **and** labelled **R**
Allow √ft if line wrong if possible — 2√ — 3 — Accept shaded in or out if R correct
or Shaded in or out, without R — C1
Allow C1 √ft if line wrong if possible
If no line, shading with R marked to right of C1
$x = 0$, below $2y = 4 - 3x$, not bounded by $y = 0$

[9] **[9]**

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17 **(a)** (3, –6) — 1

(b) –4 — 1 — Accept equivalents, such as $\frac{-16}{4}$ or $\frac{16}{-4}$

(c) $y = -4x + 6$ or 3 term equivalent
Accept $y = -4x + c$ with $c = 6$ seen — 2 — 4 — 3 term line of gradient their **(b) or** which passes through (1, 2) or (5, –14) — C1
$-4x + 6$ alone — C1

---

18 **(a)** 9.19×10^7 (km) — 2 — Accept $9(\text{or } 9.2) \times 10^7$
Correct answer not in standard form — C1
or 150 000 000 – 58 100 000
or $15 \times 10^7 - 5.81 \times 10^7$ seen — M1

(b) (0).15, $\frac{15}{100}$ or $\frac{3}{20}$ (terametres) — 2 — 4 — $1.5 \times 10^8 \times 10^3 / 10^{12}$ seen — M1

1.5×10^{-4} oe seen — S C1

19	**(a)** **(i)** $5x(3x + 2)$	1		In both parts, ignore extra brackets, condone missing outside brackets If only solutions, accept factors in working		
	(ii) $(t + 3)(t – 5)$	1				
	(b) (0).6 oe	2	4	$4x – 1.2 = 3x – 0.6$ oe, or better seen		M1
20	**(a)** $\begin{pmatrix} 1 & 3 \\ 2 & 1 \end{pmatrix}$	2		At least 2 correct elements		C1
	(b) $\frac{1}{5}\begin{pmatrix} 4 & -1 \\ -3 & 2 \end{pmatrix}$ oe	2	4	$\frac{1}{5}$ soi **or** $\begin{pmatrix} 4 & -1 \\ -3 & 2 \end{pmatrix}$ soi		C1
			[16]			**[16]**
21	**(a)** $(t) < –1.5, –1\frac{1}{2}$ or $-\frac{3}{2}$ oe (e.g. $-\frac{6}{4}$)	2		$t > –1.5$ **or** $–1.5$ alone		C1
				or $–6 > 4t$ oe or better seen		M1
	(b) 58	2	4	At least two of +4, +36 and +18 seen		M1
22	**(a)** –39	1				
	(b) **(i)** $3n + 1$ or **any** equivalent	1				
	(ii) **(a)** $\frac{19}{36}$	1				
	(b) $\frac{3n+1}{n^2}$ or $\frac{\text{their (b)(i)}}{n^2}$	1	4			

23 **(a)** **(i)** (1 :) 300 000 — 1

(ii) 30 (km) — 1 — Accept answers in range 29.5 to 30.5

(b) Correct triangle drawn with sides 7 (± 0.2) and 6 (±0.2) cm, arcs visible — 2
No arcs seen, sides in wrong order and/or sides ± 0.4 cm and/or *AC*, *BC* not joined — C1
If *C* on wrong side of *AB*, otherwise correct — C1

(c) Perpendicular bisector of *AB* drawn — 1 — Within 0.2 cm of centre of *AB* and within 2° of perp
Minimum length 5 cm

(d) *F* and *G* marked correctly ft — 1 — 6 — Each to be 3 (±0.2) cm from *C* on attempt at perp bisector, even if *C* is below *AB*

[14] **[14]**

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24 **(a)** **(i)** 2 — 1

(ii) 2.52, $2\frac{13}{25}$ or $2\frac{26}{50}$ www — 3
2.52 oe or 2.5 seen www
or such as $\frac{126}{50}$ seen — M2
or $\frac{(0\times10)+1\times11+2\times8+3\times3+...}{10+11+8+3+...}$ — M1
(condoning one error)

(iii) $\frac{3k}{175k}$ oe — 2
$\frac{7}{50}\times\frac{6}{49}$ or $\frac{7}{50}\times\frac{6}{50}$ or better seen — M1

(b) Ignore any block diagrams and outside the range $5 \leqslant t \leqslant 11$
Plots at heights 21, 11, 13 and 5 joined with straight lines — 1 — (Accept 10½, 5½, 6½ and 2½)

Time axis scaled and plots at 5, 7, 9 and 11 — 1 — 8 — independent

[8] **[8]**

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/02**

Paper 2 **May/June 2007**

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (1 sheet)
Mathematical tables (optional)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

SP (SLM/KS) T28376/3

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

Section A [52 marks]

Answer **all** questions in this section.

1 **(a)** The table shows the fares charged by a taxi company.

\$1.20 per kilometre for the first 10 km then 80 cents for each additional kilometre after the first 10 km

(i) Calculate the fare for a journey of

(a) 8 km, [1]

(b) 24 km. [1]

(ii) Find the length of the journey for which the fare was \$16. [2]

(b) The table gives the times of high tides at a harbour.

Date	May 5	May 6	May 7
Times	10 00	11 20	00 36
	22 56		12 50

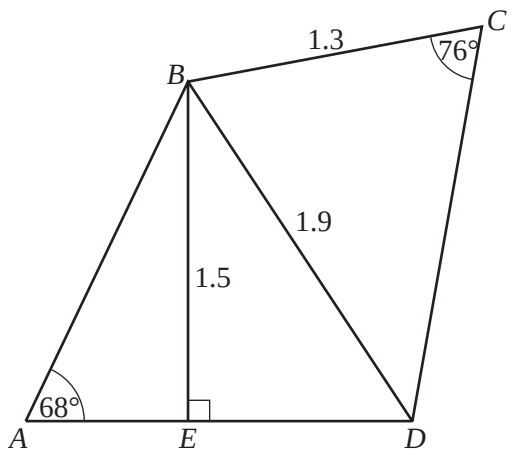
(i) Calculate, in hours and minutes, the length of time between the high tide on May 6 and the morning high tide on May 7. [1]

(ii) Given that low tides occurred midway between high tides, calculate the time of the low tide on the afternoon of May 5. [2]

(c) The height of a mountain is 1800 metres.
It is suggested that this mountain has been worn away at an average rate of 0.15 mm per year.
Assuming that the suggestion is correct, calculate the height of the mountain 20 million years ago. [2]

2 The diagram represents a framework.

$BC = 1.3\,\text{m}$, $BD = 1.9\,\text{m}$ and $BE = 1.5\,\text{m}$.
$B\hat{C}D = 76°$, $B\hat{A}E = 68°$ and $B\hat{E}D = 90°$.



Calculate

(a) $D\hat{B}E$, [2]

(b) AE, [2]

(c) $B\hat{D}C$. [3]

---

3 **(a)** Express as a single fraction in its simplest form $\frac{7}{6a} - \frac{5}{9a}$. [2]

(b) Simplify $3b(b - 1) - 2(b - 2)(b + 2)$. [2]

(c) The nth term of a sequence, S, is $n^3 + 2$.
The first four terms are 3, 10, 29 and 66.

(i) Find the fifth term of S. [1]

(ii) The first four terms of another sequence, T, are 4, 12, 32 and 70.
By comparing S and T, write down

(a) the fifth term of T, [1]

(b) an expression, in terms of n, for the nth term of T. [1]

(d) On Monday, two girls, Jane and Susan, collected some seashells.
Jane collected x shells and Susan collected 22 **more** than Jane.
On Tuesday, Susan gave 60 of her shells to Jane.
The table shows the numbers of shells each girl had on the two days.

	Jane	Susan
Monday	x	$x + 22$
Tuesday	$x + 60$	y

(i) Write down an expression for y in terms of x. [1]

(ii) Given that, on Tuesday, Jane had three times as many shells as Susan,

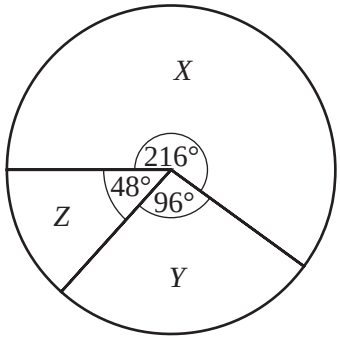
(a) write down and solve an equation in x, [2]

(b) find the total number of shells the girls collected. [1]

---

4 **(a)** In a survey, some students were asked which of three pictures, labelled *X*, *Y* and *Z*, they preferred.

The results are represented in the pie chart.



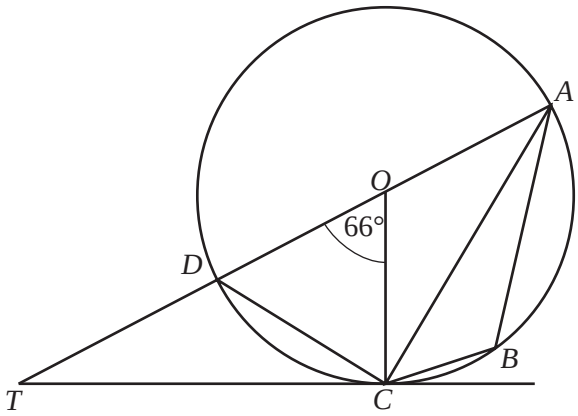
(i) Calculate the percentage of students who preferred *X*. [1]

(ii) Find, **in its simplest form**, the ratio of the number of students who preferred *X* to those who preferred *Y*.

Give your answer in the form $m : n$, where m and n are integers. [1]

(iii) Given that 44 students preferred *Y*, calculate the number of students who took part in the survey. [2]

(b) In the diagram, *A*, *B*, *C* and *D* lie on a circle centre *O*.



The tangent to the circle at *C* meets the diameter *AD* produced, at *T*.

$D\hat{O}C = 66°$.

Calculate

(i) $D\hat{A}C$, [1]

(ii) $D\hat{T}C$, [1]

(iii) $A\hat{D}C$, [1]

(iv) $A\hat{B}C$. [1]

5 Emma noted the number of letters in each of the 25 words in an examination question.
The results are given in the table below.

Number of letters	2	3	4	5	6	7	8
Frequency	2	6	5	5	4	0	3

(a) For this distribution,

(i) write down the mode, [1]

(ii) find the median, [1]

(iii) calculate the mean. [2]

(b) Emma chose one word, at random, from the 25 words.

Find the probability that this word had

(i) 5 or 6 letters, [1]

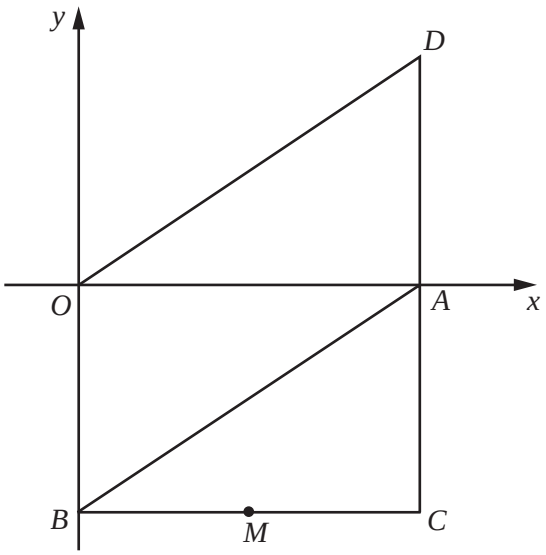
(ii) fewer than 9 letters. [1]

(c) Peter chose one word, at random, from the 25 words.
He then chose a second word, at random, from the remaining words.
Expressing each answer as a fraction in its lowest terms, find the probability that

(i) both words had 6 letters, [1]

(ii) one word had 2 letters and the other had 4 letters. [2]

6



In the diagram, A is the point (6, 0) and B is the point (0, −4).
$OACB$ is a rectangle and M is the midpoint of BC.
$\overrightarrow{CA} = \overrightarrow{AD}$.

(a) Describe, fully, the symmetry of quadrilateral $ODAB$. [2]

(b) Express as column vectors

(i) $\overrightarrow{CD}$, [1]

(ii) $\overrightarrow{OC}$, [1]

(iii) $\overrightarrow{DO}$. [1]

(c) What type of triangle is OCD? [1]

(d) The transformation P maps the rectangle $OBCA$ onto the quadrilateral $OBAD$.
It also maps M onto M'.

(i) Write down the coordinates of M'. [1]

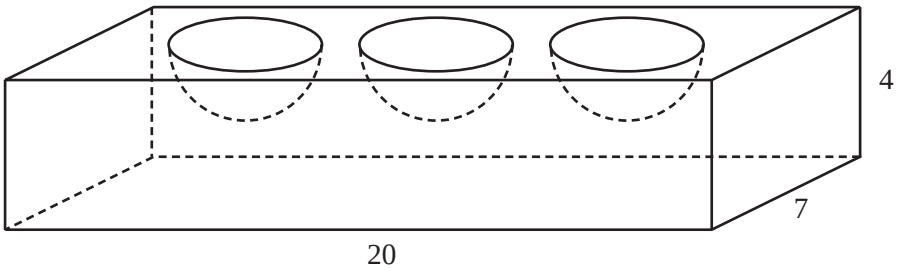
(ii) Identify the transformation P. [1]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 **(a)** **[The volume of a sphere is $\frac{4}{3}\pi r^3$.]**
[The surface area of a sphere is $4\pi r^2$.]



A wooden cuboid has length 20 cm, width 7 cm and height 4 cm.
Three **hemispheres**, each of radius 2.5 cm, are hollowed out of the top of the cuboid, to leave the block as shown in the diagram.

(i) Calculate the volume of wood in the block. [3]

(ii) The four vertical sides are painted blue.
Calculate the total area that is painted blue. [1]

(iii) The inside of each **hemispherical** hollow is painted white.
The flat part of the top of the block is painted red.
Calculate the total area that is painted

(a) white, [2]

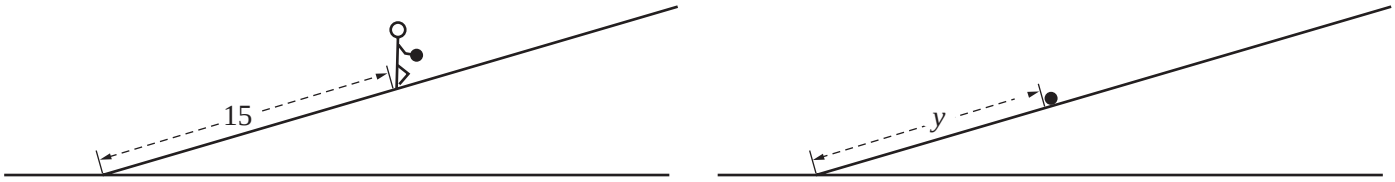
(b) red. [2]

(b) The volume of water in a container is directly proportional to the cube of its depth.
When the depth is 12 cm, the volume is 576 cm^3.
Calculate

(i) the volume when the depth is 6 cm, [2]

(ii) the depth when the volume is 1300 cm^3. [2]

8 Answer the whole of this question on a sheet of graph paper.



Adam stood on a slope, 15 m from the bottom.
He rolled a heavy ball directly up the slope.
After t seconds the ball was y metres from the bottom of the slope.
The table below gives some values of t and the corresponding values of y.

t	0	1	2	2.5	3	3.5	4	4.5	5	5.5
y	15	22	25	25	24	22	19	15	10	4

(a) Using a scale of 2 cm to represent 1 unit, draw a horizontal t-axis for $0 \leqslant t \leqslant 6$.

Using a scale of 2 cm to represent 5 units, draw a vertical y-axis for $0 \leqslant y \leqslant 30$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(b) Extend the curve to find the value of t when the ball reached the bottom of the slope. [1]

(c) (i) By drawing a tangent, find the gradient of the curve when $t = 3.5$. [2]

(ii) State briefly what this gradient represents. [1]

(d) Immediately after he rolled the ball, Adam ran down the slope at a constant speed of 1.5 m/s.

(i) Write down the distance of Adam from the bottom of the slope when

(a) $t = 0$,

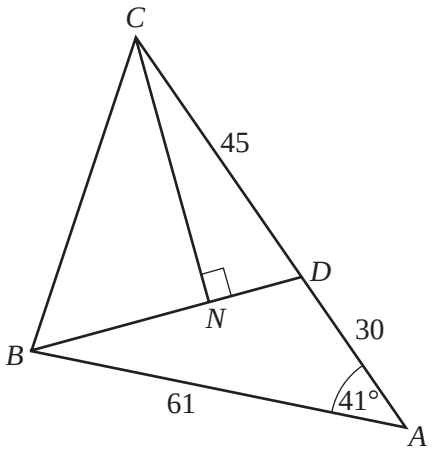
(b) $t = 4$. [2]

(ii) On the same axes, draw the graph that represents the distance of Adam from the bottom of the slope for $0 \leqslant t \leqslant 6$. [2]

(iii) Hence find the distance of Adam from the bottom of the slope when the ball passed him. [1]

9

Diagram I



In Diagram I, the point D lies on AC and N is the foot of the perpendicular from C to BD.
$AB = 61\,\text{m}$, $AD = 30\,\text{m}$ and $DC = 45\,\text{m}$.
Angle $BAC = 41°$.

(a) Calculate BD. [4]

(b) Show that, correct to the nearest square metre, the area of triangle BDA is $600\,\text{m}^2$. [2]

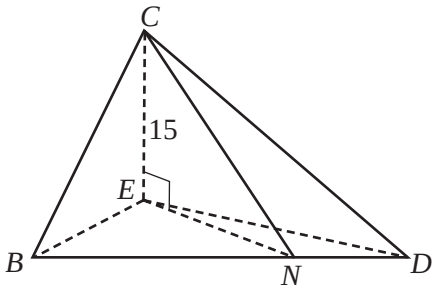
(c) Explain why $\dfrac{\text{area of } \Delta BCD}{\text{area of } \Delta BDA} = \dfrac{3}{2}$. [1]

(d) Calculate the area of triangle BCD. [1]

(e) Hence calculate CN. [2]

(f)

Diagram II



The same points B, C, D and N lie on a sloping plane.
The point E is 15 m vertically below C.
The points B, E, D and N lie on a horizontal plane.
Diagram II represents this information.
Calculate the angle of elevation of C from N. [2]

10 It is given that $y = \frac{3x^2 - 12}{5}$.

(a) Find y when $x = -3$. [1]

(b) Find the values of x when $y = 0$. [2]

(c) For values of x in the range $-3 \leqslant x \leqslant 2$, write down

(i) the largest value of y, [1]

(ii) the smallest value of y. [1]

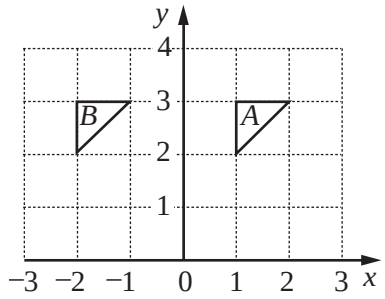
(d) Express x in terms of y. [2]

(e) It is also given that $y = \frac{t - 3}{2}$ when $x = t$.

(i) Show that t satisfies the equation $6t^2 - 5t - 9 = 0$. [1]

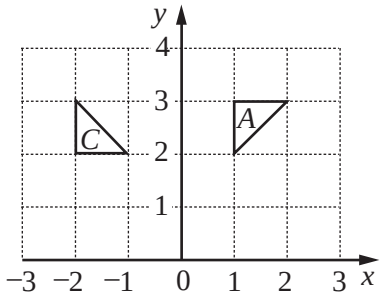
(ii) Solve the equation $6t^2 - 5t - 9 = 0$, giving each answer correct to **two significant figures**. [4]

11 **(a)** The diagrams show triangles *A*, *B*, *C* and *D*.



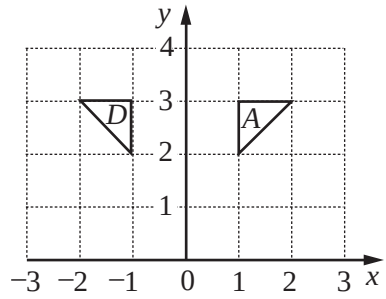
(i) The single transformation P maps Δ*A* onto Δ*B*.

Describe, fully, the transformation P. [2]



(ii) The single transformation Q maps Δ*A* onto Δ*C*.

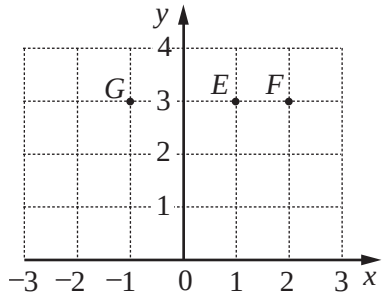
Describe, fully, the transformation Q. [2]



(iii) The reflection R maps Δ*A* onto Δ*D*.

Find the matrix that represents the reflection R. [2]

(b) The diagram shows the points *E* (1, 3), *F* (2, 3) and *G* (–1, 3). An enlargement, centre *E*, maps *F* onto *G*.



Write down

(i) the scale factor, [1]

(ii) the coordinates of the image of (0, 4). [1]

(c) $\mathbf{M} = \begin{pmatrix} -1 & 3 \\ -2 & 4 \end{pmatrix}$

(i) Find the determinant of **M**. [1]

(ii) Write down the inverse of **M**. [1]

(iii) Find the matrix **X**, where $\mathbf{MX} = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$. [2]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1 **May/June 2007**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

For Examiner's Use

This document consists of **15** printed pages and **1** blank page.

UNIVERSITY of CAMBRIDGE International Examinations

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 **(a)** Evaluate $3 + 25 \div 2$.

(b) Express $17\frac{1}{2}\%$ as a decimal.

Answer (*a*) ..... [1]

(*b*) .....[1]

---

2 Evaluate

(a) $\frac{1}{4} + \frac{1}{7}$,

(b) $1\frac{7}{8} \div \frac{3}{16}$.

Answer (*a*) .....[1]

(*b*) .....[1]

---

3 It is given that $\frac{2}{3}$, $\frac{8}{d}$ and $\frac{n}{39}$ are equivalent fractions.

Find the value of *d* and the value of *n*.

Answer *d* = ...[1]

n = ...[1]

---

4 **(a)** A car decelerates uniformly from 20 m/s to 5 m/s in 25 seconds.
Calculate the retardation.

(b) Express 20 metres per second in kilometres per hour.

Answer (*a*) ..... m/s^2 [1]

(*b*) ..... km/h [1]

---

5 **(a)** Write the following in order of size, starting with the smallest.

$$\frac{66}{100} \qquad 0.\dot{6} \qquad 0.67 \qquad \frac{666}{1000}$$

Answer (*a*) ..... , ... , ... , ... [1]
smallest

(b) The distance of Saturn from the Sun is 1507 million kilometres.
Express 1507 million in standard form.

Answer (*b*) .....[1]

---

6 **(a)** Express 154 as the product of its prime factors.

(b) Find the lowest common multiple of 154 and 49.

Answer (*a*) .....[1]

(*b*) .....[1]

---

7 In the quadrilateral $ABCD$, $\hat{A} = x°$, $\hat{B} = 2x°$, $\hat{C} = 3x°$ and $\hat{D} = 4x°$.

(a) Find x.

(b) Explain why AB is parallel to DC.

Answer (*a*) $x =$ .....[1]

(b) .....[1]

---

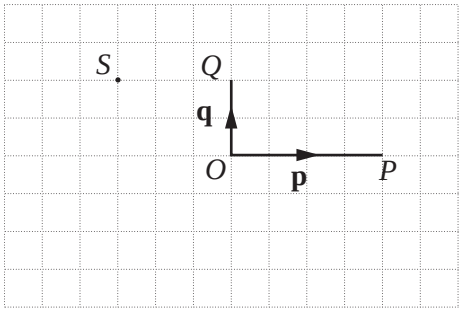
8 On the grid in the answer space, $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.

(a) Given that $\overrightarrow{OR} = \mathbf{p} - \mathbf{q}$, mark the point R clearly on the grid.

(b) The point S is shown on the grid.

Given that $\overrightarrow{OS} = \mathbf{q} + h\mathbf{p}$, find h.

Answer (*a*)



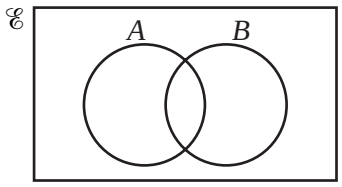
[1]

(*b*) $h =$ .....[1]

---

9 **(a)** The sets A and B are shown on the Venn Diagram in the answer space.
The element y is such that $y \in A$ and $y \notin B$.
On the diagram, write y in the correct region.

Answer (*a*)



[1]

(b) $\mathscr{E} = \{x : x \text{ is an integer and } 1 \leqslant x \leqslant 8\}$.
$P = \{x : x > 5\}$.
$Q = \{x : x \leqslant 3\}$.

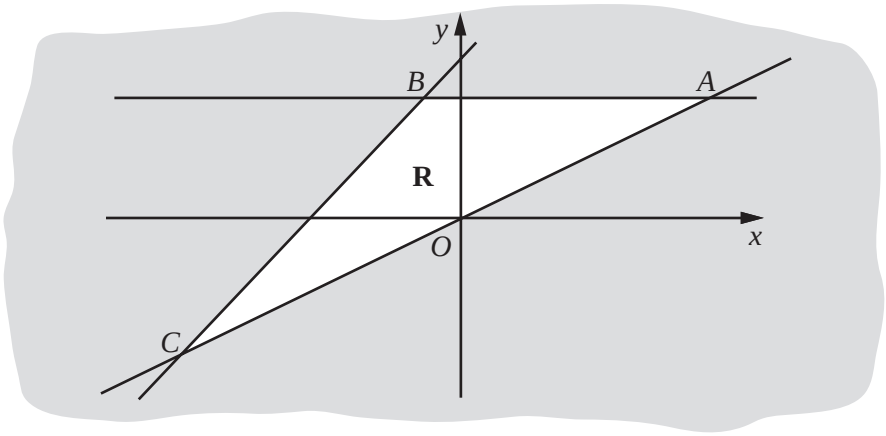
(i) Find the value of $n(P \cup Q)$.

(ii) List the elements of $P' \cap Q'$.

Answer (*b*)(i) .....[1]

(ii) {.....} [1]

10



In the diagram, A is the point (6, 3) and C is the point (−8, −4).
The equation of AB is $y = 3$ and the equation of CB is $y = x + 4$.

(a) Find the coordinates of B.

(b) The unshaded region **R** inside triangle ABC is defined by three inequalities.
One of these is $y < x + 4$.

Write down the other two inequalities.

Answer (*a*) (..... , ...) [1]

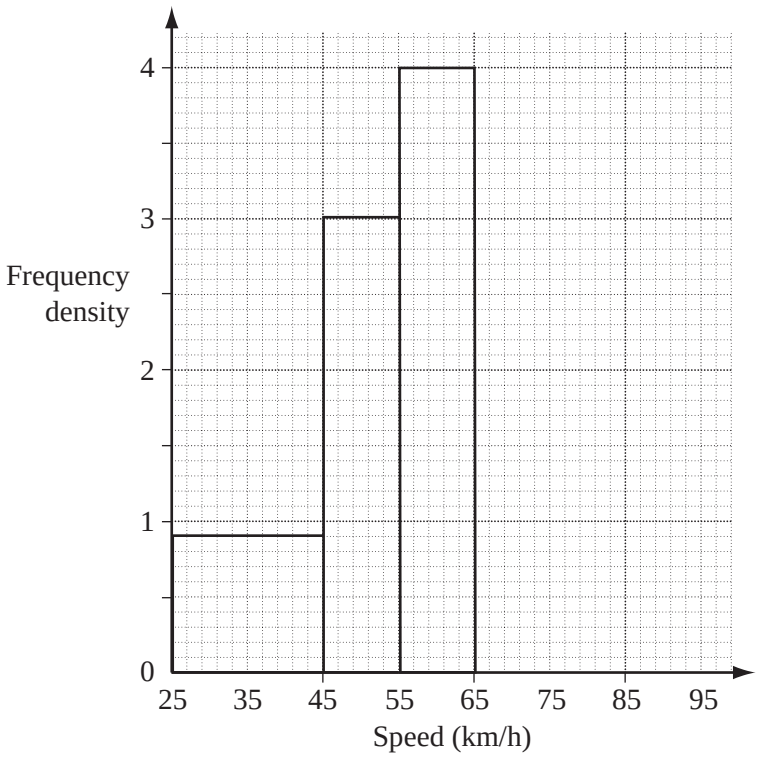
(*b*).....

.....[2]

---

11 On a certain stretch of road, the speeds of some cars were recorded.
The results are summarised in the table.
Part of the corresponding histogram is shown alongside.

Speed (x km/h)	Frequency
$25 < x \leqslant 45$	q
$45 < x \leqslant 55$	30
$55 < x \leqslant 65$	p
$65 < x \leqslant 95$	12



(a) Find the value of

(i) p,

(ii) q.

Answer (*a*)(i) p =.....[1]

(ii) q =.....[1]

(b) Complete the histogram. [1]

---

12 Evaluate

(a) 17^0,

(b) $4^{\frac{5}{2}}$,

(c) $(0.2)^{-2}$.

Answer (*a*) .....[1]

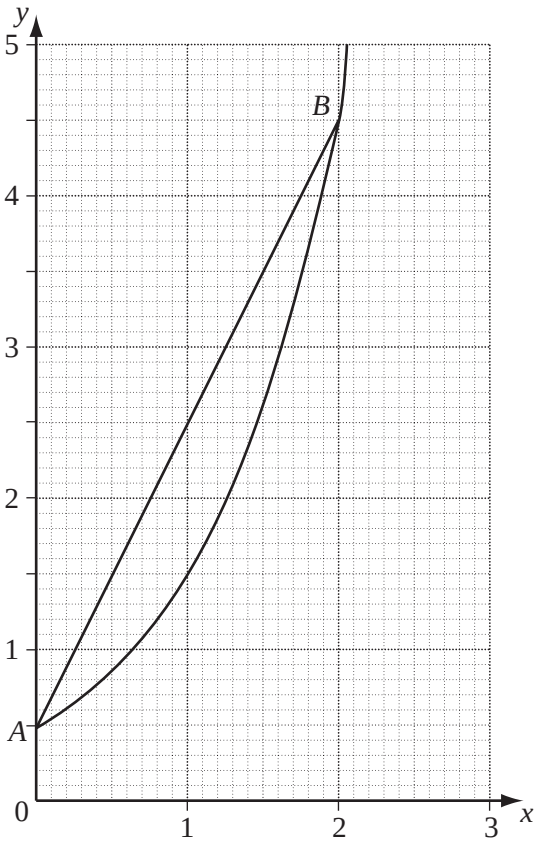
(*b*) .....[1]

(*c*) .....[1]

13 **(a)** Given that $2y = 3^x$, find x when $y = 40\frac{1}{2}$.

Answer (*a*) $x =$ .....[1]

(b) The points, $A(0, \frac{1}{2})$ and $B(2, 4\frac{1}{2})$, lie on the curve as shown in the diagram.



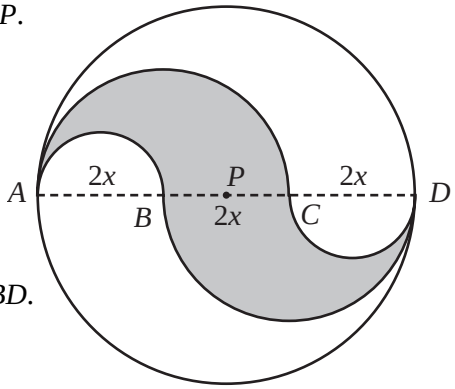
(i) Calculate the gradient of the straight line *AB*.

(ii) Using the diagram, estimate the value of x at which the gradient of the curve is equal to the gradient of the straight line *AB*.

Answer (*b*)(i) ..... [1]

(ii) $x =$ ..... [1]

14 In the diagram, *ABCD* is a diameter of the circle centre *P*. *AB* = *BC* = *CD* = 2*x* centimetres.



(a) Find an expression, in terms of *x* and π, for the circumference of this circle.

(b) The perimeter of the shaded region consists of two semicircles whose diameters are *AB* and *CD*, and two semicircles whose diameters are *AC* and *BD*.

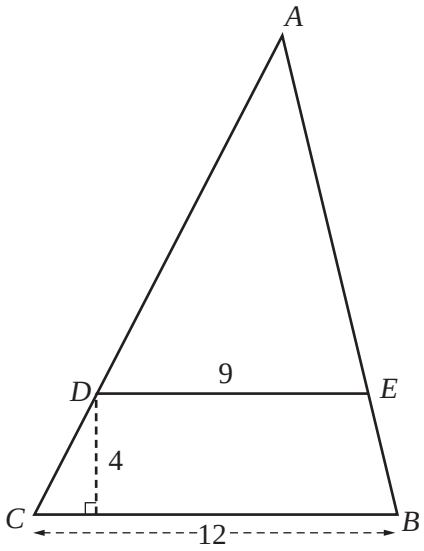
Find an expression, in terms of *x* and π, for the area of the shaded region.

Answer (*a*) .....cm [1]

(*b*) ..... cm^2 [2]

---

15 In the diagram, *BCDE* is a trapezium, and the sides *CD* and *BE* are produced to meet at *A*. *CB* = 12 cm, *DE* = 9 cm and the perpendicular distance from *D* to *CB* is 4 cm.



Calculate

(a) the area of *BCDE*,

(b) the perpendicular distance from *A* to *CB*.

Answer (*a*) ..... cm^2 [1]

(*b*) .....cm [2]

---

16 Given that $f(x) = \frac{5x-4}{3}$, find

(a) $f(1\frac{1}{5})$,

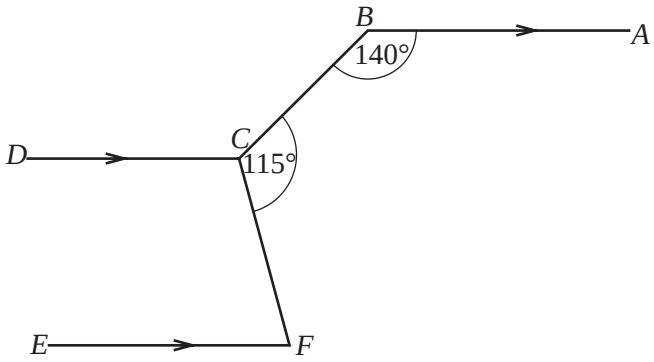
(b) $f^{-1}(x)$.

Answer (*a*) .....[1]

(*b*) .....[2]

---

17 In the diagram, the lines *BA*, *DC* and *EF* are parallel.
$A\hat{B}C = 140°$ and $B\hat{C}F = 115°$.



Find

(a) $D\hat{C}B$,

(b) $D\hat{C}F$,

(c) $E\hat{F}C$.

Answer (*a*) $D\hat{C}B$ =.....[1]

(*b*) $D\hat{C}F$ = ...[1]

(*c*) $E\hat{F}C$ = ...[1]

---

18 **(a)** Calculate 5% of \$280 000.

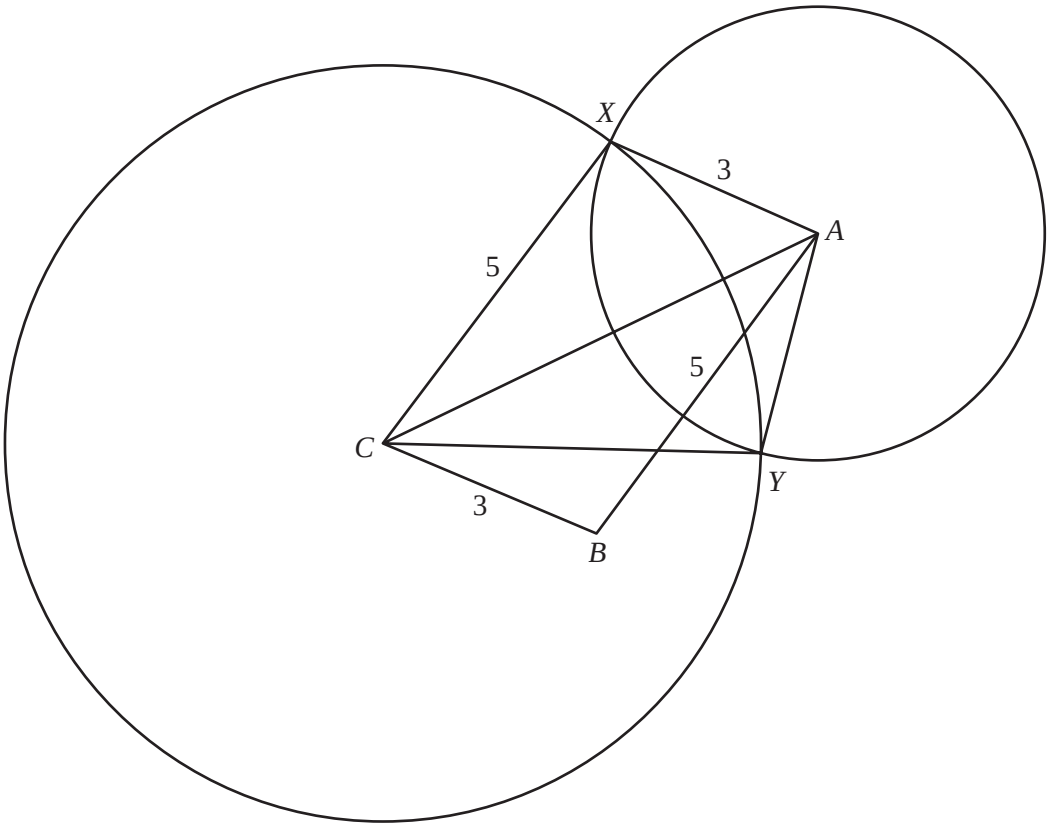
(b) A single carton of juice costs \$4.20.
A special offer pack of 3 cartons costs \$9.45.
Ali bought a special offer pack instead of 3 single cartons.

Calculate his percentage saving.

Answer (*a*) \$.....[1]

(*b*) ..... % [2]

19



The diagram shows a circle, centre C, of radius 5 cm, and a circle, centre A, of radius 3 cm. The circles intersect at X and Y.
B is a point such that $AB = 5$ cm and $BC = 3$ cm.

(a) Show that triangles ABC and CYA are congruent.

Answer (*a*) .....

.....

.....

.....[2]

(b) Show that the areas of the quadrilaterals $ABCX$ and $AYCX$ are equal.

Answer (*b*) .....

.....

.....

.....[1]

(c) State the name of the special quadrilateral $AYCX$.

Answer (*c*) ..... [1]

20 The plan of a field has a scale of 1 cm to 5 metres.

(a) Express this scale in the form 1 : *n*.

Answer (*a*) .....[1]

(b) The plan was made by measuring angles from two points, *A* and *B*, 50 m apart.
The line *AB* is drawn to scale in the answer space below.

(i) A tree is at the point *T* in the field.
$B\hat{A}T = 35°$ and $A\hat{B}T = 70°$.

Locate and label *T* on the plan.

(ii) Given that *A* is due west of *B*, state the bearing of *T* from *B*.

(iii) By making an appropriate measurement, find the actual distance, in metres, of the tree from *B*.

Answer (*b*)(i)

[1]

Answer (*b*)(ii) ..... [1]

(iii) ..... m [1]

21 Factorise

(a) $2x^2 - 7x - 15$,

(b) $2yt - 8ys - zt + 4zs$.

Answer (*a*) .....[2]

(*b*) .....[2]

---

22 **(a)** Solve

(i) $9 - k < 7$,

(ii) $\frac{5}{2t} = \frac{1}{12}$.

(b) Solve the simultaneous equations $x + y = 29$,
$4x = 95 - 2y$.

Answer (*a*) (i) .....[1]

(ii) t = ...[1]

(*b*) x = ... y = ...[3]

---

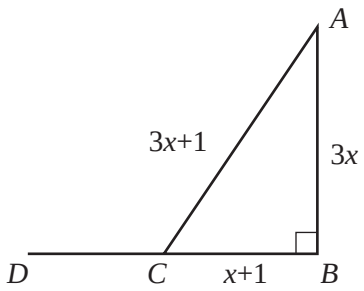
23 **(a)**

	sin	cos
30°	0.5	0.87
60°	0.87	0.5

Using as much information in the table as necessary, evaluate 2sin150°.

Answer (*a*).....[1]

(b)



In the triangle ABC, $A\hat{B}C = 90°$, $AB = 3x$ cm, $BC = (x + 1)$ cm and $AC = (3x + 1)$ cm.

(i) Form an equation in x and show that it reduces to $x^2 - 4x = 0$.

Answer (*b*)(i) .....

.....

.....

.....

.....

.....[2]

(ii) Find the value of x.

(iii) Given that BCD is a straight line, state the numerical value of $\cos D\hat{C}A$.

Answer (*b*) (ii) x =.....[1]

(iii) .....[1]

24 **(a)** Evaluate $\begin{pmatrix} 12 \\ 4 \\ 6 \end{pmatrix} - 3\begin{pmatrix} 3 \\ -1 \\ 2 \end{pmatrix}$.

Answer (*a*) $\begin{pmatrix} \quad \\ \quad \\ \quad \end{pmatrix}$ [1]

(b) A business makes toy buses and toy lorries.
The following table is used in calculating the cost of making each toy.

	Labour (hours)	Wood (blocks)	Paint (tins)
Bus	2	3	1
Lorry	1	*w*	2

Labour costs \$10 per hour, wood costs \$1 per block and paint costs \$*p* per tin.

The information above can be summarised in the matrices **A** and **B**,

where $\mathbf{A} = \begin{pmatrix} 2 & 3 & 1 \\ 1 & w & 2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 10 \\ 1 \\ p \end{pmatrix}$.

(i) Given that $\mathbf{AB} = \begin{pmatrix} 28 \\ 24 \end{pmatrix}$, find

(a) *p*,

(b) *w*.

(ii) Evaluate $(100 \quad 200)\begin{pmatrix} 28 \\ 24 \end{pmatrix}$.

(iii) Explain what your answer to **(ii)** represents.

Answer (*b*)(i)(*a*) *p* = ...[1]

(*b*) *w* = ...[1]

(ii) .....[1]

(iii).....[1]

25 The heights of 40 children were measured.
The results are summarised in the table below.

Height (h cm)	$105 < h \leqslant 115$	$115 < h \leqslant 125$	$125 < h \leqslant 135$	$135 < h \leqslant 145$
Frequency	5	10	20	5

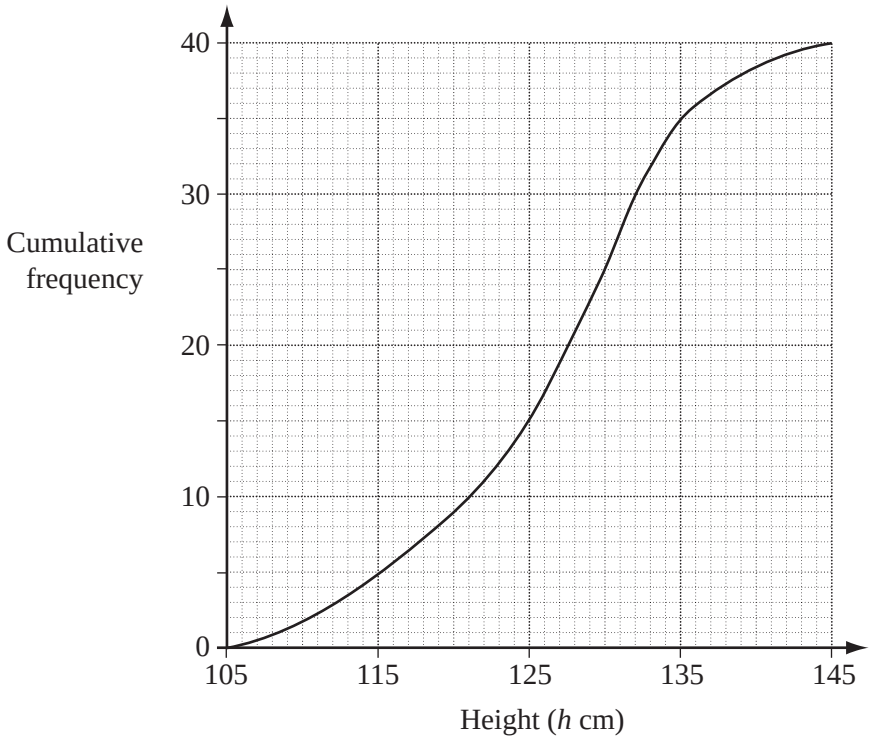
(a) **(i)** Identify the modal class.

(ii) Calculate an estimate of the mean height.

Answer (*a*)(i) .....[1]

(ii) .....cm [3]

(b) The cumulative frequency curve representing this information is shown below.



Use the curve to find

(i) the interquartile range,

(ii) the number of children whose heights are in the range 120 cm to 130 cm.

Answer (*b*)(i) .....cm [2]

(ii) .....[1]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2007 question paper

4024 MATHEMATICS

4024/02 Paper 2, maximum raw mark 100

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

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Type of mark

In general:

(i) 'M' marks are awarded for any correct method applied to the appropriate numbers, even though a numerical error may be involved.

a) Once earned they cannot be lost.

b) They are earned for a numerical statement which is usually explicit as regards the quantity to be found.

c) e.g. the use of a wrong formula, wrong trigonometrical ratio or misapplication of 'Pythagoras' is wrong method.

(ii) 'A' marks are awarded for a numerically correct stage, for a correct result or for an answer lying within a specified range.

a) They are given only if the relevant 'M' mark has been earned.

b) They are not given for a correct result following an error in working.

(iii) 'B' marks are independent of method and are usually awarded for an accurate result or statement.

(iv) In graph or drawing questions some marks may carry a letter (e.g. G4 for drawing the graph, Q1 for quality, L3 for drawing loci) to make their identification easier.

Abbreviations which may be used in mark schemes or in comments on scripts:

A.G.	Answer given
b.o.d.	Benefit of doubt
c.a.o.	Correct answer only
(in)dep	(In) dependent
Ex.Q.	Extra question
✓	Follow through
✗	Further error made
I.S.W.	Ignore subsequent working
M.R.	Misread
o.e.	Or equivalent
O.W.	Omission of essential working
P.A.	Premature approximation
S.C.	Special case
s.o.i.	Seen or implied
S.O.S.	See other solution
t.&e.	Trial and error
W.W.	Without working (i.e. answer only seen)
W.W.W.	Without wrong working
(£) or (°)	Condone the omission of the £ or degree sign etc.

1	(a)	(i)	(a)	($)9.60	B1		96c or 1.20	B0	9.60	B1
			(b)	($) 23.20	B1		12.40	B1	40	B1
		(ii)		$\frac{16-12}{0.8}$ or $\frac{4}{0.8}$ or 5	B1		$\frac{16-1.2}{0.8}$ o.e.	B1		
				15	B1	4	28.5	B1	12	B1
	(b)	(i)		13(h) 16(m)	B1					
		(ii)		$10\ 00 + \frac{22\ 56 - 10\ 00}{2}$ or $\frac{10\ 00 + 22\ 56}{2}$	M1					
				16 28	A1	3	Allow 16 h 28 min			
	(c)			'figs 15 × figs 2' OR 'figs 3'	B1					
				4800	B1	2				
2	(a)			$\cos D\hat{B}E = \frac{1.5}{1.9}$ o.e.	M1		All M and A marks available for any COMPLETE alternative method.			
				37.86 – 37.9	A1	2				
	(b)			$\tan 68 = \frac{1.5}{AE}$ o.e.	M1		condone $\frac{\sin 22}{AE} = \frac{\sin 68}{1.5}$ for **M1**			
				0.6 – 0.61	A1	2				
	(c)			$\frac{1.3}{\sin D} = \frac{1.9}{\sin 76}$ o.e.	M1					
				$\sin D = \frac{1.3 \sin 76}{1.9}$	M1		dep on first **M1**			
				41.59 – 42	A1	3				
3	(a)			$\frac{11}{18a}$	B2	2	**SC1** for any equiv. unsimplified form or figs $^{11}/_{18}$ in final answer.			
	(b)			$b^2 - 3b + 8$ (final answer)	B2	2	**SC1** for 2 collected terms correct in final answer (without b^3, b^4 …) OR: for a correct form without brackets.			
	(c)	(i)		127	B1					
		(ii)	(a)	132	B1					
			(b)	$n^3 + 2 + n$ o.e.	B1	3	e.g. accept $n^3 + 3 + n - 1$.			
	(d)	(i)		$(y =)\ x - 38$ o.e.	B1		e.g. accept $x + 22 - 60$.			
		(ii)	(a)	$x + 60 = 3\ (x - 38)$ ✓	B1		✓ $x + 60 = 3 \times$ their $(x - 38)$			
				87	B1					
			(b)	196 ✓ strict ✓ on positive x	B1	4	✓ 2 × their 87 + 22			

4	**(a)** **(i)**	60	**B1**		
	(ii)	9 : 4	**B1**		Accept 4 : 9 Not $^9/_4$ or 2.25 : 1
	(iii)	165	**B2**	**4**	**SC1** for $\frac{44 \times 360}{96}$ or $\frac{44 \times 100}{26 \text{ to } 27}$
	(b) **(i)**	$D\hat{A}C = 33$	**B1**		
	(ii)	$D\hat{T}C = 24$	**B1**		
	(iii)	$A\hat{D}C = 57$	**B1**		
	(iv)	$A\hat{B}C = 123$ ♪	**B1**	**4**	♪ 180 – their 57
5	**(a)** **(i)**	Mode = 3	**B1**		If 6 is mentioned 3 must be the clearly intended answer
	(ii)	Median = 4	**B1**		
	(iii)	(2 × 2) + (3 × 6) + ….. (115) 4.6	**M1** **A1**	**4**	
	(b) **(i)**	$^9\!/_{25}$	**B1**		Accept 36% or 0.36.
	(ii)	1	**B1**	**2**	Accept 100%; Not $^{25}/_{25}$ or $^1/_1$
	(c) **(i)**	$\frac{1}{50}$	**B1**		
	(ii)	$\frac{2}{25} \times \frac{5}{24}$ $\frac{1}{30}$	**M1** **A1**	**3**	$\frac{10}{600}$ or better implies **M1**
6	**(a)**	Rotational (symmetry) Order 2, centre (3, 0) o.e.	**B1** **B1**	**2**	–1 if line symmetry stated or implied.
	(b) **(i)**	$\overrightarrow{CD} = \begin{pmatrix} 0 \\ 8 \end{pmatrix}$	**B1**		
	(ii)	$\overrightarrow{OC} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$	**B1**		
	(iii)	$\overrightarrow{DO} = \begin{pmatrix} -6 \\ -4 \end{pmatrix}$	**B1**	**3**	
	(c)	Isosceles	**B1**	**1**	
	(d)	(3, –2) Shear	**B1** **B1**	**2**	

7	**(a)** **(i)**	$20 \times 7 \times 4$ $(3\times)\frac{1}{2}\times\frac{4}{3}\times\pi\times 2.5^3$ $461.7 \rightarrow 462$ (cm^3)	**M1** **M1** **A1**	**3**	560 implies **M1** 32.7… or 98.2… imply **M1**
	(ii)	216 (cm^3)	**B1**	**1**	
	(iii) **(a)**	$(3\times)\frac{1}{2}\times 4\times\pi\times 2.5^2$ $117.7 \rightarrow 118$ (cm^2)	**M1** **A1**	**2**	39.2… implies **M1**
	(b)	$(20\times 7-3\times)\pi\times 2.5^2$ $81 \rightarrow 81.2$ (cm^2)	**M1** **A1**	**2**	19.6.. or 58.9.. implies **M1**
	(b) **(i)**	$V = kx^3 \Rightarrow k = \frac{1}{3}$ or $\left(\frac{6}{12}\right)^3$ o.e. seen $71 \rightarrow 72$ (cm^3)	**B1** **B1**	**2**	
	(ii)	$15.7 \rightarrow 16.4$ (cm)	**B2**	**2**	
8	**(a)**	Correct scales 10 correct plots (within 1 mm) Smooth curve (not grossly thick)	**S1** **P1** **C1**	**3**	
	(b)	5.7 to 5.9	**T1**	**1**	Must be clearly identified if written on the graph.
	(c) **(i)**	Negative value } final answer 4 to 6 }	**G1** **G1**		Accept $\frac{a}{b}$ if, a, b integers
	(ii)	Speed or velocity.	**G1**	**3**	Accept ‘rate of change of distance with time’.
	(d) **(i)** **(a)**	15 (m)	**D1**		
	(b)	9 (m)	**D1**		
	(ii)	Straight line –*ve* slope Through (0, 15) and (6, 6)	**L1** **L1**		(6, 6) within 2 mm
	(iii)	7 – 7.4	**B1**	**5**	Must be clearly identified if written on the graph.

9	**(a)**	Attempt at cosine rule $BD^2 = 61^2 + 30^2 - 2.30.61 \cos 41$ $= 1850 - 1860$ BD = 43.1 to 43.12	**M1** **M1** **A1** **A1**	**4**	e.g. $61^2 + 30^2 \pm (2).30.61 \cos 41$ BD can be implied.
	(b)	$\frac{1}{2} \times 61 \times 30 \times \sin 41 (= 600.2...)$	**B2**		A.G.
	(c)	Same height ⇒ 45 : 30 (or common vortex)	**B1**		A.G. Accept use of $^1/_2\ ab \sin C$.
	(d)	900 → 901 (cm^2)	**B1**	**4**	
	(e)	$900 = \frac{1}{2} \times 43.1 \times CN$ ✓ 41.7 – 41.9	**M1** **A1**	**2**	✓ their $900 = \frac{1}{2}$ their $BD \times CN$
	(f)	$\sin e = \frac{15}{41.8}$ ✓ 21.0° – 21.1°	**M1** **A1**	**2**	✓ $\sin e = \frac{15}{\text{their}CN}$ **SC1** for final answer 68.9° → 69°
10	**(a)**	3	**B1**		
	(b)	2 o r –2	**B1+B1**	**3**	
	(c) **(i)**	3	**B1**		
	(ii)	$-\frac{12}{5}$ o.e.	**B1**	**2**	
	(d)	$3x^2 = 5y + 12$ $x = \sqrt{\frac{5y+12}{3}}$ o.e.	**M1** **A1**	**2**	NB $x^2 = \frac{5}{3}y + 4$ or $\frac{\sqrt{5y+12}}{3}$ score **M1**
	(e) **(i)**	$\frac{t-3}{2} = \frac{3t^2-12}{5}$ o.e. ⇒ $5(t-3) = 2(3t^2 - 12)$ ⇒ Given result	 **B1**	 **1**	method must be clear and accurate must reach $6t^2 - 5t - 9 (= 0)$
	(ii)	For numerical $\frac{p +/- \sqrt{q}}{r}$ p = +5 and r = 12 q = 241 of $\sqrt{q}$ = 15.5… (s.o.i.) 1.7 or -0.88	 **B1** **B1** **B1+B1**	 **4**	For 'completing the square' $\left(t - \frac{5}{12}\right)^2$ **B1**, $\frac{241}{144}$, … **B1** **SC1** for 1.7 – 1.72 AND – 0.88 to – 0.87 or for any 2 ans to 2 sig figs

11	**(a)**	**(i)**	Translation $\begin{pmatrix}-3\\0\end{pmatrix}$ o.e.	**B1** **B1**	**2**	With 2nd transformation **BO BO** Coords don't score
		(ii)	Rotation 90° AC, centre (0, 1)	**B1** **B1**	**2**	With 2nd transformation **BO BO**
		(iii)	$\begin{pmatrix}-1 & 0\\0 & 1\end{pmatrix}$	**B2**	**2**	
	(b)	**(i)**	–2	**B1**		Allow $^{-2}/_{1}$
		(ii)	(3, 1)	**B1**	**2**	Allow $\begin{pmatrix}3\\1\end{pmatrix}$
	(c)	**(i)**	2	**B1**		
		(ii)	$\frac{1}{2}\begin{pmatrix}4 & -3\\2 & -1\end{pmatrix}$ ∫ I.S.W.	**B1**		∫ $\frac{1}{\text{their}2}$
		(iii)	$\begin{pmatrix}2 & -1\frac{1}{2}\\1 & -\frac{1}{2}\end{pmatrix}\begin{pmatrix}4\\-2\end{pmatrix}$ ∫ OR $\begin{pmatrix}-1 & 3\\-2 & 4\end{pmatrix}\begin{pmatrix}x\\y\end{pmatrix}=\begin{pmatrix}4\\-2\end{pmatrix}$ $\begin{pmatrix}11\\5\end{pmatrix}$ $x=11, y=5$	**M1** **A1**	 **4**	∫ from their **(c)(ii)**

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2007 question paper

4024 MATHEMATICS

4024/01 Paper 1, maximum raw mark 80

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1	**(a)**	15½ or 15.5	1		Not 31/2
	(b)	(0).175	1	2	
2	**(a)**	$\frac{11}{28}$	1		If answer decimal in range 0.39 to 0.40, accept fraction in working
	(b)	10	1	2	
3		(d =) 12 (implied by 8/12)	1		Accept answer reversed without evidence After 0+0.allow M1 for $\frac{8\times3}{2}$ or $\frac{39\times2}{3}$ seen M1
		(n =) 26 (implied by 26/39)	1	2	
4	**(a)**	(0).6 or $\frac{3k}{5k}$ (m/s²)	1		Accept – 0.6 etc
	(b)	72 (km/h)	1	2	
5	**(a)**	$\frac{66}{100}$ $\frac{666}{1000}$ 0.6r 0.67 **or** 0.6 $\frac{66}{100}$ $\frac{666}{1000}$ 0.67	1		Accept any equivalents
	(b)	1.507×10^9 cao	1	2	
6	**(a)**	2 × 7 × 11 (× 1)	1		Accept without "×" if clear (e.g. 2, 7, 11)
	(b)	1078 cao	1	2	
				12	**12**
7	**(a)**	36	1		Accept 36°
	(b)	B + C = 180 or A + D = 180	1	2	Accept reference to interior or allied angles supplementary

8	**(a)**	R correctly marked	1		2 squares "below" P
	(b)	$-\frac{3}{4}$ or – (0).75	1	2	
9	**(a)**	*y* marked in correct region	1		Within A ∩ B′. Not just shading
	(b)	**(i)** 6	1		Without brackets or braces
		(ii) 4 , 5	1	3	Ignore extra braces
10	**(a)**	(– 1 , 3)	1		
	(b)	$y < 3$ oe	1		Accept ≤ for < etc in both cases
		$y > \frac{1}{2}x$ oe	1	3	Both reversed,after 0 + 0 allow C1
				10	**10**
11	**(a)**	**(i)** $p = 40$	1		
		(ii) $q = 18$	1		Accept answer(s) reversed without evidence
	(b)	Rectangle, width 30, height 0.4	1	3	
12	**(a)**	1	1		
	(b)	32	1		Accept ±32, but not – 32 alone
	(c)	25	1	3	
13	**(a)**	4	1		
	(b)	**(i)** 2	1		Accept 2/1 or 4/2
		(ii) 1.1 to 1.3	1	3	Ignore any value of *y*
				9	**9**

14	**(a)**	$6\pi x$ (cm) only	1		Accept numerical π in both parts
	(b)	$3\pi x^2$ (cm²) or unsimplified equiv (e.g. $4\pi x^2 - \pi x^2$)	2	3	$3\pi x^2 / 2$ or unsimplified equiv C1 **or** area larger (semi)circle = $(½)\pi(2x)^2$ M1 **or** area smaller (semi)circle = $(½)\pi x^2$ M1
15	**(a)**	42 (cm²)	1		
	(b)	16 (cm)	2	3	Use of similar triangles e.g. $\frac{h-4}{h} = \frac{9}{12}$ M1 **or** use their BCDE = ½ 12(4 + h) - ½ 9h
16	**(a)**	2/3	1		Accept 0.666 or better
	(b)	$\frac{3x+4}{5}$ asc	2	3	$ax + b$ with $a = 3/5$ $b \neq 0$ or $a \neq 0$ b=4/5 seen M1 Use of letter other than x, give - 1 if possible
17	**(a)**	(DCB =) 140	1		Not reflex angle
	(b)	(DCF =) 105 or {245 – their **(a)**} √	1		No √ for 122.5 then 122.5
	(c)	(EFC =) 75 or {180 – their **(b)**} √	1	3	**SC** 155, 90 , 90 scores 0, 1√, 0
18	**(a)**	($) 14 000	1		
	(b)	25 (%)	2	3	Answer 75 or 125 C1 figs $\frac{4.20-3.15}{4.20}$ oe seen M1
				15	**15**

19 **(a)** $AY = BC$ (=3)
$CY = AB$ (=5)
AC common
Triangles congruent — 2

Conclusion must be stated
but SSS not needed unless extra facts are quoted
Two correct pairs of facts stated C1

(b) Area AYC = area ABC
(Add ACX)
$AYCX = ABCX$ — 1

Use of "right angle" scores 0

(c) Kite — 1 — 4

20 **(a)** 1 : 500 — 1

Accept 500

(b) **(i)** Triangle drawn with angles
35° ± 2° and 70° ± 2° — 1

(ii) 340 or 200 — 1

Accept 340° ± 2° or 200° ± 2°

(iii) 28 to 31 (m) — 1 — 4

dep on scoring 1 in **(b)(i)**

8 **8**

21 Condone missing outside brackets, "= 0" and use of wrong letter if clear. If only "solutions" (even incorrect) in answer space, give marks if factors seen

(a) $(2x + 3)(x – 5)$ oe — 2

$(2x – 3)(x + 5)$ C1
or $\frac{7 \pm \sqrt{169}}{4}$ or better seen M1

(b) $(2y – z)(t – 4s)$ oe — 2 — 4

Complete correct extraction of one factor M1
such as $2yt – 8ys – z(t – 4s)$

22 **(a)** **(i)** $k > 2$ — 1

Accept $2 < k$ Not just 2

(ii) (t =) 30 — 1

(b) x = 18½ or 18.5
y = 10½ or 10.5 — 3 — 5

$x = \frac{37k}{2k}$ and $y = \frac{21k}{2k}$ seen C2
or one correct **with supporting working** C2
or one correct improper answer **with supporting working** C1
or correct method to eliminate x or y, M1
condoning 1 arithmetic slip

23	**(a)**	1	1			
	(b)	**(i)** $x^2 - 4x = 0$ correctly obtained **AG**	2		$(3x + 1)^2 = (x + 1)^2 + (3x)^2$ oe seen M1 [Condone $3x^2$ for $(3x)^2$ for M1 etc]	
		(ii) $(x =)$ 4	1		Ignore $x = 0$	
		(iii) $-\frac{5}{13}$ or $-\frac{\text{their (ii)}+1}{3\,\text{their (ii)}+1}$ √	1	5	If answer decimal look back for fraction	
				14		**14**
24	**(a)**	$\begin{pmatrix}3\\7\\0\end{pmatrix}$	1			
	(b)	**(i)** **(a)** $(p =)$ 5	1			
		(b) $(w =)$ 4 or $14 - 2 \times$ their p √	1		Only allow √ if their $w > 0$	
		(ii) 7600	1		Ignore lack of braces	
		(iii) Total cost of making (100) buses and (200) lorries	1	5	Accept reasonable equivalents involving **cost** (and **toys)**	
25	**(a)**	**(i)** $125 < h \leq 135$ implied	1		Not just 20	
		(ii) 126.25, 126.2, 126.3, 126 or 126¼	3		**or** Correct method such as $\frac{5\times110+10\times120+20\times130+5\times140}{5+10+20+5}$ M2 condoning one error or omission **or** consistent use of wrong h in above M1 **or** $5 \times 110 + 10 \times 120 + 20 \times 130 + 5 \times 140$ M1	
	(b)	**(i)** 11 (cm)	2		121 or 132 used	
		(ii) 16	1	7		
				12		**12**

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/02**

Paper 2

May/June 2006

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (1 sheet)
Mathematical tables (optional)

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate Answer Booklet/Paper provided.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 100.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

This document consists of **11** printed pages and **1** blank page.

Section A [52 marks]

Answer **all** questions in this section.

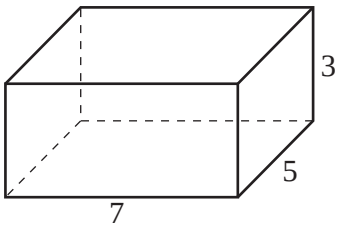
1 **(a)** Solve the equation $3x^2 - 4x - 5 = 0$, giving your answers correct to two decimal places. [4]

(b) Remove the brackets and simplify $(3a - 4b)^2$. [2]

(c) Factorise completely $12 + 8t - 3y - 2ty$. [2]

---

2 **(a)** A solid cuboid measures 7 cm by 5 cm by 3 cm.

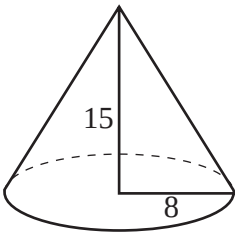


(i) Calculate the total surface area of the cuboid. [2]

(ii) A cube has the same volume as the cuboid.
Calculate the length of an edge of this cube. [2]

(b) [The volume of a cone is $\frac{1}{3} \times$ base area $\times$ height.]
[The area of the curved surface of a cone of radius r and slant height l is πrl.]

A solid cone has a base radius of 8 cm and a height of 15 cm.



Calculate

(i) its volume, [2]

(ii) its slant height, [1]

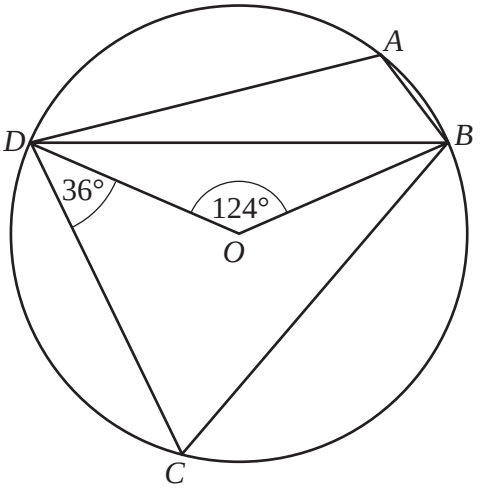
(iii) its curved surface area, [2]

(iv) its **total** surface area. [1]

---

3 **(a)** In the diagram, the points A, B, C and D lie on a circle, centre O.

$\hat{DOB} = 124°$ and $\hat{CDO} = 36°$.



Calculate

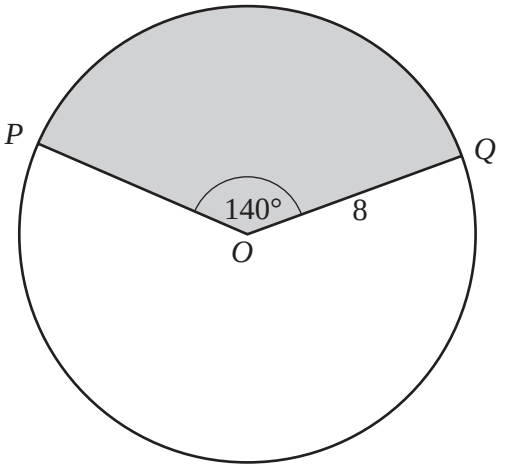
(i) $\hat{DCB}$, [1]

(ii) $\hat{DAB}$, [1]

(iii) $\hat{ODB}$, [1]

(iv) $\hat{CBO}$. [1]

(b) The diagram shows a circle, centre O, with the sector POQ shaded.



Given that $\hat{POQ} = 140°$ and the radius of the circle is 8 cm, calculate

(i) the area of the shaded region, [2]

(ii) the **total** perimeter of the **unshaded** region. [3]

4 **(a)** These are the prices for a ride in an amusement park.

Adult	\$3.60
Child	\$2.25

(i) A family of two adults and three children went on the ride.
They paid with a \$20 note.

Calculate the change they received. [1]

(ii) Express \$2.25 as a percentage of \$3.60. [1]

(b) Diagram I represents part of the framework of the ride.

The points *A*, *B*, *C*, *D*, *E* and *F* are on the framework.
The points *H*, *C*, *G*, *E* and *F* lie on a horizontal line.
The lines *BH* and *DG* are vertical.

$BC = 80$ m, $HC = 60$ m, $DG = 40$ m, $GE = 35$ m and $D\hat{C}G = 32°$.

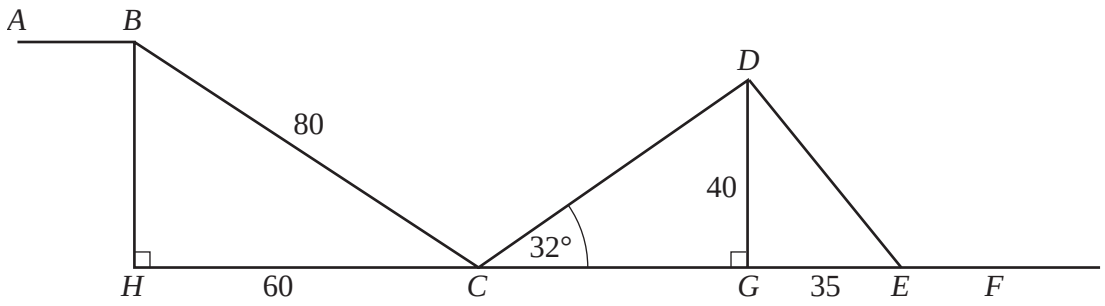


Diagram I

Calculate

(i) $H\hat{C}B$, [2]

(ii) CD, [3]

(iii) the angle of depression of *E* from *D*. [2]

(c)

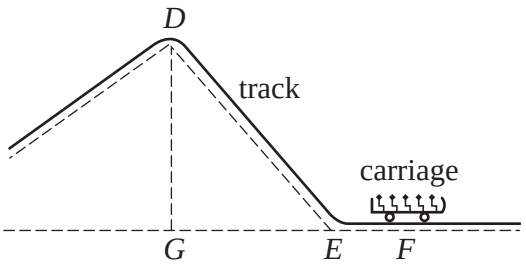


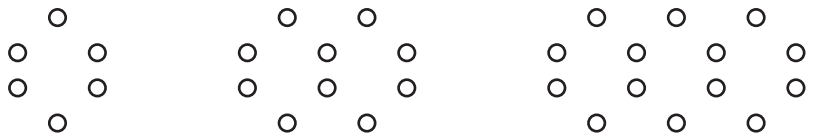
Diagram II

Diagram II shows part of the ride.
The carriage that carried the family was 4.6 m long.
It was travelling at a constant speed of 15 m/s as it passed the point *F*.

(i) Calculate, correct to the nearest hundredth of a second, the time taken for the carriage to pass the point *F*. [2]

(ii) Express 15 m/s in kilometres per hour. [1]

5



Pattern 1 Pattern 2 Pattern 3

Counters are used to make patterns as shown above.
Pattern 1 contains 6 counters.
The numbers of counters needed to make each pattern form a sequence.

(a) Write down the first four terms of this sequence. [1]

(b) The number of counters needed to make Pattern n is $An + 2$.
Find the value of A. [1]

(c) Mary has 500 counters.
She uses **as many of** these counters as she can to make **one** pattern.

Given that this is Pattern m, find

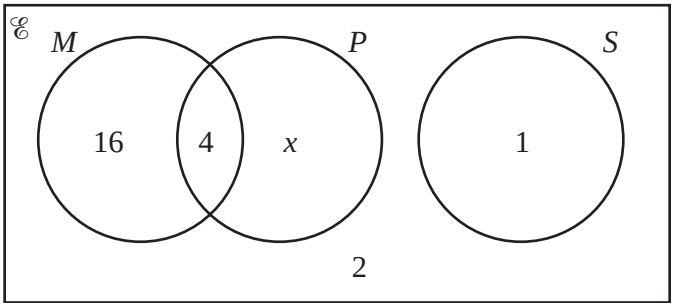
(i) the value of m, [1]

(ii) how many counters are **not** used. [1]

---

6 **(a)** The results of a survey of 31 students are shown in the Venn diagram.

$\mathscr{E}$ = {students questioned in the survey}
M = {students who study Mathematics}
P = {students who study Physics}
S = {students who study Spanish}



(i) Write down the value of

(a) x, [1]

(b) $n(M \cap P)$, [1]

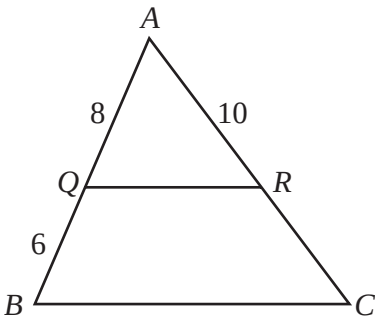
(c) $n(M \cup S)$, [1]

(d) $n(P')$. [1]

(ii) Write down a description, in words, of the set that has 16 members. [1]

(b) In the diagram, triangle AQR is similar to triangle ABC.

$AQ = 8$ cm, $QB = 6$ cm and $AR = 10$ cm.



(i) Calculate the length of RC. [2]

(ii) Given that the area of triangle AQR is $32\,\text{cm}^2$, calculate the area of triangle ABC. [2]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 James and Dan are partners in a small company.
From each year's profit, James is paid a bonus of \$15 000 and the remainder is shared between James and Dan in the ratio 2 : 3.

(a) In 1996 the profit was \$20 000.

Show that Dan's share was \$3000. [1]

(b) In 1997 the profit was \$21 800.

Calculate

(i) the percentage increase in the profit in 1997 compared to 1996, [2]

(ii) the total amount, including his bonus, that James received in 1997. [2]

(c) In 1998 Dan received \$7500.

Calculate the profit in 1998. [3]

(d) In 1999, the profit was \$$x$, where $x > 15\,000$.

(i) Write down an expression, in terms of x, for the amount Dan received. [1]

(ii) Given that Dan received half the profit, write down an equation in x and hence find the amount that Dan received. [3]

[Turn over

8 Answer the whole of this question on a sheet of graph paper.

The table below gives some values of x and the corresponding values of y, correct to one decimal place, where

$$y = \frac{x^2}{8} + \frac{18}{x} - 5.$$

x	1	1.5	2	2.5	3	4	5	6	7	8
y	13.1	7.3	4.5	3.0	2.1	1.5	1.7	p	3.7	5.3

(a) Find the value of p. [1]

(b) Using a scale of 2 cm to 1 unit, draw a horizontal x-axis for $0 \leqslant x \leqslant 8$.

Using a scale of 1 cm to 1 unit, draw a vertical y-axis for $0 \leqslant y \leqslant 14$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to find

(i) the value of x when $y = 8$, [1]

(ii) the least value of $\frac{x^2}{8} + \frac{18}{x}$ for values of x in the range $0 \leqslant x \leqslant 8$. [1]

(d) By drawing a tangent, find the gradient of the curve at the point where $x = 2.5$. [2]

(e) On the axes used in part **(b)**, draw the graph of $y = 12 - x$. [2]

(f) The x coordinates of the points where the two graphs intersect are solutions of the equation

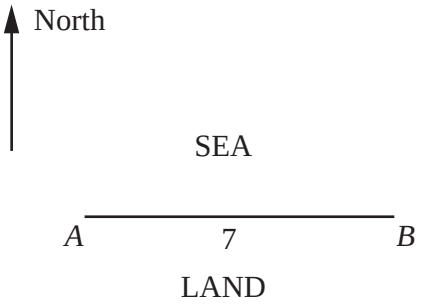
$$x^3 + Ax^2 + Bx + 144 = 0.$$

Find the value of A and the value of B. [2]

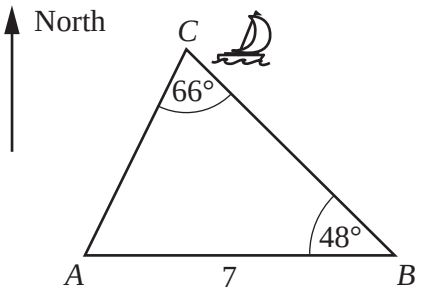
9 In the diagram, A and B are two points on a straight coastline.

B is due east of A and $AB = 7$ km.

The position of a boat at different times was noted.



(a) At 8 a.m., the boat was at C, where $A\hat{C}B = 66°$ and $A\hat{B}C = 48°$.

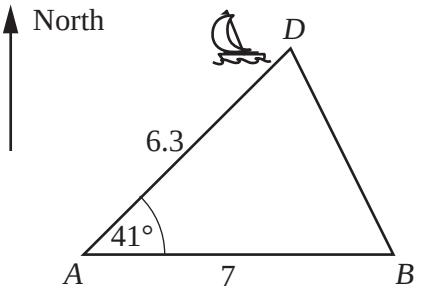


Calculate

(i) the bearing of B from C, [1]

(ii) the distance AC. [3]

(b) At 9 a.m., the boat was at D, where $AD = 6.3$ km and $D\hat{A}B = 41°$.

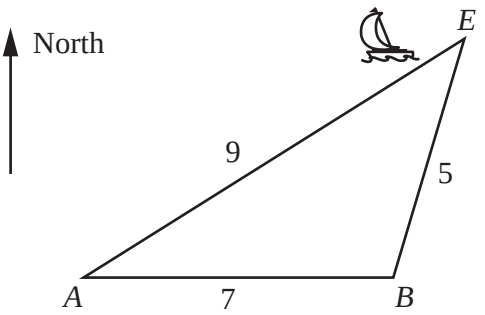


Calculate

(i) the area of triangle ADB, [2]

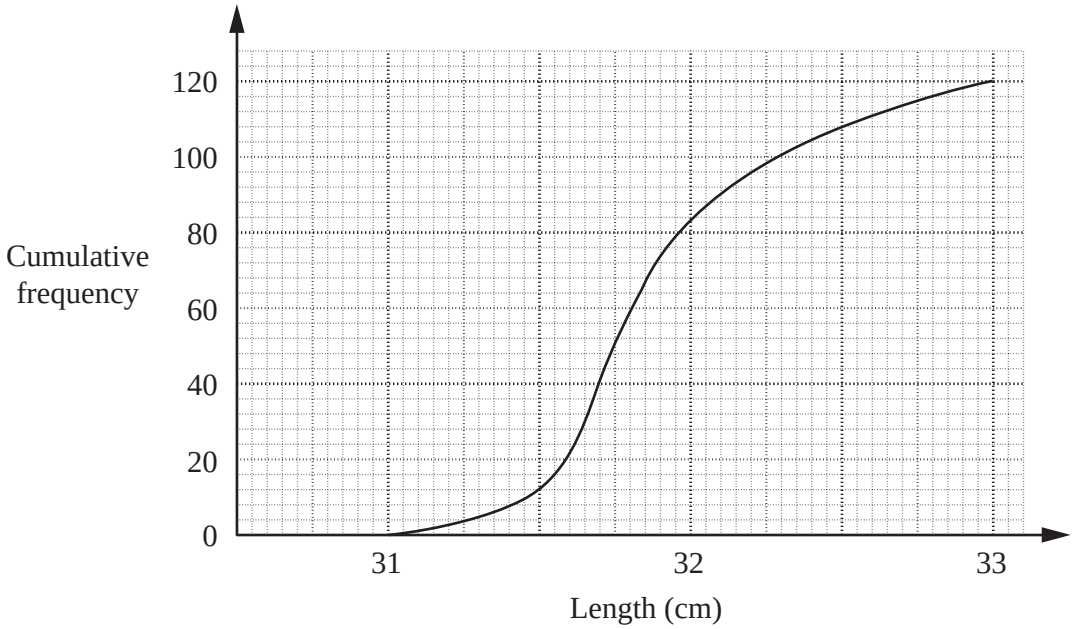
(ii) the shortest distance from the boat to the coastline. [2]

(c) At 11 a.m., the boat was at E, where $AE = 9$ km and $BE = 5$ km.



Calculate the bearing of E from A. [4]

10 **(a)** The lengths of 120 leaves were measured.
The cumulative frequency graph shows the distribution of their lengths.



Use this graph to estimate

(i) the median, [1]

(ii) the interquartile range, [2]

(iii) the number of leaves whose length is more than 31.5 cm. [1]

(b) Each member of a group of 16 children solved a puzzle.
The times they took are summarised in the table below.

Time (t minutes)	$5 < t \leqslant 10$	$10 < t \leqslant 12$	$12 < t \leqslant 14$	$14 < t \leqslant 16$	$16 < t \leqslant 20$
Frequency	2	4	6	3	1

(i) Write down an estimate of the number of children who took less than 13 minutes. [1]

(ii) Calculate an estimate of the mean time taken to solve the puzzle. [3]

(iii) Two children are chosen at random.

Calculate, as a fraction in its simplest form, the probability that one of these children took more than 10 minutes and the other took 10 minutes or less. [2]

(iv) A histogram is drawn to illustrate this information.
The height of the rectangle representing the number of children in the interval $10 < t \leqslant 12$ is 8 cm.
Calculate the height of the rectangle representing the number of children in the interval $5 < t \leqslant 10$. [2]

11 **(a)** $\mathbf{A} = \begin{pmatrix} 1 & -3 \\ 3 & -2 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} -2p & 3p \\ -3p & p \end{pmatrix}$ $\mathbf{C} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

(i) Evaluate $4\mathbf{C} - 2\mathbf{A}$. [2]

(ii) Given that $\mathbf{B} = \mathbf{A}^{-1}$, find the value of p. [2]

(iii) Find the 2×2 matrix $\mathbf{X}$, where $\mathbf{AX} = \mathbf{C}$. [2]

(iv) The matrix $\mathbf{C}$ represents the **single** transformation T.

Describe, fully, the transformation T. [2]

(b) $\overrightarrow{PQ} = \begin{pmatrix} 3 \\ -9 \end{pmatrix}$ $\overrightarrow{PR} = \begin{pmatrix} h \\ -6 \end{pmatrix}$ $\overrightarrow{QU} = \begin{pmatrix} 7 \\ 2 \end{pmatrix}$ $\overrightarrow{PS} = \begin{pmatrix} 17 \\ k \end{pmatrix}$

(i) Given that R lies on PQ, find the value of h. [1]

(ii) Express $\overrightarrow{PU}$ as a column vector. [1]

(iii) Given that U is the midpoint of QS, find the value of k. [2]

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Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1

May/June 2006

2 hours

Candidates answer on the Question Paper.
Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 80.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

For Examiner's Use

This document consists of **14** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE
International Examinations

[Turn over

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

1 **(a)** Express 0.527 as a percentage.

(b) Evaluate $5.6 \div 0.08$.

Answer (*a*) ..... % [1]

(*b*) .....[1]

---

2 Evaluate

(a) $\frac{6}{7} - \frac{1}{3}$,

(b) $\frac{2}{5} \times \frac{4}{9}$.

Answer (*a*) .....[1]

(*b*) .....[1]

---

3 The rate of exchange between pounds (£) and dollars ($) was £1 = $2.80.

Calculate

(a) the number of dollars received in exchange for £120,

(b) the number of pounds received in exchange for $224.

Answer (*a*) $.....[1]

(*b*) £.....[1]

---

4 Complete the statements in the answer spaces.

Answer (*a*) 4872 correct to 1 significant figure is ..... [1]

(*b*) 4872 correct to ..... significant figures is 4870. [1]

---

5 **(a)** A journey of 170 kilometres took $4\frac{1}{4}$ hours.
Calculate the average speed in kilometres per hour.

(b) Potatoes cost 75 cents per kilogram.
John paid \$1.20 for a bag of potatoes.
How many kilograms did he buy?

Answer (*a*) ..... km/h [1]

(*b*) ..... kg [1]

---

6 It is given that $p = \frac{12}{\sqrt{q}}$.

(a) Describe the relationship between p and q in words by completing the sentence in the answer space.

(b) Calculate q when $p = 4$.

Answer (*a*) p is ..... proportional to the square root of q. [1]

(*b*) q = ...[1]

---

7 A dealer sold a painting for $800.
She made a profit of 25% on the price she paid for it.
Calculate the price she paid for the painting.

Answer $ .....[2]

---

8 **(a)** The time difference between Brunei and London is 7 hours.
So, when it is 19 00 in Brunei, it is 12 00 in London.
When it is 03 30 in Brunei, what time is it in London?

(b) An aircraft leaves Brunei at 6 30 p.m. local time.
It arrives in Dubai at 10 p.m. local time.
The flight took $7\frac{1}{2}$ hours.
Calculate the time difference between Dubai and Brunei.

Answer (*a*) .....[1]

(*b*) .....hours [1]

---

9 The thickness of an oil film is 0.000 004 cm.

(a) Express 0.000 004 in standard form.

(b) The oil covers an area of $20\,m^2$.
Calculate the volume of the oil in cubic centimetres.

Answer (*a*) .....[1]

(*b*) ..... cm^3 [2]

---

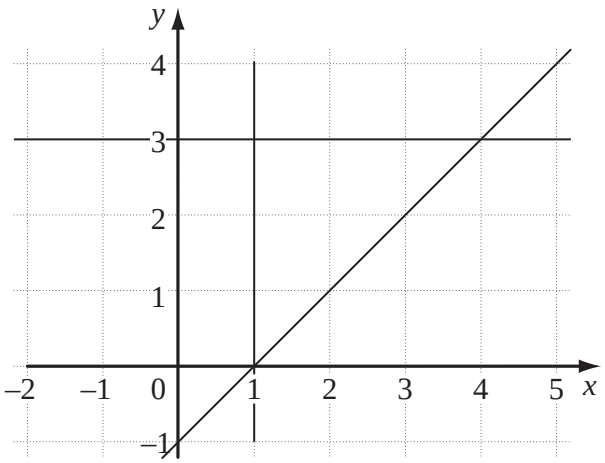
10 **(a)** **(i)** Find the smallest integer k which satisfies $7k \geqslant 36$.

(ii) Find the largest integer n which satisfies $3n - 1 < 26$.

Answer (*a*)(i) smallest k = ...[1]

(ii) largest n = ...[1]

(b)



The diagram shows the graphs of $x = 1$, $y = 3$ and $y = x - 1$.
The region, **R**, is defined by the inequalities $x > 1$, $y < 3$ and $y > x - 1$.
Given that the point (x , y) is in the region **R**, find the integer values of x and y.

Answer (*b*) x = ... y = ...[1]

---

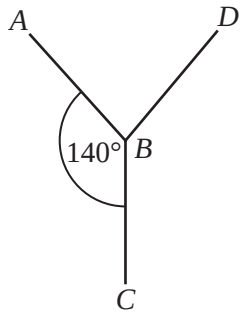
11 Solve the simultaneous equations

$$3x = 7y ,$$
$$12y = 5x - 1 .$$

Answer x =.....

y =.....[3]

12 AB and BC are adjacent sides of a regular polygon.
$A\hat{B}C = 140°$.



(a) Calculate the number of sides of the polygon.

(b) CB and BD are adjacent sides of a congruent regular polygon.
Calculate $A\hat{B}D$.

Answer (*a*) .....[2]

(*b*) $A\hat{B}D$ = ...[1]

---

13 **(a)** Evaluate $5^2 + 5^0$.

(b) Simplify

(i) $\left(\frac{1}{x}\right)^{-2}$,

(ii) $\left(x^6\right)^{\frac{1}{2}}$.

Answer (*a*) .....[1]

(*b*)(i) ..... [1]

(ii) ..... [1]

---

14 **(a)** $f(x) = (x + 2)(2x – 1)$.
Evaluate f(5.5).

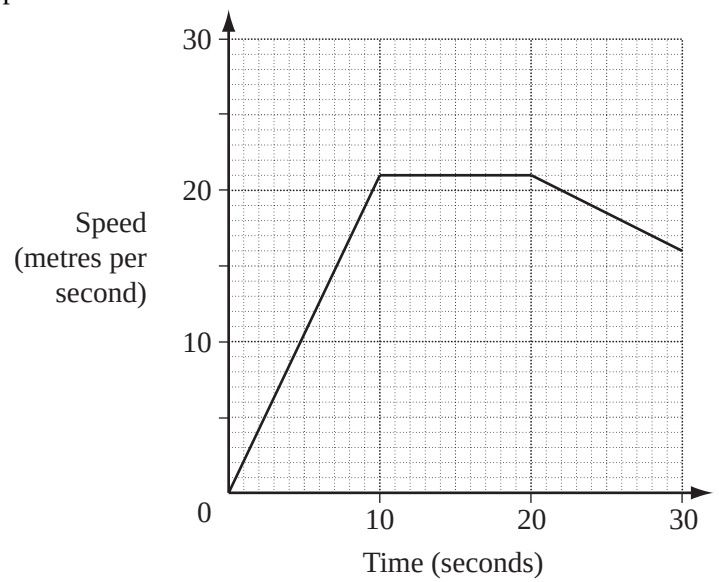
(b) $g(x) = \frac{1}{3}(2x – 1)$.
Find $g^{-1}(5)$.

Answer (*a*) f(5.5) = ...[1]

(*b*) $g^{-1}(5)$ = ...[2]

---

15 A cyclist took 30 seconds to ride from *A* to *B*.
The diagram is the speed-time graph of his ride.



Calculate

(a) the distance from *A* to *B*,

(b) his retardation during the final 10 seconds.

Answer (*a*) ..... m [2]

(*b*) ..... m/s^2 [1]

---

16 **(a)** A prism has a cross-section which is a regular hexagon.
How many planes of symmetry does this prism have?

Answer (*a*) .....[1]

(b) The length and width of a rectangle are 50 cm and 15 cm respectively.
Each measurement is correct to the nearest centimetre.

(i) Write down the upper bound of the length.

(ii) Find the least possible perimeter of the rectangle.

Answer (*b*)(i) .....cm [1]

(ii) .....cm [1]

17 **(a)** Given that $x = 6$ is a solution of $\frac{x^2}{3} + k = 0$, find the value of k.

(b) Solve $2y^2 - 3y - 2 = 0$.

Answer (*a*) $k =$ .....[1]

(*b*) $y =$ ..... or .....[2]

---

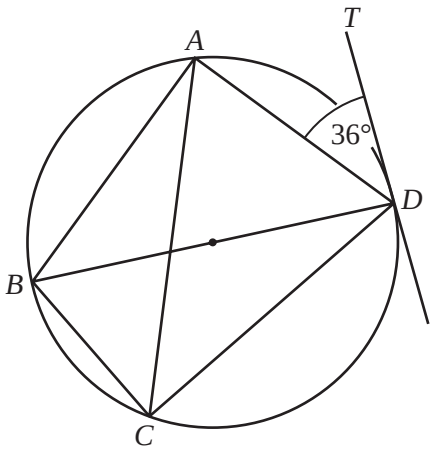
18 A, B, C and D are points on a circle with BD as diameter. TD is a tangent at D and $T\hat{D}A = 36°$.

Find

(a) $A\hat{D}B$,

(b) $A\hat{B}D$,

(c) $A\hat{C}D$.



Answer (*a*) $A\hat{D}B =$.....[1]

(*b*) $A\hat{B}D =$ .....[1]

(*c*) $A\hat{C}D =$ .....[1]

19 $C = \frac{5}{9}(F - 32)$

(a) Calculate C when $F = -4$.

(b) Express F in terms of C.

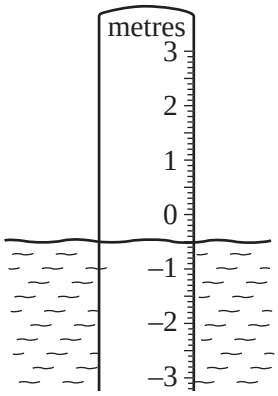
Answer (*a*) $C =$ .....[1]

(*b*) $F =$ .....[2]

---

20 The diagram shows a gauge for measuring the water level in a reservoir.
Readings, in metres, taken over a certain period were as follows:

$-2.3,\ -1.6,\ -0.4,\ 0.1,\ -0.5,\ 0.3,\ -1.2$.



For these readings

(a) find the difference, in metres, between the highest and lowest levels,

(b) find the median,

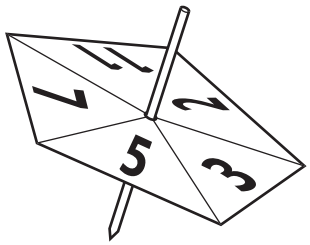
(c) calculate the mean.

Answer (*a*) ..... m [1]

(*b*) ..... m [1]

(*c*) ..... m [2]

21 A fair five-sided spinner is numbered using the prime numbers 2, 3, 5, 7 and 11.



(a) In a game, players spin it twice and add the two numbers obtained.

(i) Complete the possibility diagram.

Answer (*a*)(i)

+	2	3	5	7	11
2	4	5			
3					
5			10	12	
7			12		
11					

[1]

(ii) Find the probability that the total of the two numbers is

(a) a prime number,

(b) a perfect square.

Answer (*a*)(ii)(*a*) .....[1]

(*b*) .....[1]

(b) In another game, players spin it twice and multiply the two numbers obtained. Without drawing another possibility diagram, write down the probability that this product is a prime number.

Answer (*b*) .....[1]

22 A map is drawn using a scale of 1 cm to 5 m.
The position of *A* is shown in the answer space below.

(a) The point *B* is 70 m due East of *A*.
Draw the line representing *AB*.

(b) The point *C* is North of *AB* and equidistant from *A* and *B*.

Angle *BAC* = 40°.

(i) By drawing appropriate lines, find and label the point *C*.

(ii) Find the actual distance *AC*.

(iii) State the size of the reflex angle *BAC*.

Answer (*a*) and (*b*)(i)

[3]

Answer (*b*)(ii) ..... m [1]

(iii) reflex $B\hat{A}C$ = ...[1]

23 **(a)** Simplify

(i) $x(3x + 2) – (2x + 4)$,

(ii) $\frac{ax^2 – x^2}{ax – x}$.

(b) Factorise completely $7x^2 – 63$.

Answer (*a*)(i) .....[1]

(ii) .....[2]

(*b*) .....[2]

24 **(a)** Under the transformation T, the origin is invariant.
T maps (1, 0) onto (2, 0) and (0, 1) onto (0, 2).

(i) Find the matrix that represents T.

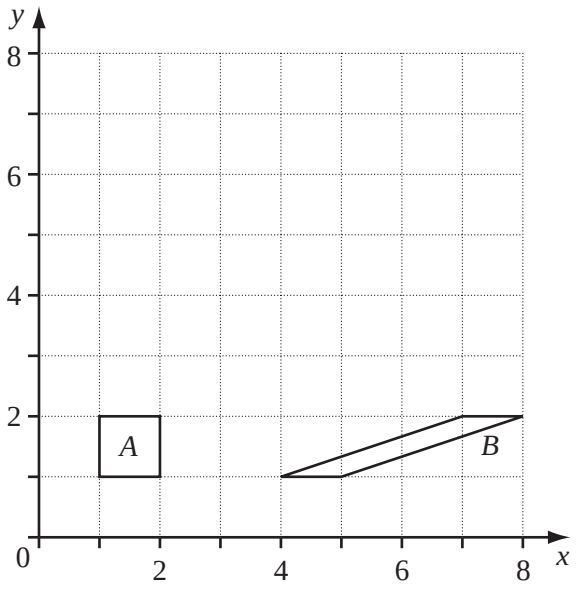
(ii) Describe, fully, the **single** transformation T.

Answer (*a*)(i) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

Answer (*a*)(ii) .....[1]

(b) The diagram shows shapes *A* and *B*.

Answer (b)(i)



[2]

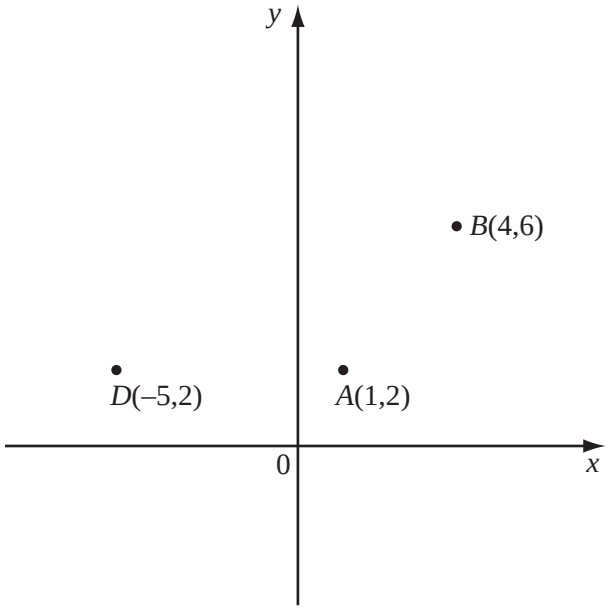
(i) Shape *B* is mapped onto shape *C* by a rotation, centre (8, 3), through 90° clockwise.
Draw shape *C* on the diagram.

(ii) Describe, fully, the **single** transformation that maps *A* onto *B*.

Answer (*b*)(ii) .....

.....[2]

25 The diagram shows the points A (1, 2), B (4, 6) and D (–5, 2).



(a) Find the coordinates of the midpoint of AB.

(b) Calculate the length of AB.

(c) Calculate the gradient of the line AB.

(d) Find the equation of the line AB.

(e) The triangle ABC has line of symmetry $x = 4$.
Find the coordinates of C.

(f) Find the value of cosine $D\hat{A}B$.

Answer (*a*) (..... , ...) [1]

(*b*) ..... [1]

(*c*) .....[1]

(*d*) .....[2]

(*e*) (..... , ...) [1]

(*f*) cos $D\hat{A}B$ = ...[1]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE O Level

MARK SCHEME for the May/June 2006 question paper

4024 MATHEMATICS

4024/02 Paper 2 maximum raw mark 100

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

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M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

C Consolation mark, sometimes awarded for an incorrect answer. In some places it may be earned in the working.

- When a part of a question has two or more "method" steps, the M marks are generally independent unless the scheme specifically says otherwise.

- FT implies that the candidate has continued correctly after an error.

The following abbreviations may be used in a mark scheme or used on the scripts:

AG Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)

BOD Benefit of Doubt (allowed when the validity of a solution may not be absolutely clear)

CAO Correct Answer Only (emphasising that no "follow through" from a previous error is allowed)

CWO Correct Working Only – often written by a ‘fortuitous' answer

FT Follow through

ISW Ignore Subsequent Working

MR Misread

PA Premature Approximation (resulting in basically correct work that is insufficiently accurate)

SOI Seen or implied

SOS See Other Solution (the candidate makes a better attempt at the same question)

1	**(a)**	For numerical $\frac{p \pm (or + or -)\sqrt{q}}{r}$			For 'completing the square' $\left(x - \frac{2}{3}\right)$ seen **B1** $2\frac{1}{9}$ oe **B1**
		$p = 4$ and $r = 6$	B1		
		$q = 76$ or $\sqrt{q} = 8.71$	B1		
		$x = 2.12$ or -0.79	B1 + B1	**4**	**SC1** for 2.1 to 2.12 AND −0.79 to −0.78
	(b)	$9a^2 + 16b^2 - 24ab$	B2	**2**	**SC1** for $9a^2 + 16b^2$ OR $-24ab$ seen
	(c)	$(4 - y)(3 + 2t)$	B2	**2**	**SC1** for any pair correctly factorised
2	**(a)**	**(i)** $2(7 \times 5 + 7 \times 3 + 3 \times 5)$	M1		
		142 cm^2	A1	**2**	
		(ii) $x^3 = 7 \times 5 \times 3$ soi	M1		
		4.7 to 4.72 cm	A1	**2**	
	(b)	**(i)** $\frac{1}{3}\pi 8^2 \times 15$	M1		
		1005 to 1010 cm^3	A1	**2**	
		(ii) 17 cm	B1	**1**	
		(iii) $\pi \times 8 \times 17$	M1		
		427 to 427.3 cm^2	A1	**2**	
		(iv) 628 to 628.6 f.t. cm^2	B1	**1**	f.t. 201 + their 427
3	**(a)**	**(i)** $D\hat{C}B = 62^\circ$	B1		
		(ii) $D\hat{A}B = 118^\circ$ f.t.	B1		f.t. 180 – their 62
		(iii) $O\hat{D}B = 28^\circ$	B1		
		(iv) $C\hat{O}B = 26^\circ$	B1	**4**	
	(b)	**(i)** $\frac{140}{360}$ soi	B1		
		78.1 to 78.25 cm^2	B1	**2**	
		(ii) 220°	B1		
		$2 \times \pi \times 8 \, x \frac{220}{360}$	M1		
		46.7 to 46.73 cm	A1	**3**	

4	**(a)**	**(i)**	\$6.05	B1	**1**	
		(ii)	62.5%	B1	**1**	
	(b)	**(i)**	$\cos H\hat{C}B = \frac{60}{80}$ oe	M1		
			41.4° to 41.41°	A1	**2**	
		(ii)	$\sin 32 = \frac{40}{CD}$	M1		
			$CD = \frac{40}{\sin 32}$	M1		
			75.48 to 75.5 m	A1	**3**	
		(iii)	$\tan d = \frac{40}{35}$	M1		
			d = 48.8° to 49°	A1	**2**	**SC1** for 41° to 41.2°
	(c)	**(i)**	$\frac{4.6}{15}$	M1		
			0.31 s	A1		
		(ii)	54 km/h	B1	**3**	
5	**(a)**	6, 10, 14, 18		B1		
	(b)	4		B1		
	(c)	**(i)**	124	B1		
		(ii)	2	B1	**4**	
6	**(a)**	**(i)**	(a) 8	B1		
			(b) 4	B1		
			(c) 21	B1		
			(d) 19 f.t.	B1	**4**	f.t. 27 – their 8
		(ii)	Students who study Maths but not Physics	B1		(nor Spanish)
			or			
			Students who study only Maths	B1	**1**	
	(b)	**(i)**	$\frac{8}{6} = \frac{10}{RC}$ or $\frac{8}{14} = \frac{10}{10+RC}$ oe	M1		
			7.5 cm	A1	**2**	
		(ii)	$\left(\frac{8}{14}\right)^2$ or $\left(\frac{14}{8}\right)^2$ oe	M1		e.g. $\left(\frac{10}{10+\text{their}7.5}\right)^2$
			98 cm^2	A1	**2**	

7	**(a)**	$\frac{3}{5}\times 5000$ seen	B1	**1**	
	(b)	**(i)** $\frac{1800}{20000}$	M1		
		9%	A1	**2**	
		(ii) $\frac{2}{5}\times(21800-15000)$	M1		
		\$17 720	A1	**2**	
	(c)	$\frac{5}{3}\times 7500$	M1		
		\$12 500	A1		
		\$27 500 f.t.	B1	**3**	f.t.15 000 + their 12 500 **SC1** for \$33 750
	(d)	**(i)** $\frac{3}{5}(x-15000)$ oe	B1		
		(ii) their $\frac{3}{5}(x-15000)=\frac{x}{2}$ f.t.	M1		
		x = 90 000	A1		
		$\Rightarrow$ \$45000	A1	**4**	
8	**(a)**	2.5	B1	**1**	
	(b)	All 10 points plotted correctly f.t. (within 1 mm)	P2		
		8 or 9 points plotted correctly (within 1 mm) (Allow P1)			
		Smooth curve, not grossly thick, thro' all plotted points of which at least 8 are correct	C1	**3**	lost for straight line, or incomplete
	(c)	**(i)** $1.4 < x < 1.5$	X1		
		(ii) 6.4 to 6.5	Y1	**2**	
	(d)	Negative value	G1		
		2.0 to 2.5	G1	**2**	
	(e)	Line with negative slope thro' (0,12)	L1		
		Also through (6,6)	L1	**2**	
	(f)	Attempt to simplify $\frac{x^2}{8}+\frac{18}{x}-5=12-x$	M1		Allow M1 for attempt to sub x = 1.2 and 7.5 and solve
		A = 8 AND B = −136	A1	**2**	

9	**(a)**	**(i)**	138^o	B1	**1**	
		(ii)	$\frac{AC}{\sin 48} = \frac{7}{\sin 66}$	M1		
			$AC = \frac{7\sin 48}{\sin 66}$	M1		
			5.69 to 5.7 km	A1	**3**	
	(b)	**(i)**	$\frac{1}{2} \times 7 \times 6.3 \sin 41$	M1		All M and A marks available for any COMPLETE alternative method
			14.46 to 14.5 km^2	A1	**2**	
		(ii)	6.3 sin 41 or $\frac{\text{area}}{3.5}$	M1		
			4.13 to 4.15 km	A1	**2**	
	(c)		Attempt at Cosine Rule involving $B\hat{A}E$	M1		
			$\cos A = \frac{9^2 + 7^2 - 5^2}{2 \times 9 \times 7} \left(= \frac{105}{126}\right)$	A1		
			33.5^o to 34^o	A1		
			$(0)56^o$ – 56.5^o f.t.	A1	**4**	f.t. 90 – their $\hat{A}$
10	**(a)**	**(i)**	31.8 cm	B1	**1**	
		(ii)	32.1 – 31.65 cm	M1		Attempting to take readings at 90 and 30
			0.42 to 0.48 cm	A1	**2**	
		(iii)	108	B1	**1**	
	(b)	**(i)**	9	B1	**1**	
		(ii)	(2 x 7.5) + (4 x 11) + (6 x 13) + (3 x 15) + (1 x 18)	M1		
			÷16	M1		
			12.5 min	A1	**3**	
		(iii)	$\frac{7}{30}$ cao	B2	**2**	**SC1** for any correct equivalent or $\frac{7}{60}$ *or* $\frac{7}{32}$
		(iv)	1.6 cm	B2	**2**	

11	**(a)**	**(i)** $\begin{pmatrix} -6 & 6 \\ -6 & 8 \end{pmatrix}$	B2	**2**	**SC1** for 3 correct elements
		(ii) Attempting to find AB or determ $A = 7$	M1		
		$p = \frac{1}{7}$	A1	**2**	
		(iii) $\begin{pmatrix} -2p & 3p \\ -3p & p \end{pmatrix}\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$ attempt			
		or $\begin{pmatrix} 1 & -3 \\ 3 & -2 \end{pmatrix}\begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$	M1		
		leading to 4 equations $\frac{1}{7}\begin{pmatrix} 2 & 3 \\ 3 & 1 \end{pmatrix}$	A1	**2**	
		(iv) Reflection	B1		
		in y axis oe	B1		
	(b)	**(i)** $h = 2$	B1	**1**	
		(ii) $\begin{pmatrix} 10 \\ 7 \end{pmatrix}$	B1	**1**	
		(iii) −5	B2	**2**	

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE O Level

MARK SCHEME for the May/June 2006 question paper

4024 MATHEMATICS

4024/01 **Paper 1** **maximum raw mark 80**

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ISW Ignore Subsequent Working

MR Misread

PA Premature Approximation (resulting in basically correct work that is insufficiently accurate)

SOI Seen or implied

SOS See Other Solution (the candidate makes a better attempt at the same question)

1	**(a)**	52.7 (%)	1				
	(b)	70	1	2			
2	**(a)**	$\frac{11}{21}$	1				
	(b)	$\frac{8}{45}$	1	2			
3	**(a)**	($) 336	1				
	(b)	(£) 80	1	2			
4	**(a)**	5000	1				
	(b)	3	1	2			
5	**(a)**	40 (km/h)	1				
	(b)	1.6 (kg)	1	2			
6	**(a)**	Inversely	1				
	(b)	9	1	2			
				12			**12**
7		($) 640	2	2	$\frac{(100 \text{ or } 25) \times 800}{125}$ oe	M1	
8	**(a)**	20 30 or 8 30 pm	1				
	(b)	4 (hours)	1	2			
9	**(a)**	4×10^{-6}	1				
	(b)	(0).8 cm^3	2	3	Answer fig 8 or Fig 4 x 2 seen	M1	
10	**(a)** **(i)**	6	1				
	(ii)	8	1				
	(b)	(x =) 2, (y =) 2	1	3			
11		(x =) –7, (y =) –3	3	3	One correct, with supporting working	C2	
				13	or correct method to eliminate x or y	M1	**13**

12	**(a)**		9	2		$\frac{360}{180-140}$ or $(2n-4)90 = 140n$ oe	M1	
	(b)		$80^{(°)}$	1	3			
13	**(a)**		26	1				
	(b)	**(i)**	x^2 cao	1				
		(ii)	x^3 cao	1	3			
14	**(a)**		75	1				
	(b)		8	2	3	3 x 5 = $2x - 1$ or $3y = 2x - 1$ oe seen or 3 x 5 = $2y - 1$ or $3x = 2y - 1$	M1	
15	**(a)**		500 (m)	2		Correct method to find area under line	M1	
	(b)		$\frac{k}{2k}$ or (0).5	1	3	Accept $-\frac{1}{2}$ etc.		
16	**(a)**		7	1				
	(b)	**(i)**	50.5 (cm)	1				
		(ii)	128 (cm)	1	3			
					15			**15**
17	**(a)**		–12	1				
	(b)		2, $-\frac{1}{2}$ oe	2	3	One correct	C1	
						or $(2y + 1)(y - 2)$ seen	M1	
18	**(a)**		$54^{(°)}$	1				
	(b)		$36^{(°)}$ or 90 – their **(a)** f.t.	1		O < B < 90 required		
	(c)		$36^{(°)}$ or their **(b)** f.t.	1	3	O < C < 90 required		
19	**(a)**		–20	1				
	(b)		$\frac{9C+160}{5}$ oe	2	3	$9C = 5F - 5 \times 32$ or $\frac{9C}{5} = F - 32$	M1	
20	**(a)**		2.6 (m) cao	1				
	(b)		–(0).5 (m)	1				
	(c)		–(0).8 (m)	2	4	$\frac{\text{Sum of readings}}{7}$ seen	M1	
					13			**13**

21	**(a)**	**(i)**	– – 7 9 13 5 6 8 10 14 7 8 – – 16 9 10 – 14 18 13 14 16 18 22	1				
		(ii) (a)	6/25 oe f.t.	1		Follow through from their table		
		(b)	5/25 oe f.t.	1		Follow through from their table		
	(b)		0	1	4			
22	**(a)**		NAB = 90° ± 2°, AB = 14.0 ± 0.4 cm	1				
	(b)	**(i)**	BAC = 40° ± 2°	1				
			Perp bisector, 90° ± 2°	1		Cuts AB up to 0.2 cm from centre		
		(ii)	45(.0) to 46.5 (m)	1				
		(iii)	320°	1	5			
					9			**9**
23	**(a)**	**(i)**	$3x^2 - 4$	1				
		(ii)	x with no wrong working seen	2		Correct factorisation of numerator or denominator	M1	
	(b)		Condone missing outside brackets, "=0", and use of wrong letter if clear			If only solutions (even incorrect) in answer give mark(s) if factors seen		
			$7(x - 3)(x + 3)$	2	5	Incomplete factorisation seen e.g. $7(x^2 - 9)$ or $(7x - 21)(x + 3)$ etc.	M1	
24	**(a)**	**(i)**	$\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$	1				
		(ii)	Enlargement, with centre (0, 0), or factor 2	1				
	(b)	**(i)**	C drawn with vertices at (7, 3), (7, 4), (6, 6) and (6, 7) Accept reasonable freehand sides	2		At least 2 correct vertices or no sides or wrong centre or wrong direction	C1	
		(ii)	Shear	1				
			Factor 3 and/or x-axis invariant dep	1	6			
					11			**11**

25	**(a)**	$\left(2\frac{1}{2},4\right)$ oe	1				
	(b)	5	1				
	(c)	4/3 oe	1		Accept 1.33 or better		
	(d)	$3y = 4x + 2$ oe	2		Line of gradient their **(c)** or which passes through (1, 2) or (4, 6)	C1	
	(e)	(7, 2)	1				
	(f)	$-\frac{3}{5}$ oe f.t.	1	7	Accept - $\frac{3}{\text{their } \mathbf{(b)}}$ f.t.		
				7			**7**

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/02**

Paper 2

May/June 2005

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (1 sheet)
Mathematical tables (optional)

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate Answer Booklet/Paper provided.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is 100.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

This document consists of **11** printed pages and **1** blank page.

Section A [52 marks]

Answer **all** the questions in this section.

1 **(a)** Remove the brackets and simplify

(i) $4(3 - 2p) - 3(1 - p)$, [1]

(ii) $(3q - r)(q + 2r)$. [2]

(b) Factorise completely $18t^2 - 2$. [2]

(c) Given that $y = 18 + 3x^2$,

(i) find the value of y when $x = -2$, [1]

(ii) find the values of x when $y = 93$, [2]

(iii) express x in terms of y. [2]

---

2 **(a)** Two varieties of tea, 'High Blend' and 'Normal Blend', are made by mixing Grade A leaves and Grade B leaves.

(i) In High Blend, the ratio of the masses of Grade A leaves to Grade B leaves is 3 : 2.

Find the mass of Grade A leaves used in making 250 g of High Blend. [1]

(ii) 1 kg of Normal Blend is made by using 450 g of Grade A leaves.

Find, **in its simplest form**, the ratio of the masses of Grade A to Grade B leaves in Normal Blend.
Give your answer in the form $m : n$, where m and n are integers. [2]

(iii) 250 g of High Blend is mixed with 1 kg of Normal Blend.

Calculate the percentage of the mass of this mixture that consists of Grade A leaves. [2]

(b) During a sale, a shop sold packets of tea for 20% less than the price shown on their labels. Elizabeth and Peter each bought a packet of tea in the sale.

(i) Elizabeth's packet had a label price of \$4.50.

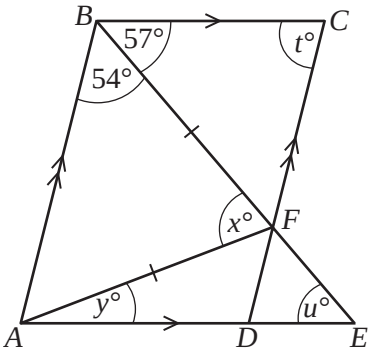
How much did she pay? [1]

(ii) Peter paid \$6.20 for his packet.

Calculate the price shown on its label. [2]

---

3 **(a)** In the diagram, *ABCD* is a parallelogram.
ADE and *BFE* are straight lines.



$AF = BF$.

$A\hat{B}F = 54°$ and $C\hat{B}F = 57°$.

Find the value of

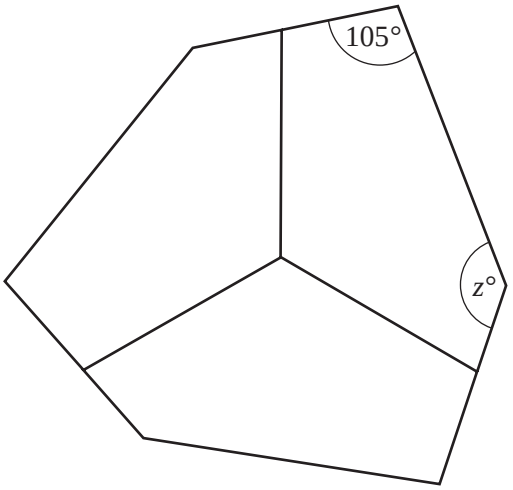
(i) *t*, [1]

(ii) *u*, [1]

(iii) *x*, [1]

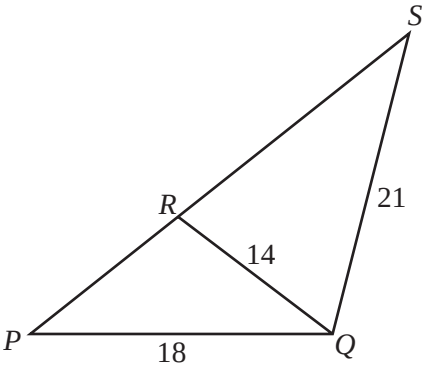
(iv) *y*. [1]

(b) This hexagon has rotational symmetry of order 3.



Calculate the value of *z*. [2]

(c) In the diagram, triangle *PQR* is similar to triangle *PSQ*.
$P\hat{Q}R = P\hat{S}Q$.



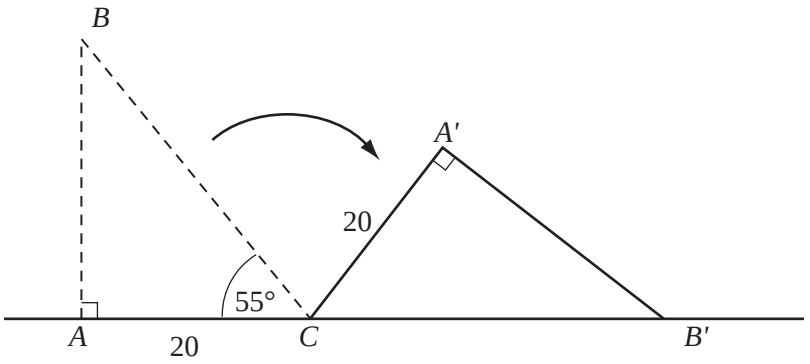
$PQ = 18$ cm, $QR = 14$ cm and $QS = 21$ cm.

Calculate the length of

(i) *PR*, [1]

(ii) *RS*. [2]

4



In triangle ABC, $B\hat{A}C = 90°$, $B\hat{C}A = 55°$ and $AC = 20$ cm.
The triangle initially stood with AC on a horizontal surface.
It was then rotated about the point C onto triangle $A'B'C$, where ACB' is a straight line.

(a) Calculate

(i) the length of BC, [2]

(ii) the distance AB', [1]

(iii) the height of A' above CB'. [2]

(b) Describe **fully** the path which the point A followed under this rotation. [2]

(c) Calculate the length of the path which the point A followed under this rotation. [2]

5 **(a)** Sweet packets contain sweets of different colours.
The number of yellow sweets in each of 25 packets was recorded.
The table below shows the results.

Number of yellow sweets	0	1	2	3	4	5
Frequency	8	5	5	4	2	1

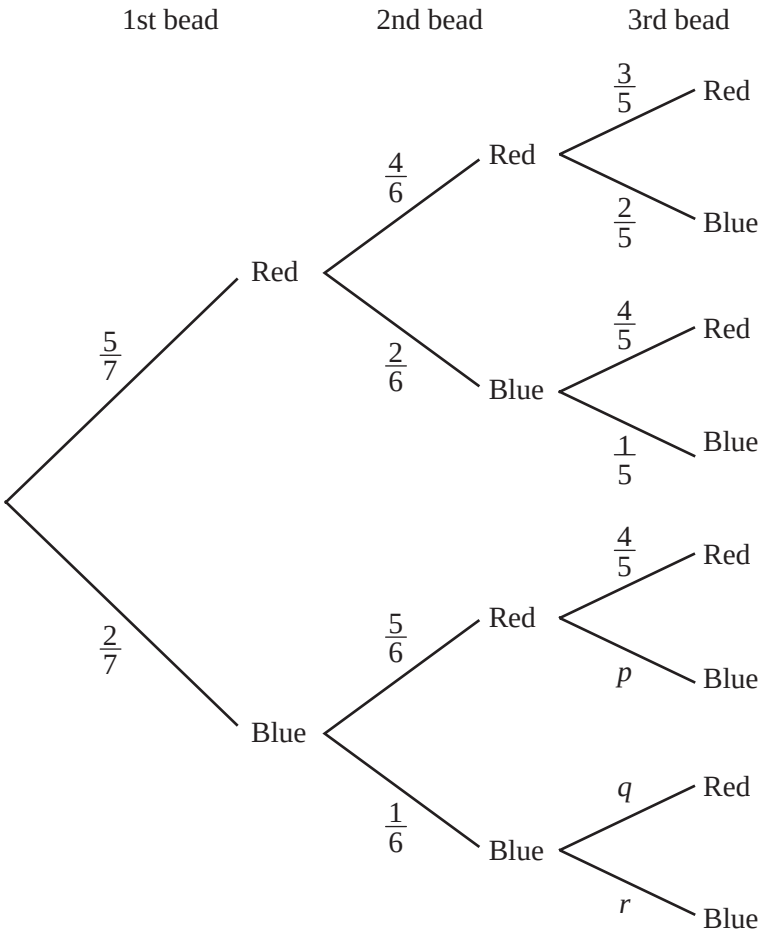
For this distribution,

(i) write down the mode, [1]

(ii) write down the median, [1]

(iii) calculate the mean. [2]

(b) A bag contained 5 Red and 2 Blue beads.
Chris took 3 beads, at random, and without replacement, from the bag.
The probability tree shows the possible outcomes and their probabilities.



(i) Write down the values of p, q and r. [2]

(ii) Expressing each answer as a fraction in its lowest terms, find the probability that

(a) three Red beads were taken, [1]

(b) the first bead was Red, the second Blue and the third Red, [1]

(c) two of the beads were Red and one was Blue. [2]

6 **Read** these instructions.

A Choose two **different** digits from 1, 2, 3, 4, 5, 6, 7, 8 and 9.
B Write down the larger two-digit number which can be formed from the chosen digits.
C Write down the smaller two-digit number which can be formed from the chosen digits.
D Subtract the smaller number from the larger and note the result.

Example:
A Choose 2 and 8.
B Larger number is eighty-two (82).
C Smaller number is twenty-eight (28).
D Subtract:
$$\begin{array}{r} 82 \\ -28 \\ \hline 54 \end{array}$$
Result = 54

(a) The digits 3 and 7 are chosen.
Follow the instructions to find the result. [1]

(b) Choose three other different pairs of digits.
Follow the instructions to find the result in each case. [1]

(c) What do you notice about all these results? [1]

(d) The digits x and y, where $x > y$, are chosen.

Find expressions, in terms of x and y, for the value of

(i) the larger number, [1]

(ii) the result. [2]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 **[The volume of a pyramid is $\frac{1}{3} \times$ base area $\times$ height.]**

[The volume of a sphere is $\frac{4}{3}\pi r^3$.]

Morph made several different objects from modelling clay.
He used 500 cm^3 of clay for each object.

(a) He made a square-based cuboid of height 2 cm.

Calculate the length of a side of the square. [2]

(b) He made a pyramid with a base area of 150 cm^2.

Calculate the height of the pyramid. [2]

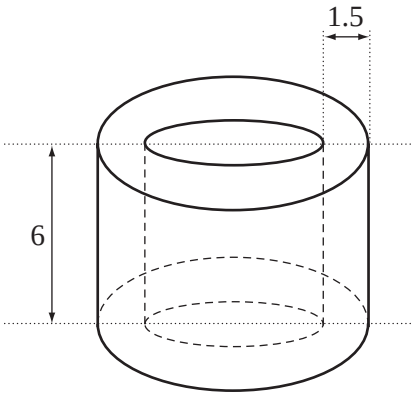
(c) He made a sphere.

Calculate the radius of the sphere. [2]

(d) He wrapped the clay around the curved surface of a hollow cylinder of height 6 cm.

The thickness of the clay was 1.5 cm.

Calculate the radius of the hollow cylinder.



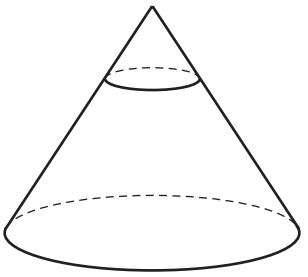
[4]

(e) He made a cone.

Then he cut through the cone, parallel to its base, to obtain a small cone and a frustum.

The height of the small cone was two-fifths of the height of the full cone.

Use a property of the volumes of similar objects to calculate the volume of clay in the small cone.



[2]

8 Answer the whole of this question on a sheet of graph paper.

During one day, at a point P in a small harbour, the height of the surface of the sea above the seabed was noted.
The results are shown in the table.

Time (t hours) after 8 a.m.	0	1	2	3	4	5	6	7	8	9
Height (y metres) above the sea-bed	3.8	3.3	2.5	1.8	1.2	1.0	1.2	1.8	2.5	3.3

(a) Using a scale of 1 cm to represent 1 hour, draw a horizontal t-axis for $0 \leqslant t \leqslant 9$.

Using a scale of 2 cm to represent 1 metre, draw a vertical y-axis for $0 \leqslant y \leqslant 4$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(b) (i) By drawing a tangent, find the gradient of the curve at the point where $t = 4$. [2]

(ii) Explain the meaning of this gradient. [1]

(c) On the same day, a straight pole was driven vertically into the seabed at the point P.
Work started at 8 a.m.
The pole was driven in at a constant rate.
The height, y metres, of the top of the pole above the seabed, t hours after 8 a.m., is given by the equation

$$y = 4 - \tfrac{1}{2}t.$$

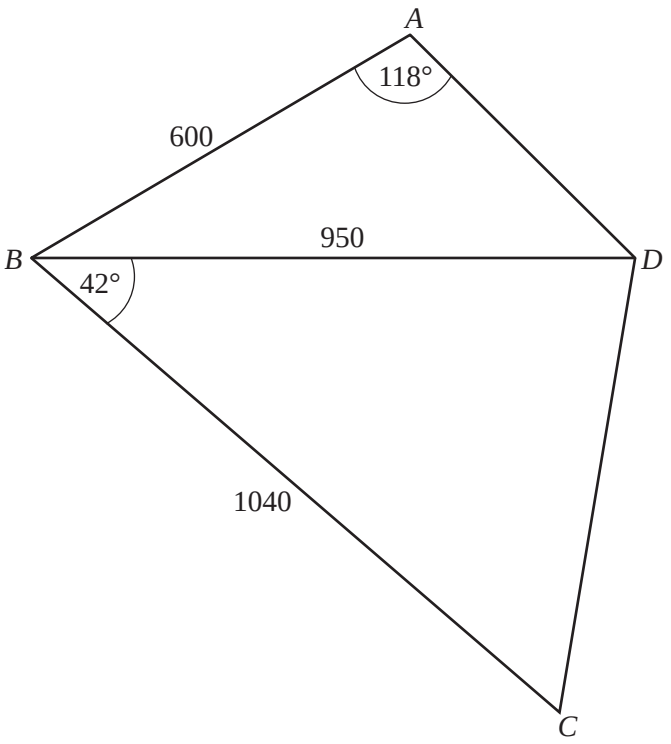
(i) Write down the length of the pole. [1]

(ii) On the same axes as the curve, draw the graph of $y = 4 - \frac{1}{2}t$. [2]

(iii) How many **centimetres** was the top of the pole above the surface of the sea at noon? [2]

(iv) Find the value of t when the top of the pole was level with the surface of the sea. [1]

9



In the diagram, the quadrilateral *ABCD* represents a level park with a path *BD*.
AB = 600 m, *BC* = 1040 m, *BD* = 950 m, $C\hat{B}D = 42°$ and $B\hat{A}D = 118°$.

(a) Calculate

(i) angle *ABD*, [4]

(ii) the length of *CD*, [4]

(iii) the shortest distance from *C* to *BD*. [2]

(b) A helicopter flew directly above the path *BD* at a constant height of 500 m.

Calculate the greatest angle of depression of the point *C* as seen by a passenger on the helicopter. [2]

10 A route up a mountain is 20 km long.
John followed this route at an average speed of x km/h.

(a) Write down an expression, in terms of x, for the number of hours he took to walk up the mountain. [1]

(b) He came down the mountain by a different route.
The length of this route was 25 km.
His average speed coming down the mountain was 2 km/h greater than his average speed going up the mountain.

Write down an expression, in terms of x, for the number of hours he took to walk down. [1]

(c) It took John $1\frac{1}{2}$ hours less to come down than to go up.

Write down an equation in x, and show that it simplifies to

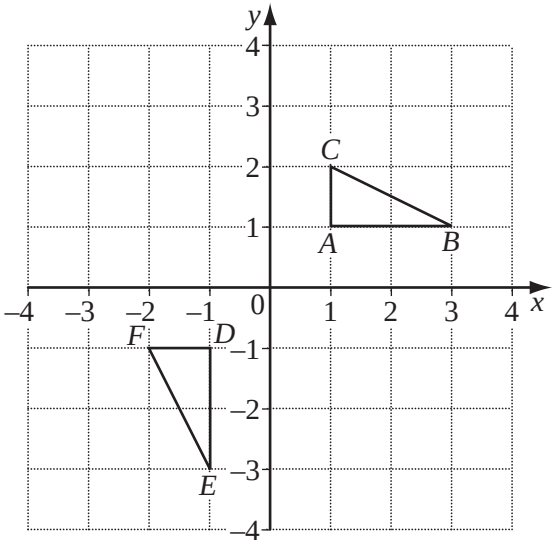
$$3x^2 + 16x - 80 = 0.$$

[3]

(d) Solve the equation $3x^2 + 16x - 80 = 0$, giving both answers correct to 3 decimal places. [4]

(e) Calculate, correct to the nearest minute, the **total** time John took to go up and come down the mountain. [3]

11



Triangle *ABC* has vertices *A* (1, 1), *B* (3, 1) and *C* (1, 2).
Triangle *DEF* has vertices *D* (–1, –1), *E* (–1, –3) and *F* (–2, –1).

The matrix **P** represents the **single** transformation, T, that maps triangle *ABC* onto triangle *DEF*.

(a) **(i)** Describe T **fully**. [2]

(ii) Write down the matrix **P**. [1]

(b) Another transformation is represented by the matrix **Q**, where $\mathbf{Q} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$.

(i) This transformation maps *B* onto *Y*.

Find the coordinates of *Y*. [1]

(ii) This transformation maps *K* onto *C*.

Find the coordinates of *K*. [2]

(iii) Describe, **fully**, the **single** transformation which is represented by **Q**. [2]

(iv) The matrix **R** is given by **Q** = **RP**.

By considering the effects of transformations on triangle *ABC*, or otherwise, find **R**. [2]

(c) The point *H* lies on *DC* produced, where $\overrightarrow{DH} = \begin{pmatrix} 18 \\ h \end{pmatrix}$.

Calculate

(i) the ratio *DC* : *DH*, [1]

(ii) the value of *h*. [1]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/11 Paper 1, maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

UNIVERSITY of CAMBRIDGE
International Examinations

Abbreviations

cao correct answer only
cso correct solution only
dep dependent
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working

Qu	Answers	Mark	Part marks
1	**(a)** 147 oe	1	
	(b) 17	1	
2	**(a)** $\frac{9}{50}$ cao	1	
	(b) π , $\sqrt{10}$, ...	1	
3	**(a)** $\frac{29}{30}$	1	
	(b) $\frac{8}{15}$	1	
4	**(a)** 1 or 25	1	
	(b) 216	1	
5	**(a)** –24	1	
	(b) 102	1	
6	**(a)** 4	1	
	(b) 36	1	
7	**(a)** $A \cup (B \cap C)$ oe	1	
	(b) Correct region shaded	1	
8	**(a)** 63	1	
	(b) 60	1	
9	**(a)** $4ab(3b - 2a)$	1	
	(b) $(2x - 5)(x + 4)$	2	C1 for $(2x \pm a)(x \pm b)$, $a = 4$ or 5, $b = 4$ or 5
10	**(a)** 14 05 or 2 05 pm	2	B1 for $\frac{65}{20}$ or M1 for 10 50 + their $3\frac{1}{4}$
	(b) $\frac{100T}{110}$ oe	1	

11	**(a)** $-\frac{3}{2}$ oe	1	
	(b) x 1 y 2 $2y$ $9 - 3x$	2	C1 for 2 of these or B1 for x ( ) 1, y ( ) 2 and $2y$ ( ) $9 - 3x$ ( ) may contain =, < etc
12	**(a)** Showing $180 - 36$	1	
	(b) 96	2	B1 for the angle of a regular hexagon or M1 for 360 – (their144 + their 120)
13	**(a)** 31	1	
	(b) 6	1	
	(c) 5	1	
14	**(a)** 12 000	2	B1 for two of 8, 300, 0.2 seen
	(b) 9.575	1	
15	(a =) 8.75 oe (b =) 6 oe	3	C2 for one correct www or B1 for $\frac{4}{7}$ or $\frac{7}{4}$ oe seen
16	**(a)** (x) $\frac{1}{4}$ or 0.25	1	
	(b) (x =) $\frac{2}{3}$ or -3	3	C2 for either www or M2 for $5x(x-1) - 2(x+1) = 8(x+1)(x-1)$ soi or M1 for $\frac{5x(x-1) - 2(x+1)}{(x+1)(x-1)}$ soi
17	**(a)** 38	1	
	(b) 104	1ft	ft $180 - 2 \times$ their **(a)**
	(c) 122	1	
	(d) 84	1ft	ft their **(c)** – 38
18	**(a)** 79 cao	1	
	(b) $n(n+1) + (n+2)^2$ oe	1	
	(c) (A =) 2, (B =) 5, (C =) 4	2	C1 for two of these or M1 for three correct equations or comparison with their **(b)**

19	**(a)** **(i)** 3.6×10^{-6}	1	
	(ii) 3.6×10^{-3} oe	1ft	ft their **(i)** $\times 10^3$
	(b) 3700	2	M1 for correct removal of brackets or for division by 2×10^3
20	**(a)** 3	1	
	(b) $\frac{3+2x}{x}$ oe	2	M1 for $yx - 2y = 3$ or $xy - 2x = 3$ soi
	(c) 4	2	M1 for $2t - 5 = 3$ soi
21	**(a)** Tree diagram correct	2	C1 for $\frac{1}{3}$ and $\frac{2}{3}$ or $\frac{4}{5}, \frac{1}{5}, \frac{4}{5}$ and $\frac{1}{5}$
	(b) $\frac{4}{15}$	1	
	(c) $\frac{1}{15}$	2	M1 for $1-\left(\frac{2}{3}\times\frac{4}{5}+\frac{2}{3}\times\frac{1}{5}+\frac{1}{3}\times\frac{4}{5}\right)$ or B1 for their $\frac{1}{3}$ and their $\frac{1}{5}$ seen
22	**(a)** $1200 + 450\pi$	2	C1 for one correct term B1 for using πr^2 correctly
	(b) $40 + 10\pi$ oe	3	B1 for using $2\pi r$ correctly and B1 for $20 + 20$
23	**(a)** Correct triangle with sides 8 and 6	2	B1 for correct triangle without arcs or arcs seen but only one correct side or sides reversed
	(b) **(i)** Bisector of ABC	1	
	(ii) Circular arc	1	
	(c) Correct region shaded	1	
24	**(a)** 4 –5	2	C1 for one correct
	(b) 6 correct plots ft and curve	2ft	C1 for at least 4 plots and "curve"
	(c) **(i)** 0 cao 2.4 to 2.5 ft	2	C1 for either
	(ii) ft from graph	1ft	

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/23**

Paper 2 **May/June 2010**

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (2 sheets)
Mathematical tables (optional)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

This document consists of **12** printed pages.

Section A [52 marks]

Answer **all** questions in this section.

1 **(a)** Sarah bought some soup, apples and mushrooms from her local shop.
The table shows some of the amounts and prices.

Items	Price ($)
p cans of soup at 90 cents per can	6.30
1.5 kilograms of apples at $\$q$ per kilogram	4.35
r kilograms of mushrooms at \$6.40 per kilogram	1.60

(i) Find the values of p, q and r. [2]

(ii) Sarah gives the shopkeeper \$20.00 to pay for all these items.

How much change does she receive? [1]

(b)

Washing Machine

\$980

Finance offer

Pay a 20% deposit
and
24 monthly payments of
\$36 each

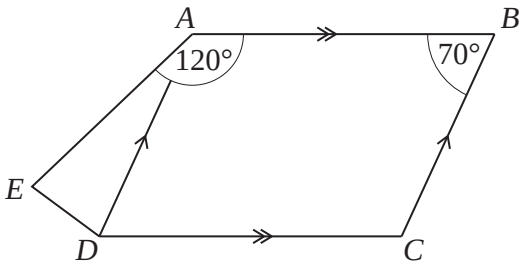
Lavin decides to buy this washing machine.

How much more would it cost Lavin if he paid for the washing machine using the finance offer instead of paying the \$980 immediately? [2]

(c) Asif deposits \$650 into a bank paying simple interest.
He leaves the money there for 5 years.
At the end of the 5 years, the amount in the bank is \$763.75.

Calculate the percentage rate of interest the bank paid per year. [3]

2



The parallelogram $ABCD$ forms part of the pentagon $ABCDE$.
$A\hat{B}C = 70°$ and $B\hat{A}E = 120°$.

(a) Find

(i) $B\hat{C}D$, [1]

(ii) $E\hat{A}D$. [1]

(b) $E\hat{D}C$ is twice $A\hat{E}D$.

Find

(i) $A\hat{E}D$, [3]

(ii) $E\hat{D}A$. [1]

---

3 The mass and diameter of the planets in the inner solar system are shown in the table.

Planet	Mass (kg)	Diameter (km)
Mercury	3.30×10^{23}	4880
Venus	4.87×10^{24}	12 100
Earth	5.97×10^{24}	12 800
Mars	6.42×10^{23}	6790

(a) List the planets in order of mass, starting with the lowest. [1]

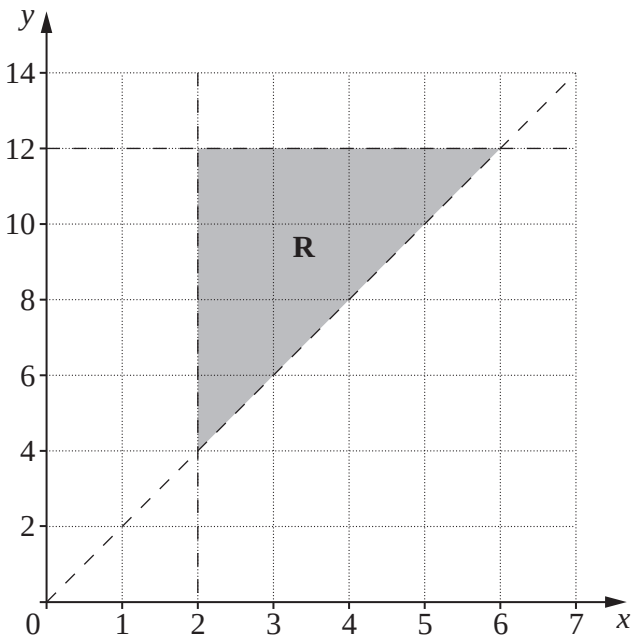
(b) Find the radius, in kilometres, of Mars, giving your answer correct to 1 significant figure. [1]

(c) Giving your answer in standard form, find the total mass, in kilograms, of Venus and Mars. [1]

(d) **[Volume of a sphere = $\frac{4}{3}\pi r^3$]**

Giving your answer in standard form, find the volume, in cubic kilometres, of the Earth. [2]

4



The shaded region, **R**, contained **inside** the dotted boundary lines, is defined by three inequalities.

(a) One of these inequalities is $x > 2$.

Write down the other two inequalities. [3]

(b) The points (c, d), where c and d are integers, lie in the shaded region **R**.

Find

(i) the maximum value of $c + d$, [1]

(ii) the value of d given that $d = 3c$. [1]

5 **(a)** Bertie goes shopping and buys three different types of fruit.
The first matrix below shows the number of kilograms of each fruit bought during two different weeks.
The second matrix shows the price per kilogram, in cents, of each fruit.

$$\begin{array}{l} \\ \text{Week 1} \\ \text{Week 2} \end{array} \begin{array}{c} \begin{array}{ccc} \text{bananas} & \text{apples} & \text{grapes} \end{array} \\ \begin{pmatrix} 1 & 2 & 0.5 \\ 1.5 & 1 & 1 \end{pmatrix} \end{array} \qquad \begin{array}{c} \text{price/kg} \\ \begin{pmatrix} 290 \\ 160 \\ 640 \end{pmatrix} \end{array} \begin{array}{l} \\ \text{bananas} \\ \text{apples} \\ \text{grapes} \end{array}$$

(i) $\mathbf{F} = \begin{pmatrix} 1 & 2 & 0.5 \\ 1.5 & 1 & 1 \end{pmatrix} \begin{pmatrix} 290 \\ 160 \\ 640 \end{pmatrix}$.

Find **F**. [2]

(ii) Explain the meaning of the information given by the matrix **F**. [1]

(iii) Find the total amount of money, in dollars, that Bertie spent on fruit during the two weeks. [1]

(b) The matrix **M** satisfies the equation

$$8\begin{pmatrix} 3 & 0 \\ -1 & 2 \end{pmatrix} + 5\mathbf{M} = \mathbf{M}.$$

Find **M**. [2]

(c) $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16\}$
$A = \{x : x \text{ is a multiple of } 3\}$
$B = \{x : x \text{ is a factor of } 24\}$
$C = \{x : x \text{ is an odd number}\}$

(i) Find

(a) $\text{n}(B)$, [1]

(b) $(A \cup B \cup C)'$. [1]

(ii) A number, k, is chosen at random from $\mathscr{E}$.

Find the probability that $k \in A \cap B$. [2]

6 Answer the WHOLE of this question on a sheet of graph paper.

The table below shows some values of x and the corresponding values of y for

$$y = \frac{2^x}{4}.$$

x	–1	0	1	2	3	4	5
y	m	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	n

(a) Calculate the values of m and n. [2]

(b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $-1 \leqslant x \leqslant 5$.
Using a scale of 2 cm to represent 1 unit, draw a vertical y-axis for $0 \leqslant y \leqslant 8$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to solve the equations

(i) $\frac{2^x}{4} = 3$, [1]

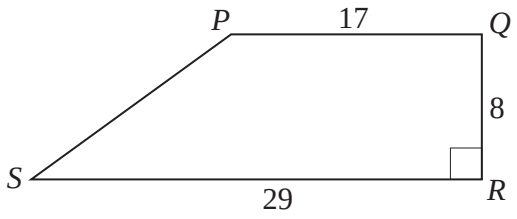
(ii) $2^x = 6$. [1]

(d) The equation $y = \frac{2^x}{4}$ can be written in the form $y = 2^t$.

(i) Find an expression for t in terms of x. [1]

(ii) Hence, find the equation of the line that can be drawn on your graph to evaluate y when $t = -\frac{3}{4}$. [1]

7 **(a)**



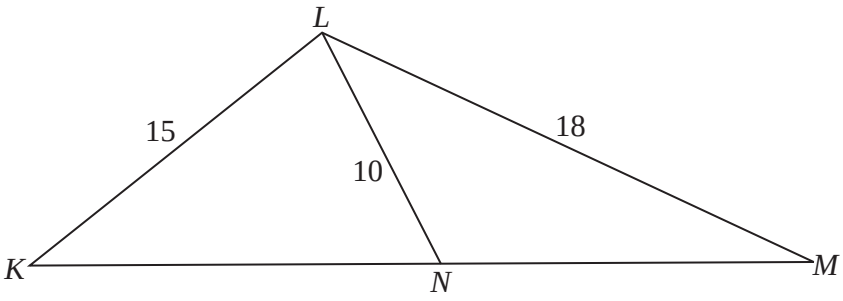
$PQRS$ is a trapezium.
$PQ = 17$ cm, $QR = 8$ cm, $SR = 29$ cm and $S\hat{R}Q = 90°$.

Calculate

(i) the area of $PQRS$, [1]

(ii) $P\hat{S}R$. [2]

(b)



In the diagram, triangle KLM is similar to triangle LNM.
$KL = 15$ cm, $LM = 18$ cm and $LN = 10$ cm.

(i) Find KM. [2]

(ii) Find KN. [2]

(iii) P is the point on LM such that PN is parallel to LK.

Find $\dfrac{\text{the area of triangle } NPM}{\text{the area of trapezium } KLPN}$.

Give your answer as a fraction in its simplest form. [2]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

8 Ahmed throws a ball to John.
The ball travels 10 metres at an average speed of x metres per second.

(a) Write an expression, in terms of x, for the time taken, in seconds, for the ball to travel from Ahmed to John. [1]

(b) John then throws the ball to Pierre.
The ball travels 15 metres.
The ball's average speed is 0.5 metres per second greater than the ball's average speed from Ahmed to John.

Write an expression, in terms of x, for the time taken, in seconds, for the ball to travel from John to Pierre. [1]

(c) The time taken between John catching the ball and then throwing it to Pierre is 2 seconds.
The total time taken for the ball to travel from Ahmed to Pierre is 7 seconds.

Write down an equation in x, and show that it simplifies to

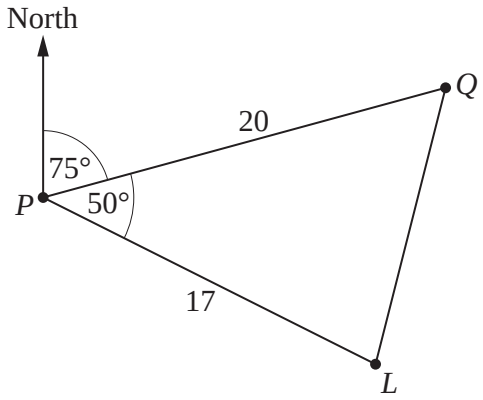
$$2x^2 - 9x - 2 = 0.$$ [3]

(d) Solve the equation $2x^2 - 9x - 2 = 0$, giving each answer correct to 2 decimal places. [4]

(e) **(i)** Find the average speed, in metres per second, of the ball as it travels from John to Pierre. [1]

(ii) How much longer does it take for the ball to travel from John to Pierre than from Ahmed to John?
Give your answer in seconds. [2]

9



The diagram shows two ports, P and Q, and a lighthouse L.
$PQ = 20$ km, $PL = 17$ km, $Q\hat{P}L = 50°$ and the bearing of Q from P is 075°.

(a) Find the bearing of P from L. [1]

(b) Calculate QL. [4]

(c) **(i)** Calculate $P\hat{L}Q$. [3]

(ii) Hence find the bearing of Q from L. [1]

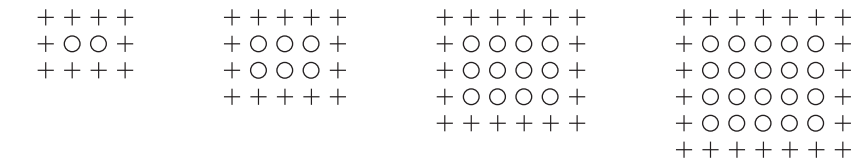
(d) A boat leaves P and sails in a straight line to Q.

(i) It takes 4 hours and 53 minutes to sail from P to Q.
It arrives at Q at 02 23.

At what time does it leave P? [1]

(ii) Calculate the shortest distance between the boat and the lighthouse. [2]

10



Flowerbed 1 Flowerbed 2 Flowerbed 3 Flowerbed 4

The diagrams above show the first four flowerbeds in a sequence.
Each flowerbed contains two types of plant, pansies (+) and primroses (○).

The table shows the number of plants in the first three flowerbeds.

Flowerbed number (n)	1	2	3	4	5
Number of pansies	10	14	18		
Number of primroses	2	6	12		
Total number of plants	12	20	30		

(a) Copy and complete the columns for flowerbeds 4 and 5. [2]

(b) Find an expression, in terms of n, for

(i) the number of pansies in flowerbed n, [1]

(ii) the number of primroses in flowerbed n. [1]

(c) **Hence** show that the total number of plants in flowerbed n can be expressed in the form

$$(n + 2)(n + 3).$$ [2]

(d) Calculate the total number of plants in flowerbed 10. [1]

(e) There are 306 plants in flowerbed k.

(i) Show that k satisfies the equation

$$k^2 + 5k - 300 = 0.$$ [2]

(ii) Solve the equation $k^2 + 5k - 300 = 0$. [2]

(iii) Hence find the number of pansies in flowerbed k. [1]

11 Answer the WHOLE of this question on a sheet of graph paper.

(a) The time taken by 140 children to run 200 metres was recorded.
The results are summarised in the table below.

Time (t seconds)	$22 \leqslant t < 24$	$24 \leqslant t < 26$	$26 \leqslant t < 31$	$31 \leqslant t < 36$	$36 \leqslant t < 46$
Frequency	12	18	42	28	40

(i) Using a scale of 1 cm to represent 2 seconds, draw a horizontal axis for time from 22 seconds to 46 seconds.
Using a scale of 1 cm to represent 1 unit, draw a vertical axis for frequency density from 0 to 9 units.

On your axes, draw a histogram to represent the information in the table. [3]

(ii) Estimate the number of children who took less than 25 seconds to run 200 metres. [1]

(iii) One child was chosen at random.

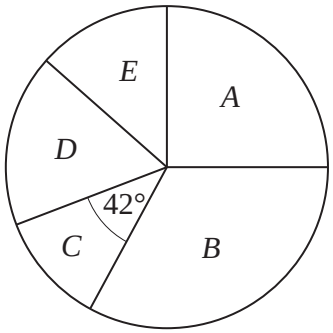
Calculate the probability that the time taken by this child was less than 36 seconds.
Express your answer as a fraction in its lowest terms. [1]

(iv) Out of the 30 children who took less than 26 seconds, two were chosen at random.

Calculate the probability that they both took less than 24 seconds. [2]

(b) Some boys were put into five groups, *A*, *B*, *C*, *D* and *E*, based on the times they took to run 100 metres.
The pie chart shows the proportion of boys in each group.

Group *A* contains $\frac{1}{4}$ of the boys.
Group *B* contains 35% of the boys.
Group *C* is represented by a sector with an angle of 42°.
Group *D* contains 9 boys.



(i) Find the fraction of boys in group *C*.
Give your answer in its lowest terms. [1]

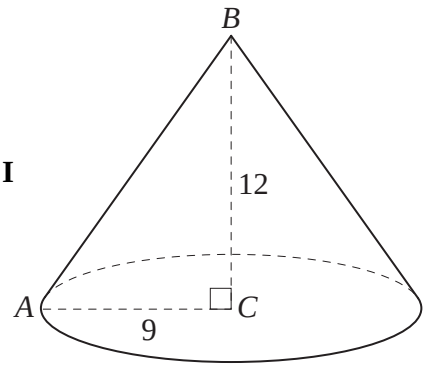
(ii) Given that the number of boys in group *B* is 21, find the total number of boys who ran the 100 metres. [2]

(iii) Calculate the number of boys in group *E*. [2]

12 **[Volume of a cone = $\frac{1}{3}\pi r^2 h$]**
[Curved surface area of a cone = πrl]

Diagram I shows a solid cone with C as the centre of its base.
B is the vertex of the cone and A is a point on the circumference of its base.
$AC = 9$ cm and $BC = 12$ cm.

Diagram I



(a) Calculate

(i) AB, [2]

(ii) the **total** surface area of the cone, [2]

(iii) the volume of the cone. [2]

(b) The cone in Diagram I is cut, parallel to the base, to obtain a small cone shown in Diagram II and a frustum shown in Diagram III.
Y is the centre of the base of the small cone.
X is the point on the circumference of this base and on the line AB such that $XY = 3$ cm.

Diagram II

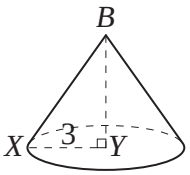
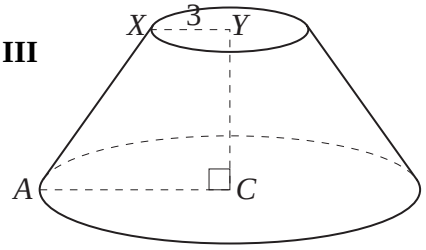


Diagram III



Calculate

(i) BY, [1]

(ii) AX, [1]

(iii) the circumference of the base of the small cone, [2]

(iv) the volume of the frustum. [2]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **May/June 2010**

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (2 sheets)
Mathematical tables (optional)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

Section A [52 marks]

Answer **all** questions in this section.

1 **(a)** Sarah bought some soup, apples and mushrooms from her local shop.
The table shows some of the amounts and prices.

Items	Price ($)
p cans of soup at 90 cents per can	6.30
1.5 kilograms of apples at $\$q$ per kilogram	4.35
r kilograms of mushrooms at \$6.40 per kilogram	1.60

(i) Find the values of p, q and r. [2]

(ii) Sarah gives the shopkeeper \$20.00 to pay for all these items.

How much change does she receive? [1]

(b)

Washing Machine

\$980

Finance offer

Pay a 20% deposit
and
24 monthly payments of
\$36 each

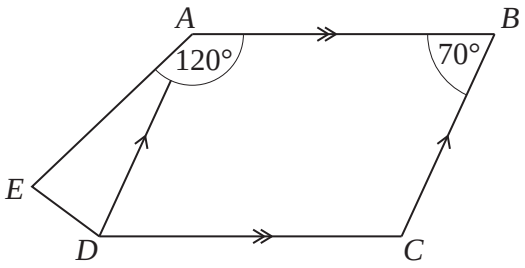
Lavin decides to buy this washing machine.

How much more would it cost Lavin if he paid for the washing machine using the finance offer instead of paying the \$980 immediately? [2]

(c) Asif deposits \$650 into a bank paying simple interest.
He leaves the money there for 5 years.
At the end of the 5 years, the amount in the bank is \$763.75.

Calculate the percentage rate of interest the bank paid per year. [3]

2



The parallelogram $ABCD$ forms part of the pentagon $ABCDE$.
$A\hat{B}C = 70°$ and $B\hat{A}E = 120°$.

(a) Find

(i) $B\hat{C}D$, [1]

(ii) $E\hat{A}D$. [1]

(b) $E\hat{D}C$ is twice $A\hat{E}D$.

Find

(i) $A\hat{E}D$, [3]

(ii) $E\hat{D}A$. [1]

---

3 The mass and diameter of the planets in the inner solar system are shown in the table.

Planet	Mass (kg)	Diameter (km)
Mercury	3.30×10^{23}	4880
Venus	4.87×10^{24}	12 100
Earth	5.97×10^{24}	12 800
Mars	6.42×10^{23}	6790

(a) List the planets in order of mass, starting with the lowest. [1]

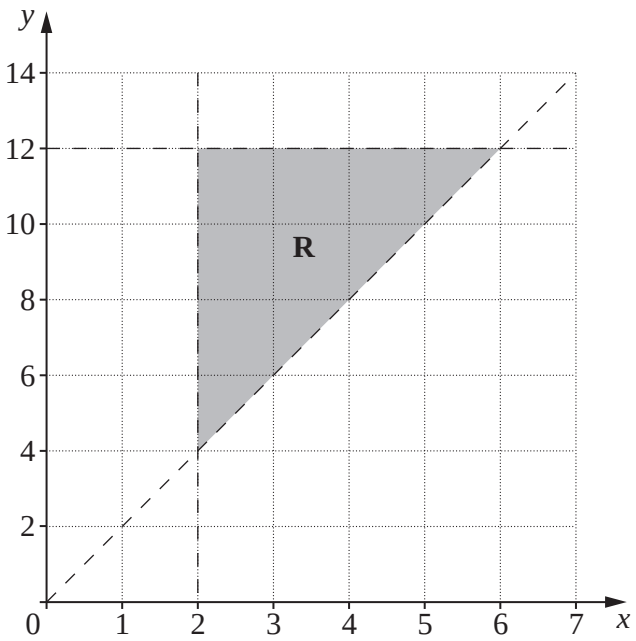
(b) Find the radius, in kilometres, of Mars, giving your answer correct to 1 significant figure. [1]

(c) Giving your answer in standard form, find the total mass, in kilograms, of Venus and Mars. [1]

(d) **[Volume of a sphere = $\frac{4}{3}\pi r^3$]**

Giving your answer in standard form, find the volume, in cubic kilometres, of the Earth. [2]

4



The shaded region, **R**, contained **inside** the dotted boundary lines, is defined by three inequalities.

(a) One of these inequalities is $x > 2$.

Write down the other two inequalities. [3]

(b) The points (c, d), where c and d are integers, lie in the shaded region **R**.

Find

(i) the maximum value of $c + d$, [1]

(ii) the value of d given that $d = 3c$. [1]

5 **(a)** Bertie goes shopping and buys three different types of fruit.
The first matrix below shows the number of kilograms of each fruit bought during two different weeks.
The second matrix shows the price per kilogram, in cents, of each fruit.

	bananas	apples	grapes
Week 1	1	2	0.5
Week 2	1.5	1	1

price/kg	
290	bananas
160	apples
640	grapes

(i) $\mathbf{F} = \begin{pmatrix} 1 & 2 & 0.5 \\ 1.5 & 1 & 1 \end{pmatrix} \begin{pmatrix} 290 \\ 160 \\ 640 \end{pmatrix}$.

Find **F**. [2]

(ii) Explain the meaning of the information given by the matrix **F**. [1]

(iii) Find the total amount of money, in dollars, that Bertie spent on fruit during the two weeks. [1]

(b) The matrix **M** satisfies the equation

$$8\begin{pmatrix} 3 & 0 \\ -1 & 2 \end{pmatrix} + 5\mathbf{M} = \mathbf{M}.$$

Find **M**. [2]

(c) $\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16\}$
$A = \{x : x \text{ is a multiple of } 3\}$
$B = \{x : x \text{ is a factor of } 24\}$
$C = \{x : x \text{ is an odd number}\}$

(i) Find

(a) $\mathrm{n}(B)$, [1]

(b) $(A \cup B \cup C)'$. [1]

(ii) A number, k, is chosen at random from $\mathscr{E}$.

Find the probability that $k \in A \cap B$. [2]

6 Answer the WHOLE of this question on a sheet of graph paper.

The table below shows some values of x and the corresponding values of y for

$$y = \frac{2^x}{4}.$$

x	–1	0	1	2	3	4	5
y	m	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	n

(a) Calculate the values of m and n. [2]

(b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $-1 \leqslant x \leqslant 5$.
Using a scale of 2 cm to represent 1 unit, draw a vertical y-axis for $0 \leqslant y \leqslant 8$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to solve the equations

(i) $\frac{2^x}{4} = 3$, [1]

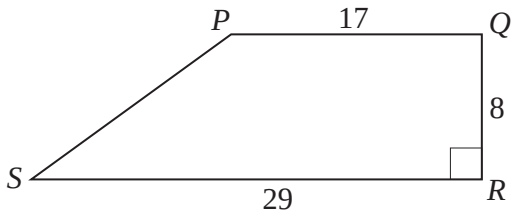
(ii) $2^x = 6$. [1]

(d) The equation $y = \frac{2^x}{4}$ can be written in the form $y = 2^t$.

(i) Find an expression for t in terms of x. [1]

(ii) Hence, find the equation of the line that can be drawn on your graph to evaluate y when $t = -\frac{3}{4}$. [1]

7 **(a)**



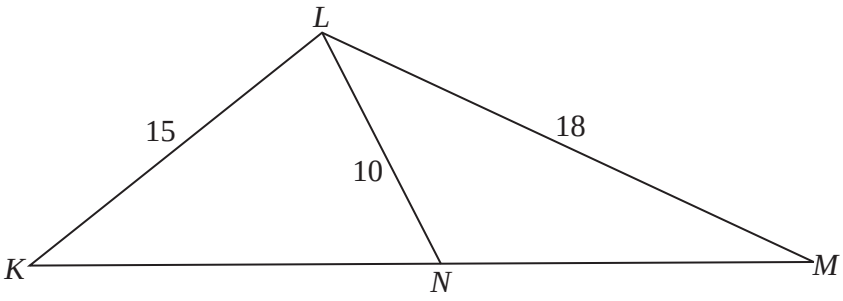
$PQRS$ is a trapezium.
$PQ = 17$ cm, $QR = 8$ cm, $SR = 29$ cm and $S\hat{R}Q = 90°$.

Calculate

(i) the area of $PQRS$, [1]

(ii) $P\hat{S}R$. [2]

(b)



In the diagram, triangle KLM is similar to triangle LNM.
$KL = 15$ cm, $LM = 18$ cm and $LN = 10$ cm.

(i) Find KM. [2]

(ii) Find KN. [2]

(iii) P is the point on LM such that PN is parallel to LK.

Find $\dfrac{\text{the area of triangle } NPM}{\text{the area of trapezium } KLPN}$.

Give your answer as a fraction in its simplest form. [2]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

8 Ahmed throws a ball to John.
The ball travels 10 metres at an average speed of x metres per second.

(a) Write an expression, in terms of x, for the time taken, in seconds, for the ball to travel from Ahmed to John. [1]

(b) John then throws the ball to Pierre.
The ball travels 15 metres.
The ball's average speed is 0.5 metres per second greater than the ball's average speed from Ahmed to John.

Write an expression, in terms of x, for the time taken, in seconds, for the ball to travel from John to Pierre. [1]

(c) The time taken between John catching the ball and then throwing it to Pierre is 2 seconds.
The total time taken for the ball to travel from Ahmed to Pierre is 7 seconds.

Write down an equation in x, and show that it simplifies to

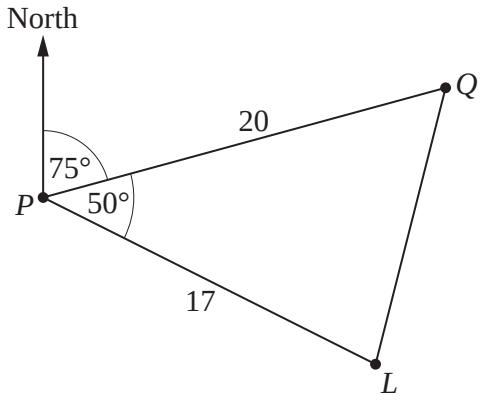
$$2x^2 - 9x - 2 = 0.$$ [3]

(d) Solve the equation $2x^2 - 9x - 2 = 0$, giving each answer correct to 2 decimal places. [4]

(e) **(i)** Find the average speed, in metres per second, of the ball as it travels from John to Pierre. [1]

(ii) How much longer does it take for the ball to travel from John to Pierre than from Ahmed to John?
Give your answer in seconds. [2]

9



The diagram shows two ports, P and Q, and a lighthouse L.
$PQ = 20$ km, $PL = 17$ km, $Q\hat{P}L = 50°$ and the bearing of Q from P is 075°.

(a) Find the bearing of P from L. [1]

(b) Calculate QL. [4]

(c) **(i)** Calculate $P\hat{L}Q$. [3]

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(d) A boat leaves P and sails in a straight line to Q.

(i) It takes 4 hours and 53 minutes to sail from P to Q.
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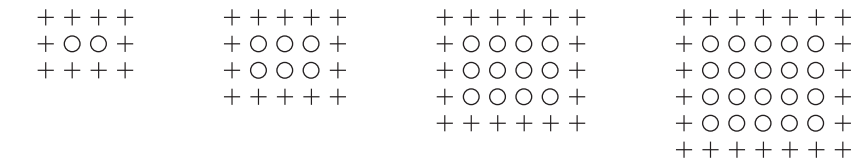

Flowerbed 1 Flowerbed 2 Flowerbed 3 Flowerbed 4

The diagrams above show the first four flowerbeds in a sequence.
Each flowerbed contains two types of plant, pansies (+) and primroses (○).

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Number of pansies	10	14	18		
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Total number of plants	12	20	30		

(a) Copy and complete the columns for flowerbeds 4 and 5. [2]

(b) Find an expression, in terms of n, for

(i) the number of pansies in flowerbed n, [1]

(ii) the number of primroses in flowerbed n. [1]

(c) **Hence** show that the total number of plants in flowerbed n can be expressed in the form

$$(n + 2)(n + 3).$$ [2]

(d) Calculate the total number of plants in flowerbed 10. [1]

(e) There are 306 plants in flowerbed k.

(i) Show that k satisfies the equation

$$k^2 + 5k - 300 = 0.$$ [2]

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(iii) Hence find the number of pansies in flowerbed k. [1]

11 Answer the WHOLE of this question on a sheet of graph paper.

(a) The time taken by 140 children to run 200 metres was recorded.
The results are summarised in the table below.

Time (t seconds)	$22 \leqslant t < 24$	$24 \leqslant t < 26$	$26 \leqslant t < 31$	$31 \leqslant t < 36$	$36 \leqslant t < 46$
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(ii) Estimate the number of children who took less than 25 seconds to run 200 metres. [1]

(iii) One child was chosen at random.

Calculate the probability that the time taken by this child was less than 36 seconds.
Express your answer as a fraction in its lowest terms. [1]

(iv) Out of the 30 children who took less than 26 seconds, two were chosen at random.

Calculate the probability that they both took less than 24 seconds. [2]

(b) Some boys were put into five groups, *A*, *B*, *C*, *D* and *E*, based on the times they took to run 100 metres.
The pie chart shows the proportion of boys in each group.

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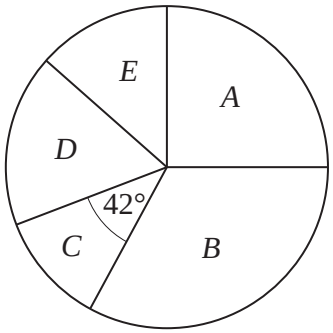


(i) Find the fraction of boys in group *C*.
Give your answer in its lowest terms. [1]

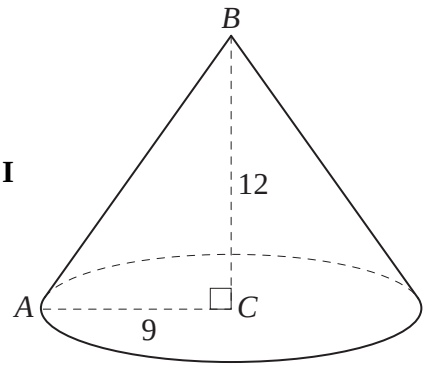
(ii) Given that the number of boys in group *B* is 21, find the total number of boys who ran the 100 metres. [2]

(iii) Calculate the number of boys in group *E*. [2]

12 **[Volume of a cone = $\frac{1}{3}\pi r^2 h$]**
[Curved surface area of a cone = $\pi r l$]

Diagram I shows a solid cone with C as the centre of its base.
B is the vertex of the cone and A is a point on the circumference of its base.
$AC = 9$ cm and $BC = 12$ cm.

Diagram I



(a) Calculate

(i) AB, [2]

(ii) the **total** surface area of the cone, [2]

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(b) The cone in Diagram I is cut, parallel to the base, to obtain a small cone shown in Diagram II and a frustum shown in Diagram III.
Y is the centre of the base of the small cone.
X is the point on the circumference of this base and on the line AB such that $XY = 3$ cm.

Diagram II

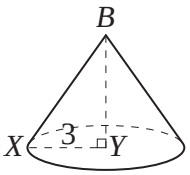
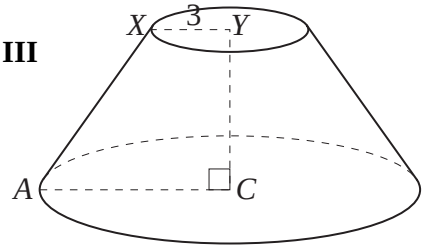


Diagram III



Calculate

(i) BY, [1]

(ii) AX, [1]

(iii) the circumference of the base of the small cone, [2]

(iv) the volume of the frustum. [2]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **May/June 2010**

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
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Mathematical tables (optional)

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Section A
Answer **all** questions.

Section B
Answer any **four** questions.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

This document consists of **10** printed pages and **2** blank pages.

DC (LEO/CGW) 15631/4

UNIVERSITY of CAMBRIDGE
International Examinations

[Turn over

Section A [52 marks]

Answer **all** questions in this section

1 A function is defined by $f(x) = \frac{x-2}{5}$.

(a) Find f(7). [1]

(b) Given that $f(t) = t$, find t. [2]

(c) Find $f^{-1}(x)$. [2]

---

2 Wasim owns a shop.
The table shows the cost price and selling price of three items in his shop.

Item	Cost Price ($)	Selling Price ($)
Trampoline	48	66
Swing	x	19.50
Bicycle	82	110

(a) Calculate his percentage profit when he sells a trampoline. [2]

(b) Wasim makes a profit of 30% when he sells a swing.

Calculate the cost price, $\$x$, of a swing. [3]

(c) In a sale, the selling price of a bicycle is reduced by 20%.

(i) Find the sale price of a bicycle. [1]

(ii)

THURSDAY SPECIAL

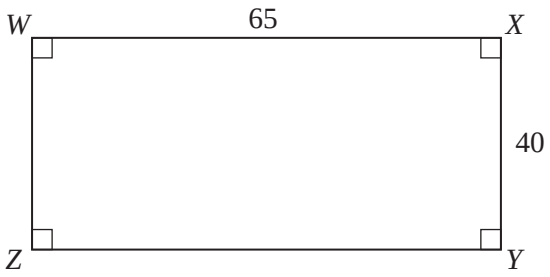
Save 10% off the **sale price**.

Jaspreet bought a bicycle on a Thursday.

Calculate the difference between the amount Jaspreet paid and the cost price. [2]

---

3 The diagram below is a sketch of a rectangular field $WXYZ$.
$WX = 65$ m and $XY = 40$ m.



(a) Using a scale of 1 cm to 5 m, make a scale drawing of the field. [1]

(b) **(i)** On your scale drawing, construct the locus of all the points in the field that are

I equidistant from Z and Y,
II 45 m from X. [2]

(ii) Hence label the region, **R**, of points that are nearer to Z than Y **and** not more than 45 m from X. [1]

(c) A post P is placed in the region **R** so that it is at the maximum distance from Y.
A post Q is placed at the midpoint of the line ZY.

(i) Label the posts P and Q on your drawing. [1]

(ii) By measurement, find

(a) the actual distance between the posts P and Q in the field, [1]

(b) the obtuse angle PQ makes with QY. [1]

---

4 **(a)** Express as a single fraction in its simplest form $\frac{4}{x+3} - \frac{3}{2x-1}$. [3]

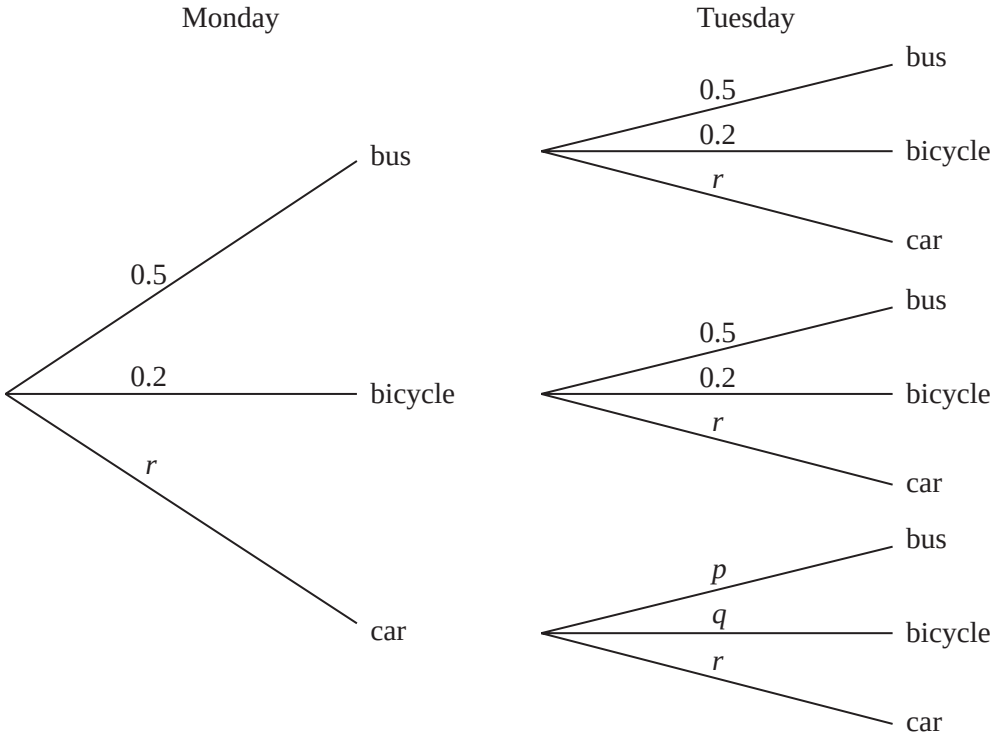
(b) It is given that $k = \sqrt{2lm + 3n}$.

Express m in terms of k, l and n. [2]

(c) Solve the equation $3x^2 - 4x - 16 = 0$.
Give your answers correct to 2 decimal places. [4]

[Turn over

5 **(a)** Ben travels to work by bus, by bicycle or by car.
The probability that he travels by bus on any day is 0.5.
The probability that he travels by bicycle on any day is 0.2.
The tree diagram below shows some of the probabilities of the possible journeys on Monday and Tuesday.



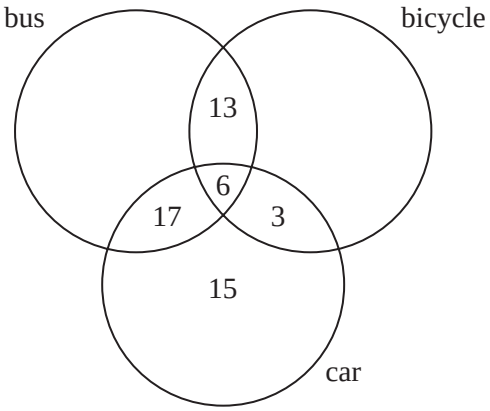
(i) Find the values of p, q and r. [2]

(ii) Find the probability that Ben travels to work

(a) by bus on both Monday and Tuesday, [1]

(b) by bus on one day and by bicycle on the other day. [2]

(b) The Venn diagram shows the three means of transport used by a group of workers during a week.

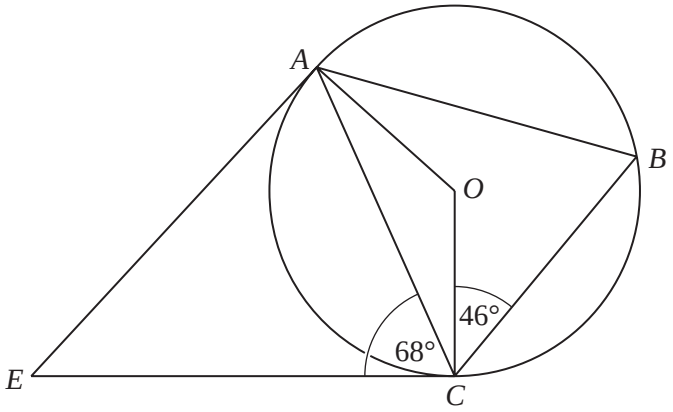


(i) How many used both a bus and a car but not a bicycle? [1]

(ii) Twice as many **only** used a bicycle as **only** used a bus.
There were 78 workers in the group.

How many used a bus **only**? [2]

6



A, *B* and *C* are points on the circumference of a circle, centre *O*.
AE and *CE* are tangents to the circle.
$A\hat{C}E = 68°$ and $B\hat{C}O = 46°$.

(a) Calculate

(i) $A\hat{O}C$, [2]

(ii) $A\hat{E}C$. [1]

(b) Find the three angles of the triangle *ABC* and hence state the name given to this special triangle. [2]

---

7 Answer the WHOLE of this question on a sheet of graph paper.

The table below shows the amount of time spent playing sport each week by 80 students.

Time (t hours)	$0 < t \leqslant 2$	$2 < t \leqslant 4$	$4 < t \leqslant 6$	$6 < t \leqslant 8$	$8 < t \leqslant 10$
Frequency	20	31	22	5	2

(a) Calculate an estimate of the mean time spent playing sport each week by the students. [3]

(b) Copy and complete the cumulative frequency table below.

Time (t hours)	$t \leqslant 2$	$t \leqslant 4$	$t \leqslant 6$	$t \leqslant 8$	$t \leqslant 10$
Cumulative frequency	20	51			80

[1]

(c) Using a horizontal scale of 1 cm to represent 1 hour and a vertical scale of 1 cm to represent 5 students, draw a smooth cumulative frequency curve for this data. [3]

(d) Use your graph to estimate

(i) the median, [1]

(ii) the interquartile range. [2]

[Turn over

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

8 Answer the WHOLE of this question on a sheet of graph paper.

The table below shows some values of x and the corresponding values of y for

$$y = \frac{12}{x} - x.$$

x	1	2	3	4	5	6
y	11	4	1	–1	p	–4

(a) Calculate p. [1]

(b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $0 \leqslant x \leqslant 6$.
Using a scale of 1 cm to represent 1 unit, draw a vertical y-axis for $-4 \leqslant y \leqslant 14$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to solve the equation $\frac{12}{x} - x = 2$ in the range $1 \leqslant x \leqslant 6$. [1]

(d) The equation $\frac{12}{x} = 2x$ can be solved using the intersection of your curve and a straight line.

(i) State the equation of this straight line. [1]

(ii) By drawing this straight line, solve the equation $\frac{12}{x} = 2x$. [2]

(e) The points A and B are (1, 11) and (4, –1) respectively.

Find the gradient of the line AB. [1]

(f) The line l is parallel to AB and is a tangent to the curve $y = \frac{12}{x} - x$.

(i) Draw the line l. [1]

(ii) Find the coordinates of the point where l crosses the y-axis. [1]

(iii) Hence find the equation of the line l. [1]

9

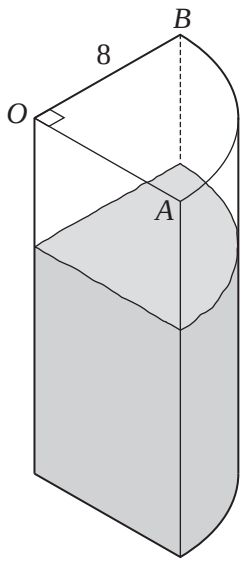


Diagram I

Diagram I shows a vessel in the shape of a prism.
The cross-section OAB is a sector of a circle of radius 8 cm and $A\hat{O}B = 90°$.

(a) (i) Calculate the perimeter of the sector OAB. [3]

(ii) The vessel, which stands on a horizontal table, contains 800cm^3 of water, shown shaded in the diagram.

Calculate the depth of the water in the vessel. [3]

(b)

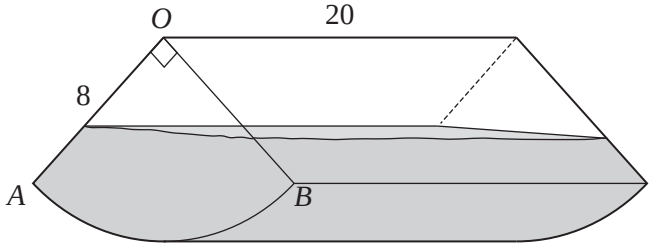


Diagram II

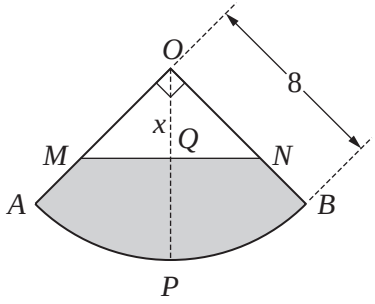


Diagram III

The vessel is now placed so that its curved surface is in contact with the horizontal table as shown in Diagram II.

Diagram III shows the cross-section of the vessel with the shaded section representing the water.
P is the midpoint of the arc AB and is in contact with the table.
Q is the point on the water surface, MN, which is vertically above P.

It is given that $OQ = x$ centimetres.

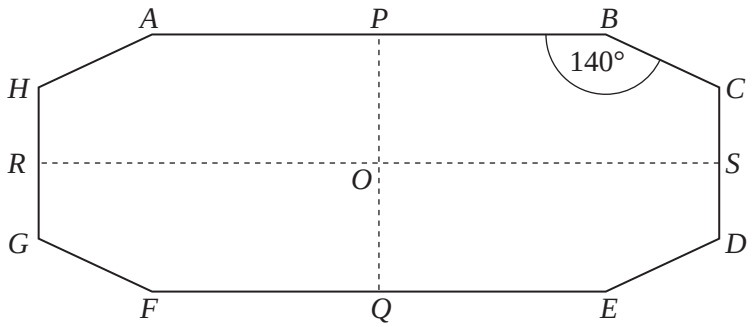
(i) (a) Write down an expression, in terms of x, for MN. [1]

(b) Show that the shaded area in Diagram III is $(16\pi - x^2)$ square centimetres. [2]

(ii) The vessel still contains 800 cm^3 of water.

Given that the length of the vessel is 20 cm, find the value of x. [3]

10



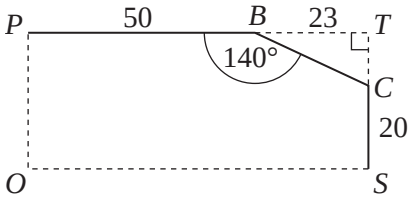
ABCDEFGH is an octagon with exactly two lines of symmetry.
These are shown by the dashed lines *PQ* and *RS* which intersect at *O*.
$A\hat{B}C = 140°$.

(a) Find

(i) $E\hat{F}G$, [1]

(ii) $F\hat{G}H$. [2]

(b) The diagram shows part of the octagon.



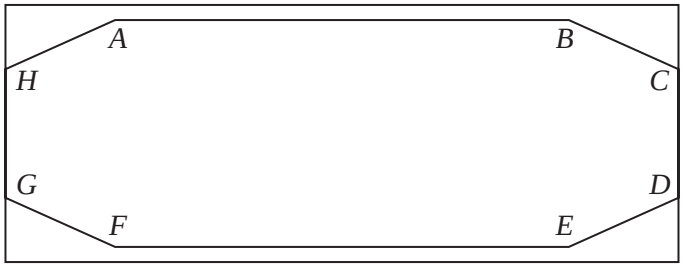
T is the point such that *PT* and *TS* are perpendicular.
PB = 50 cm, *BT* = 23 cm and *CS* = 20 cm.

(i) Calculate *CT*. [2]

(ii) Calculate the area of the pentagon *PBCSO*. [3]

(iii) Hence find the area of the octagon *ABCDEFGH*. [1]

(iv)



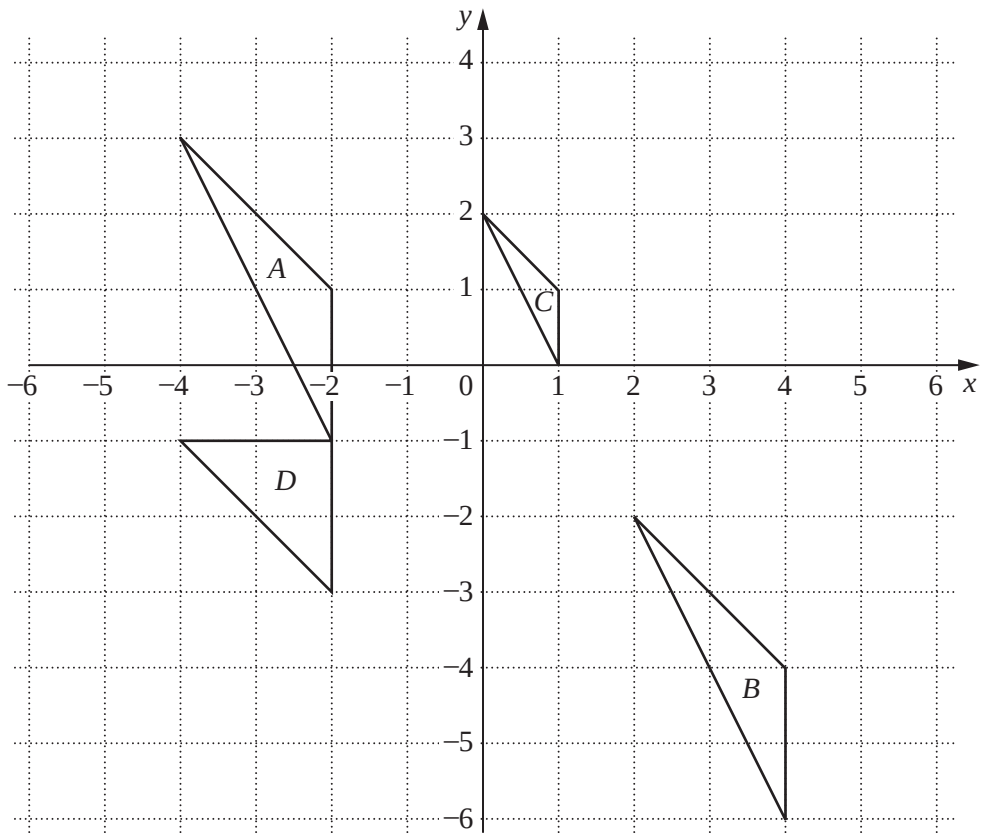
The octagonal shape *ABCDEFGH* is to be cut from a rectangular piece of card where the length and breadth, measured in centimetres, are integers.
The remaining card is wasted.
The card that is wasted must be kept to a minimum.

Find

(a) the length and breadth of the rectangular piece of card, [2]

(b) the area of the card that is wasted. [1]

11 **(a)** The diagram shows triangles *A*, *B*, *C* and *D*.



(i) Triangle *A* is mapped onto triangle *B* by the translation **T**.

Write down the column vector that represents **T**. [1]

(ii) Describe **fully** the **single** transformation that maps triangle *A* onto triangle *C*. [3]

(iii) Triangle *A* is mapped onto triangle *D* by a **single** transformation.

What is the name of this transformation? [1]

(iv) Triangle *D* has one line of symmetry.

Find the equation of this line of symmetry. [2]

(b) *K* is the point (p, q).

(i) The transformation **U** is represented by the matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$.
This transformation maps the point *K* onto the point *L*.

Find, in terms of *p* and *q*, the coordinates of *L*. [2]

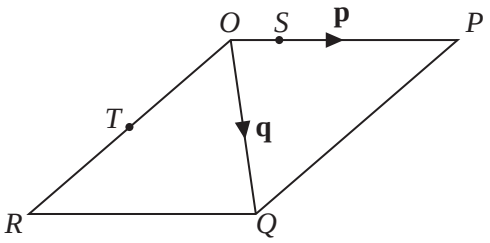
(ii) The transformation **V** is a rotation 90° clockwise about the point (0, 0).
This transformation maps the point *K* onto the point *M*.

Find, in terms of *p* and *q*, the coordinates of *M*. [2]

(iii) The point *L* is mapped onto the point *M* by the **single** transformation **W**.

Find the matrix that represents the transformation **W**. [1]

12 (a)



In the diagram, $OPQR$ is a parallelogram.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.
S is the point on OP such that $OS : SP$ is 1 : 3.
T is the midpoint of OR.

Giving your answers in their simplest form, find, in terms of **p** and **q**,

(i) $\overrightarrow{QP}$, [1]

(ii) $\overrightarrow{TS}$. [2]

(b) In triangle WXY, $WX = 24$ cm, $WY = 17$ cm and $X\hat{W}Y = 55°$.

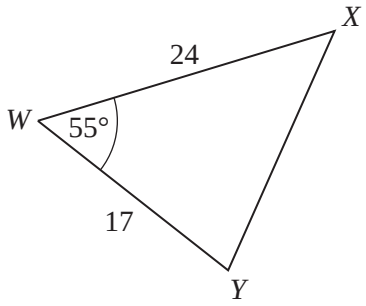


Diagram I

(i) Calculate

(a) the area of triangle WXY, [2]

(b) XY. [4]

(ii) **[Volume of a pyramid = $\frac{1}{3}$ × base area × height]**

The triangle WXY shown in Diagram I forms the horizontal base of the triangular pyramid $VWXY$, shown in Diagram II.

The vertex V is vertically above Z, a point on WX.
$WV = 15$ cm and $WZ = \frac{1}{4} WX$.

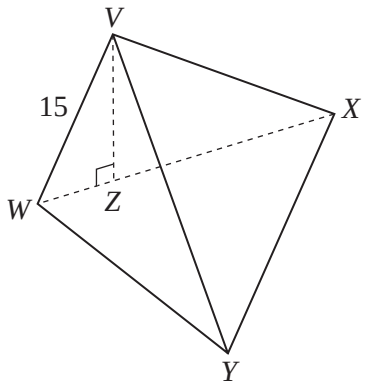


Diagram II

(a) Calculate VZ. [2]

(b) Hence find the volume of the pyramid. [1]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9964901203

MATHEMATICS (SYLLABUS D) **4024/13**

Paper 1 **May/June 2010**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

For Examiner's Use

This document consists of **20** printed pages.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

For Examiner's Use

1 Evaluate

(a) $1.5 - 0.2 \times 4$,

Answer (*a*) .....[1]

(b) $4.2 \div 0.07$.

Answer (*b*) .....[1]

---

2 Express as a single fraction

(a) $\frac{5}{7} - \frac{2}{5}$,

Answer (*a*) .....[1]

(b) $1\frac{1}{5} \div 2\frac{1}{3}$.

Answer (*b*) .....[1]

For Examiner's Use

3 **(a)** In a town, 11 000 people out of the total population of 50 000 are aged under 18.

What percentage of the population is aged under 18?

Answer (*a*) ..... % [1]

(b) A company employing 1200 workers increased the number of workers by 15%.

How many workers does it now employ?

Answer (*b*) ..... [1]

---

4 Evaluate

(a) $9^1 + 9^0$,

Answer (*a*) .....[1]

(b) $\left(\frac{1}{9}\right)^{\frac{1}{2}}$.

Answer (*b*) ..... [1]

---

5 By writing each number correct to 1 significant figure, estimate the value of

$$\frac{48.9 \times 0.207^2}{3.94}.$$

For Examiner's Use

Answer ..... [2]

---

6 **(a)** Solve $\frac{3}{x-1} = 2$.

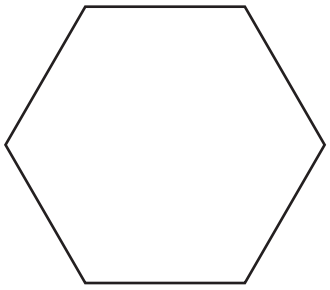
Answer (*a*) $x =$ .....[1]

(b) Given that $p = 2t - r$, express t in terms of p and r.

Answer (*b*) $t =$ ..... [1]

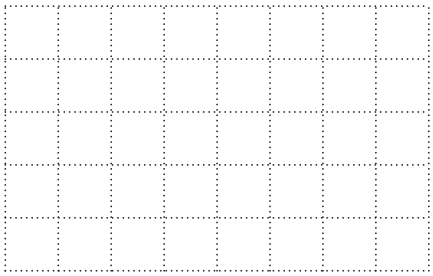
For Examiner's Use

7 **(a)** On the regular hexagon below, draw all the lines of symmetry.



[1]

(b) On the grid below, draw a quadrilateral with rotational symmetry of order 2.



[1]

---

8 The table shows the record minimum monthly temperatures, in °C, in Vostok and London.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Vostok	–36	–47	–64	–70	–71	–71	–74	–75	–72	–61	–45	–35
London	–10	–9	–8	–2	–1	5	7	6	3	–4	–5	–7

Find

(a) the difference between the temperatures in Vostok and London in July,

Answer (*a*) ..... °C [1]

(b) the difference between the temperatures in Vostok in February and June.

Answer (*b*) ..... °C [1]

For Examiner's Use

9 Written as a product of prime factors, $168 = 2^3 \times 3 \times 7$.

(a) Express 140 as a product of its prime factors.

Answer (*a*) .....[1]

(b) Find the highest common factor of 168 and 140.

Answer (*b*) .....[1]

(c) Find the smallest positive integer, n, such that $168n$ is a square number.

Answer (*c*) .....[1]

---

10 **(a)** Jane and Ken share some money in the ratio 5 : 3.
Ken's share is \$16 less than Jane's share.

Find each person's share.

Answer (*a*) Jane \$ .....

Ken \$ ..... [2]

(b) The scale of a map is 1 : 25 000.
The distance between two villages is 10 cm on the map.

Find the actual distance, in kilometres, between the villages.

Answer (*b*) ..... km [1]

For Examiner's Use

11 Given that $f(x) = \frac{5 - 2x}{3x}$, find

(a) f(–2),

Answer (*a*) f(–2) = ... [1]

(b) $f^{-1}(x)$.

Answer (*b*) $f^{-1}(x)$ = ... [2]

---

12 It is given that y is inversely proportional to the square of x and that $y = 48$ when $x = \frac{1}{2}$.

Find

(a) the formula for y in terms of x,

Answer (*a*) y = ... [2]

(b) the values of x when $y = 3$.

Answer (*b*) x = ... , ... [1]

---

13 Solve the simultaneous equations.

For Examiner's Use

$$3x + 2y = 7$$
$$x - 3y = 17$$

Answer $x =$ .....

$y =$ .....[3]

14 A straight line passes through the points P (–8, 10) and Q (4, 1).

For Examiner's Use

Find

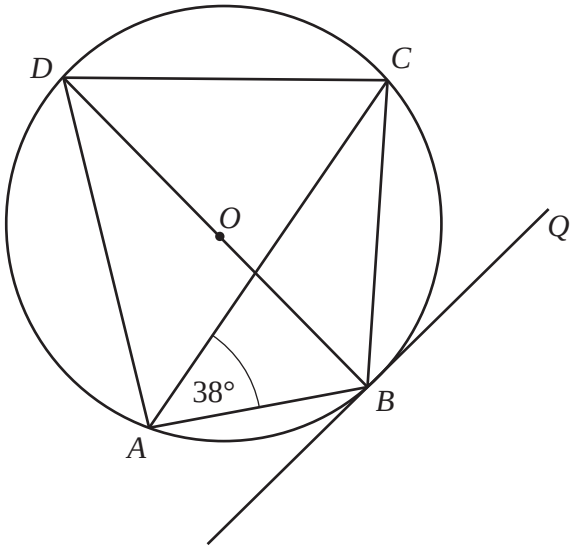
(a) the coordinates of the midpoint of PQ,

Answer (*a*) (..... , ...) [1]

(b) the equation of PQ.

Answer (*b*) ..... [2]

15



The diagram shows a circle, centre O, passing through A, B, C and D.
BOD is a straight line and $B\hat{A}C = 38°$.
The line BQ is a tangent to the circle at B.

Find

(a) $D\hat{A}C$,

Answer (*a*) $D\hat{A}C$ = ... [1]

(b) $D\hat{B}C$,

Answer (*b*) $D\hat{B}C$ = ... [1]

(c) $C\hat{B}Q$.

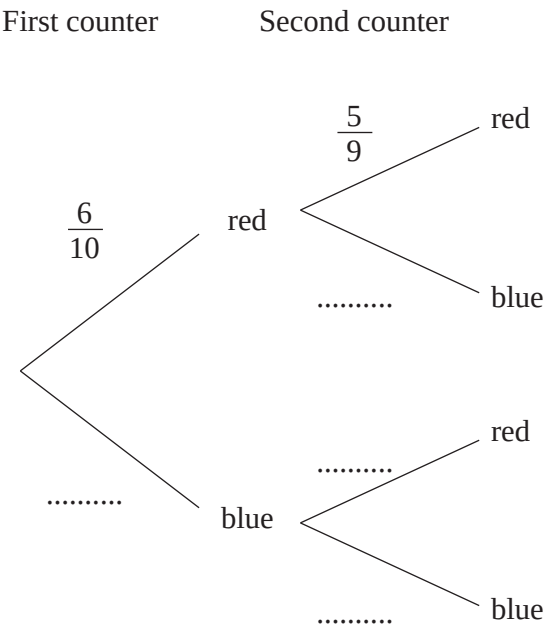
Answer (*c*) $C\hat{B}Q$ = ... [1]

16 A bag contains 6 red counters and 4 blue counters.
Two counters are taken from the bag at random, without replacement.

For Examiner's Use

(a) Complete the tree diagram below that represents these events.

Answer (a)

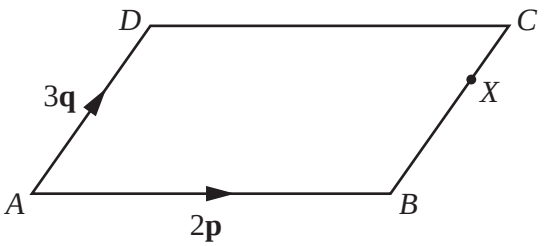


[1]

(b) Expressing your answer as a fraction in its simplest form, calculate the probability that both counters are the same colour.

Answer (*b*) .....[2]

17



ABCD is a parallelogram.
X is the point on *BC* such that $BX : XC = 2 : 1$.
$\overrightarrow{AB} = 2\mathbf{p}$ and $\overrightarrow{AD} = 3\mathbf{q}$.

Find, in terms of **p** and **q**,

(a) $\overrightarrow{AC}$,

Answer (*a*) $\overrightarrow{AC}$ = ...[1]

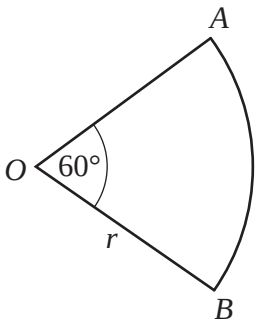
(b) $\overrightarrow{AX}$,

Answer (*b*) $\overrightarrow{AX}$ = ... [1]

(c) $\overrightarrow{XD}$.

Answer (*c*) $\overrightarrow{XD}$ = ... [1]

18 OAB is the sector of a circle of radius r cm.
$A\hat{O}B = 60°$.



Find, in its simplest form, an expression in terms of r and π for

(a) the area of the sector,

Answer (*a*) ..... cm^2 [1]

(b) the perimeter of the sector.

Answer (*b*) ..... cm [2]

---

19 $\mathbf{A} = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 0 & 2 \\ -1 & 3 \end{pmatrix}$.

Find

(a) $\mathbf{A} - \mathbf{B}$,

Answer (*a*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

(b) $\mathbf{B}^{-1}$.

Answer (*b*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

For Examiner's Use

20 The graph shows the cumulative frequency curve for the ages of 60 employees.

For Examiner's Use

Use the graph to estimate

(a) the median,

Answer (*a*) ..... [1]

(b) the interquartile range,

Answer (*b*) ..... [2]

(c) the number of employees aged over 50.

Answer (*c*) ..... [1]

For Examiner's Use

21 **(a)** Factorise completely

(i) $3x^2 - 12x$,

Answer (*a*)(i) ..... [1]

(ii) $x^2 - xy - 2y^2$.

Answer (*a*)(ii) ..... [1]

(b) Simplify $\frac{x^2 + 4x}{x^2 - 16}$.

Answer (*b*) ..... [2]

22 **(a)** A box has volume $2.5\,m^3$.

Express this volume in cm^3.

Answer (*a*) ..... cm^3 [1]

(b) John has a length of string.
The string is 4 m long, correct to the nearest 10 cm.

(i) Write down the lower bound of the length of the string.
Give your answer in centimetres.

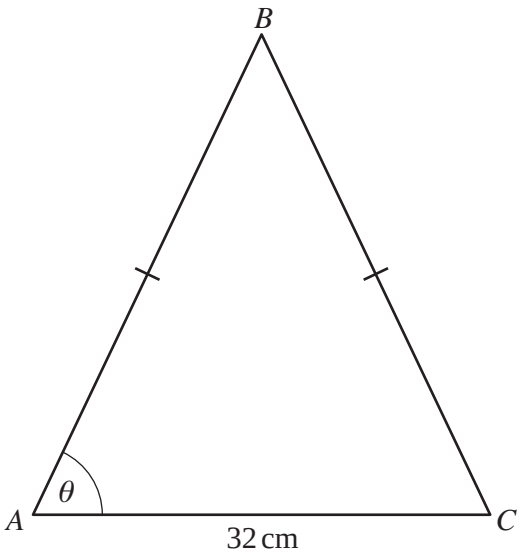
Answer (*b*)(i) ..... cm [1]

(ii) John cuts off ten pieces of string.
Each piece is 5 cm long, correct to the nearest centimetre.

Find the minimum possible length of string remaining.
Give your answer in centimetres.

Answer (*b*)(ii) ..... cm [2]

23



sin θ	$\frac{15}{17}$
cos θ	$\frac{8}{17}$
tan θ	$\frac{15}{8}$

ABC is an isosceles triangle with $AB = BC$ and $AC = 32$ cm.

Using as much information from the table as is necessary, calculate

(a) *AB*,

Answer (*a*) ..... cm [2]

(b) the area of triangle *ABC*.

Answer (*b*) .....c m^2 [2]

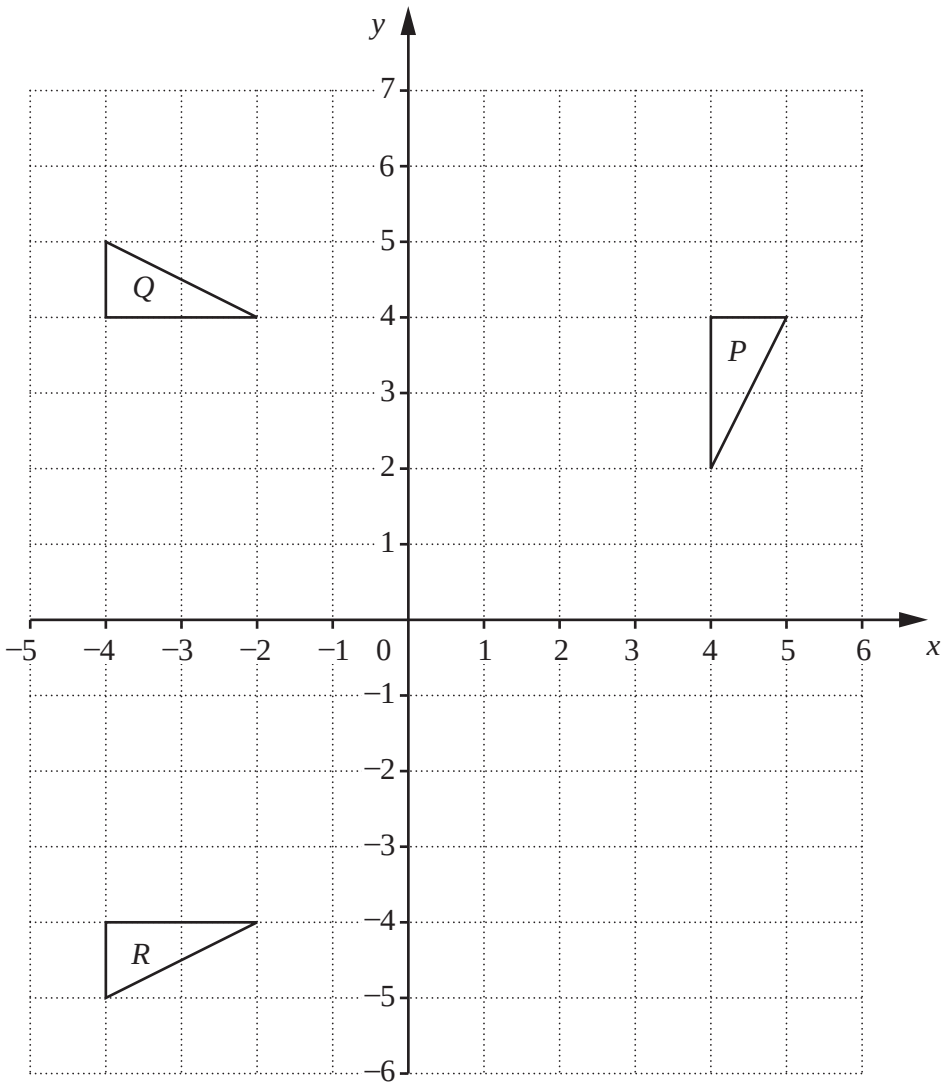
24 The diagram below shows three triangles, *P*, *Q* and *R*.

For Examiner's Use

(a) Triangle *T* is the image of triangle *P* under an enlargement with centre (5, 2) and scale factor 2.

Draw and label triangle *T* on the diagram.

Answer (a)



[2]

(b) Describe fully the **single** transformation that maps triangle *P* onto triangle *Q*.

Answer (b) .....

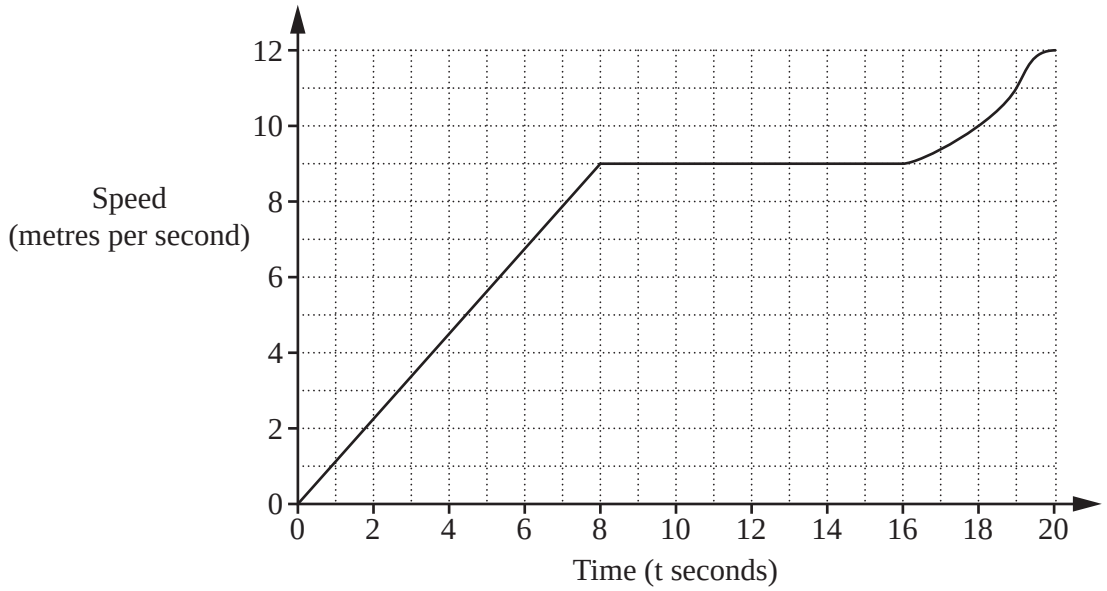
..... [2]

(c) Find the matrix representing the transformation that maps triangle *Q* onto triangle *R*.

Answer (*c*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

25 The diagram is the speed-time graph for the first 20 seconds of a cyclist's journey.

For Examiner's Use



(a) Calculate the distance travelled in the first 16 seconds.

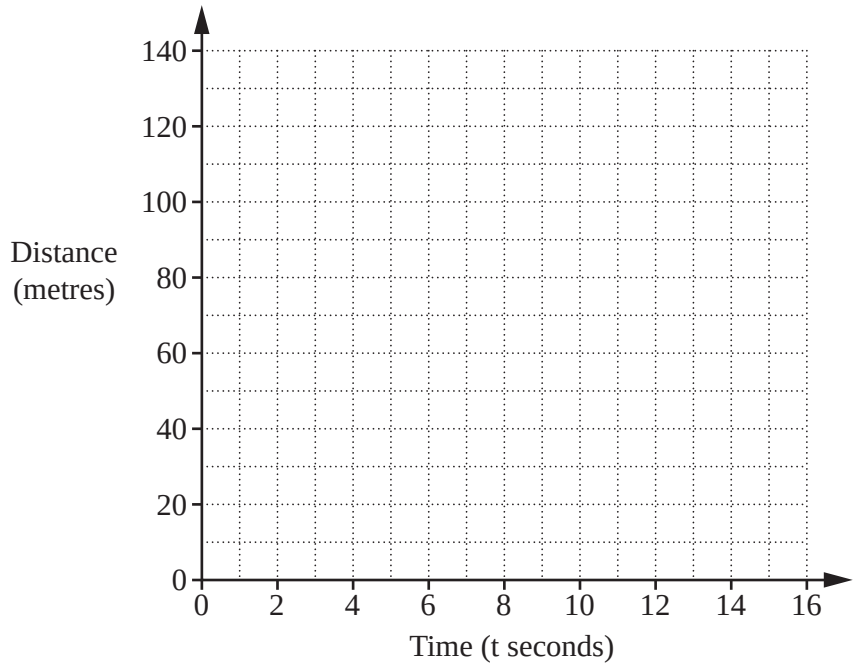
Answer (*a*) ..... m [1]

(b) By drawing a tangent, find the acceleration of the cyclist when $t = 18$.

Answer (*b*) ..... m/s^2 [2]

(c) On the grid in the answer space, sketch the distance-time graph for the first 16 seconds of the cyclist's journey.

Answer (c)



[2]

26 A map is drawn to a scale of 1 cm to 5 km.
The diagram below shows the positions of two radio masts *A* and *B* on the map.

For Examiner's Use

Answer (a), (b)

(a) A third radio mast, *C*, is north of the line *AB*.
It is 40 km from *A* and 50 km from *B*.

Using ruler and compasses, construct triangle *ABC*. [2]

(b) A house *D*, inside the triangle, is more than 35 km from *B* and closer to *B* than to *A*.

Shade the region on your diagram that represents the possible positions of the house *D*. [3]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/12**

Paper 1 **May/June 2010**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

For Examiner's Use

This document consists of **20** printed pages.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

For Examiner's Use

1 Evaluate

(a) $1.5 - 0.2 \times 4$,

Answer (*a*) .....[1]

(b) $4.2 \div 0.07$.

Answer (*b*) .....[1]

---

2 Express as a single fraction

(a) $\frac{5}{7} - \frac{2}{5}$,

Answer (*a*) .....[1]

(b) $1\frac{1}{5} \div 2\frac{1}{3}$.

Answer (*b*) .....[1]

For Examiner's Use

3 **(a)** In a town, 11 000 people out of the total population of 50 000 are aged under 18.

What percentage of the population is aged under 18?

Answer (*a*) ..... % [1]

(b) A company employing 1200 workers increased the number of workers by 15%.

How many workers does it now employ?

Answer (*b*) ..... [1]

---

4 Evaluate

(a) $9^1 + 9^0$,

Answer (*a*) .....[1]

(b) $\left(\frac{1}{9}\right)^{\frac{1}{2}}$.

Answer (*b*) ..... [1]

---

5 By writing each number correct to 1 significant figure, estimate the value of

$$\frac{48.9 \times 0.207^2}{3.94}.$$

For Examiner's Use

Answer ..... [2]

---

6 **(a)** Solve $\frac{3}{x-1} = 2$.

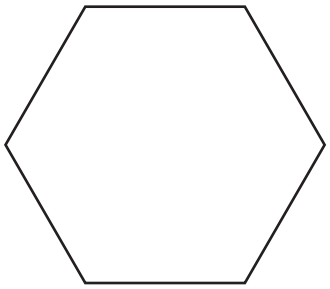
Answer (*a*) $x =$ .....[1]

(b) Given that $p = 2t - r$, express t in terms of p and r.

Answer (*b*) $t =$ ..... [1]

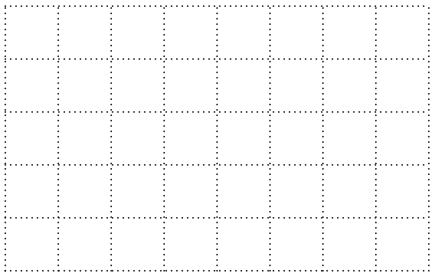
For Examiner's Use

7 **(a)** On the regular hexagon below, draw all the lines of symmetry.



[1]

(b) On the grid below, draw a quadrilateral with rotational symmetry of order 2.



[1]

---

8 The table shows the record minimum monthly temperatures, in °C, in Vostok and London.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Vostok	–36	–47	–64	–70	–71	–71	–74	–75	–72	–61	–45	–35
London	–10	–9	–8	–2	–1	5	7	6	3	–4	–5	–7

Find

(a) the difference between the temperatures in Vostok and London in July,

Answer (*a*) ..... °C [1]

(b) the difference between the temperatures in Vostok in February and June.

Answer (*b*) ..... °C [1]

For Examiner's Use

9 Written as a product of prime factors, $168 = 2^3 \times 3 \times 7$.

(a) Express 140 as a product of its prime factors.

Answer (*a*) .....[1]

(b) Find the highest common factor of 168 and 140.

Answer (*b*) .....[1]

(c) Find the smallest positive integer, n, such that $168n$ is a square number.

Answer (*c*) .....[1]

---

10 **(a)** Jane and Ken share some money in the ratio 5 : 3.
Ken's share is \$16 less than Jane's share.

Find each person's share.

Answer (*a*) Jane \$ .....

Ken \$ ..... [2]

(b) The scale of a map is 1 : 25 000.
The distance between two villages is 10 cm on the map.

Find the actual distance, in kilometres, between the villages.

Answer (*b*) ..... km [1]

For Examiner's Use

11 Given that $f(x) = \frac{5 - 2x}{3x}$, find

(a) f(–2),

Answer (*a*) f(–2) = ... [1]

(b) $f^{-1}(x)$.

Answer (*b*) $f^{-1}(x)$ = ... [2]

---

12 It is given that y is inversely proportional to the square of x and that $y = 48$ when $x = \frac{1}{2}$.

Find

(a) the formula for y in terms of x,

Answer (*a*) y = ... [2]

(b) the values of x when $y = 3$.

Answer (*b*) x = ... , ... [1]

---

13 Solve the simultaneous equations.

For Examiner's Use

$$3x + 2y = 7$$
$$x - 3y = 17$$

Answer $x =$ .....

$y =$ .....[3]

14 A straight line passes through the points P (–8, 10) and Q (4, 1).

For Examiner's Use

Find

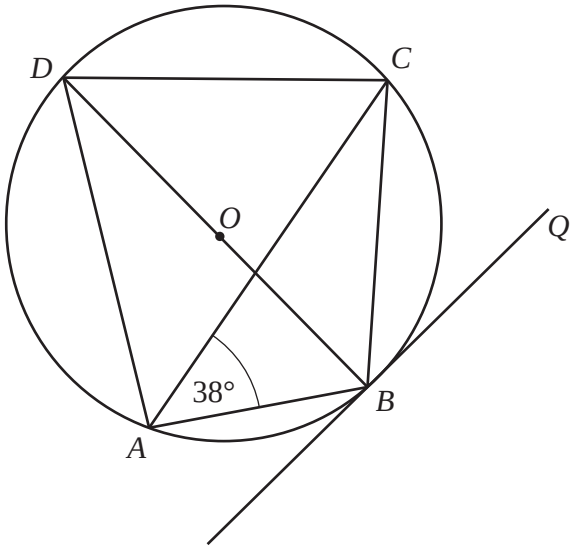
(a) the coordinates of the midpoint of PQ,

Answer (*a*) (..... , ...) [1]

(b) the equation of PQ.

Answer (*b*) ..... [2]

15



The diagram shows a circle, centre O, passing through A, B, C and D.
BOD is a straight line and $B\hat{A}C = 38°$.
The line BQ is a tangent to the circle at B.

Find

(a) $D\hat{A}C$,

Answer (*a*) $D\hat{A}C$ = ... [1]

(b) $D\hat{B}C$,

Answer (*b*) $D\hat{B}C$ = ... [1]

(c) $C\hat{B}Q$.

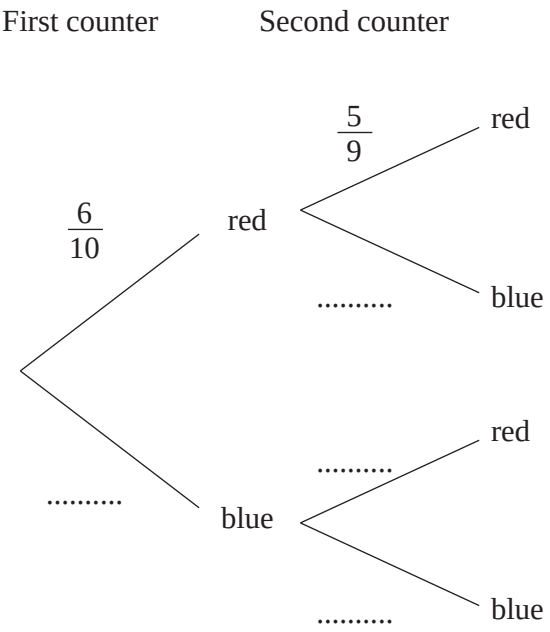
Answer (*c*) $C\hat{B}Q$ = ... [1]

16 A bag contains 6 red counters and 4 blue counters.
Two counters are taken from the bag at random, without replacement.

For Examiner's Use

(a) Complete the tree diagram below that represents these events.

Answer (a)

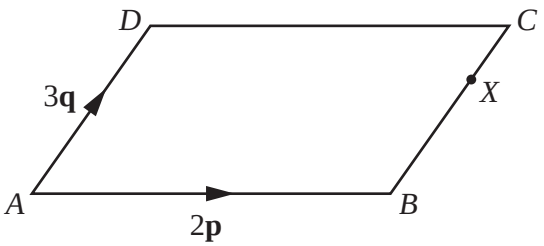


[1]

(b) Expressing your answer as a fraction in its simplest form, calculate the probability that both counters are the same colour.

Answer (*b*) .....[2]

17



ABCD is a parallelogram.
X is the point on *BC* such that $BX : XC = 2 : 1$.
$\overrightarrow{AB} = 2\mathbf{p}$ and $\overrightarrow{AD} = 3\mathbf{q}$.

Find, in terms of **p** and **q**,

(a) $\overrightarrow{AC}$,

Answer (*a*) $\overrightarrow{AC}$ = ...[1]

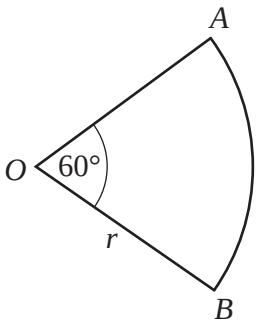
(b) $\overrightarrow{AX}$,

Answer (*b*) $\overrightarrow{AX}$ = ... [1]

(c) $\overrightarrow{XD}$.

Answer (*c*) $\overrightarrow{XD}$ = ... [1]

18 OAB is the sector of a circle of radius r cm.
$A\hat{O}B = 60°$.



Find, in its simplest form, an expression in terms of r and π for

(a) the area of the sector,

Answer (*a*) ..... cm^2 [1]

(b) the perimeter of the sector.

Answer (*b*) ..... cm [2]

---

19 $\mathbf{A} = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 0 & 2 \\ -1 & 3 \end{pmatrix}$.

Find

(a) $\mathbf{A} - \mathbf{B}$,

Answer (*a*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

(b) $\mathbf{B}^{-1}$.

Answer (*b*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

For Examiner's Use

20 The graph shows the cumulative frequency curve for the ages of 60 employees.

For Examiner's Use

Use the graph to estimate

(a) the median,

Answer (*a*) ..... [1]

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Answer (*b*) ..... [2]

(c) the number of employees aged over 50.

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For Examiner's Use

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(i) $3x^2 - 12x$,

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22 **(a)** A box has volume $2.5\,m^3$.

Express this volume in cm^3.

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(b) John has a length of string.
The string is 4 m long, correct to the nearest 10 cm.

(i) Write down the lower bound of the length of the string.
Give your answer in centimetres.

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(ii) John cuts off ten pieces of string.
Each piece is 5 cm long, correct to the nearest centimetre.

Find the minimum possible length of string remaining.
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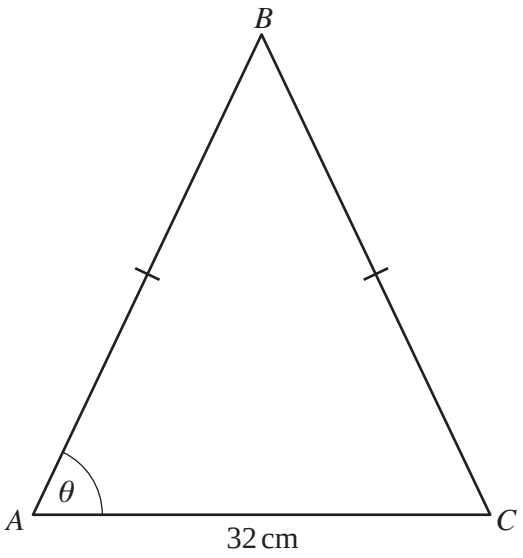
23



sin θ	$\frac{15}{17}$
cos θ	$\frac{8}{17}$
tan θ	$\frac{15}{8}$

ABC is an isosceles triangle with $AB = BC$ and $AC = 32$ cm.

Using as much information from the table as is necessary, calculate

(a) *AB*,

Answer (*a*) ..... cm [2]

(b) the area of triangle *ABC*.

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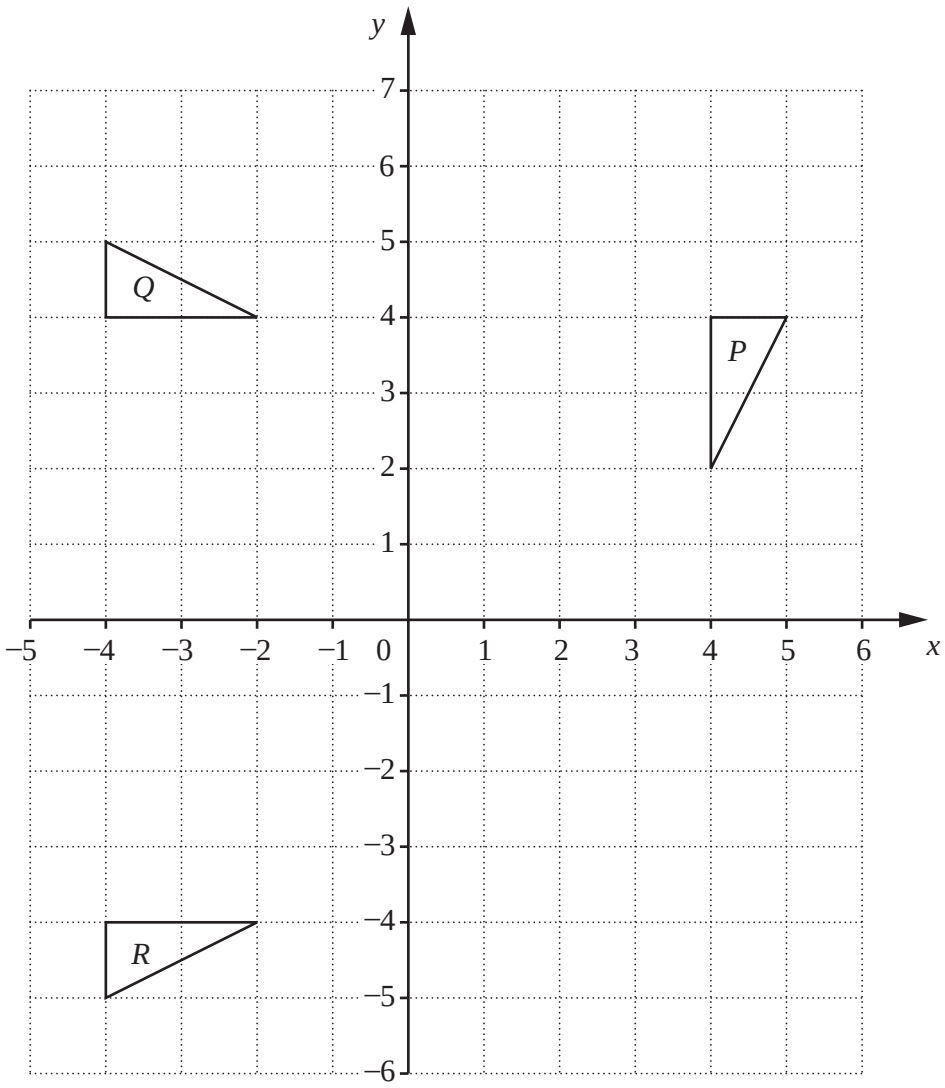
For Examiner's Use

(a) Triangle *T* is the image of triangle *P* under an enlargement with centre (5, 2) and scale factor 2.

Draw and label triangle *T* on the diagram.

Answer (a)



[2]

(b) Describe fully the **single** transformation that maps triangle *P* onto triangle *Q*.

Answer (b) .....

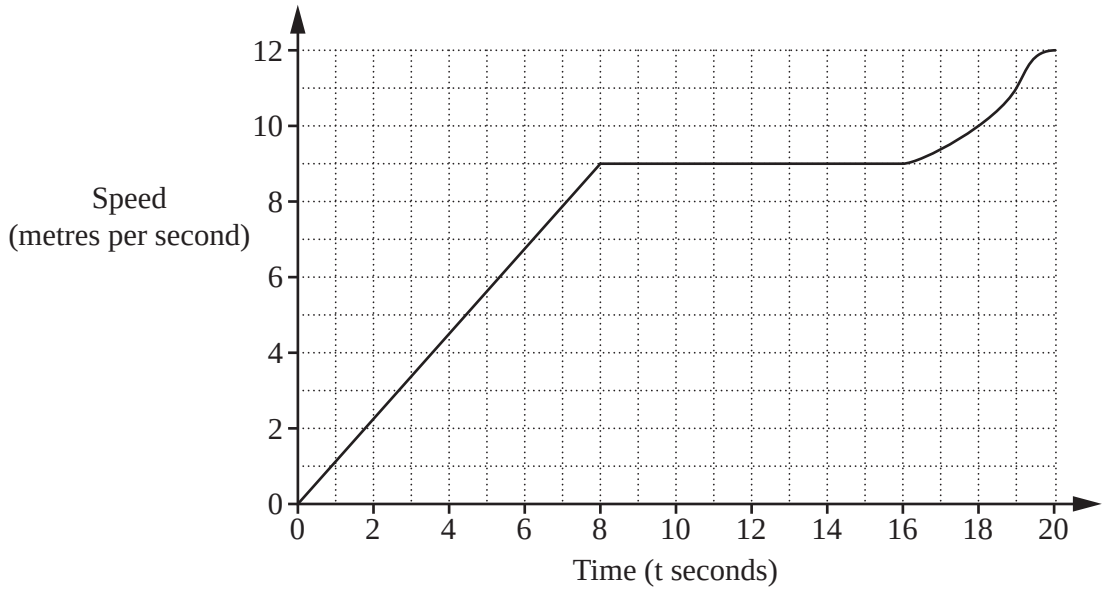
..... [2]

(c) Find the matrix representing the transformation that maps triangle *Q* onto triangle *R*.

Answer (*c*) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

25 The diagram is the speed-time graph for the first 20 seconds of a cyclist's journey.

For Examiner's Use



(a) Calculate the distance travelled in the first 16 seconds.

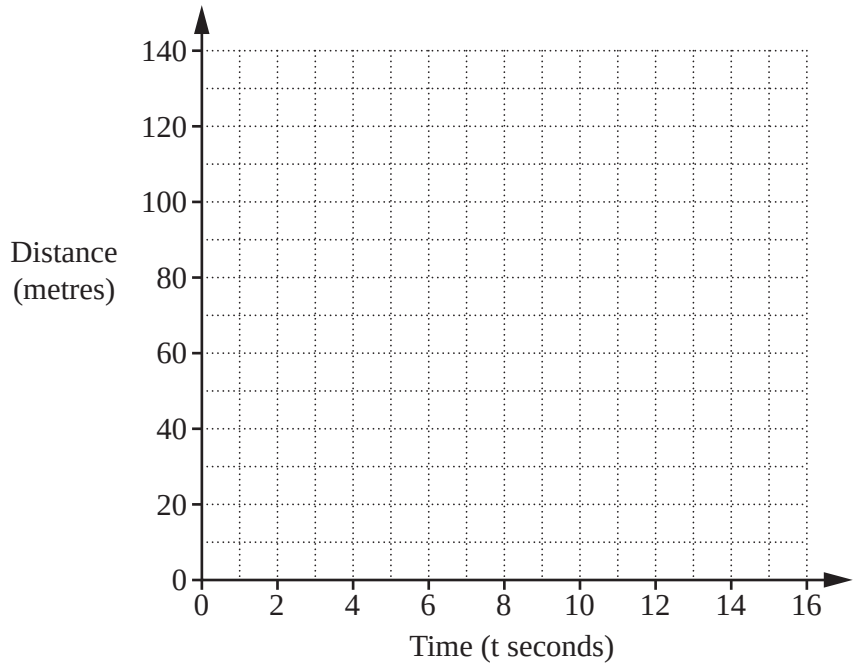
Answer (*a*) ..... m [1]

(b) By drawing a tangent, find the acceleration of the cyclist when $t = 18$.

Answer (*b*) ..... m/s^2 [2]

(c) On the grid in the answer space, sketch the distance-time graph for the first 16 seconds of the cyclist's journey.

Answer (c)



[2]

26 A map is drawn to a scale of 1 cm to 5 km.
The diagram below shows the positions of two radio masts *A* and *B* on the map.

For Examiner's Use

Answer (a), (b)

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It is 40 km from *A* and 50 km from *B*.

Using ruler and compasses, construct triangle *ABC*. [2]

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Shade the region on your diagram that represents the possible positions of the house *D*. [3]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/11**

Paper 1 **May/June 2010**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

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The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

For Examiner's Use

This document consists of **20** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

For Examiner's Use

1 Evaluate

(a) $\frac{1}{2} + \frac{2}{9}$,

Answer (*a*) .....[1]

(b) $\frac{2}{3} \div \frac{9}{11}$.

Answer (*b*) .....[1]

---

2 **(a)** Evaluate $10 - 8 \div 2 + 3$.

Answer (*a*) .....[1]

(b) Find 20% of 60 cm.

Answer (*b*) ..... cm [1]

---

3 Sara carries out a survey of the colours of cars in a car park.
She draws a pie chart to represent her results.

For Examiner's Use

(a) There are 7 red cars.
The angle representing the red cars is 40°.

Calculate the total number of cars in the car park.

Answer (*a*) .....[1]

(b) Sara's pie chart is a circle with circumference 28 cm.

Find, in terms of π, the diameter of the circle.

Answer (*b*) ..... cm [1]

---

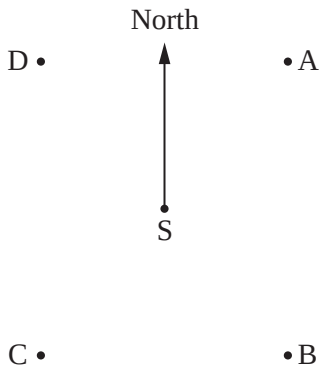
4 Ed goes on a car journey.
The first 60 km of the journey takes 45 minutes.
The remaining 20 km of the journey takes 30 minutes.

Calculate his average speed, in kilometres per hour, for the whole journey.

Answer .....km/h [2]

[Turn over

5



The bearing of a lighthouse from a ship, S, is 220º.
The position of S is marked on the diagram.

(a) Which of the four points A, B, C or D is a possible position of the lighthouse?

Answer (*a*) ..... [1]

(b) Write down the bearing of S from the lighthouse.

Answer (*b*) ..... [1]

---

6 **(a)** Solve $6x - 5 < 9 + 2x$.

Answer (*a*) ..... [1]

(b) Write down the largest integer which satisfies the inequality
$6x - 5 < 9 + 2x$.

Answer (*b*) ..... [1]

---

7 Given that n is an integer and $\boldsymbol{n > 1}$, decide whether each statement in the table is **true** or **false**.

For Examiner's Use

For each statement write **true** or **false** in the table.
If you write **false**, give an example to justify your decision.

Statement	True or False	Example (if false)
$n^3 > 1$		
$\frac{1}{n} > \frac{1}{n^2}$		
$(n - 1)(n + 3)$ is always odd		

[2]

---

8 **(a)** The ratio of Sayed's age to his mother's age is 2 : 7.
Sayed is 14 years old.

How old is his mother?

Answer (*a*) .....years[1]

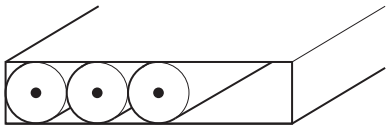
(b) The ratio of Fatima's age to her father's age is 3 : 8.
The total of their ages is 66 years.

How old is Fatima?

Answer (*b*) .....years[1]

9

For Examiner's Use



Pencils are packed in a box.
Each pencil has a diameter of 7 mm, correct to the nearest millimetre.

(a) Write down the lower bound of the diameter of a pencil.

Answer (*a*) .....mm[1]

(b) Find the smallest width of a box that can **always** hold 8 pencils side by side.
Give your answer in centimetres.

Answer (*b*) ..... cm[2]

---

10 Evaluate

(a) 0.2×0.06,

Answer (*a*) ..... [1]

(b) $3 \div 0.01$,

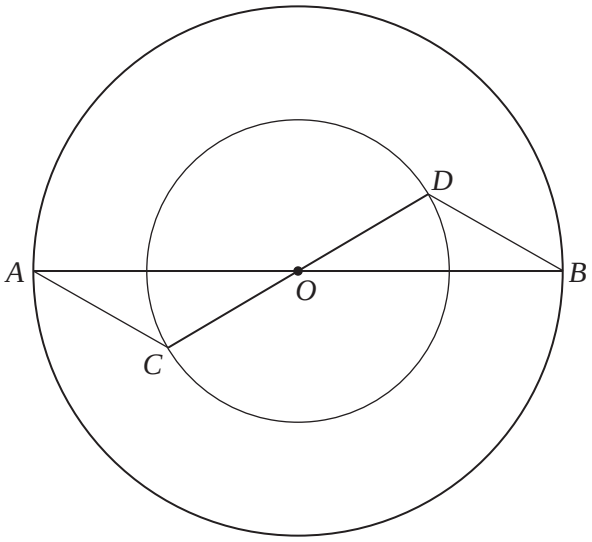
Answer (*b*) ..... [1]

(c) $27^{\frac{1}{3}}$.

Answer (*c*) ..... [1]

11

For Examiner's Use



The diagram shows two circles, both with centre *O*.
CD is a diameter of the small circle and *AB* is a diameter of the large circle.

Using congruent triangles, show that *BD* = *AC*.
State your reasons clearly.

In triangles ..... and .....

.....

.....

.....

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.....

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.....

.....

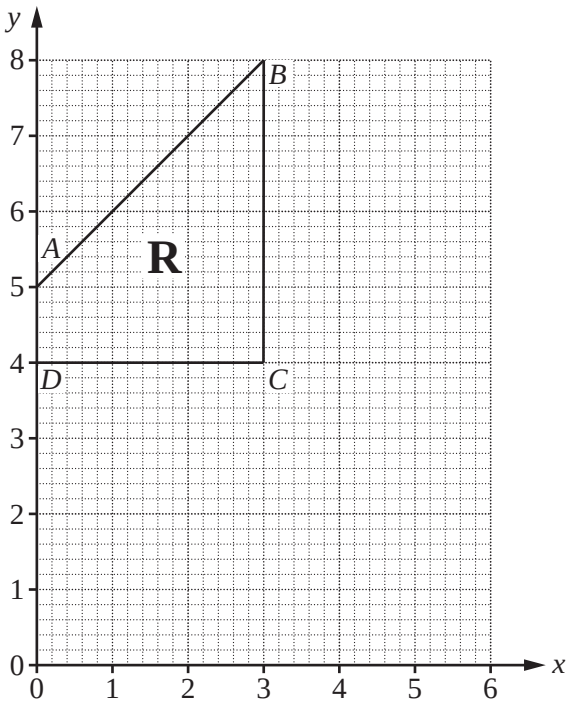
.....

.....

..... [3]

12

For Examiner's Use



In the diagram, the region, **R**, is bounded by the lines *AB*, *BC*, *CD* and *DA*.

(a) Write down the coordinates of the midpoint of *AB*.

Answer (*a*) (..... , ...) [1]

(b) Region **R** is defined by four inequalities.
One of these is $y \leqslant x + 5$.

Write down the other three inequalities.

Answer (*b*) .....

.....

.....[2]

13 Two families ordered three basic food items from their local shop.
The Jones family ordered 1 bag of sugar, 4 cartons of milk and 3 loaves of bread.
The Singh family ordered no sugar, 3 cartons of milk and 5 loaves of bread.
Their orders can be represented by the matrix **A** where

$$\mathbf{A} = \begin{pmatrix} 1 & 0 \\ 4 & 3 \\ 3 & 5 \end{pmatrix}.$$

The cost of a bag of sugar is 80 cents, the cost of a carton of milk is 50 cents and the cost of a loaf of bread is 40 cents.
This information can be represented by the matrix **B** where

$$\mathbf{B} = (\ 80 \quad 50 \quad 40\ ).$$

(a) Work out **BA**.

Answer (*a*) ..... [2]

(b) What does the matrix **BA** represent?

Answer (*b*) .....

.....

.....

.....[1]

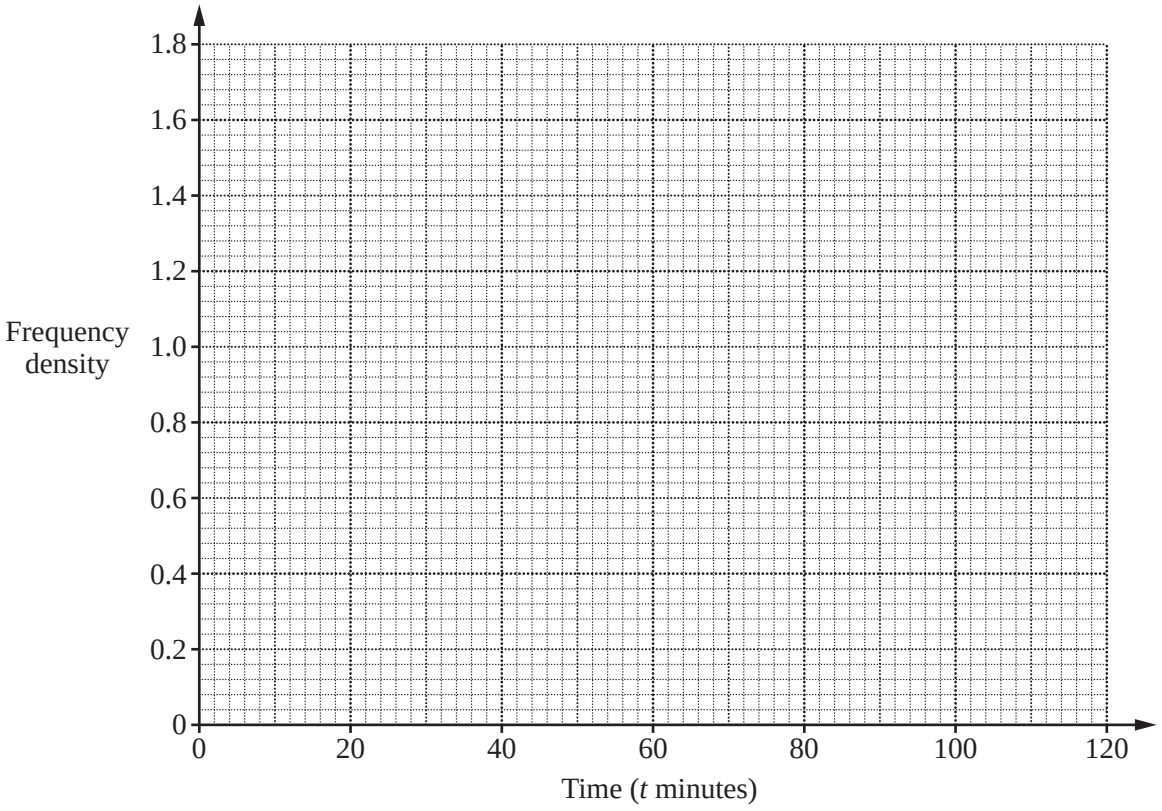
For Examiner's Use

14 Ida keeps a record of time spent on the internet each day.
Her results are summarised in the table.

For Examiner's Use

Time (t minutes)	Frequency
$0 \leqslant t < 10$	4
$10 \leqslant t < 30$	20
$30 \leqslant t < 60$	39
$60 \leqslant t < 100$	32
$100 \leqslant t < 120$	6

On the axes below, draw a histogram to show these results.



[3]

15 Ahmed goes shopping.

For Examiner's Use

(a) In one shop he buys shorts for $26.84 and a shirt for $13.97.

How much does Ahmed spend altogether?

Answer (*a*) $..... [1]

(b) In another shop he buys 15 postcards for 46 cents each.

(i) Calculate the total cost, in dollars, of the postcards.

Answer (*b*)(i) $..... [1]

(ii) The rate of exchange between pounds (£) and dollars ($) was £1 = $2.50.

Calculate the total cost of the postcards in pounds.

Answer (*b*)(ii) £..... [2]

16 Dai played three games of cricket.
His mean score was 9 runs.
His median score was 8 runs.
His highest score was 7 runs more than his lowest score.

For Examiner's Use

(a) Find the number of runs he scored in each of the three games.

Answer (*a*)..... , ... , ... [3]

(b) Dai batted in a fourth game.
The mean of his four scores was 11 runs.

Find the number of runs that Dai scored in the fourth game.

Answer (*b*) ..... [1]

17 y is inversely proportional to x^2.
Some values of y and x are given in the table below.

For Examiner's Use

x	3	2	q
y	4	p	1

Find

(a) the formula for y in terms of x,

Answer (*a*) $y =$ ..... [2]

(b) the value of p,

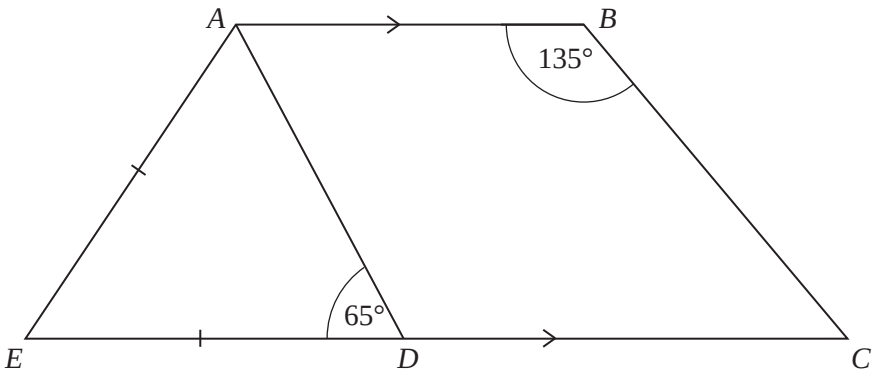
Answer (*b*) $p =$ ..... [1]

(c) the two values of q.

Answer (*c*) $q =$..... , ... [1]

18

For Examiner's Use



In the diagram, AB is parallel to EC.
D is the point on EC such that $ED = EA$.
$A\hat{B}C = 135°$ and $A\hat{D}E = 65°$.

Find

(a) $A\hat{E}D$,

Answer (*a*) $A\hat{E}D$ = ... [1]

(b) $D\hat{A}B$,

Answer (*b*) $D\hat{A}B$ = ... [1]

(c) $B\hat{C}D$,

Answer (*c*) $B\hat{C}D$ = ... [1]

(d) reflex $A\hat{B}C$.

Answer (*d*) reflex $A\hat{B}C$ = ... [1]

19 Some data about two planets, Earth and Mars, is shown in the table.

For Examiner's Use

Planet	Average temperature (°C)	Mass (tonnes)	Volume (km^3)
Earth	15	5.98×10^{21}	1.08×10^{12}
Mars	–63	6.58×10^{20}	162 000 million

(a) How much greater is the average temperature on Earth than that on Mars?

Answer (*a*) .....°C [1]

(b) Write down the volume of Mars in standard form.

Answer (*b*) ..... km^3 [1]

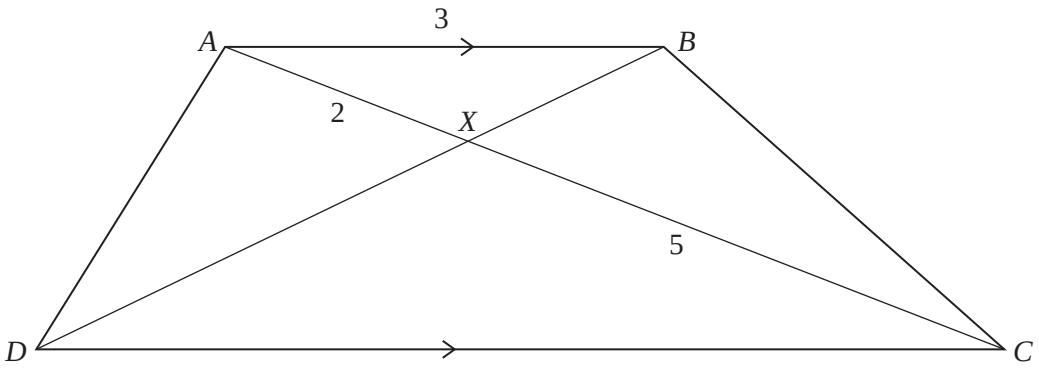
(c) Calculate the difference in mass between Earth and Mars.
Give your answer in standard form.

Answer (*c*) .....tonnes [2]

[Turn over

20

For Examiner's Use



In the diagram, *AC* and *BD* intersect at *X*.
Triangle *ABX* is similar to triangle *CDX*.
AB = 3 cm, *AX* = 2 cm and *XC* = 5 cm.

(a) Find the ratio of the area of triangle *ABX* to the area of triangle *CDX*.

Answer (*a*)..... : ..... [1]

(b) Find the ratio of the area of triangle *ABX* to the area of triangle *BCX*.

Answer (*b*)..... : ..... [1]

(c) Calculate *CD*.

Answer (*c*) ..... cm [2]

21 **(a)** Write down, in terms of n, an expression for the nth term of the sequence

19 16 13 10 ..... .

For Examiner's Use

Answer (*a*) ..... [2]

(b) Factorise completely

(i) $4x^2 - 25y^2$,

Answer (*b*)(i) ..... [1]

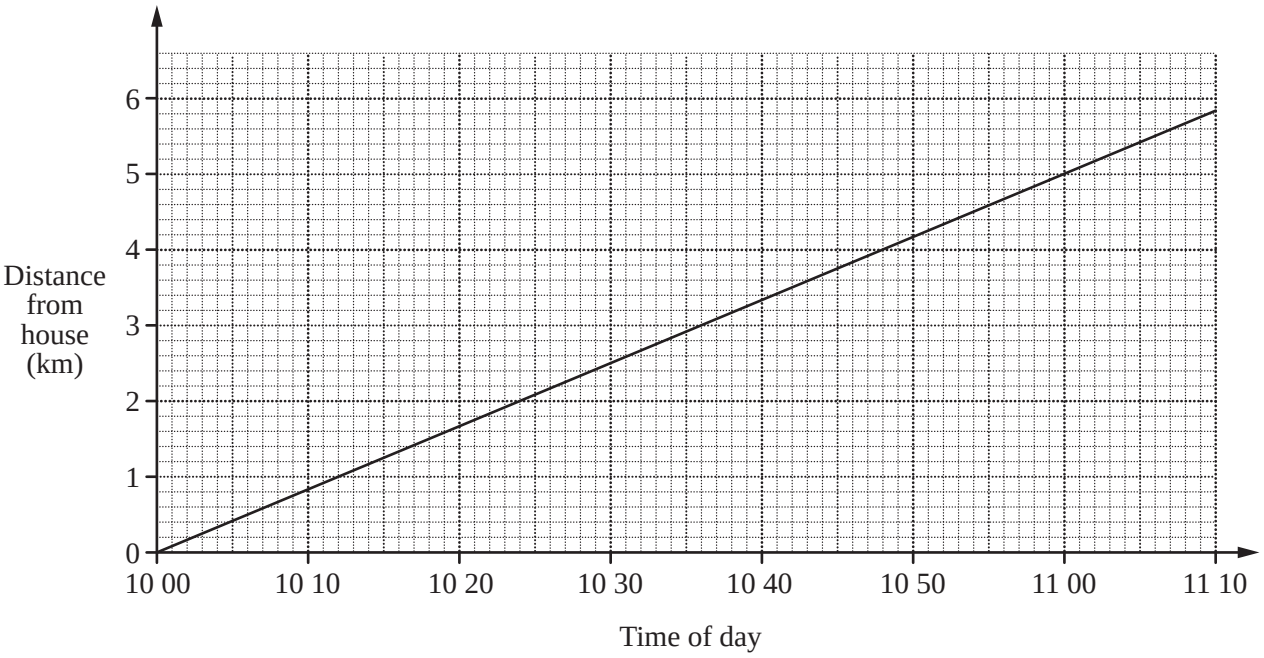
(ii) $5ax - 5a^2 - 2x + 2a$.

Answer (*b*)(ii) ..... [2]

22 A walker leaves his house at 10 00 and walks towards a shopping centre at a constant speed of 5 km/h.
A cyclist leaves the same house 10 minutes later.
He travels along the same road at a constant speed of 20 km/h until he reaches the shopping centre which is 6 km from the house.
The cyclist stops at the shopping centre for 14 minutes.
He then returns to the house along the same road at a constant speed of 20 km/h.

(a) The distance-time graph for the walker is drawn below.

On the same axes, draw the distance-time graph for the cyclist.



[3]

(b) Using the graphs, find

(i) the time when the cyclist, on his return journey, meets the walker,

Answer (*b*)(i) ..... [1]

(ii) the distance from the house when this meeting takes place.

Answer (*b*)(ii) .....km [1]

23 A stone is thrown vertically upwards from the ground so that its height above the ground after t seconds is $(20t - 5t^2)$ metres.

For Examiner's Use

(a) (i) Show that the values of t when the stone is 15 metres above the ground satisfy the equation

$$t^2 - 4t + 3 = 0.$$

[1]

(ii) Find the values of t when the stone is 15 metres above the ground.

Answer (*a*)(ii) t = ... and ..... [2]

(b) Find the value of t when the stone hits the ground.

Answer (*b*) t = ... [2]

Question 24 is printed on the following page

24 **(a)** Solve

For Examiner's Use

(i) $5 - 2\,(3x - 1) = 2x + 1$,

Answer (*a*)(i) $x =$ ..... [2]

(ii) $\frac{2}{5t} = \frac{3}{4}$.

Answer (*a*)(ii) $t =$ ..... [2]

(b) Solve the simultaneous equations

$$5x - 2y = 16,$$
$$2x - 3y = 13.$$

Answer (*b*) $x =$ .....

$y =$ ..... [3]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/22 Paper 22, maximum raw mark 100

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Section A

Qu	Answers	Mark	Comments
1	**(a)** **(i)** $p = 7$, $q = 2.9(0)$ $r = 0.25$ or $\frac{1}{4}$ **(ii)** \$7.75 **(b)** 0.2×980 (= 196) and 24×36 (= 864) soi \$80 **(c)** 3.5%	B1 B1 B1 M1 A1 B3 [8]	Correct method for both parts SC2 for answer of 23.5 or 17.5 SC1 for answer of 117.5 or 763.75 – 650 soi by 113.75 or 22.75
2	**(a)** **(i)** 110 **(ii)** 10 **(b)** **(i)** $x + 2x - 70$ + their 10 = 180 oe or $x + 2x$ + their 110 + 70 + 120 = 540 oe 80 **(ii)** 90	B1 B1ft M2 A1 B1ft [6]	120 – their **(a)(i)** (provided answer > 0) Allow M2 for $2x - y = 70$ and $x + y = 170$ where $y = E\hat{D}A$ If M0, SC1 for $3x$ soi NB: 80 from wrong working is M0 180 – their **(a)(ii)** – their **(b)(i)** Or 2 × their **(b)(i)** – 70 (provided answer > 0)
3	**(a)** Mercury, Mars, Venus, Earth **(b)** 3000 or 3×10^3 cao **(c)** $5.5(12) \times 10^{24}$ isw **(d)** $\frac{4}{3}\pi (6.4 \times 10^3)^3$ 1.09 to $1.1(0) \times 10^{12}$ isw	B1 B1 B1 M1 A1 [5]	
4	**(a)** $y < 12$ y and $2x$ seen in an equality or an inequality $y > 2x$ oe **(b)** **(i)** 16 **(ii)** $d = 9$ or (3, 9)	B1 M1 A1 B1 B1 [5]	Condone $4 < y < 12$ and $y \leqslant 12$ SC1 for $y > x$

5	**(a)** **(i)** $\begin{pmatrix}930\\1235\end{pmatrix}$ final answer After B0, column matrix with one correct or row matrix with both correct B1	B2	
	(ii) Top value – cost of fruit in week 1 Bottom value – cost of fruit in week 2	B1	
	(iii) \$21.65	B1ft	Sum of their two values divided by 100
	(b) M = $\begin{pmatrix}-6 & 0\\2 & -4\end{pmatrix}$ oe without fractions	B2	SC1 for either +4M or –4M or + or – $\begin{pmatrix}24 & 0\\-8 & 16\end{pmatrix}$
	(c) **(i)** **(a)** 7	B1	
	(b) {10, 14, 16}	B1	
	(ii) $\frac{3}{16}$	B2 [10]	SC1 for $(A \cap B =)$ {3, 6, 12} Or n$(A \cap B)$ = 3
6	**(a)** $m = \frac{1}{8}$	B1	Accept 0.12 or 0.13
	$n = 8$	B1	Accept $\frac{32}{4}$ or $\frac{8}{1}$ if correctly plotted
	(b) 5 correct central points	P2	–1 for each wrong plot –1 wrong scale –2 non-uniform scale
	Smooth curve through 5 correct central plots	C1	Lost for ruled or thick lines
	(c) **(i)** 3.5 – 3.7 ft from $y = 3$	B1	Do not accept embedded answers unless clearly justified on graph
	(ii) 2.5 – 2.7 ft from $y = 1.5$	B1	
	(d) **(i)** $t = x - 2$	B1	
	(ii) $x = \frac{5}{4}$ or 1.25 final answer	B1 [9]	Follow through their expression provided it is linear

7	**(a)** **(i)** 184 (cm^2)	B1		
	(ii) Tan $P\hat{S}R = \frac{8}{12}$	M1		
	$P\hat{S}R$ = 33.69 to 33.7	A1		
	(b) **(i)** $\frac{KM}{LM} = \frac{KL}{LN}$ oe	M1		$\frac{KM}{18} = \frac{15}{10}$ oe
	27 (cm)	A1		
	(ii) KN = 15 cm	B2		After B0, NM = 12 seen B1
	(iii) $\frac{16}{65}$ cao	B2	[9]	B1 for unsimplified equivalents or 0.246...

Section B

Qu	Answers	Mark	Comments
8	**(a)** $\frac{10}{x}$	B1	
	(b) $\frac{15}{x+0.5}$	B1	
	(c) their $\frac{10}{x}$ $+2+$ their $\frac{15}{x+0.5}=7$ oe	B1	
	$5x(x+0.5)=10x+5+15x$	M1	Correct removal of the denominators x and $x+0.5$
	$2x^2-9x-2\ (=0)$	A1	All correct – Answer given Must see at least 2 steps from previous line
	(d) For numerical $\frac{p\pm(\text{or}+\text{or}-)\sqrt{q}}{r}$		
	$p=9$ and $r=4$	B1	
	$q=97$ or $\sqrt{q}=9.848...$	B1	
	4.71	B1	SC1 for 4.7 to 4.72 and –0.2 to –0.22
	–0.21	B1	ww...max 2 marks
	(e) **(i)** 5.2(1)	B1ft	Their $x+0.5$ (provided $x>0$) If 2 positive values allow ft on either
	(ii) $\frac{10}{\text{their } 4.71}$ and $\frac{15}{\text{their } 4.71+0.5}$	M1	
	$0.75 \leqslant t \leqslant 0.8$	A1 [12]	
9	**(a)** 305° cao	B1	
	(b) $20^2+17^2\pm(2)\times 20\times 17\cos 50°$	M1	
	$QL^2=20^2+17^2-2\times 20\times 17\cos 50$	M1	
	15.87 – 15.9	A2	After A0, 251.9, 252 SC1
	(c) **(i)** $\frac{\sin P\hat{L}Q}{20}=\frac{\sin 50}{\text{their } 15.9}$	M1	
	$\sin P\hat{L}Q=\frac{20\sin 50}{\text{their } 15.9}$ (= 0.9653)	M1	Dep on first M1
	$P\hat{L}Q$ = 74.48 to 74.9	A1ft	ww 2 marks
	(ii) (0)19.48 to (0)20	B1ft	Their **(c)(i)** – 55
	(d) **(i)** 2130 or 9 30pm	B1	Not 09 30 (pm)
	(ii) $\sin 50=\frac{x}{17}$ or $\sin Q=\frac{x}{QL}$	M1	
	x = 12.9 to 13.1 (km)	A1 [12]	

10	**(a)** $n = 4$ 22, 20, 42 $n = 5$ 26, 30, 56	B2	After B0, 4 correct values SC1
	(b) **(i)** $4n + 6$	B1	Accept $2(2n + 3)$ or $4 \times n + 6$
	(ii) $n^2 + n$	B1	Accept $n(n + 1)$ or $n \times n + n$
	(c) $n^2 + 5n + 6$ $(n + 2)(n + 3)$	M1 A1	Adds their expressions for **(b)(i)** and **(b)(ii)** Factorises – answer given NB: Alternative complete methods can score M1A1
	(d) 156	B1	
	(e) **(i)** $((k + 2)(k + 3) = 306)$ $k^2 + 5k + 6 = 306$ $k^2 + 5k - 300 = 0$	M1 A1	
	(ii) 15 –20	B1 B1	SC1 for –15 and 20
	(iii) 66	B1ft[12]	Their positive integer k substituted into their **(b)(i)**
11	**(a)** **(i)** Correct scales and Correct widths (2, 2, 5, 5, 10) Correct heights (6, 9, 8.4, 5.6, 4)	SW1 H2	 3 or 4 correct heights H1
	(ii) 21 or 20	B1	
	(iii) $\frac{5}{7}$ cao	B1	
	(iv) $\frac{132}{870}, \frac{22k}{145k}$ or 0.15(0) to 0.152	B2	SC1 for $\frac{132}{900}, \frac{11k}{75k}$ or 0.147 or $\frac{12 \times 11}{30 \times 29}$ or $\frac{132}{870}$ seen
	(b) **(i)** $\frac{7}{60}$ cao	B1	
	(ii) 60	B2	After B0, 35% = 21 seen SC1
	(iii) 8	B2 [12]	SC1 for either 15,21 and 7 seen or 48° or 13 ⅓ % seen

12	**(a)** **(i)** 15	P2	After P0, $\sqrt{9^2+12^2}$ P1
	(ii) 678 – 679 (cm^2)	S2	After S0, $\pi \times 9 \times$ their $15 + \pi \times 9^2$ S1
	(iii) 1017 – 1020 (cm^3)	V2	After V0, $\frac{1}{3} \times \pi \times 9^2 \times 12$ V1
	(b) **(i)** 4 cm	B1	
	(ii) 10 cm	B1	
	(iii) 18.8 – 18.9 (cm)	C2	After C0, $\pi \times 3 \times 2$ C1
	(iv) 979 – 983 (cm^3)	W2	After W0, $\frac{26}{27}$ × their 1018 or
		[12]	their $1018 - \frac{1}{3}\pi 3^2 \times$ their 4 W1

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/21 Paper 21, maximum raw mark 100

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Section A

Qu	Answers	Mark	Comments
1	**(a)** f(7) = 1 as final answer	B1	
	(b) $\frac{t-2}{5} = t$	M1	Forms an equation in t and attempts to solve
	$t = -\frac{1}{2}$	A1	
	(c) Attempt to make x the subject	M1	
	$f^{-1}(x) = 5x + 2$	A1 [5]	SC1 for $(x =)5y + 2$
2	**(a)** $\frac{66-48}{48}$ (× 100)	M1	
	37.5%	A1	
	(b) 130% oe soi	M1	
	$\frac{19.5}{1.3}$ o.e	M1	
	($)15	A1	
	(c) **(i)** $88	B1	
	(ii) $79.20	B1√ft	
	$2.8(0) cao	B1 [8]	Accept –2.8
3	**(a)** Rectangle 13 cm by 8 cm	B1	
	(b) **(i)** Constructs perpendicular bisector of ZY	B1	to cross rectangle
	Arc of circle radius 9 centre X	B1	across rectangle
	(ii) Labels the correct region	B1	No need to shade – but must be correct
	(c) **(i)** P and Q correctly positioned	B1ft	
	(ii) **(a)** 42 ±1 m cao	B1	Dep on correct P and Q
	(b) 107° (±2°) cao	B1 [7]	

4	**(a)** $\frac{4(2x-1)-3(x+3)}{(x+3)(2x-1)}$	M1	Single fraction. Brackets not essential. Multiplies the first fraction by $(2x-1)$ and the second fraction by $(x+3)$
	$\frac{8x-4-3x-9}{(x+3)(2x-1)}$	M1	Multiplies out the numerator with at least 1 pair of terms correct
	$\frac{5x-13}{(x+3)(2x-1)}$ oe as final answer	A1	
	(b) Squares both sides of the equation	M1	
	$m=\frac{k^2-3n}{2l}$ as final answer	A1	
	(c) For num $\frac{p\pm\sqrt{q}}{r}$		
	$p=4$ and $r=6$	B1	s.o.i. or used
	$q=208$ or $\sqrt{q}=14.4...$	B1	
	$x=3.07$, $x=-1.74$ Final answers	B1 B1 [9]	SC1 for both 3.0 to 3.1 and –1.7 to –1.74 seen
5	**(a)** **(i)** $p=0.5$, $q=0.2$ $r=0.3$	B1 B1	
	(ii) **(a)** 0.25	B1	
	(b) 0.5×0.2 seen 0.2	M1 A1	
	(b) **(i)** 17	B1	
	(ii) $78-54$ soi $x=8$	M1 A1 [8]	Can be implied by $x+2x+54=78$
6	**(a)** Either 136° or 44° correct	B2	After B0, allow SC1 for $A\hat{C}O=22°$, $A\hat{B}C=68°$, $A\hat{E}C=68°$ or for sum = 180°.
	Other one correct	B1ft	
	(b) $A\hat{B}C=68°$, $B\hat{A}C=44°$ and $B\hat{C}A=68°$	B1	
	Isosceles triangle	B1 [5]	Dep

7	**(a)**	Mid value used o.e. Sum of (value × frequency) / 80 3.45 (hours)	M1 M1 A1	
	(b)	73, 78	B1	
	(c)	Correct scale, points correct and smooth curve	S1 P1 C1	Minus 1 each error P1 for 5 plots which could form ogive C1 reasonable curve
	(d)	**(i)** 3.3 (hours)	B1ft	Read at 40 ft within 0.1
		(ii) Upper quartile and lower quartile used 2.5 (hours)	M1 A1ft[10]	Upper quartile – 2 ft within 0.1

Section B

Qu	Answers	Mark	Comments
8	**(a)** $p = -2.6$ stated	B1	
	(b) Scales	S1	
	Five points plotted ft	P1ft	
	Smooth curve	C1	Lost for ruled lines, incomplete, very thick
	(c) $x = 2.55$ to 2.65	X1	
	(d) **(i)** $y = x$	L1	
	(ii) Line drawn and attempt to read at intersect	M1	
	$x = 2.4(0)$ to $2.5(0)$	A1	
	(e) –4	G1	
	(f) **(i)** Correct line drawn	T1	Tangent of gradient part **(e)**
	(ii) (0, 12)	Y1ft	ft from *their* attempted tangent
	(iii) $y = -4x + 12$	E1ft [12]	ft from *their* gradient and *their* intercept
9	**(a)** **(i)** $\frac{90}{360} \times \pi \times 16$	M1	Correct formula and 90° used
	+16	M1	Indep. Attempt to add 2 × radius
	28.56 to 28.6(0) cm	A1	
	(ii) $\frac{90}{360} \times \pi \times 8^2$	M1	Area of cross-section
	[Their $\frac{90}{360} \times \pi \times 8^2$] × h = 800 soi	M1	Indep. Forms equation
	h = 15.9(0) to 15.92 cm	A1	
	(b) **(i)** **(a)** $MN = 2x$	B1	
	(b) Area of triangle = $\frac{1}{2}$ their $(2x \times x)$	M1	Expect justification and a subtraction
	Area of sector = 16π and Subtraction	A1	
	(ii) $20(16\pi - x^2) = 800$	M1	Forms equation
	$x^2 = 10.2...$ to 10.3	A1	Correct method of solution
	$x = 3.2(0)$ to 3.21 cm	A1 [12]	

10	**(a)** **(i)**	140^o	B1	
	(ii)	$\frac{6\times180-4\times140}{4}$	M1	Correct method leading to solution
		or $3 \times 180 - 410$ or $180 - 50$ oe		
		130^o	A1	
	(b) **(i)**	$\tan 40^o = \frac{CT}{23}$ oe	M1	
		$CT = 19.29$ to $19.3(0)$ cm	A1	
	(ii)	73×39.3 or 50×39.3	M1	Accept 20 + their CT for 39.3
		$\frac{1}{2}\times23\times(\text{their } CT)$ or $\frac{1}{2}(20+20+\text{their } CT)\times23$	M1	
		2640 to 2650 cm^2	A1	
	(iii)	10560 to 10600	B1ft	4 × their **(b)(ii)**
	(iv) **(a)**	146 cm 79 cm	B1 B1ft	40 + 2 × their **(b)(i)** rounded up
		(b) 930 to 980 cm^2 cao	B1 [12]	
11	**(a)** **(i)**	$\begin{pmatrix}6\\-5\end{pmatrix}$	B1	Accept $\begin{matrix}6\\-5\end{matrix}$ but not 6, –5 or (6, –5)
	(ii)	Enlargement	M1	
		Scale factor $\frac{1}{2}$	A1	A1 and A1 not lost if transformation stated, when SC1 SC1 scored
		Centre (4, 1)	A1	
	(iii)	Shear	B1	
	(iv)	$y = x$ (+ c) $y = x + 1$	M1 A1	Knowing the equation has gradient 1
	(b) **(i)**	x-coordinate $-q$ y-coordinate $-p$	B1 B1	SC1 for $\begin{pmatrix}-q\\-p\end{pmatrix}$
	(ii)	x-coordinate q y-coordinate $-p$	B1 B1	SC1 for $\begin{pmatrix}q\\-p\end{pmatrix}$
	(iii)	$\mathbf{W} = \begin{pmatrix}-1 & 0\\0 & 1\end{pmatrix}$	B1 [12]	

12	**(a) (i)** $\mathbf{p} - \mathbf{q}$	B1	
	(ii) $\frac{1}{2}(\mathbf{p} - \mathbf{q}) + \frac{1}{4}\mathbf{p}$	M1	Correct method
	$\frac{3}{4}\mathbf{p} - \frac{1}{2}\mathbf{q}$ cao	A1	
	(b) (i) (a) $\frac{1}{2} \times 24 \times 17 \times \sin 55^\circ$	M1	
	167 to 167.5cm^2	A1	
	(b) Attempt at cosine rule	M1	
	$XY^2 = 865 - 816 \cos 55$	M1	Correct formula and sign and correct algebra soi
	19.9 to 19.93 (cm)	A2	SC1 for 396 to 397 seen
	(ii) (a) $VZ^2 = 15^2 - 6^2$	M1	Value of 6 and correct use of Pythagoras
	$VZ = 13.7$ to 13.75 cm	A1	
	(b) 766 cm^3 (Accept 762 – 766)	B1ft [12]	ft $\frac{1}{3}$ × their **(b)(i)(a)** × their **(b)(ii)(a)**

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

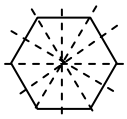
4024/12 Paper 12, maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2010 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Qu	Answers	Mark	Part Marks
1	**(a)** 0.7	1	
	(b) 60	1	
2	**(a)** $\frac{11}{35}$	1	
	(b) $\frac{18}{35}$	1	
3	**(a)** 22	1	
	(b) 1380	1	
4	**(a)** 10	1	
	(b) $\frac{1}{3}$	1	
5	0.5	2	B1 for two of 50, 0.2 and 4 seen
6	**(a)** 2.5	1	
	(b) $\frac{p+r}{2}$	1	
7	**(a)** 	1	
	(b) Rectangle, parallelogram or rhombus drawn	1	
8	**(a)** 81	1	
	(b) 24	1	
9	**(a)** $2^2 \times 5 \times 7$	1	
	(b) 28	1	
	(c) 42	1	
10	**(a)** 40 24	2	C1 for one correct or M1 for $\frac{x}{x-16}$ or $\frac{y+16}{y}=\frac{5}{3}$ or $\frac{5}{8}z=\frac{3}{8}z+16$
	(b) 2.5	1	
11	**(a)** –1.5	1	
	(b) $\frac{5}{3x+2}$	2	C1 for $\frac{5}{3y+2}$ or $\frac{5}{ax+b}$ with $a = 3$ or $b = 2$ or B1 for $3xy = 5 – 2x$ or $3yx = 5 – 2y$ or better seen

12	**(a)** $\frac{12}{x^2}$	2	C1 for $\frac{k}{x^2}$ or B1 for $k = 12$ seen or $y = \frac{k}{x^2}$ with k or k any number
	(b) 2 –2	1	
13	$(x =)$ 5 $(y =) -4$	3	C2 for one correct with working. M1 for a correct method to eliminate one variable, reaching such as $11x = k$, $hx = 55$, $11y = p$ or $qy = -44$
14	**(a)** –2 5.5	1	
	(b) $y = -0.75x + 4$	2	C1 for $y = -0.75x + c$ or $y = mx + 4$ or B1 for $m = -0.75$ or $c = 4$ soi or a line through either point (–8, 10) or (4, 1)
15	**(a)** 52	1	
	(b) 52	1	Accept their **(a)** ft
	(c) 38	1	Accept 90 – their **(b)** ft
16	**(a)** Correct completion with $\frac{4}{10}$, $\frac{4}{9}$, $\frac{6}{9}$ and $\frac{3}{9}$	1	
	(b) $\frac{7}{15}$	2	C2 for a correct ft from **(a)** M1 for $\frac{6}{10}\times\frac{5}{9}+\frac{4}{10}\times\frac{3}{9}$
17	**(a)** $2\mathbf{p} + 3\mathbf{q}$	1	
	(b) $2\mathbf{p} + 2\mathbf{q}$	1	
	(c) $-2\mathbf{p} + \mathbf{q}$	1	Accept $3\mathbf{q}$ – their **(b)** ft
18	**(a)** $\frac{\pi r^2}{6}$	1	
	(b) $2r + \frac{\pi r}{3}$	2	B1 for $\frac{60}{360} \times 2\pi r$ seen
19	**(a)** $\begin{pmatrix} 3 & -1 \\ 0 & -1 \end{pmatrix}$	1	
	(b) $\begin{pmatrix} \frac{3}{2} & -1 \\ \frac{1}{2} & 0 \end{pmatrix}$ o.e.	2	B1 for $\frac{1}{2}$ or $\begin{pmatrix} 3 & -2 \\ 1 & 0 \end{pmatrix}$ or (det =) 2

20	**(a)** 39	1	
	(b) 14	2	B1 for 46 or 32 seen
	(c) 9	1	
21	**(a)** **(i)** $3x(x-4)$	1	
	(ii) $(x+y)(x-2y)$	1	
	(b) $\frac{x}{x-4}$	2	B1 for $x(x+4)$ or $(x+4)(x-4)$ seen
22	**(a)** 2 500 000	1	
	(b) **(i)** 395	1	
	(ii) 340	2	B1 for 5.5 seen
23	**(a)** 34	2	M1 for $\frac{16}{AB} = \cos\theta$ soi
	(b) 480	2	B1 for height of $ABC = 16\tan\theta$ o.e. or for $\frac{1}{2} \times 32 \times$ their 34 $\times \sin\theta$ or M1 for any correct method
24	**(a)** T with vertices (5, 6), (3, 6) and (3, 2)	2	C1 for two vertices correct or for T same orientation as P and correct size
	(b) Rotation 90˚ anticlockwise about (0, 0)	2	B1 for Rotation or 90˚ anticlockwise about (0, 0) oe
	(c) $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$	1	
25	**(a)** 108	1	
	(b) 0.5 – 0.9 with tangent drawn at $t = 18$	2	C1 for 0.5 – 0.9 or B1 for tangent at $t = 18$
	(c) Correct distance / time graph	2	B1 for curve from (0, 0) to (8, 36) with correct curvature or straight line from (8, 36) to (16, 108ft)
26	**(a)** Correct triangle	2	B1 if no arcs seen or arcs seen but sides in the wrong order or arcs seen, but only one side the correct length
	(b) Correct region shaded	3	B1 for arc radius 7, centre B B1 for perp. bisector of AB

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/11 Paper 11, maximum raw mark 75

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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Qu	Answers	Mark	Part Marks
1	**(a)** $\frac{13}{18}$ oe	1	
	(b) $\frac{22}{27}$ oe	1	
2	**(a)** 9	1	
	(b) 12	1	
3	**(a)** 63	1	
	(b) $\frac{28}{\pi}$	1	
4	64	2	M1 for (60 + 20) ÷ (total time)
5	**(a)** C	1	
	(b) (0)40$^{(°)}$	1	
6	**(a)** $x < 3.5$	1	
	(b) 3	1ft	ft from their **(a)**
7	TRUE TRUE FALSE Valid Example	2	B1 for TRUE TRUE or FALSE with valid example evaluated
8	**(a)** 49	1	
	(b) 18	1	
9	**(a)** 6.5	1	
	(b) 6	2	B1 for 7.5 seen
10	**(a)** (0).012	1	
	(b) 300	1	
	(c) 3 cao	1	
11	Congruent triangles established and conclusion	3	M1 for CO = OD or AO = OB M1 for $A\hat{O}C = B\hat{O}D$ A1 for both pairs of equal sides, equal angles, a valid reason and conclusion
12	**(a)** 1.5 , 6.5	1	
	(b) $x \geqslant 0, y \geqslant 4, x \leqslant 3$	2	C1 for two correct or all 3 inequalities consistently wrong, or =

13	**(a)** (400 350)	2	C1 for 750 B1 for 400 or 350 seen
	(b) Total cost (of each family's order).	1	
14	Correct histogram	3	B2 for three correct columns B1 for one correct column SC1 for correct frequency densities
15	**(a)** 40.81	1	
	(b) **(i)** 6.9(0)	1	
	(ii) 2.76	2	M1 for their **(b)(i)** ÷ 2.50
16	**(a)** 6 8 13	3	C2 for total 27 with their median 8 or C1 8 or total 27 or B1 for 27 seen or M1 for a relevant equation containing such as x and $x+7$ or $y-7$ and y
	(b) 17 cao	1	
17	**(a)** $y = \frac{36}{x^2}$	2	C1 for $y = \frac{k}{x^2}$ B1 for $k = 36$ seen M1 for $y = \frac{k}{x^2}$ seen with any k
	(b) 9 cao	1	
	(c) ±6 cao	1	
18	**(a)** 50	1	
	(b) 65	1	
	(c) 45	1	
	(d) 225	1	
19	**(a)** 78	1	
	(b) 1.62×10^{11}	1	
	(c) $5.32(2) \times 10^{21}$	2	C1 for figs 5322 or $5.3....\times 10^{21}$
20	**(a)** 4 : 25	1	
	(b) 2 : 5	1	
	(c) 7.5	2	M1 for $\frac{3}{CD} = \frac{2}{5}$ or better

21	**(a)** 22 – 3n	2	B1 for –3n soi
	(b) **(i)** $(2x – 5y)(2x + 5y)$	1	
	(ii) $(5a – 2)(x – a)$	2	M1 for the correct extraction of a common factor at any stage
22	**(a)** Correct distance/time graph	3	B2 for any two correct lines or L_1 (10 10,0) to (a, 6), gradient m, L_2 (a, 6) to (b, 6) L_3 (b, 6) to (11 00,0) or (c, 0), gradient – m. B1 for a horizontal line at d = 6 or a horizontal line, 14 mins, anywhere or $\frac{6}{20}$ soi
	(b) **(i)** 10 48	1	
	(ii) 4	1	
23	**(a)** **(i)** $t^2 – 4t + 3 = 0$ correctly derived AG	1	Must see $(20t – 5t^2) = 15$
	(ii) 1, 3	2	C1 for one value correct , and no incorrect value given M1 for $(t – 1)(t – 3)$ oe seen
	(b) 4	2	M1 for $20t – 5t^2 = 0$ or better seen
24	**(a)** **(i)** 0.75 oe	2	M1 for $5 – 6x \pm 2 = 2x + 1$ soi
	(ii) $\frac{8}{15}$ oe	2	M1 for $\frac{5t}{2} = \frac{4}{3}$ or better
	(b) $x = 2 \quad y = –3$	3	C2 for one correct www M1 for elimination or substitution reaching such as $11x = k$ or $hx = 22$ or $11y = p$ or $qy = –33$

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/02**

Paper 2 **May/June 2009**

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (2 sheets)
Mathematical tables (optional)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

This document consists of **11** printed pages and **1** blank page.

DC (GB/CGW) 10602/4

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

Section A [52 marks]

Answer **all** questions in this section.

1 **(a)** Express as a single fraction in its simplest form $\frac{2a}{3} + \frac{3}{2a}$. [1]

(b) Factorise completely $5b^2 - 10b$. [1]

(c) The points P and Q are (4, 7) and (8, −3) respectively.

Find

(i) the midpoint of PQ, [1]

(ii) the length of PQ. [2]

(d) Solve the equation $3x^2 + 11x - 7 = 0$, giving each answer correct to 2 decimal places. [4]

---

2 **(a)** During a 20 week period in 2007, a bank made a profit of \$378 million.

(i) Calculate the average profit it made each second. [2]

(ii) During the same 20 week period in 2008, the profit was \$945 million.

For this 20 week period, calculate the percentage increase in the profit from 2007 to 2008. [2]

(iii) Find the ratio of \$378 million to \$945 million.
Give your answer in the form $m : n$, where m and n are the smallest possible integers. [2]

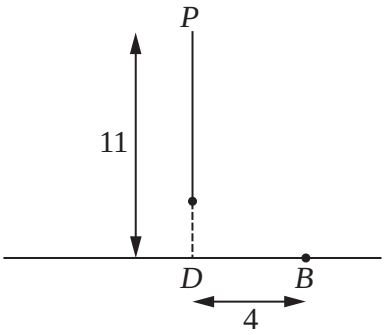
(b) Mary changed 480 euros into dollars.
The exchange rate was \$1 = 0.6 euros.
The bank took, as commission, 2% of the amount that had been changed.

Calculate the number of **dollars** the bank took as commission. [2]

---

3 **(a)** A heavy ball hangs from a point P, 11 m above horizontal ground, by means of a thin wire.

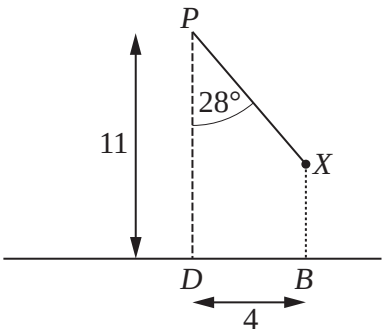
The point D is on the ground vertically below P. The point B is on the ground 4 m from D.



(i) Calculate the angle of elevation of P from B. [2]

(ii) The ball swings, with the wire straight, in the vertical plane PDB.

When the ball is at X, directly above B, $D\hat{P}X = 28°$.



Calculate

(a) PX, [2]

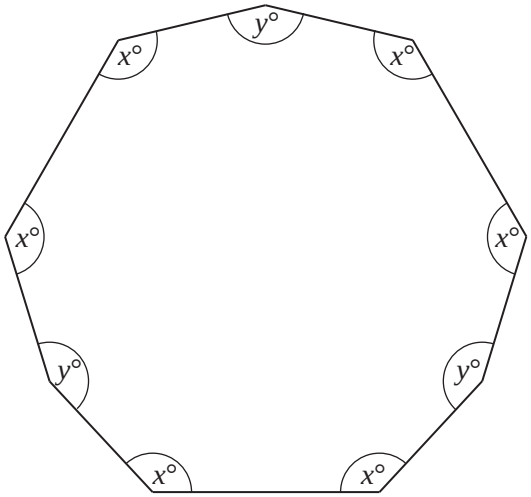
(b) XB. [3]

(b) **[The volume of a sphere is $\frac{4}{3}\pi r^3$.]**

The ball is a sphere of volume 96 cm^3.

Calculate its radius. [2]

4 (a)



In the diagram, the 9-sided polygon has 6 angles of $x°$ and 3 angles of $y°$.

(i) For this polygon, state

(a) the number of lines of symmetry, [1]

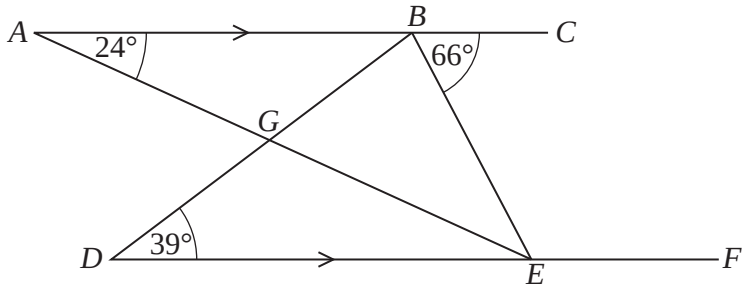
(b) the order of rotational symmetry. [1]

(ii) **(a)** Show that the sum of the interior angles of a 9-sided polygon is 1260°. [1]

(b) Find an expression for y in terms of x. [2]

(c) Given also that $y = 12 + x$, find x. [2]

(b)



In the diagram, the lines ABC and DEF are parallel.
AE meets DB at G.
$B\hat{A}E = 24°$, $C\hat{B}E = 66°$ and $B\hat{D}E = 39°$.

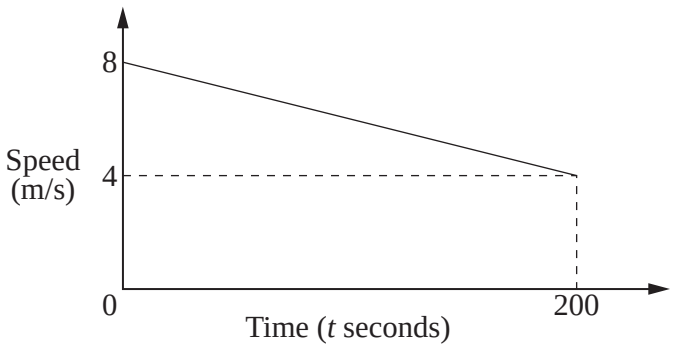
Calculate

(i) $F\hat{E}B$, [1]

(ii) $B\hat{E}A$, [1]

(iii) $A\hat{G}D$. [1]

5 (a)



Ali was on a training run.
The diagram is the speed-time graph of part of his run.
At $t = 0$, his speed was 8 m/s.
His speed decreased at a constant rate until it was 4 m/s at $t = 200$.

(i) Calculate

(a) his retardation during the 200 s, [1]

(b) the distance he ran during the 200 s, [2]

(c) his speed at $t = 150$. [1]

(ii) Ben ran at a constant speed in the same direction as Ali.
At $t = 0$, Ali and Ben were level.
They ran the same distance in the next 150 seconds.

Calculate Ben's speed. [2]

(b) Chris ran 200 m, correct to the nearest 10 metres.
He took 25 s, correct to the nearest second.

Find lower bounds for

(i) the distance run, [1]

(ii) his average speed. [3]

6 The diagram shows the first four rows of a pattern of numbers.

Row 1 1 2 1

Row 2 2 3 2 3 2

Row 3 3 4 3 4 3 4 3

Row 4 4 5 4 5 4 5 4 5 4

The table shows some results obtained from this pattern.

Row number	1	2	3	4	5		*n*
Number of numbers in the row	3	5	7	9	*p*		*x*
Product of the first two numbers in the row	2	6	12	20	*q*		*y*
Sum of all the numbers in the row	4	12	24	40	*r*		*z*
Middle number in the row	2	2	4	4	*s*		

(a) Find the values of *p*, *q*, *r* and *s*. [2]

(b) Find expressions, in terms of *n*, for *x*, *y* and *z*. [3]

(c) Write down the middle number in Row 101. [1]

Section B [48 marks]

Answer **four** questions in this section.

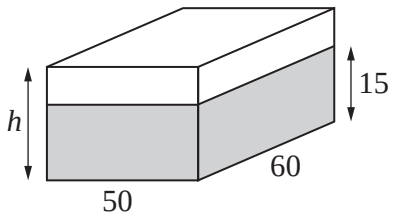
Each question in this section carries 12 marks.

7 **(a)** When a solid rectangular wooden block of oak floats, 60% of its height is under water.

(i) What fraction of its height is **above** water? [1]

(ii) A block of oak has length 60 cm, breadth 50 cm and height h centimetres.

It floats with 15 cm of its height under water.

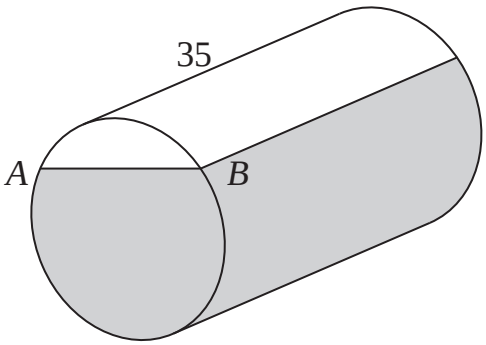


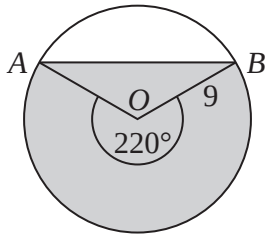
(a) Find the value of h. [1]

(b) In the diagram, the shaded region represents part of the surface area of the block that is in contact with the water.

Calculate the **total** surface area of the block that is in contact with the water. [2]

(b)





A solid cylinder, made from a different type of wood, floats in water.
The shaded region represents part of the surface of the cylinder that is in contact with the water.
The right hand diagram shows the circular cross-section of one end.
The centre of the circle is O and the water level reaches the points A and B on the circumference.
Reflex angle $AOB = 220°$.
The cylinder has radius 9 cm and length 35 cm.

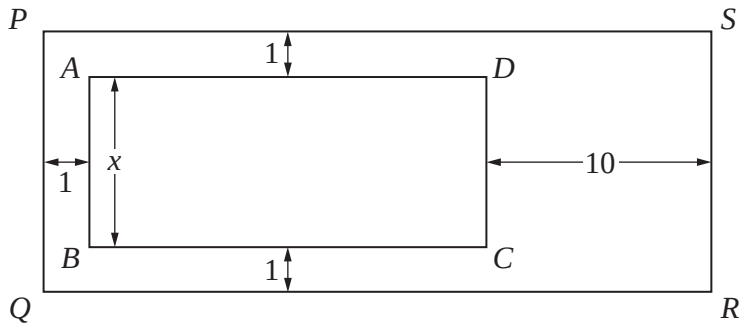
Calculate

(i) the area of the **curved surface** of the cylinder that is in contact with the water, [2]

(ii) the surface area of **one end** of the cylinder that is in contact with the water, [4]

(iii) the distance between the water level AB and the top of the cylinder. [2]

8 **Answer THE WHOLE of this question on a sheet of graph paper.**



The diagram represents a rectangular pond, *ABCD*, surrounded by a paved region.
The paved region has widths 1 m and 10 m as shown.
The pond and paved region form a rectangle *PQRS*.
The area of the pond is 168 m^2.

(a) Taking the length of *AB* to be *x* metres, write down expressions, in terms of *x*, for

(i) *PQ*,

(ii) *BC*,

(iii) *QR*. [2]

(b) Hence show that the area, *y* square metres, of the paved region, is given by

$$y = 22 + 11x + \frac{336}{x}.$$ [2]

(c) The table below shows some values of *x* and the corresponding values of *y*.

x	3	3.5	4	5	6	7	8	9
y	167	156.5	150	144.2	144	147	152	*p*

Calculate *p*. [1]

(d) Using a scale of 2 cm to represent 1 metre, draw a horizontal *x*-axis for $3 \leqslant x \leqslant 9$.

Using a scale of 2 cm to represent 5 square metres, draw a vertical *y*-axis for $140 \leqslant y \leqslant 170$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

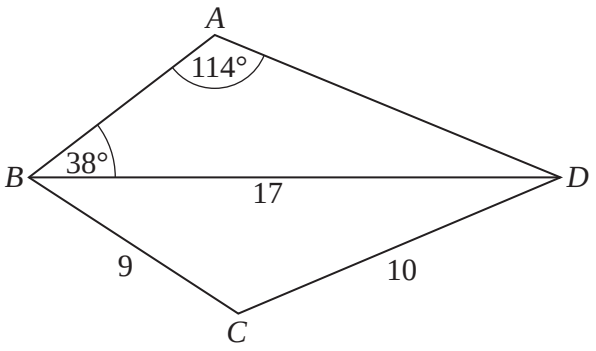
(e) By drawing a tangent, find the gradient of the curve at (4, 150). [2]

(f) Use your graph to find

(i) the smallest area of the paved region, [1]

(ii) the length of *PQ* when the area of the paved region is smallest. [1]

9 **(a)**



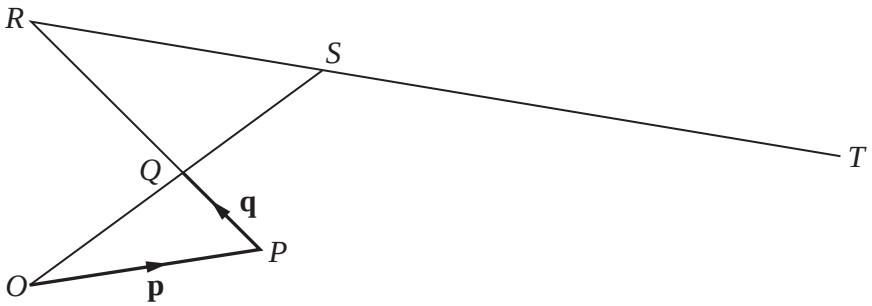
In the diagram, $BD = 17\,\text{cm}$, $CD = 10\,\text{cm}$, $BC = 9\,\text{cm}$, $B\hat{A}D = 114°$ and $A\hat{B}D = 38°$.

Calculate

(i) AD, [3]

(ii) $B\hat{C}D$. [3]

(b)



In the diagram, $\overrightarrow{OQ} = \overrightarrow{QS}$, $\overrightarrow{QR} = 2\overrightarrow{PQ}$ and $\overrightarrow{ST} = 2\overrightarrow{RS}$.

$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{PQ} = \mathbf{q}$.

(i) Express, as simply as possible, in terms of **p** and/or **q**,

(a) $\overrightarrow{OQ}$, [1]

(b) $\overrightarrow{RS}$, [1]

(c) $\overrightarrow{OS}$, [1]

(d) $\overrightarrow{OT}$. [1]

(ii) Hence write down two facts about O, P and T. [2]

10 Answer THE WHOLE of this question on a sheet of graph paper.

The waiting times of 50 people at a supermarket checkout were recorded.
The results are summarised in the table below.

Time (t minutes)	$1 < t \leqslant 3$	$3 < t \leqslant 4$	$4 < t \leqslant 5$	$5 < t \leqslant 7$	$7 < t \leqslant 9$	$9 < t \leqslant 12$
Number of people	4	10	8	14	8	6

(a) Using a scale of 1 cm to represent 1 minute, draw a horizontal axis for waiting times between 0 and 12 minutes.
Using a scale of 1 cm to represent 1 unit, draw a vertical axis for frequency densities from 0 to 10 units.
On your axes, draw a histogram to illustrate the distribution of waiting times. [3]

(b) In which class does the upper quartile lie? [1]

(c) Calculate an estimate of the mean waiting time. [3]

(d) One person is chosen, at random, from the 50 people.

Write down the probability that this person waited

(i) less than 1 minute, [1]

(ii) more than 5 minutes. [1]

(e) A second person is now chosen, at random, from the remaining 49 people.

Expressing each answer as a fraction in its lowest terms, calculate the probability that

(i) both people waited more than 5 minutes, [1]

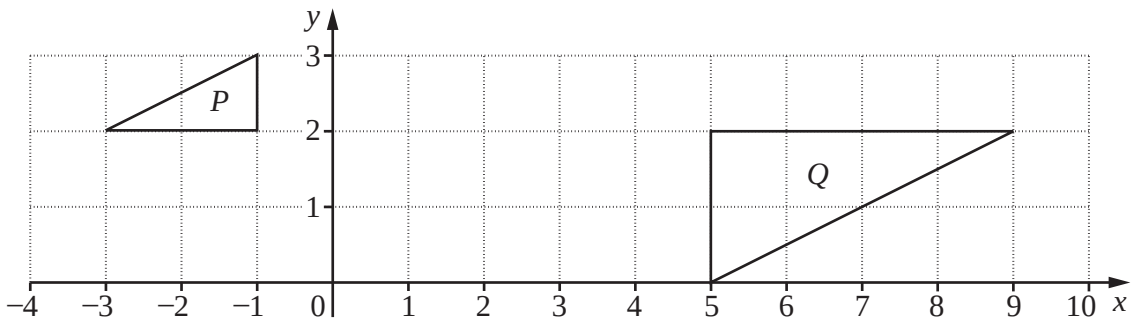
(ii) one person waited more than 5 minutes and the other waited 5 minutes or less. [2]

11 **(a)** $\mathbf{A} = \begin{pmatrix} 0 & 3 \\ -1 & x \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 1 & -1 \\ \frac{1}{3} & 0 \end{pmatrix}$

(i) Express $2\mathbf{A} - 3\mathbf{B}$ in terms of x. [2]

(ii) Given that $\mathbf{A} = \mathbf{B}^{-1}$, find the value of x. [2]

(b)



The diagram shows the triangles P and Q.

(i) The enlargement E maps triangle P onto triangle Q.

For this enlargement,

(a) write down the scale factor, [1]

(b) find the coordinates of the centre of enlargement. [2]

(ii) The **single** transformation T is represented by the matrix $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$.

Describe T completely. [2]

(iii) L is the point $(k, 2)$.
T maps L onto $(8, 2)$.

(a) Find the value of k. [1]

(b) Find the coordinates of ET(L). [2]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/01**

Paper 1 **May/June 2009**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

For Examiner's Use

This document consists of **20** printed pages.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

For Examiner's Use

1 **(a)** Evaluate $17 - 5 \times 3 + 1$.

Answer (*a*) .....[1]

(b) Express 0.82 as a percentage.

Answer (*b*) ..... % [1]

---

2 Express as a single fraction in its lowest terms,

(a) $\frac{8}{9} \times \frac{3}{4}$,

Answer (*a*) .....[1]

(b) $\frac{3}{4} - \frac{2}{3}$.

Answer (*b*) ..... [1]

---

3 **(a)** Write down the two cube numbers between 10 and 100.

For Examiner's Use

Answer (*a*) .....[1]

(b) Write down the two prime numbers between 30 and 40.

Answer (*b*) ..... [1]

---

4 **(a)** Factorise $x^2 - y^2$.

Answer (*a*) .....[1]

(b) Evaluate $102^2 - 98^2$.

Answer (*b*) ..... [1]

---

5 **(a)** Evaluate 0.5×0.007.

Answer (*a*) .....[1]

(b) Evaluate $\frac{1}{1.25}$ as a decimal.

Answer (*b*) ..... [1]

---

6 **(a)** Write down all the factors of 18.

Answer (*a*) .....[1]

(b) Write 392 as the product of its prime factors.

Answer (*b*) ..... [1]

---

7 **(a)** Simplify $4a^3 \times a^2$.

Answer (*a*) .....[1]

(b) Simplify fully $3x(x + 5) – 2(x – 3)$.

Answer (*b*) ..... [2]

---

8 **(a)** Convert 0.8 kilometres into millimetres.

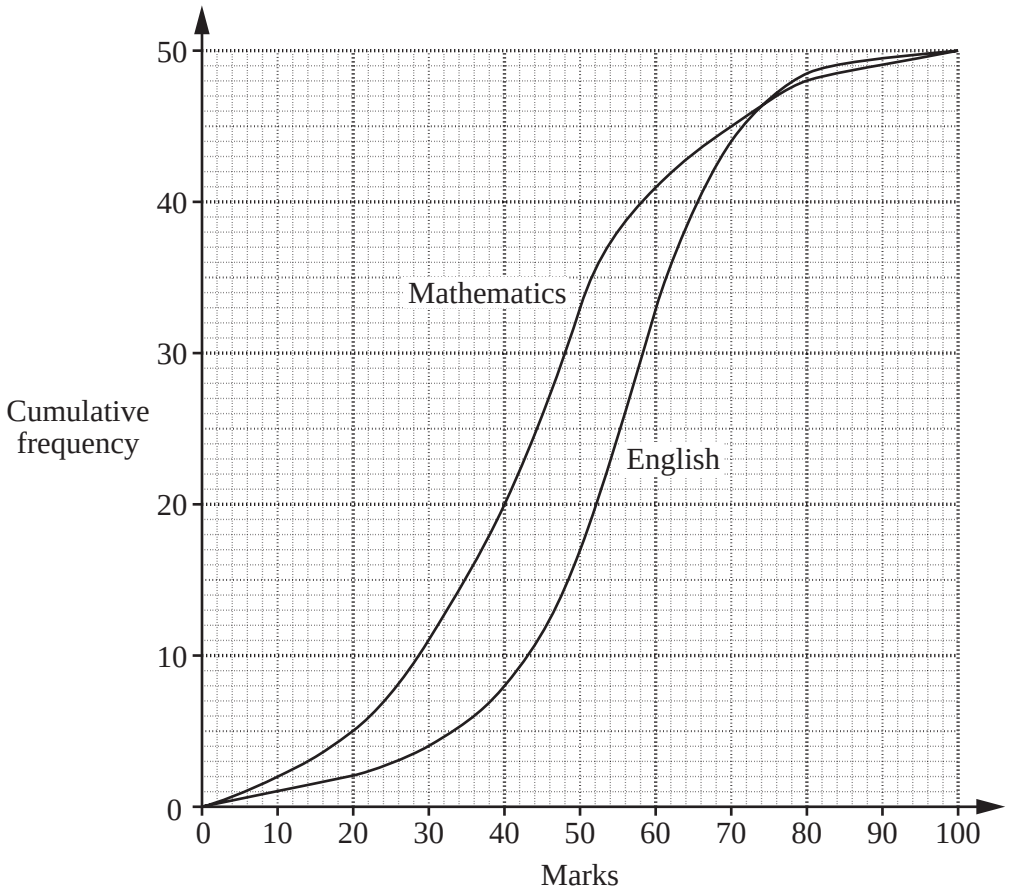
Answer (*a*) ..... mm [1]

(b) Evaluate $(6.3 \times 10^6) \div (9 \times 10^2)$, giving your answer in standard form.

Answer (*b*) ..... [2]

[Turn over

9



Fifty students each took a Mathematics and an English test. The distributions of their marks are shown in the cumulative frequency graph.

(a) Use the graph

(i) to estimate the median mark in the English test,

Answer (*a*)(i) .....[1]

(ii) to estimate the 20th percentile mark in the Mathematics test.

Answer (*a*)(ii) .....[1]

(b) State, **with a reason**, which test the students found more difficult.

Answer (*b*) .....

.....

.....

..... [1]

10 Five clocks at a hotel reception desk show the local times in five different cities at the same moment.

For Examiner's Use

LONDON	MOSCOW	SYDNEY	TOKYO	NEW YORK
07 38	10 38	16 38	15 38	02 38

(a) Rosidah has breakfast at 08 00 in Moscow.
What is the local time in Sydney?

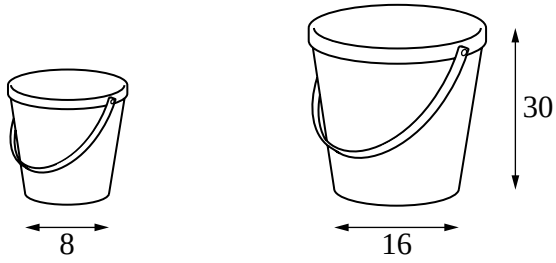
Answer (*a*) .....[1]

(b) Elias catches a plane in London and flies to New York.
He leaves London at 11 30 local time.
The flight time is 8 hours 10 minutes.
What is the local time in New York when he lands?

Answer (*b*) ..... [2]

11 Similar buckets are available in two sizes.
The large bucket has height 30 cm and base diameter 16 cm.
The small bucket has base diameter 8 cm.

For Examiner's Use



(a) Find the height of the small bucket.

Answer (*a*) ..... cm [1]

(b) Given that the small bucket has volume 850 cm^3, find the volume of the large bucket.

Answer (*b*) ..... cm^3 [2]

12 y is directly proportional to the square root of x.
Given that $y = 12$ when $x = 36$,

find

(a) the formula for y in terms of x,

Answer (*a*) $y =$ ..... [2]

(b) the value of x when $y = 10$.

Answer (*b*) $x =$ ..... [1]

For Examiner's Use

13

For Examiner's Use

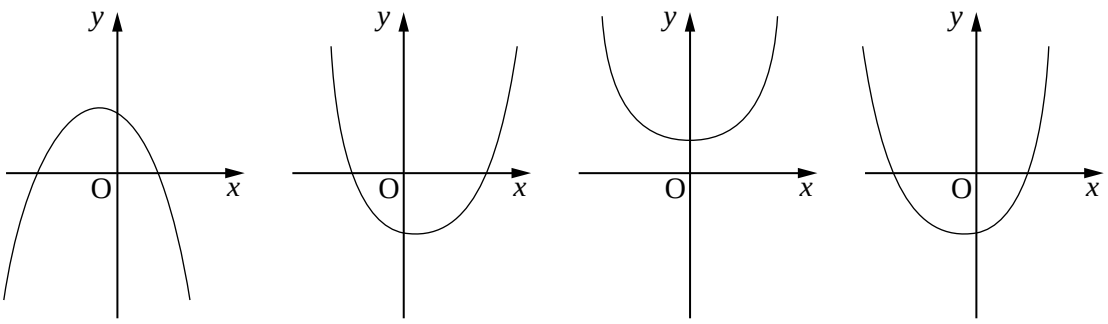


Figure 1 Figure 2 Figure 3 Figure 4

Which of the figures shown above could be the graph of

(a) $y = x^2 + 2$,

Answer (*a*) Figure .....[1]

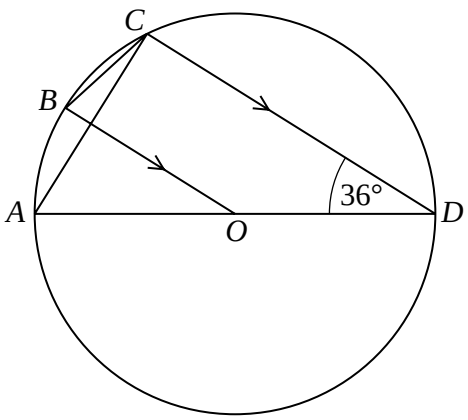
(b) $y = (x - 2)(x + 1)$,

Answer (*b*) Figure .....[1]

(c) $y = 2 - x - x^2$?

Answer (*c*) Figure.....[1]

14



The diagram shows a circle, centre O, passing through A, B, C and D.
AOD is a straight line, BO is parallel to CD and $C\hat{D}A = 36^{\circ}$.

Find

(a) $B\hat{O}A$,

Answer (*a*) $B\hat{O}A$ ..... [1]

(b) $B\hat{C}A$,

Answer (*b*) $B\hat{C}A$ ..... [1]

(c) $D\hat{C}B$,

Answer (*c*) $D\hat{C}B$ ..... [1]

(d) $O\hat{B}C$.

Answer (*d*) $O\hat{B}C$ ..... [1]

15 The times taken for a bus to travel between five stops *A, B, C, D* and *E* are shown below.

For Examiner's Use

A		*B*		*C*		*D*		*E*
	4 minutes		$1\frac{1}{2}$ minutes		75 seconds		2 minutes 35 seconds	

Expressing each answer in minutes and seconds, find

(a) the total time for the journey from *A* to *E*,

Answer (*a*) .....minutes..... seconds [1]

(b) the mean time taken between the stops,

Answer (*b*) .....minutes..... seconds [2]

(c) the range of times taken between the stops.

Answer (*c*) .....minutes..... seconds [1]

16 It is given that f(x) = 12 – 5x.

For Examiner's Use

Find

(a) f(4) ,

Answer (*a*) f(4) =.....[1]

(b) the value of x for which f(x) = 17,

Answer (*b*) x = ...[1]

(c) $f^{-1}(x)$.

Answer (*c*) $f^{-1}(x)$ =.....[2]

---

17 **(a)** Solve $\frac{3x-2}{5} = \frac{x}{3}$.

Answer (*a*) x = ...[2]

(b) Given that y is an integer and $-3 < 2y - 6 < 4$, list the possible values of y.

Answer (*b*) ..... [2]

---

18 **(a)** $\mathscr{E}$ = { 1, 2, 3, 4, 5 },
A = { 1, 2, 3 },
B = { 5 },
C = { 3, 4 }.

List the elements of

(i) $A \cup C$,

Answer (*a*)(i) .....[1]

(ii) $B' \cap C'$.

Answer (*a*)(ii) .....[1]

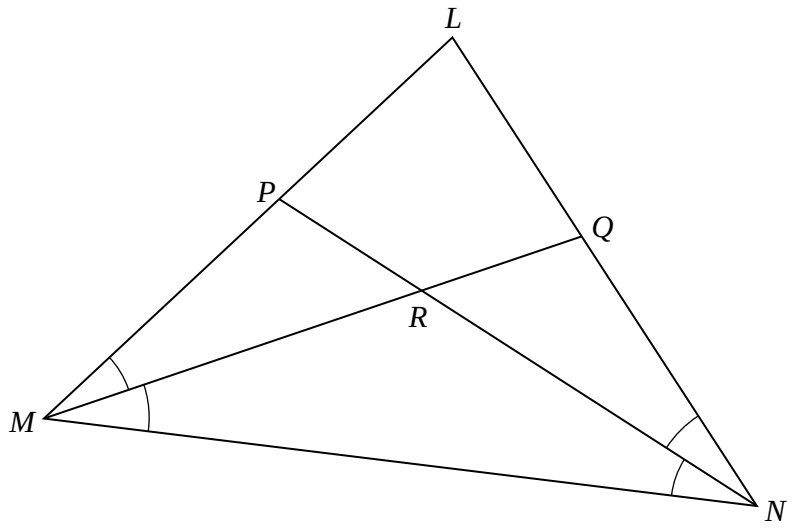
(b) A group of 60 children attend an after school club.
Of these, 35 children play football and 29 play hockey.
3 children do not play either football or hockey.

By drawing a Venn diagram, or otherwise, find the number of children who play only hockey.

Answer (*b*) .....[2]

19

For Examiner's Use



In the diagram, $L\hat{M}Q = Q\hat{M}N = M\hat{N}P = P\hat{N}L$.

(a) Show that triangles *LMQ* and *LNP* are congruent.

[3]

(b) Show that $M\hat{P}N = M\hat{Q}N$.

[1]

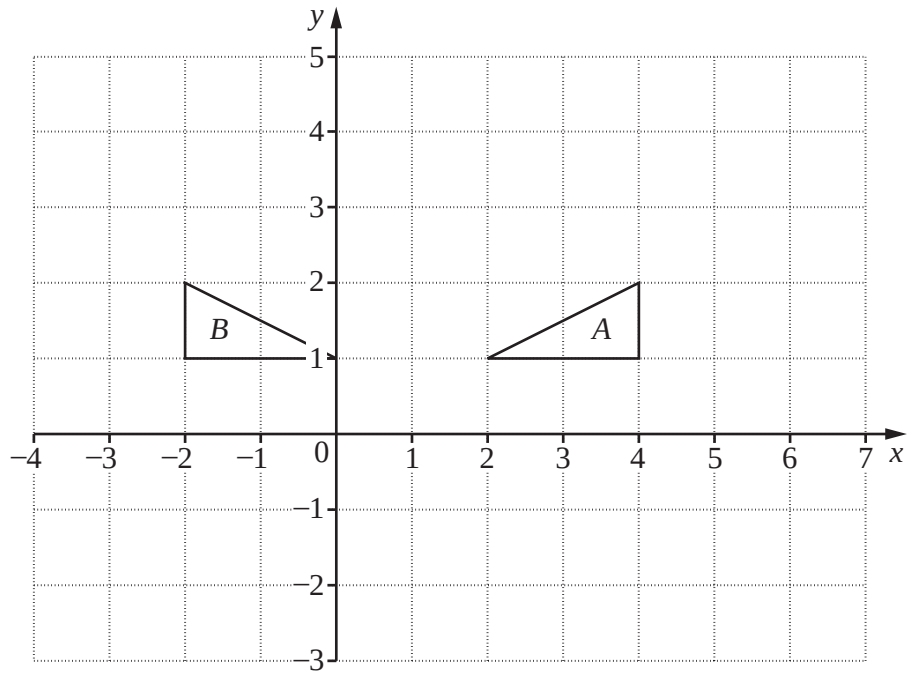
(c) The straight lines *MQ* and *NP* intersect at *R*.

State the name of the special quadrilateral *LPRQ*.

Answer (*c*) .....[1]

20 *Answer (a), (b)*

For Examiner's Use



The diagram shows triangles *A* and *B*.

(a) The translation $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ maps ΔA onto ΔC.

On the diagram, draw and label ΔC. [1]

(b) The rotation 90° clockwise, centre (2, 0), maps ΔA onto ΔD.

On the diagram, draw and label ΔD. [2]

(c) Describe **fully** the **single** transformation which maps ΔA onto ΔB.

Answer (c) .....

..... [2]

21 The nth term of a sequence is $\frac{4}{n^2}$.

For Examiner's Use

(a) Write down the first three terms of the sequence, expressing each term in its simplest form.

Answer (*a*)..... , ... , ...[1]

(b) The kth term in the sequence is $\frac{1}{100}$.

Find the value of k.

Answer (*b*) k = ...[2]

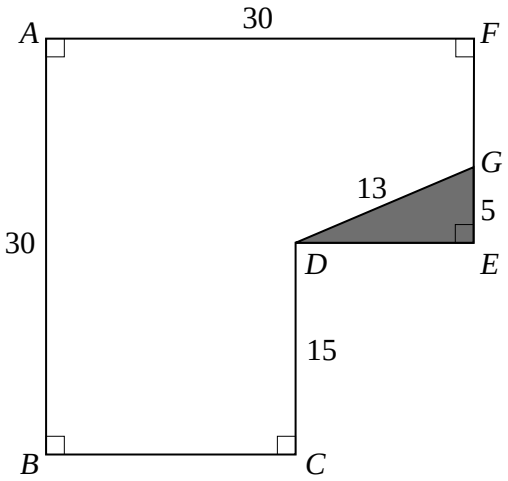
(c) Given that the mth term of the sequence is less than 0.0064, find the smallest value of m.

Answer (*c*) m = ...[2]

[Turn over

22

For Examiner's Use



ABCDEF represents an L-shaped piece of glass with $AB = AF = 30$ cm and $CD = 15$ cm.
The glass is cut to fit the window in a door and the shaded triangle *DEG* is removed.
$DG = 13$ cm and $EG = 5$ cm.

(a) Show that DE = 12 cm.

Answer (*a*) .....

.....

.....

..... [1]

(b) For the remaining piece of glass *ABCDGF*, find

For Examiner's Use

(i) its perimeter,

Answer (*b*)(i) ..... cm [2]

(ii) its area.

Answer (*b*)(ii) ..... cm^2 [2]

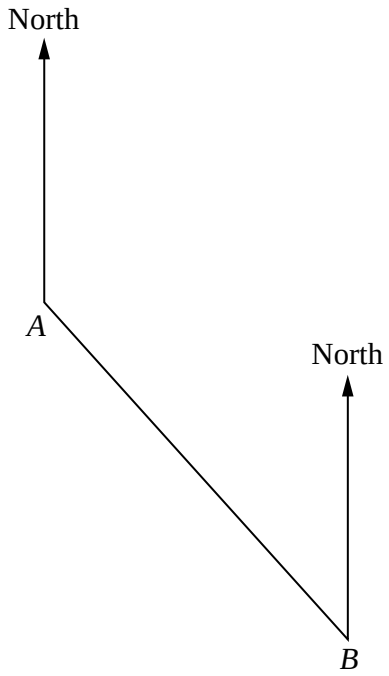
(c) State the value of cos $D\hat{G}F$.

Answer (*c*) .....[1]

23 A sailing club has five moorings in the river at *A, B, C, D* and *E*.
A and *B* are 12 metres apart.
The positions of *A* and *B* are shown in the scale drawing below.

For Examiner's Use

Answer (b), (c), (d)



(a) Write the scale in the form 1 : *n*.

Answer (*a*) 1 : .....[1]

(b) *C* is due west of *B* and on a bearing of 210º from *A*.

Find and label the position of *C*. [2]

(c) *D* lies north of the line *AB* .
The triangle *ABD* is equilateral.

Using ruler and compasses only, construct triangle *ABD*.
Show your construction arcs clearly. [1]

(d) The bearing of *E* from *A* is the same as the bearing of *B* from *A*.

Given that *AB* : *AE* = 3 : 5, find and label the position of *E*. [2]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

4024 MATHEMATICS

4024/02 Paper 2, maximum raw mark 100

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

1	**(a)**		$\frac{4a^2+9}{6a}$ final answer	**B1**	1	
	(b)		$5b(b-2)$ final answer	**B1**	1	Condone missing final bracket After 0 + 0 give sc1 for <u>both</u> correct forms seen.
	(c)	**(i)**	(6, 2)	**B1**	1	Condone missing brackets
		(ii)	$\sqrt{(\pm 4)^2+(\pm 10)^2}$	**M1**		
			10.7 to 10.8	**A1**	2	Accept $2\sqrt{29}$
	(d)		For numerical $\frac{p \pm (or + or-)\sqrt{q}}{r}$			Completing the square
			$p = -11$ and $r = 6$ (or 2×3)	**B1**		B1 for $\frac{-11}{6}$; B1 for $\sqrt{\frac{205}{36}}$ oe
			$q = 205$ or $\sqrt{q} = 14.3$ to 14.32	**B1**		dep. on correct formula s.o.i or <u>used</u>

			0.55	**B1**		If final B0 + B0 then
			–4.22	**B1**	4	sc1 for 0.5 to 0.6 AND –4.2 to –4.22; or for any two answers given to 2 d.p.
					[9]	
2	**(a)**	**(i)**	Figs 378/the product of at least 2 of 20, 24, 7 and 60	**M1**		
			\$31.25	**A1**	2	Accept \$31.2 → \$31.3 \$0.000 031 2 → \$0.000 031 3 million;
		(ii)	$\frac{945-378}{378} \times 100$ or $\frac{945}{378} \times 100$	**M1**		Accept $\frac{78.125-31.25}{31.25} \times 100$
			150% cao	**A1**	2	
		(iii)	2:5 or m = 2, n = 5	**B2**	2	sc1 for partial simplification seen. 126:315, 54:135, 42:105, 18:45, 14:35, 6:15; or for $\frac{2}{5}$, or 1:2.5, or 5:2 or 2m:5m
	(b)		$\frac{480}{0.6} \times \left(\frac{2}{100} = 16\right)$	**M1**		
			16 cao	**A1**	2	sc1 for 9.6(euros) or (\$)800 seen.
					[8]	

3	**(a)**	**(i)**	$\tan x = \frac{11}{4}$	**M1**		For any <u>complete</u> methods allow appropriate M and A marks. sc1 for 19.9 to 20
			70 to 70.02	**A1**	2	
		(ii) (a)	$\sin 28 = \frac{4}{PX}$ or $\frac{PX}{(\sin 90)} = \frac{4}{\sin 28}$	**M1**		GRADIAN ANSWERS **(i)** 77.80 sc1 for 22.2 or 12.2 **(ii)** **(a)** 9.39 … **(b)** 8.50 (leading to 2.5) or 7.77 … from Sine Rule (leading to 3.23)
			8.5 to 8.525	**A1**	2	
		(b)	$d = \frac{4}{\tan 28}$, or $PX \cos 28$, or $\frac{4 \sin 62}{\sin 28}$ or $\sqrt{PX^2 - 4^2}$	**M1**		
			7.5 to 7.6	**A1**		
			$11 - d$ (= 3.4 to 3.5)	**M1**	3	
	(b)		$r^3 = \frac{96}{\frac{4}{3}\pi}$ or 22.9 …	**M1**		
			2.84 to 2.841	**A1**	2 **[9]**	
4	**(a)**	**(i) (a)**	3 (lines of symmetry)	**B1**	1	
		(b)	order 3	**B1**	1	
		(ii) (a)	Use of $(9 - 2) \times 180$ etc.	**M1**	1	AG. Allow if 140° calculated, but not if quoted.
		(b)	$6x + 3y = 1260$ oe	**B1**		
			$y = 420 - 2x$ oe isw	**B1**	2	The second B mark implies the first.
		(c)	Sensible attempt at solving for x or y	**M1**		
			$x = 136$	**A1**	2	
	(b)	**(i)**	$\angle FEB = 114°$	**B1**	1	
		(ii)	$\angle BEA = 42°$	**B1**	1	
		(iii)	$\angle AGD = 63°$	**B1**	1 **[10]**	
5	**(a)**	**(i) (a)**	$\frac{1}{50}$, 0.02 cao	**B1**	1	Accept negatives
		(b)	$\frac{1}{2} \times (8 + 4) \times 200$ oe	**M1**		
			1200 m	**A1**	2	
		(c)	5 m/s	**B1**	1	
		(ii)	$150u = \frac{1}{2} \times 13 \times 150$ (= 975) oe	**M1**		
			$u = 6\frac{1}{2}$	**A1**	2	$\sqrt{4 + \frac{1}{2}}$ (their 5)

	(b)	**(i)**	195 m	**B1**	1	
		(ii)	24.5 or (25.4 to 25.5) seen	**B1**		
			$\frac{\text{Distance}}{\text{Time}}$	**M1**		
			7.64 to 7.65	**A1**	3	**N.B.** $\frac{190}{25}$ = 7.6 scores the M1 only
					[10]	
6	**(a)**		$p = 11$ $q = 30$ $r = 60$ $s = 6$ all four	**B2**	2	sc1 for 2 or 3 correct
	(b)		$x = 2n + 1$ oe	**B1**		In **(b)**, accept any unsimplified form but –1, once, if not given explicitly
			$y = n(n + 1)$ oe	**B1**		
			$z = 2n(n + 1)$ oe √ $2 \times y$	**B1**	3	
	(c)		102	**B1**	1	
					[6]	
7	**(a)**	**(i)**	$\frac{2}{5}$ oe **fraction**	**B1**	1	Not 40%; 0.4
		(ii) (a)	$h = 25$	**B1**	1	
		(b)	$2(50 \times 15 + 60 \times 15) + 50 \times 60$	**M1**		
			6300 cm^2	**A1**	2	sc1 for 3300 or for 9300 cm^2
	(b)	**(i)**	$\frac{220}{360} \times 2\pi \times 9 \times 35$	**M1**		
			1208 to 1210	**A1**	2	
		(ii)	$\frac{220}{360} \times \pi \times 9^2$ (= 155.50 …)	**M1**		POSSIBLE GRAD ANSWERS **(ii)** 188 to 188.3 from $\frac{1}{2} \times 9^2 \times \sin 140$ (= 32.7 …); 177 to 178 from 81 × sin70 × sin20 (= 22.3 …) **(iii)** 4.9 from cos70; 6.2 from sin20 sc1 for 4.08 … or for 2.7 … --- If A0, then sc1 for 155 to 156 seen or for 25.9 to 26.1 seen
			$\frac{1}{2} \times 9^2 \times \sin 140$ (= 26.03 …)	**M1**		
			181 to 182	**A2**	4	
		(iii)	d = 9 – 9cos 70	**M1**		}
			= 5.92 to 5.93	**A1**	2	}sc1 for 3.07 to 3.08 seen
					[12]	

8	**(a)**	**(i)**	$PQ = (x + 2)$ m			If **AB** used instead of x, –1 once
		(ii)	$BC = \frac{168}{x}$			
		(iii)	$QR = \frac{168}{x} + 11$ $\sqrt{}$ $BC + 11$ all 3 (condone 10 + 1 for 11)	**B2**	2	sc1 for 1 or 2 correct
	(b)		Area = $(x + 2)(\frac{168}{x} + 11) - 168$ or $\sqrt{}$ $PQ \times QR - 168$ as an expression in x	**M1**		or $(x + 2) + 10(x + 2) + 2 \times \frac{168}{x}$ oe
			correct working to $22 + 11x + \frac{336}{x}$	**A1**	2	Answer given
	(c)		$p = 158$ to $158\frac{1}{3}$	**B1**	1	
	(d)		Correct scales	**S1**		Condone reversed axes, if labelled
			7 correct plots (ignore $x = 9$) within 1 mm	**P1**		Accept if curve goes through correct points
			Smooth curve	**C1**	3	Not grossly thick; no straight lines Ignore curve for $x < 3$ and $x > 8$
	(e)		Clear attempt to draw tangent at (4, 150)	**T1**		
			gradient = –6 to –12	**G1**	2	Accept "integer" fractions
	(f)	**(i)**	143 ⩽ answer < 144	**B1**	1	
		(ii)	7.4 to 7.6	**B1**	1 **[12]**	
9	**(a)**	**(i)**	$\frac{AD}{\sin 38} = \frac{17}{\sin 114}$	**M1**		
			$AD = 17 \times \frac{\sin 38}{\sin 114}$	**M1 dep.**		----------
			11.4 to 11.5	**A1**	3	GRADIAN ANSWERS **(i)** 9.7 to 9.8 **(ii)** 140.9 to 141
		(ii)	$17^2 = 9^2 + 10^2 \pm (2) \times 9 \times 10 \cos x$ } or $\cos x = \pm [(9^2 + 10^2 - 17^2)/(2) \times 9 \times 10]$ }	**M1**		
			$\cos C = \frac{10^2 + 9^2 - 17^2}{2 \times 9 \times 10} = (-0.6)$	**A1**		
			126 to 127	**A1**	3	

	(b)	**(i) (a)**	$\overrightarrow{OQ} = \mathbf{p} + \mathbf{q}$	**B1**	1	In **(b) (i)**, –1, once, for unsimplified answers
		(b)	$\overrightarrow{RS} = \mathbf{p} - \mathbf{q}$ √ **(a)** $- 2\mathbf{q}$	**B1**	1	
		(c)	$\overrightarrow{OS} = 2\mathbf{p} + 2\mathbf{q}$ √ $2 \times$ **(a)**	**B1**	1	
		(d)	$\overrightarrow{OT} = 4\mathbf{p}$	**B1**	1	
		(ii)	(O, P and T are) collinear oe	**B1**		Marks in **(ii)** are dep on a correct **(i) (d)**
			$OT = 4OP$ oe	**B1**	2	
					[12]	
10	**(a)**		Correct scales and axes	**S1**		Condone reversed axes if clearly labelled
			Correct bases (width + position)	**B1**		
			Heights (2), 10, 8, 7, 4, 2	**H1**	3	
	(b)		$7 < t \leqslant 9$	**B1**	1	
	(c)		$(4 \times 2) + (10 \times 3.5) + (8 \times 4.5) +$ $(14 \times 6) + (8 \times 8) + (6 \times 10.5)$ $(= 290)$	**M1**		8, 35, 36, 84, 64, 63 Condone up to 3 slips
			$\div 50$	**M1**		Indep of first M
			5.8	**A1**	3	
	(d)	**(i)**	0	**B1**	1	Condone $\frac{0}{50}$, none, nil
		(ii)	$\frac{14}{25}$ oe 0.56	**B1**	1	
	(e)	**(i)**	$\frac{54}{175}$ $(= \frac{14}{25} \times \frac{27}{49})$ (0.308 to 0.309)	**B1**	1	In **(e)**, –1, once, for any answer not in lowest terms, or in decimal form
		(ii)	$\frac{88}{175}$ $(= 2 \times \frac{14}{25} \times \frac{22}{49})$ (0.502 to 0.503)	**B2**	2	sc1 for $\frac{44}{175}$ (0.251 to 0.252)
					[12]	
11	**(a)**	**(i)**	$\begin{pmatrix} -3 & 9 \\ -3 & 2x \end{pmatrix}$	**B2**	2	sc1 for 3 correct elements
		(ii)	$\mathbf{AB} = \begin{pmatrix} 1 & 0 \\ -1 + \frac{x}{3} & 1 \end{pmatrix}$ or $\mathbf{BA} = \begin{pmatrix} 1 & 3 - x \\ 0 & 1 \end{pmatrix}$			
			or $\mathbf{B^{-1}} = \begin{pmatrix} 0 & 3 \\ -1 & 3 \end{pmatrix}$ oe	**B1**		e.g. $3\begin{pmatrix} 0 & 1 \\ -\frac{1}{3} & 1 \end{pmatrix}$, (0.33 or better)
			$x = 3$	**B1 dep.**	2	

	(b)	**(i) (a)**	SF = –2	**B1**	1	
		(b)	Centre is (1, 2)	**B2**	2	B1 for each coord. sc1 for $\begin{pmatrix}1\\2\end{pmatrix}$
		(ii)	Shear,	**B1**		Mention of a 2nd transformation
			x-axis inv., SF = 2	**B1**	2	loses both marks
		(iii) (a)	$\begin{pmatrix}1 & 2\\0 & 1\end{pmatrix}\begin{pmatrix}k\\2\end{pmatrix}=\begin{pmatrix}k+4\\2\end{pmatrix}$			
			$k = 4$	**MA1**	1	
		(b)	ET(L) = E((8, 2)) = (–13, 2)	**B2**	2	sc1 for (–2.5, 2)
					[12]	

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

4024 MATHEMATICS

4024/01 Paper 1, maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

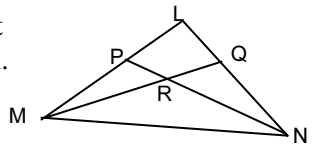
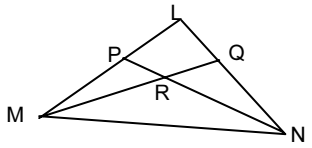
- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

		Mark scheme details	Part Marks	Comments	Sub Marks
1	**(a)**	3	1		
	(b)	82	1	Here and elsewhere, ignore superfluous zeros.	
2	**(a)**	$\frac{2}{3}$ cao	1		
	(b)	$\frac{1}{12}$ cao	1		
3	**(a)**	27, 64	1	Accept 3^3, 4^3 if 27, 64 seen. Ignore the additional cube number 125	
	(b)	31, 37	1		
4	**(a)**	$(x - y)(x + y)$	1		
	(b)	800	1	(102 – 98)(102 + 98) must be evaluated	
5	**(a)**	(0).0035	1	Accept standard form.	
	(b)	(0).8	1		
6	**(a)**	1,2,3,6,9,18	1	Condone embellishments such as $2 \times 9 = 18$ etc. if all the correct factors seen. Missing factors or incorrect factors seen gets 0.	
	(b)	$2^3 \times 7^2$	1	Accept other forms such as $2 \times 2 \times 7^2 \times 2$ but ignore = 392 Factor Tree not sufficient.	
7	**(a)**	$4a^5$	1		
	(b)	$3x^2 + 13x + 6$	2 *	Condone further "simplification" www and solution of quadratic equation $3x^2 + 15x - 2x + 6$ or better seen	M1
8	**(a)**	800 000	1	Accept standard form. Condone notation such as 800.000.	
	(b)	7×10^3	2	Any correct equivalent using fig. 7	C1

9	**(a)**	**(i)** 54 to 56	1		
		(ii) 28 to 30	1		
	(b)	Mathematics + valid reason	1	e.g. because median is lower or both medians stated. because the curve for Maths is to the left of/higher than the curve for English. Comparisons at arbitrarily chosen points will be 0	
10	**(a)**	14 00	1	Condone embellishments. Accept 2 **p.m.**	
	(b)	14 40	2 *	Accept 2 40 **p.m**. 19 40 ,(0)7 40 (p.m.) , (0)6 30 (a. m.) or (0)2 40 seen	B1
11	**(a)**	15	1		
	(b)	6 800	2 *	Ratio of corresponding lengths **cubed** soi	B1
12	**(a)**	(±)2$\sqrt{x}$	2 *	$k\sqrt{x}$ or using $y = k\sqrt{x}$ **NB** for C or M, must be k or $k = 2$ seen	C1 M1 B1
	(b)	25 cao	1		
13	**(a)**	3	1		
	(b)	2	1		
	(c)	1	1		
14	**(a)**	36	1	Degree sign optional	
	(b)	18	1	Accept ½(a) ft	
	(c)	108	1	Accept 90 + (b) ft	
	(d)	72	1	Accept 180 – (c) or 90 – (b) ft	

15	**(a)**	9 (minutes) 20 (seconds)	1		
	(b)	2 (minutes) 20(seconds) cao	2 *	$\Sigma t \div 4$	M1
	(c)	2 (minutes) 45 (seconds)	1		
16	**(a)**	– 8	1		
	(b)	–1	1		
	(c)	$\frac{12-x}{5}$ oe (e.g. asc)	2	$\frac{12-y}{5}$ oe or a + bx with a = $\frac{12}{5}$,b ≠ 0, or a ≠ 0, b = $-\frac{1}{5}$ or $\frac{x-12}{5}$	C1 SC1
17	**(a)**	1.5 oe	2 *	e.g. $\frac{3}{2}$, 1 2/4 $9x - 6 = 5x$	M1
	(b)	2,3,4	2 *	1.5 < y < 5 or 1.5<y and y<5 separately. oe but must be y.	M1
18	**(a)**	**(i)** 1,2,3,4	1	Condone extra brackets 3 repeated is 0.	
		(ii) 1,2	1		
	(b)	22	2 *	$(35 - x) + x + (29 - x) + 3 = 60$ or better or $(35 - x)$, x, $(29 - x)$, 3 correctly placed in a Venn Diagram 28,7,22,3 in diagram	M1 SC1

19	**(a)**	$LM = LN$ stated	**M1	For both M's, accept if clear on a diagram. Independent But 0 if measured. 	
		$\hat{L}$ is common or $L\hat{M}Q = L\hat{N}P$ stated	M1		
		Remaining angle pair and conclusion – congruent stated or accept ASA.	A1	Dependent on M1 + M1 and www. Condone wrong case quoted if "Congruent" stated	
	(b)	$M\hat{P}N = 180 - L\hat{P}N$ and $M\hat{Q}N = 180 - L\hat{Q}M$ seen	**	This mark can be earned for a convincing diagram. 	
		or $P\hat{R}M = Q\hat{R}N$			
		or $Q\hat{M}N = P\hat{N}M$ and $Q\hat{N}M = P\hat{M}N$			
		with convincing conclusion.	M1	Not available if dependent on measured angles	
	(c)	Kite	1		
20	**(a)**	ΔC : (-1,3),(1,3),(1,4)	1	Plotting points in **(a)** and **(b)**: allow the usual tolerance, judged by eye. Is the intention clear?	
	(b)	ΔD : (3,0), (3,-2), (4,-2)	2	Two vertices correct or a 90° clockwise rotation	C1
	(c)	Reflection (in the line) $x = 1$	2	Dependent on only one transformation stated. Either Reflection or $x = 1$ seen	C1
21	**(a)**	4, 1, $\frac{4}{9}$	1	Accept 0.4.. if $\frac{4}{9}$ seen.	
	(b)	20	2 *	$\frac{4}{k^2} = \frac{1}{100}$ soi	M1
	(c)	26	2 *	25 $4/m^2 <$ or = 0.0064	C1 M1

22	**(a)**	Either $\sqrt{13^2 - 5^2} = 12$ seen or 12 used in verification	1	**AG** so www essential	
	(b)	**(i)** 116	2 *	30 + 30 + (30 –12) + 15 + 13 + (15 –5) soi Condone one omission or error 120	 M1 SC1
		(ii) 690	2 *	Methodically correct attempts to evaluate all the relevant areas required e.g.(30 – 12) × 15, 30 × (30 –15), ½ × 12 × 5 soi	 M1
	(c)	$-\frac{5}{13}$	1	Condone embellishments	
23	**(a)**	200	1	Throughout, allow the usual tolerance judged by eye	
	(b)	BC = 6.5 cm and AC = 5.1 cm	2	Either C due West of B or $C\hat{A}N = 150^\circ$	C1
	(c)	AD = BD = 6 cm	1		
	(d)	ABE = 10 cm	2	E lies on AB or AB produced or AE = 10 cm	C1

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **May/June 2011**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

For Examiner's Use

This document consists of **24** printed pages.

Section A [52 marks]

Answer **all** questions in this section.

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1 **(a)** Express as a single fraction in its simplest form

(i) $\frac{1}{2x} - \frac{2}{5x}$,

Answer .....[1]

(ii) $\frac{4}{x} + \frac{7}{x-3}$.

Answer .....[2]

(b) A function is defined by $f(x) = \frac{2x - 3}{4}$.

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(i) Find f(2).

Answer .....[1]

(ii) Given that $f^{-1}(x) = cx + d$, find the values of c and d.

Answer c = ... d = ... [2]

(iii) Given that $f(g) = -g$, find the value of g.

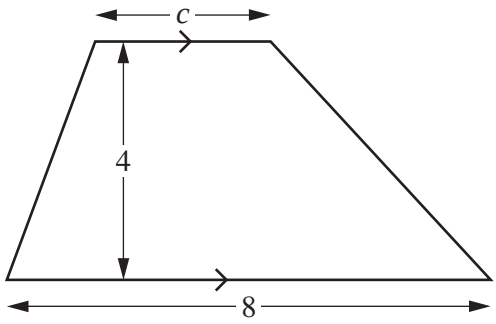
Answer .....[2]

2 **(a)** The formula for the area of a trapezium is $A = \frac{1}{2}h\,(c + d)$.

(i) Find an expression for c in terms of A, h and d.

Answer .....[2]

(ii)

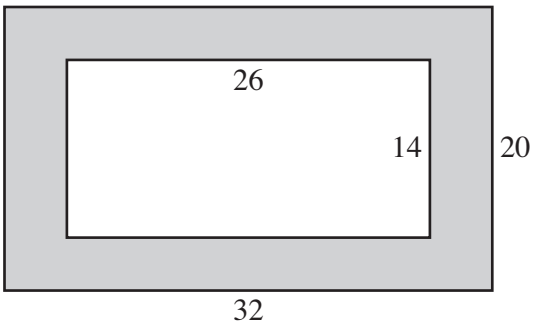


The diagram shows a trapezium with dimensions given in centimetres.
The perpendicular distance between the parallel lines is 4 cm.
The area of the trapezium is 22 cm^2.

Find c.

Answer .....[1]

(b)



In the diagram, the shaded area represents a rectangular picture frame.
The outer rectangle is 32 cm by 20 cm.
The inner rectangle is 26 cm by 14 cm.
All measurements are given to the nearest centimetre.

(i) Calculate the lower bound of the perimeter of the outer rectangle.

Answer ..... cm [2]

(ii) Calculate the upper bound of the area of the frame.

Answer .....cm^2 [3]

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3

The letters spelling the word BANANA are written on six tiles.

(a) Find the probability that a tile chosen at random has the letter N on it.
Give your answer as a fraction in its simplest form.

Answer .....[1]

(b) The six tiles are placed in a bag.
Three tiles are chosen at random without replacement.
The first is placed in Position 1, the second in Position 2 and the third in Position 3.

_____	_____	_____
Position 1	Position 2	Position 3

(i) Find the probability that the three tiles spell BAN.
Give your answer as a fraction in its simplest form.

Answer .....[2]

(ii) The tiles are now replaced and the process is repeated.

Find the probability that the three tiles spell either ANN or ANA.
Give your answer as a fraction in its simplest form.

Answer .....[2]

4 u_n is the nth term of the sequence 4, 7, 10, 13, ...

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(a) (i) Write down an expression, in terms of n, for u_n.

Answer .....[1]

(ii) Hence find the 20th term of the sequence.

Answer .....[1]

(b) v_n is the nth term of the sequence 15, 13, 11, 9, ...

(i) Write down an expression, in terms of n, for v_n.

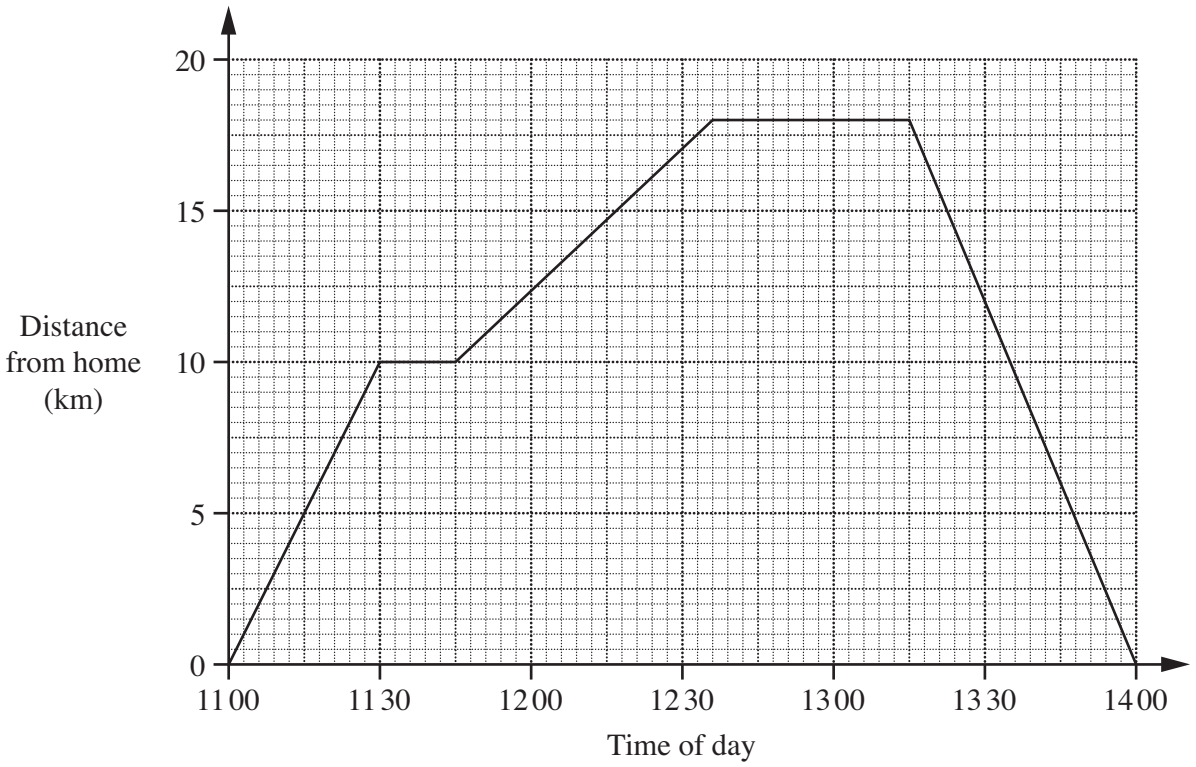
Answer .....[1]

(ii) w_n is the nth term of another sequence that is obtained by multiplying u_n by v_n.

Given that $w_n = 17 + kn - 6n^2$, find k.

Answer .....[1]

5



The distance-time graph shows Ravi's cycle journey.
He sets out from home and cycles to a park.
After a short stop at the park, he then continues his journey to a shopping centre.
He stops for lunch at the shopping centre before cycling home.

(a) At what time does Ravi arrive at the park?

Answer .....[1]

(b) How many minutes does Ravi spend at the shopping centre?

Answer ..... minutes [1]

(c) How far is the park from the shopping centre?

Answer .....km [1]

(d) At what speed does Ravi cycle home?
Give your answer in kilometres per hour.

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Answer .....km/h [1]

(e) Between which two places did Ravi cycle slowest?

Answer ..... and .....[1]

(f) Salim, Ravi's brother, sets out from home at 11 15.
He cycles directly to the shopping centre at a constant speed of 15 km/h.

Who arrives at the shopping centre first?
How many minutes later does his brother arrive?

Answer ..... arrives first and his brother arrives ..... minutes later. [2]

6 The pie chart, not drawn accurately, represents the weekly income of the five employees in a small British company in 2009.

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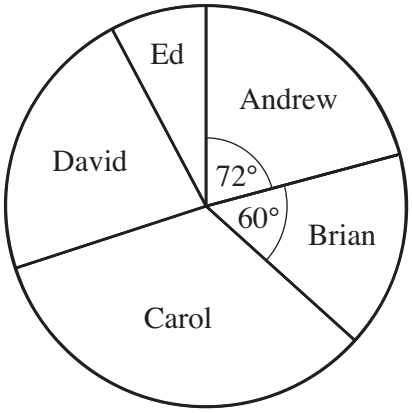

Andrew's weekly income is represented by a sector with an angle of 72º.
Brian's weekly income is represented by a sector with an angle of 60º.

(a) Andrew's weekly income was £270.

Find the total weekly income of the five employees.

Answer £ ..... [1]

(b) Calculate Brian's weekly income.

Answer £ ..... [1]

(c) Carol's weekly income was £405.

Calculate the angle of the sector representing Carol's weekly income.

Answer ..... [1]

(d) David's weekly income was twice as much as Ed's weekly income.

Calculate David's weekly income.

Answer £ ..... [2]

(e) Andrew paid 20% of his weekly income of £270 as tax.
He also paid 6% of his weekly income of £270 towards his pension.

How much of his weekly income did he have left after paying tax and pension?

Answer £ ..... [2]

(f) Carol paid 20% of her weekly income of £405 as tax.
She also paid x% of her weekly income towards her pension.
She then had £287.55 of her weekly income left.

Find x.

Answer ..... [3]

(g) Andrew's weekly income of £270 in 2009 was 8% more than his weekly income in 2008.

Find his weekly income in 2008.

Answer £ ..... [2]

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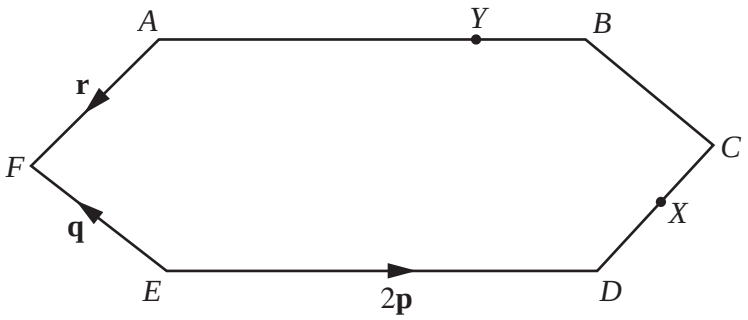
7 (a)



In the diagram, *ABCDEF* is a hexagon with rotational symmetry of order 2.
$\overrightarrow{ED} = 2\mathbf{p}$, $\overrightarrow{EF} = \mathbf{q}$ and $\overrightarrow{AF} = \mathbf{r}$.
X is the midpoint of *CD* and *Y* is the point on *AB* such that $AY : YB$ is 3 : 1.

(i) How many lines of symmetry does *ABCDEF* have?

Answer .....[1]

(ii) Express, as simply as possible, in terms of one or more of the vectors **p**, **q** and **r**,

(a) $\overrightarrow{EA}$,

Answer .....[1]

(b) $\overrightarrow{FC}$,

Answer .....[1]

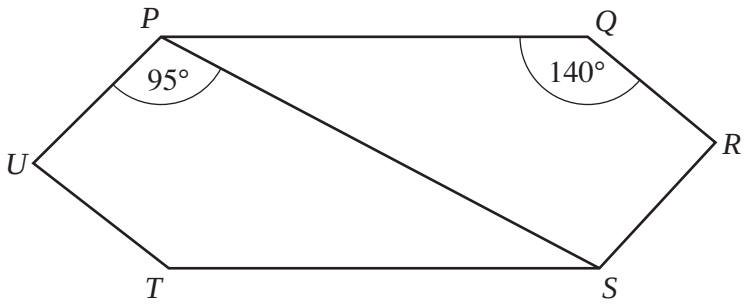
(c) $\overrightarrow{FY}$,

Answer .....[1]

(d) $\overrightarrow{YX}$.

Answer .....[1]

(b)



PQRSTU is a similar hexagon to *ABCDEF*.
$U\hat{P}S = 95^o$ and $P\hat{Q}R = 140^o$.

Find

(i) $Q\hat{P}S$,

Answer .....[1]

(ii) $P\hat{S}R$,

Answer .....[1]

(iii) $P\hat{U}T$.

Answer .....[1]

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Section B [48 marks]

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Answer **four** questions in this section.

Each question in this section carries 12 marks.

8 **(a)** $\mathbf{A} = \begin{pmatrix} 4 & 3 \\ -1 & 1 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 5 & 4 \\ -3 & -2 \end{pmatrix}$.

Find

(i) $2\mathbf{A} - \mathbf{B}$,

Answer [2]

(ii) $\mathbf{B}^{-1}$.

Answer [2]

(b) The diagram shows triangles *A*, *B* and *C*.

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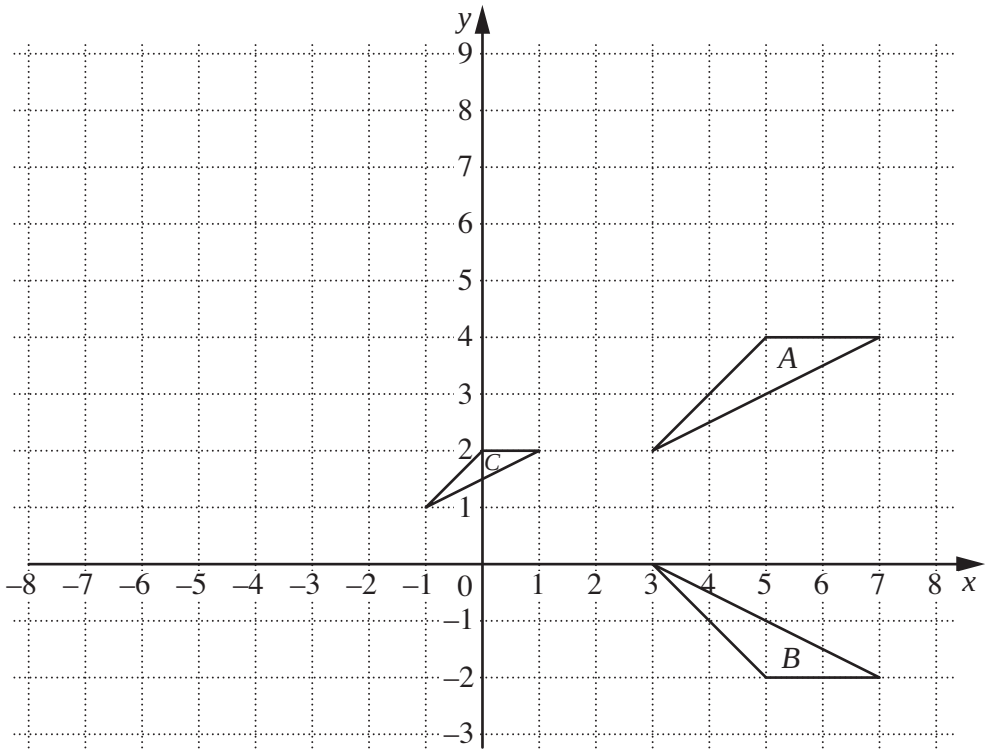

(i) Describe fully the **single** transformation that maps triangle *A* onto triangle *B*.

Answer .....

..... [2]

(ii) Describe fully the **single** transformation that maps triangle *A* onto triangle *C*.

Answer .....

..... [2]

(iii) Another transformation is represented by the matrix **P,** where $\mathbf{P} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$.
This transformation maps triangle *A* onto triangle *D*.

Find the vertices of triangle *D*.

Answer (..... , ...) (..... , ...) (..... , ...) [2]

(iv) Describe fully the **single** transformation represented by the matrix **P**.

Answer .....

..... [2]

9 The table below shows some of the values of x and the corresponding values of y for

$$y = (2x - 3)(x + 2).$$

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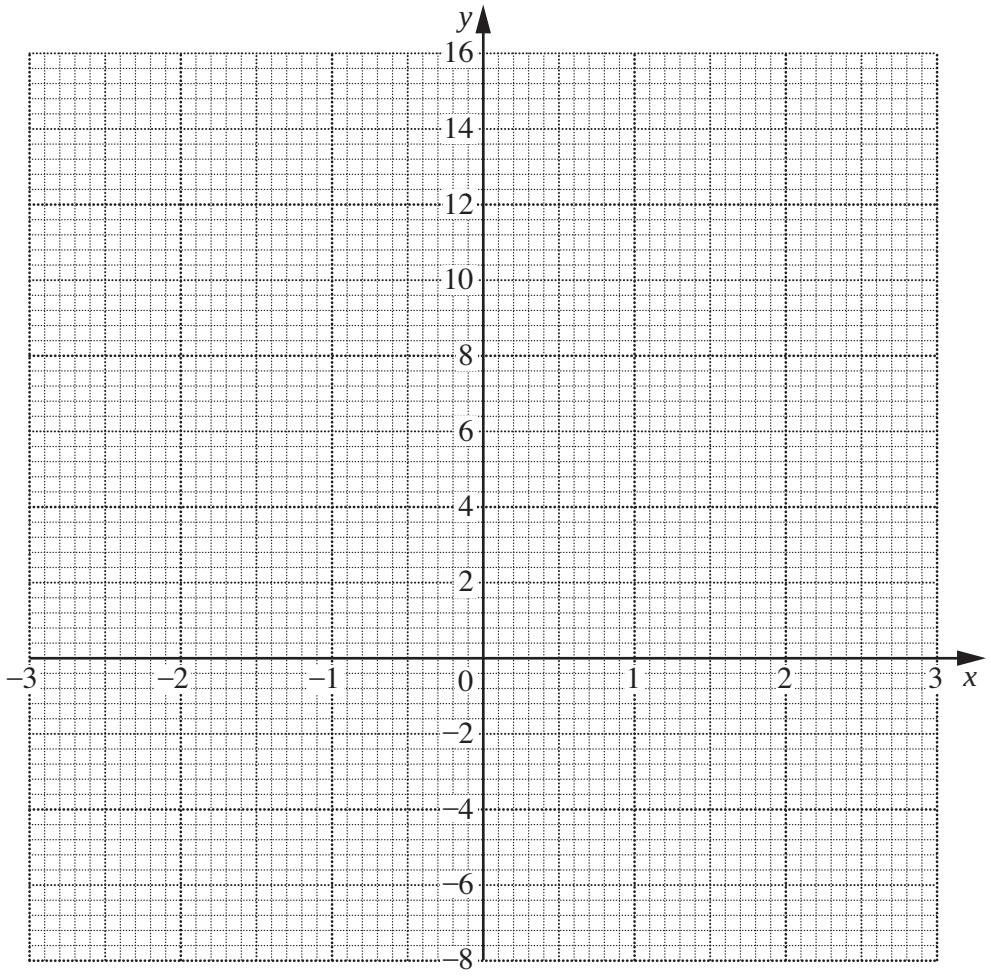
x	–3	–2	–1	0	1	2	3
y	9	0			–3	4	15

(a) Complete the table. [1]

(b) On the axes below, plot the points from the table and join them with a smooth curve.



[2]

(c) Use your graph to

(i) solve the equation $(2x - 3)(x + 2) = 2$,

Answer .....[1]

(ii) find the minimum value of y,

Answer .....[1]

(iii) find the gradient of the curve at (2 , 4).

Answer .....[2]

(d) (i) Show that the x-coordinates of the points where $y = (2x - 3)(x + 2)$ and $y = 1 - 2x$ would intersect are the solutions of the equation

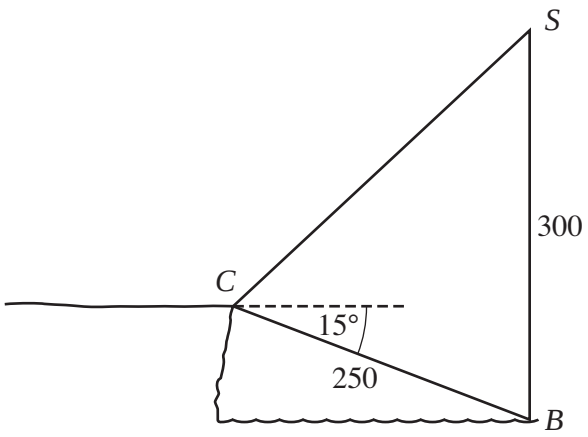
$$2x^2 + 3x - 7 = 0.$$

[1]

(ii) Solve **algebraically** the equation $2x^2 + 3x - 7 = 0$, giving each answer correct to 2 decimal places.

Answer x = ... or .....[4]

10



The angle of depression of a buoy, *B*, from a point, *C*, on a cliff is 15º.
The distance *BC* is 250 m.
A seagull, *S*, hovers so that it is vertically above *B* and *SB* = 300 m.

(a) (i) Find $S\hat{B}C$.

Answer .....[1]

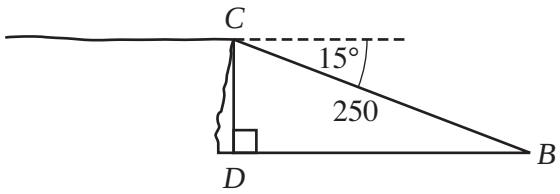
(ii) Find *SC*.

Answer .....m [3]

(iii) Find the angle of elevation of *S* from *C*.

Answer ..... [3]

(b)



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D is a marker at sea level vertically below *C* and due west of *B*.

(i) Find *DB*.

Answer .....m [2]

(ii) *M* is a marker at sea level 200 m from *B* and $D\hat{B}M = 30^{o}$.

Find the area of triangle *DBM*.

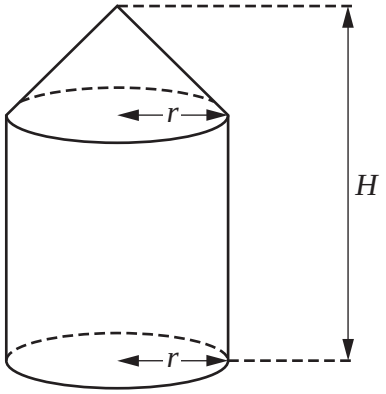
Answer ..... m^2 [2]

(iii) *N* is a marker at sea level due south of *B* and *DN* = 450 m.
A boat sails on a circular course through *D*, *B* and *N*.

Write down the radius of the circle.

Answer .....m [1]

11 **[Volume of a cone = $\frac{1}{3}\pi r^2 h$]**



The solid above consists of a cone with base radius r centimetres on top of a cylinder of radius r centimetres.
The height of the cylinder is twice the height of the cone.
The total height of the solid is H centimetres.

(a) Find an expression, in terms of π, r and H, for the volume of the solid.
Give your answer in its simplest form.

Answer ..... [3]

(b) It is given that $r = 10$ and the height of the **cone** is 15 cm.

(i) Show that the slant height of the cone is 18.0 cm, correct to one decimal place.

[2]

(ii) Find the circumference of the base of the cone.

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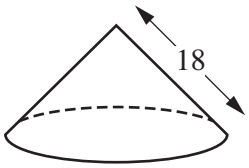
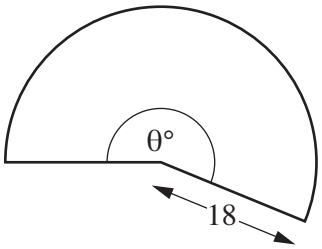
Answer ..... cm [2]

(iii) The curved surface area of the cone can be made into the shape of a sector of a circle with angle θº.

Show that θ is 200, correct to the nearest integer.





[2]

(iv) Hence, or otherwise, find the **total** surface area of the solid.

Answer .....cm^2 [3]

12 The time taken by each of 320 students taking a Physics test was recorded. The following table shows a distribution of their times.

Do not write in this margin

Time (m minutes)	$60 < m \leqslant 70$	$70 < m \leqslant 80$	$80 < m \leqslant 90$	$90 < m \leqslant 100$	$100 < m \leqslant 110$	$110 < m \leqslant 120$
Frequency	24	92	104	68	24	8

(a) Complete the cumulative frequency table below.

Time (m minutes)	$m \leqslant 60$	$m \leqslant 70$	$m \leqslant 80$	$m \leqslant 90$	$m \leqslant 100$	$m \leqslant 110$	$m \leqslant 120$
Cumulative frequency	0	24	116				

[1]

(b) For this part of the question use the graph paper opposite.

(i) Using a scale of 2 cm to represent 10 minutes, draw a horizontal m-axis for $60 \leqslant m \leqslant 120$.
Using a scale of 1 cm to represent 20 students, draw a vertical axis for cumulative frequencies from 0 to 320.
On your axes, draw a smooth cumulative frequency curve to illustrate the information. [3]

(ii) Use your graph to estimate

(a) the median,

Answer ..... minutes [1]

(b) the interquartile range,

Answer ..... minutes [2]

(c) the percentage of students who took at least 95 minutes to complete the test.

Answer ..... [2]

Please turn over for the rest of this question.

(iii) A group of 300 students of similar ability took an equivalent test the previous year. The following graph shows a distribution of their times.

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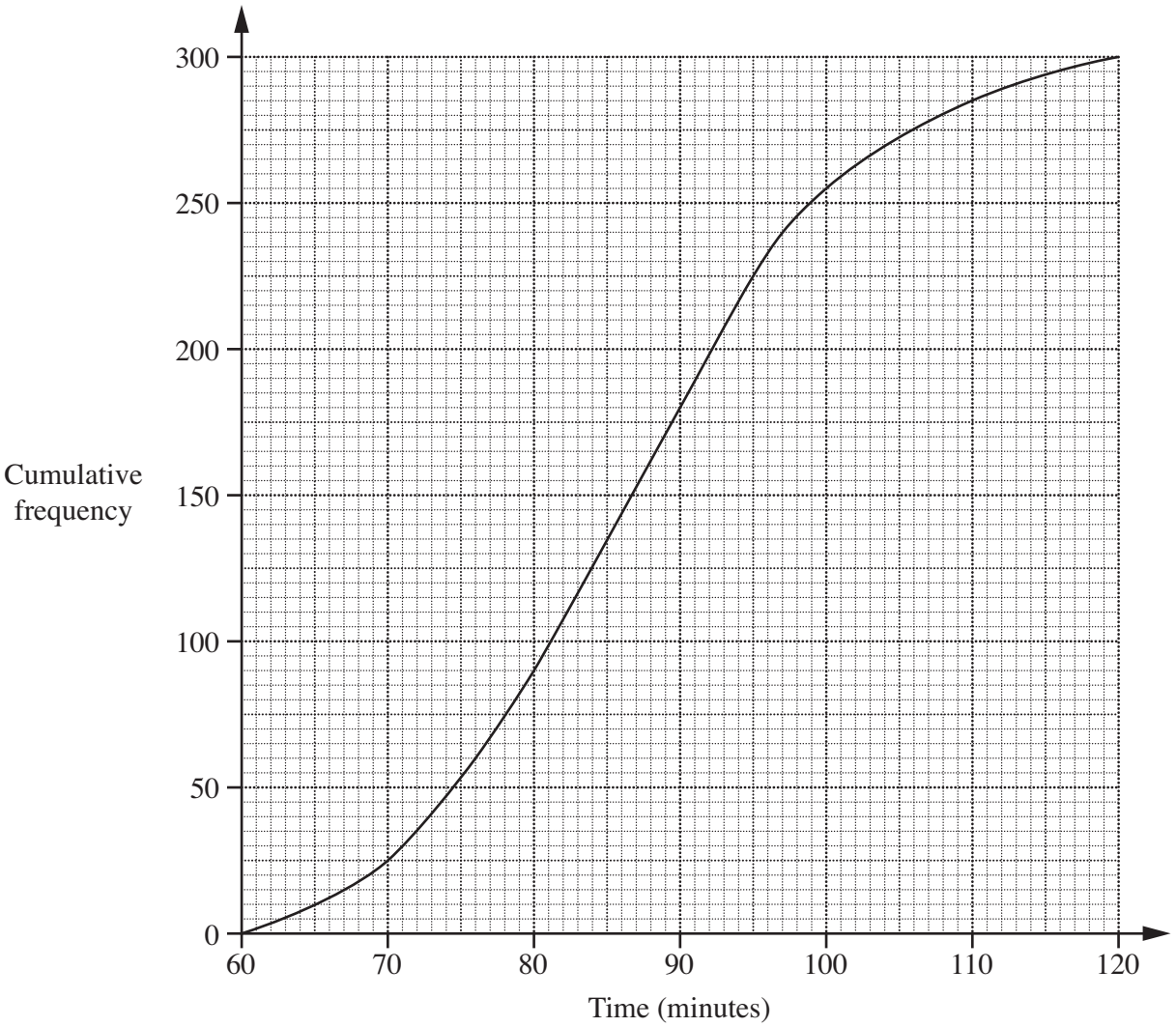

(a) Find the 20th percentile.

Answer ..... minutes [1]

(b) Find the percentage of students who took at least 95 minutes to complete the test.

Answer .....[1]

(c) Hence make a comparison between the two tests.

Answer .....

.....[1]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **May/June 2011**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

For Examiner's Use

This document consists of **24** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

Section A [52 marks]

Answer **all** questions in this section.

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1 **(a)** Ahmed's internet provider offers two payment schemes.

Scheme A : \$30 per month for unlimited use.
Scheme B : \$0.05 per minute on weekdays and \$0.03 per minute at the weekend.

Each month Ahmed uses the internet for a **total** of $5\frac{1}{4}$ hours at the weekday rate and a **total** of 12 hours at the weekend rate.

Find the cost per month, in dollars, for Scheme B and decide which payment scheme is cheaper.

Answer Scheme B costs \$.....

Scheme .....is cheaper [2]

(b) Ahmed's printer can use large or small black cartridges.
A large cartridge costs \$48.50 and prints 1000 pages.
A small cartridge prints 650 pages.
2 small cartridges cost \$65.

(i) Find the cost per page, in dollars, if Ahmed buys 2 small cartridges.

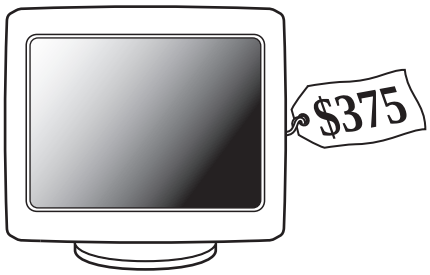
Answer \$ ..... [1]

(ii) Is it cheaper per page for Ahmed to buy 2 small cartridges or a large cartridge?
Show your working.

[1]

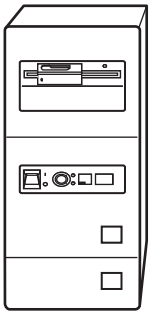
(c)

Monitor



Keyboard

Computer



Ahmed buys a new monitor, keyboard and computer.
He is given a 15% discount off the total price.
The discounted price that Ahmed pays is $1134.75.
The price of the monitor before the discount was $375.
The price of the keyboard before the discount was $70.

Calculate the price of the computer before the discount.

Answer $..... [3]

2 **(a)** A is the point (3, 6) and B is the point (11, 12).

Find the coordinates of the midpoint of AB.

Answer (..... , ...) [1]

(b) C and D have coordinates (10, 15) and (–8, –21).

(i) Find the equation of the line CD in the form $y = mx + c$.

Answer $y =$ ..... [2]

(ii) Does the point (–2, –9) lie on the line CD?
Show your working to justify your answer.

[1]

(c) The line l has equation $4y = 3x + 15$.

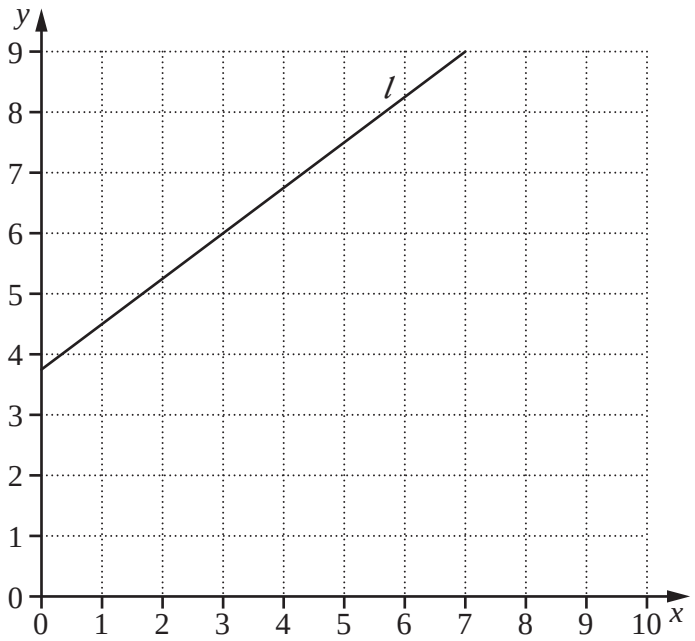
(i) **(a)** Find the coordinates of the point where l crosses the x axis.

Answer (..... , ...) [1]

(b) Find the coordinates of the point where l intersects the line $y = p$.
Express each coordinate in terms of p.

Answer (..... , ...) [2]

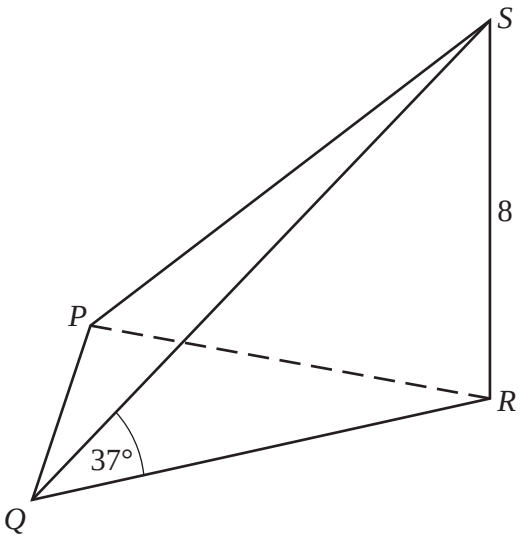
(ii) The line l is drawn on the grid below.



By drawing the line $3x + 2y = 30$ on the grid, find the coordinates of the point where these two lines intersect.

Answer (..... , ...) [2]

3 (a)

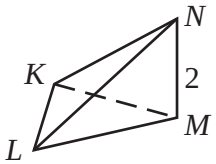


PQRS is a triangular-based pyramid.
RS is perpendicular to the base *PQR*.
$RS = 8\,\text{cm}$ and $R\hat{Q}S = 37°$.

(i) Find *QR*.

Answer ..... cm [2]

(ii)



Pyramid *KLMN* is similar to pyramid *PQRS*.
$MN = 2\,\text{cm}$ and the volume of *KLMN* is $3\,\text{cm}^3$.

Find the volume of *PQRS*.

Answer ..... cm^3 [2]

(b)

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Exchange Rate
$1 = £0.45

Jean-Pierre bought a watch for $110.
Simon bought an identical watch for £46.62.

Find the difference, in dollars, between the amount Jean-Pierre paid and the amount Simon paid.

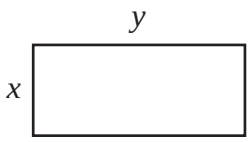
Answer $..... [2]

(c) The time taken to build a brick wall is inversely proportional to the number of workers.
3 workers took 30 hours to build a wall.

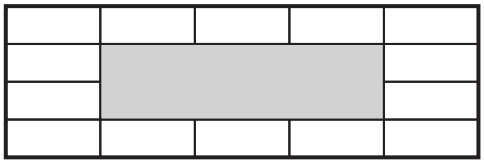
Calculate the time it would have taken 5 workers to build this wall.

Answer ..... hours [2]

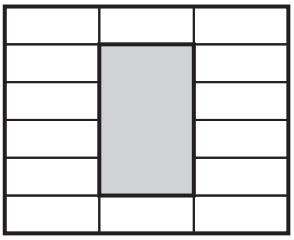
4



Rectangular paving slabs measure x centimetres by y centimetres, where $x < y$.
Fourteen of these slabs form a path around each of two different rectangular gardens.
These two gardens are shaded in the designs below.



Design 1



Design 2

(a) The **outside** perimeter of the path in **Design 1** is 10.2 metres.
The **total** perimeter of the path in **Design 2** is 13.6 metres.

Show that $4x + 5y = 510$ and $5x + 2y = 340$.

[2]

(b) Solve the simultaneous equations.

Do not write in this margin

$$4x + 5y = 510$$
$$5x + 2y = 340$$

Answer $x =$ .....

$y =$ ..... [3]

(c) Find the difference between the areas of the two gardens.
Give your answer in square metres.

Answer ..... m^2 [2]

5 **(a)** $\mathbf{A} = \begin{pmatrix} -1 & 2 \\ 3 & -1 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 4 & 2 \\ -3 & -1 \end{pmatrix}$.

(i) Find **AB**.

Answer [2]

(ii) Find $\mathbf{B}^{-1}$.

Answer [2]

(b) $\overrightarrow{PQ} = \begin{pmatrix} 12 \\ 5 \end{pmatrix}$ and $\overrightarrow{QR} = \begin{pmatrix} -4 \\ 1 \end{pmatrix}$.

(i) Calculate $|\overrightarrow{PQ}|$.

Answer ..... [2]

(ii) Find $\overrightarrow{PR}$.

Answer [1]

(c) You may use the grid below to help you answer this question.
T is the point (13, 7) and U is the point (8, 9).

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(i) Find $\overrightarrow{TU}$.

Answer [1]

(ii) TUV is an isosceles triangle with $TU = TV$.
The y-coordinates of the points U and V are equal.

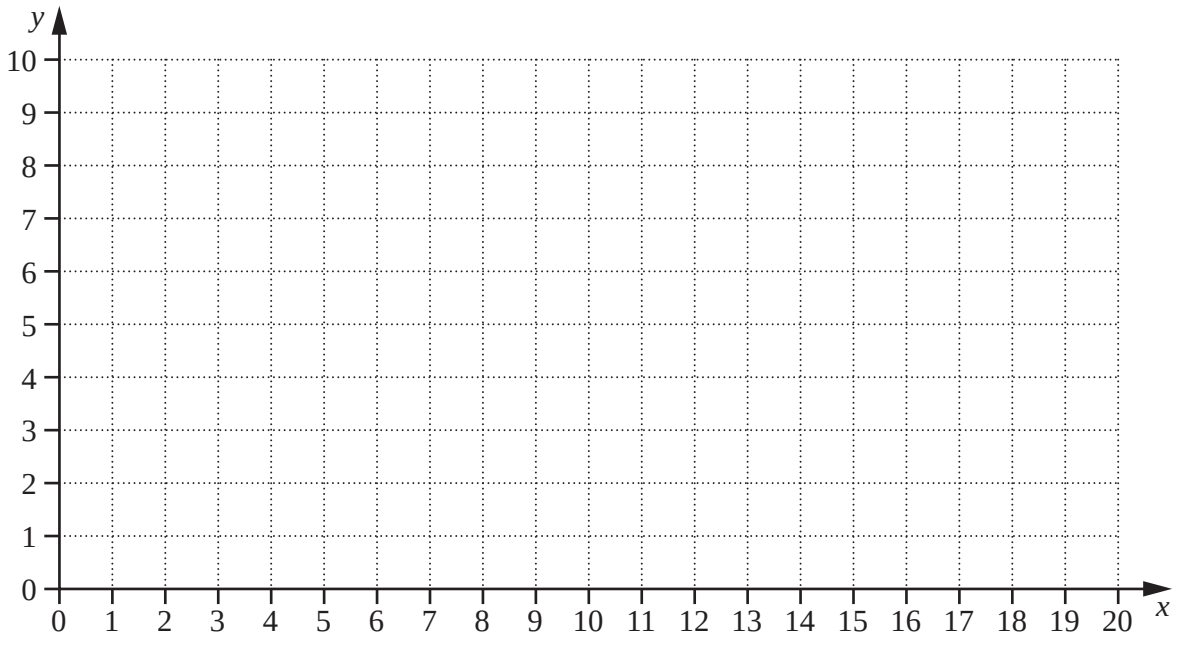
Find the coordinates of V.

Answer (..... , ...) [1]

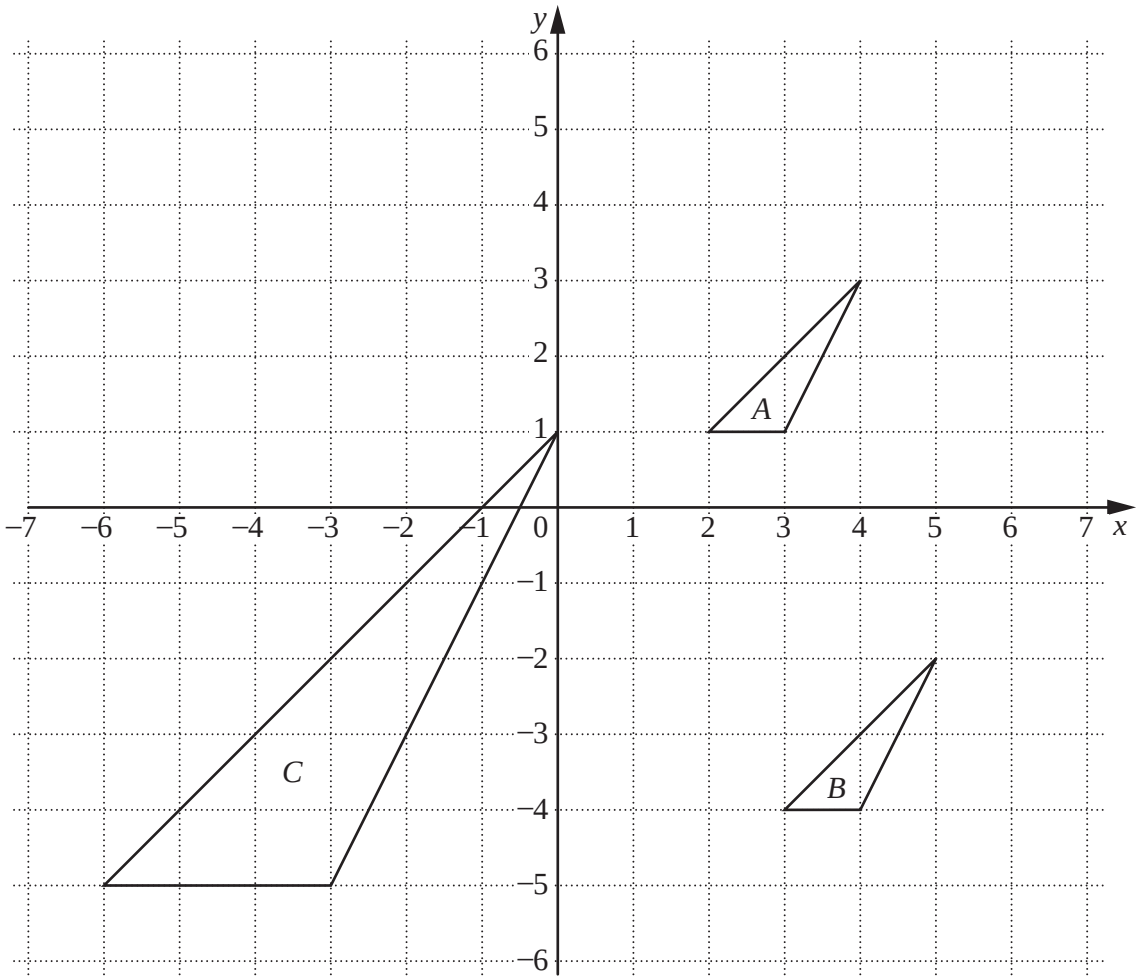
(iii) W is the point (1, 3).

Calculate the area of triangle TUW.

Answer ..... units^2 [3]



6 **(a)** The diagram shows triangles *A*, *B* and *C*.



(i) Describe fully the **single** transformation that maps

(a) triangle *A* onto triangle *B*,

Answer .....

.....

..... [2]

(b) triangle *A* onto triangle *C*.

Answer .....

.....

..... [2]

(ii) One vertex of triangle A is (2, 1).

Find the coordinates of this point when it is

(a) reflected in the line $y = -x$,

Answer (..... , ...) [1]

(b) rotated through 90° anticlockwise about (1, –1).

Answer (..... , ...) [1]

(b) You may use the grid below to help you answer this question.

The points (2, 1), (4, 3), (3, 1) and (p, q) form a quadrilateral.
This quadrilateral has rotational symmetry order 1 and one line of symmetry.

(i) One possible position of (p, q) is (2, 2).

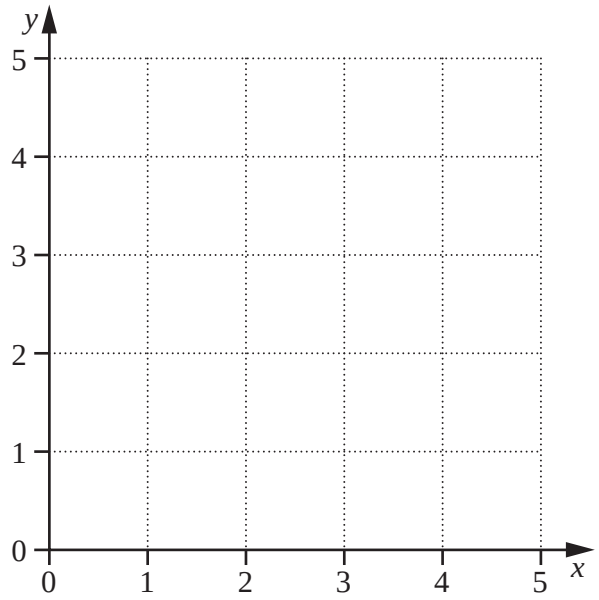
Write down the name of this special quadrilateral.

Answer ..... [1]

(ii) Given that p and q are integers, find two other possible positions of (p, q).

Answer (..... , ...)

(..... , ...) [2]



Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

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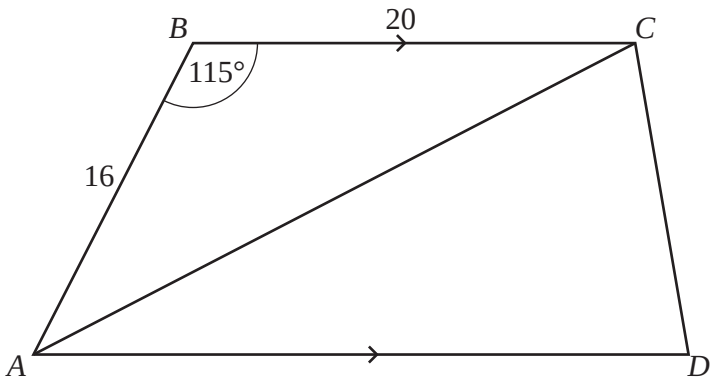
7



ABCD is a trapezium with *AD* parallel to *BC*.
AB = 16 cm, *BC* = 20 cm and $A\hat{B}C$ = 115°.

(a) Find *AC*.

Answer ..... cm [4]

(b) Show that the perpendicular distance between *BC* and *AD* is 14.5 cm.

[2]

(c) The area of the trapezium $ABCD$ is $348\,\text{cm}^2$.

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(i) Find AD.

Answer ..... cm [2]

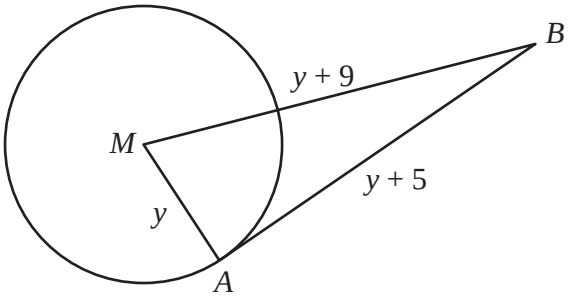
(ii) Show that the area of triangle ACD is $203\,\text{cm}^2$.

[1]

(iii) Hence, or otherwise, find $C\hat{A}D$.

Answer ..... [3]

8 (a)



A is a point on the circle, centre *M*, and *AB* is a tangent at *A*.
AM = *y* centimetres, *AB* = (*y* + 5) centimetres and *MB* = (*y* + 9) centimetres.

(i) Show that $y^2 - 8y - 56 = 0$.

[2]

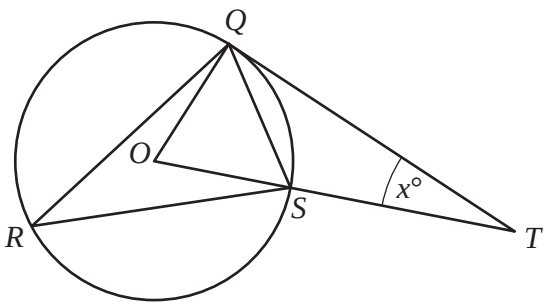
(ii) Solve the equation $y^2 - 8y - 56 = 0$, giving each answer correct to 1 decimal place.

Answer $y =$ ..... or ..... [3]

(iii) Find the length of the longest side of triangle *ABM*.

Answer ..... cm [1]

(b)



Q, *R* and *S* are points on a circle, centre *O*.
QT is the tangent at *Q* and $Q\hat{T}O = x°$.

(i) **(a)** Show that $Q\hat{R}S$ is $\frac{1}{2}(90 - x)$.

[1]

(b) Find an expression, in terms of *x*, for $O\hat{Q}S$.

Answer ..... [2]

(ii) It is given that three times $Q\hat{R}S$ is twice $O\hat{Q}S$.

(a) Show that $180 + 2x = 270 - 3x$.

[2]

(b) Hence find $Q\hat{T}O$.

Answer ..... [1]

9 The masses of 120 potatoes were recorded.
The table below shows the distribution of their masses.

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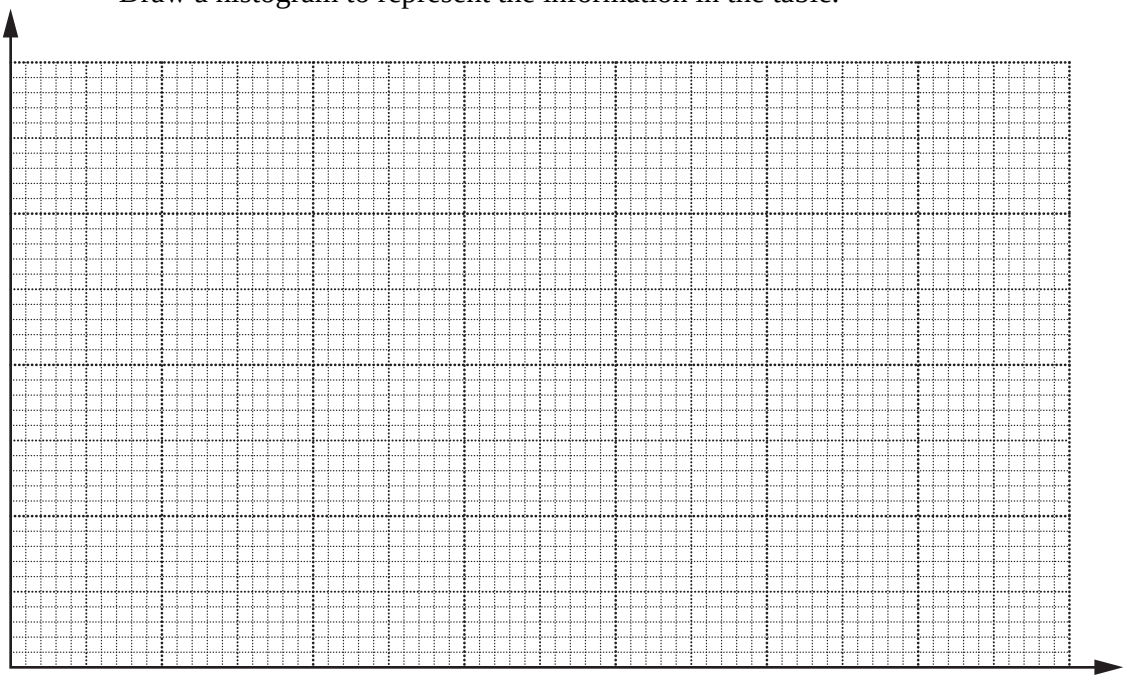
Mass (m grams)	$0 \leqslant m < 100$	$100 \leqslant m < 150$	$150 \leqslant m < 200$	$200 \leqslant m < 250$	$250 \leqslant m < 350$
Frequency	14	28	37	21	20

(a) (i) Using a scale of 2 cm to represent 50 grams, label the horizontal axis for masses from 0 to 350 grams.
Using a scale of 1 cm to represent 0.1 unit, label the vertical axis for frequency densities from 0 to 0.8 units.

Draw a histogram to represent the information in the table.



[3]

(ii) Estimate the number of potatoes with a mass greater than 270 grams.

Answer ..... [1]

(iii) In which interval is the upper quartile of the distribution?

Answer ..... [1]

(iv) Find the probability that a potato chosen at random has a mass less than 150 grams.
Give your answer as a fraction in its simplest form.

Answer ..... [1]

The masses of some oranges were recorded.
The table below shows the distribution of their masses.

Mass (n grams)	$100 \leqslant n < 150$	$150 \leqslant n < 200$	$200 \leqslant n < 250$
Frequency	14	p	26

(b) The estimated mean mass of an orange is 183 grams.

Find the value of p.

Answer ..... [3]

(c) (i) An orange is chosen at random.

Find the probability that it has a mass less than 250 grams.

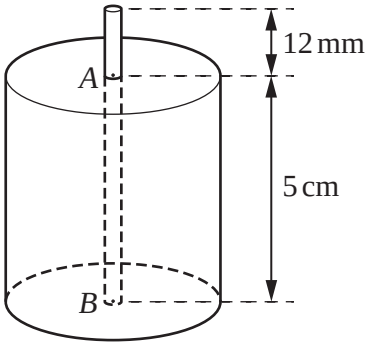
Answer ..... [1]

(ii) A potato and an orange are chosen at random.

Calculate the probability that they both have a mass less than 150 grams.

Answer ..... [2]

10 A cylindrical candle has a height of 5 cm.
A is the centre of the top of the candle and *B* is the centre of the base of the candle.
The wick runs from *B* through *A* and extends 12 mm above *A*.



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(a) How many of these candles can be made using a 2 m length of wick?

Answer ..... [2]

(b) The wick is in the form of a solid cylinder.
The volume of the wick **inside** the candle from *A* to *B* is $0.2\,cm^3$.

(i) Calculate the radius of the wick.
Give your answer in millimetres.

Answer ..... mm [3]

(ii) One candle was made by pouring candle wax into a cylindrical mould so that it surrounded the wick.
This mould has an internal radius of 1.9 cm.

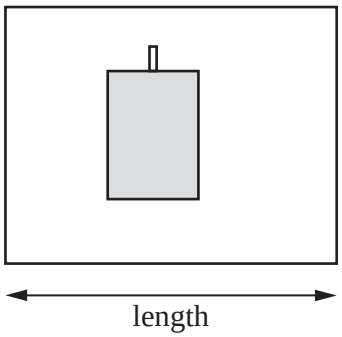
(a) Calculate the volume of candle wax required to make this candle.

Answer ..... cm^3 [3]

(b) How many of these candles can be made using 3 litres of candle wax?

Answer ..... [2]

(c)

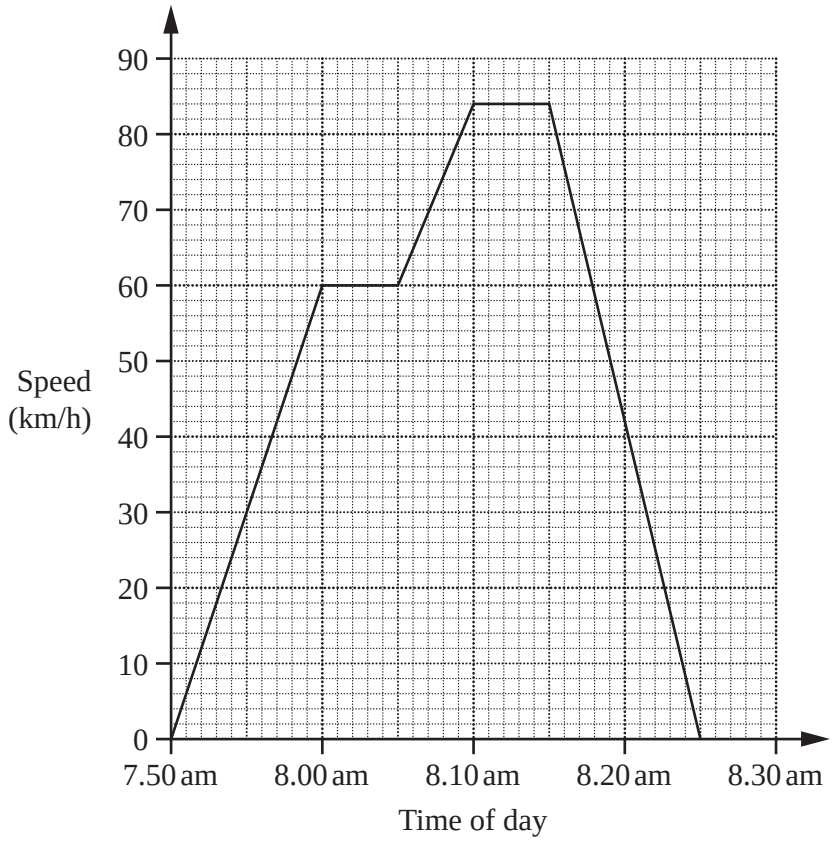


One of these candles is placed on a rectangular piece of wrapping paper.
The paper is wrapped around the candle so that it covers the outside and there is an extra 1 cm for an overlap.

What is the length, in centimetres, of paper required to wrap one candle?

Answer ..... cm [2]

11 (a)



The speed-time graph represents Brian's car journey to work on Monday.

(i) How long does his journey take?

Answer ..... minutes [1]

(ii) During the first 10 minutes he travels with a constant acceleration.

Find this acceleration in kilometres per hour per hour.

Answer ..... km/h^2 [1]

(iii) How far does Brian travel at his maximum speed?

Answer ..... km [1]

(b) On Tuesday Brian leaves home at 8.00 am and travels 30 km to work.
On the first part of his journey he travels for 15 minutes at a speed of 40 km/h.
On the second part of his journey he travels 12 km in 8 minutes at a constant speed.
On the third part of his journey he travels at a constant speed.
He arrives at work at 8.47 am.

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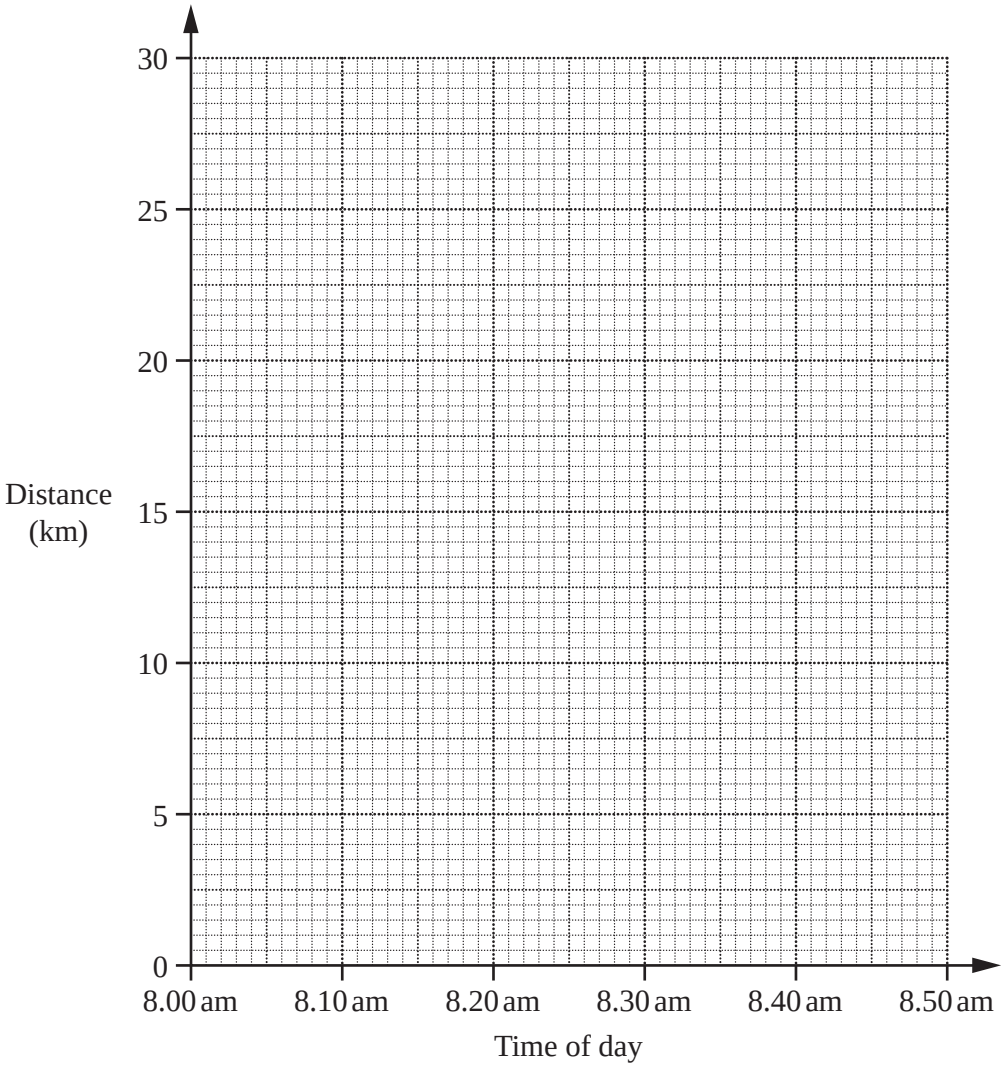
(i) Find the distance he travels on the first part of his journey.

Answer ..... km [1]

(ii) On the axes below, draw a distance-time graph to represent his journey to work on Tuesday.



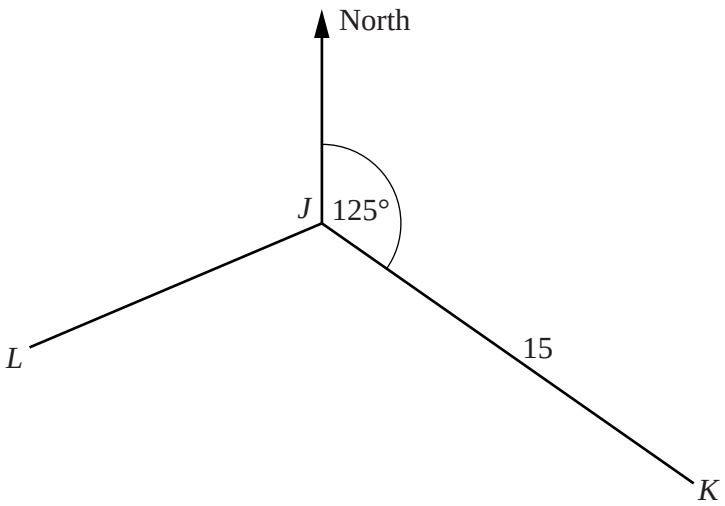
[2]

(iii) Calculate the speed, in kilometres per hour, for the third part of his journey.

Answer ..... km/h [2]

Please turn over for the rest of this question.

(c)



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The scale drawing shows a map of three towns, *J*, *K* and *L*.
The distance of *K* from *J* is 15 km and the bearing of *K* from *J* is 125°.

(i) *M* is due south of *J* and due west of *K*.

Calculate the distance, in kilometres, of *M* from *K*.
Give your answer correct to 2 decimal places.

Answer ..... km [2]

(ii) Using measurements from the diagram, find

(a) the bearing of *L* from *J*,

Answer ..... [1]

(b) the actual distance, in kilometres, of *L* from *J*.

Answer ..... km [1]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

7468497684

MATHEMATICS (SYLLABUS D) **4024/12**

Paper 1 **May/June 2011**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

READ THESE INSTRUCTIONS FIRST

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Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
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Answer **all** questions.

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Omission of essential working will result in loss of marks.

ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 80.

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1 **(a)** Evaluate $12 + 6 \div 2 - 8$.

Answer ..... [1]

(b) Evaluate 2.6×0.2 .

Answer ..... [1]

---

2 **(a)** It is given that $\frac{1}{5} < n < \frac{1}{4}$.

Write down a decimal value of n that satisfies this inequality.

Answer ..... [1]

(b) Express $\frac{48}{60}$ as a percentage.

Answer ..... % [1]

---

3 **(a)** Evaluate $\frac{2}{3} - \frac{3}{8}$.

Answer ..... [1]

(b) Evaluate $1\frac{3}{4} \times \frac{2}{9}$, giving your answer as a fraction in its lowest terms.

Answer ..... [1]

---

4 **(a)** Solve $5y - 3 > 3y + 12$.

Answer y ..... [1]

(b) Write down all the integers that satisfy the inequality $-6 \leqslant 3x < 6$.

Answer ..... [1]

---

5 $\mathbf{c} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\mathbf{d} = \begin{pmatrix} 8 \\ -6 \end{pmatrix}$

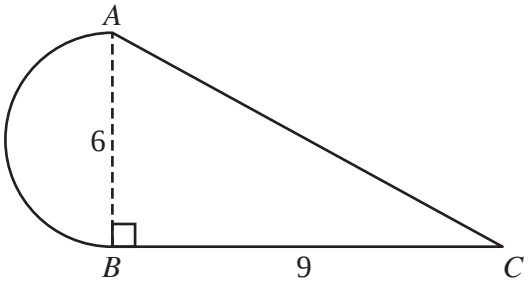
(a) Calculate $2\mathbf{c} - \mathbf{d}$.

Answer $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) Calculate $|\mathbf{d}|$.

Answer ..... [1]

6



ABC is a right-angled triangle with *AB* = 6 cm and *BC* = 9 cm.
A semicircle of diameter 6 cm is joined to the triangle along *AB*.

Find an expression, in the form $a + b\pi$, for the **total** area of the shape.

Answer ..... cm^2 [2]

---

7 **(a)** The ratio of boys to girls in a class is $4 : 5$.

What fraction of the class are boys?

Answer ..... [1]

(b) The ratio of boys to girls in a school is $3 : 4$.
There are 120 more girls than boys.

How many students are in the school?

Answer ..... [1]

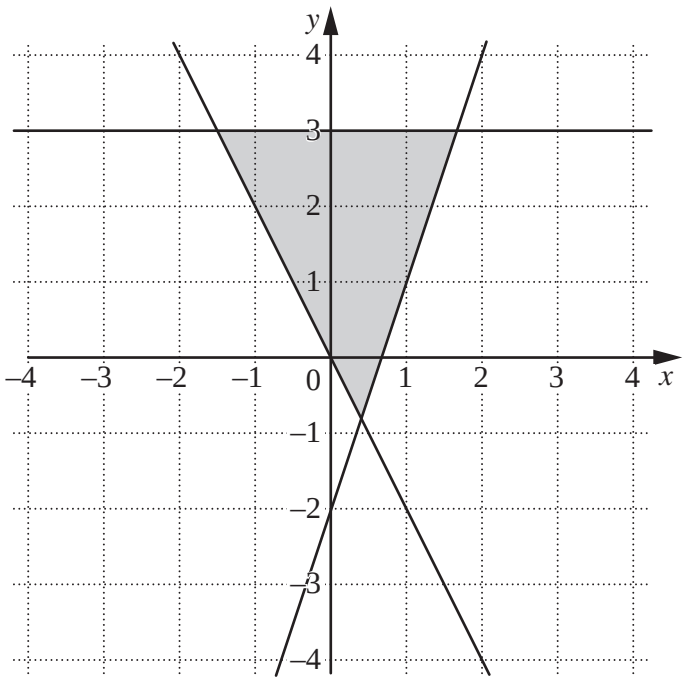
---

8 y is directly proportional to the square of x.

Given that $y = 2$ when $x = 4$, find y when $x = 10$.

Answer $y =$ ..... [2]

9



The shaded region on the diagram is represented by three inequalities.

One of these is $y \geqslant 3x - 2$.

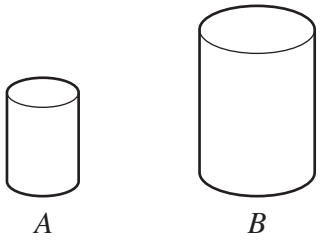
Write down the other two inequalities.

Answer .....

..... [2]

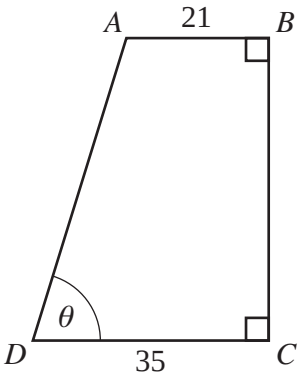
10 These two cylinders are similar.
The ratio of their volumes is 8 : 27.
The height of cylinder *A* is 12 cm.

Find the height of cylinder *B*.



Answer ..... cm [2]

11



$\sin\theta$	$\frac{24}{25}$
$\cos\theta$	$\frac{7}{25}$
$\tan\theta$	$\frac{24}{7}$

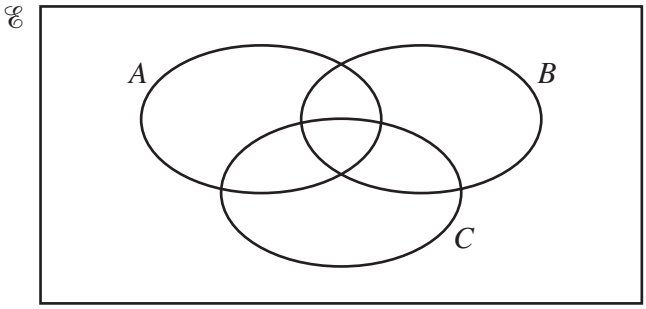
ABCD is a trapezium with *AB* = 21 cm and *CD* = 35 cm.
$A\hat{B}C = B\hat{C}D = 90°$ and $A\hat{D}C = \theta$.

Using as much information from the table as is necessary, calculate *AD*.

Answer ..... cm [2]

---

12 **(a)** On the Venn diagram, shade the set $A \cap B \cap C'$.



[1]

(b) $\mathscr{E} = \{2, 3, 4, 5, 6, 7, 8, 9, 10\}$
$P = \{x : x \text{ is a prime number}\}$
$Q = \{x : x \geqslant 5\}$

(i) Find the value of $\text{n}(P \cap Q)$.

Answer ..... [1]

(ii) List the elements of $P \cup Q'$.

Answer ..... [1]

13 **(a)** The mass of one grain of rice is 0.000 02 kg.

Write 0.000 02 in standard form.

Answer ..... [1]

(b) The table shows the amount of rice grown in some countries in 2002.

	China	Brazil	India	Vietnam
Amount (tonnes)	1.2×10^8	7.6×10^6	8.0×10^7	2.1×10^7

(i) Write these amounts in order, smallest first.

Answer ..... , ... , ... , ... [1]
smallest

(ii) Calculate the difference in the amount of rice grown in Brazil and Vietnam.
Give your answer in standard form.

Answer ..... tonnes [1]

14 **(a)** Express 108 as a product of its prime factors.

Answer ..... [1]

(b) Written as products of their prime factors, $N = 2^p \times 5^q \times 7^r$ and $500 = 2^2 \times 5^3$.

The highest common factor of N and 500 is $2^2 \times 5^2$.
The lowest common multiple of N and 500 is $2^3 \times 5^3 \times 7$.

Find p, q and r.

Answer p = ... , q = ... , r = ... [2]

---

15 **(a)** Factorise completely $9pq - 12q^2$.

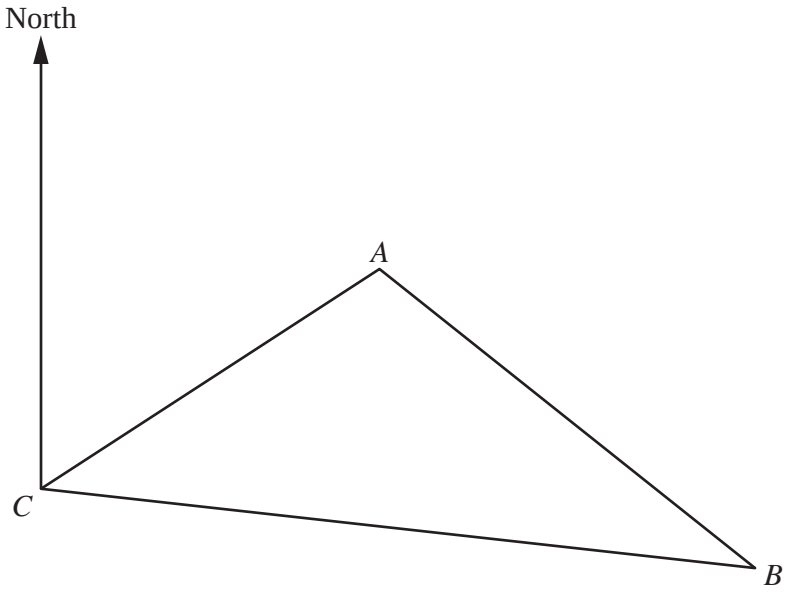
Answer ..... [1]

(b) Factorise completely $8px + 4py - 6x - 3y$.

Answer ..... [2]

---

16 The scale drawing shows three towns, *A*, *B* and *C*.
The scale of the drawing is 1 cm to 25 km.



(a) Measure the bearing of *A* from *C*.

Answer ..... [1]

(b) Find the bearing of *C* from *A*.

Answer ..... [1]

(c) Find the actual distance, in kilometres, from *B* to *C*.

Answer ..... km [1]

17 The table shows the height, in metres, above sea level of the highest and lowest points in some continents.
A negative value indicates a point below sea level.

	Asia	Africa	Europe	South America
Highest point (m)	8850	5963	5633	6959
Lowest point (m)	–409	–156	–28	–40

(a) What is the height above sea level of the highest point in Africa?
Give your answer in **kilometres**.

Answer ..... km [1]

(b) In South America, how much higher is the highest point than the lowest point?
Give your answer in metres.

Answer ..... m [1]

(c) How much higher is the lowest point in Europe than the lowest point in Asia?
Give your answer in metres.

Answer ..... m [1]

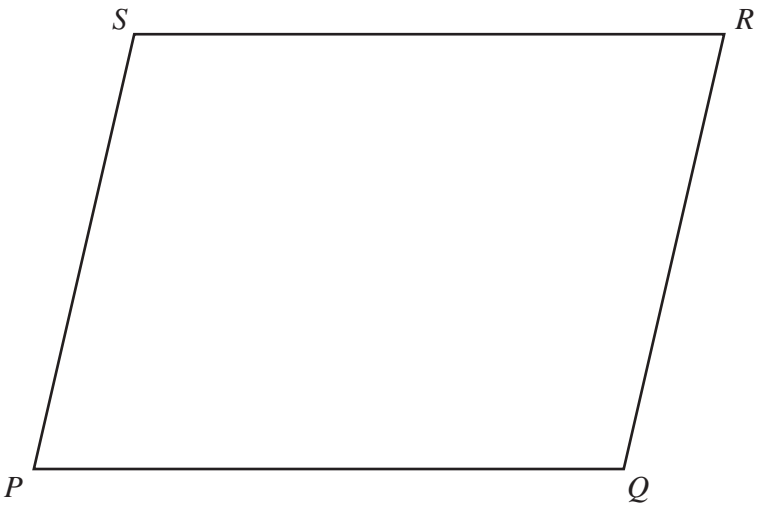
18 The diagram below shows the quadrilateral $PQRS$.

(a) On the diagram, construct

(i) the bisector of $S\hat{P}Q$, [1]

(ii) the perpendicular bisector of QR. [1]

(b) On the diagram, shade the region inside the quadrilateral containing the points that are closer to PQ than to PS and nearer to Q than to R. [1]



19 **(a)** Express 0.047 852 correct to two decimal places.

Answer ..... [1]

(b) Estimate the value of $\sqrt{200}$, giving your answer correct to two significant figures.

Answer ..... [1]

(c) By writing each number correct to one significant figure, estimate the value of

$$\frac{212 \times 1.97^2}{0.763}.$$

Answer ..... [2]

20 The table shows the distribution of the number of complete lengths swum by a group of swimmers.

Number of complete lengths (n)	$0 < n \leqslant 20$	$20 < n \leqslant 40$	$40 < n \leqslant 60$	$60 < n \leqslant 80$
Frequency	5	20	10	5

(a) Find the modal class.

Answer ..... [1]

(b) Calculate an estimate of the mean.

Answer ..... [3]

---

21 **(a)** Evaluate $\left(\frac{1}{4}\right)^{-2}$.

Answer ..... [1]

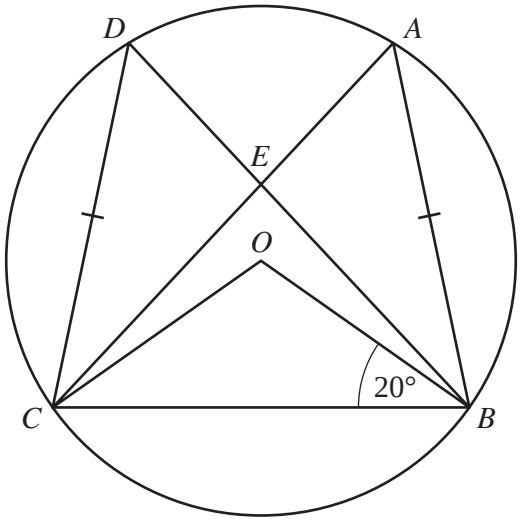
(b) Evaluate $64^{\frac{2}{3}}$.

Answer ..... [1]

(c) Simplify $\left(\frac{4x^2y^9}{x^4y}\right)^{\frac{1}{2}}$.

Answer ..... [2]

22



Points *A*, *B*, *C* and *D* lie on the circumference of a circle, centre *O*, and *AB* = *CD*.
AC and *BD* intersect at *E*.
$O\hat{B}C = 20°$.

(a) Calculate $B\hat{O}C$.

Answer $B\hat{O}C =$ ..... [1]

(b) Calculate $C\hat{A}B$.

Answer $C\hat{A}B =$ ..... [1]

(c) Show that triangles *AEB* and *DEC* are congruent.

Answer .....

.....

.....

.....

..... [3]

23 **(a)** Imran is paid $16 per hour.

(i) One week he works 35 hours.

Calculate the amount he is paid for the week.

Answer $..... [1]

(ii) Imran is paid 20% extra per hour for working at weekends.

Work out the total amount Imran is paid for working 4 hours at the weekend.

Answer $..... [2]

(b) The exchange rate between pounds and dollars is £1 = $1.80.
Anna converts $270 into pounds.

Calculate the number of pounds Anna receives.

Answer £..... [2]

24 P is the point (–2, 1) and Q is the point (3, 7).

(a) M is the midpoint of PQ.

Find the coordinates of M.

Answer (....., ...) [1]

(b) Find the gradient of the line PQ.

Answer ..... [1]

(c) The line with equation $2y + 3x + k = 0$ passes through the point P.

(i) Find k.

Answer $k =$ ..... [2]

(ii) Find the gradient of this line.

Answer ..... [1]

25 **(a)** Solve $10 - 3(2x - 1) = 3x + 1$.

Answer $x =$ ..... [2]

(b) Solve the simultaneous equations.

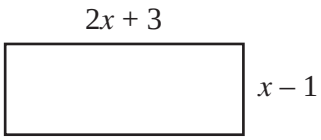
$$4x + 3y = 11$$
$$2x - 5y = 25$$

Answer $x =$ .....

$y =$ ..... [3]

Question 26 is printed on the following page.

26 The diagram shows a rectangle with length $(2x + 3)$ cm and width $(x - 1)$ cm.



(a) The area of the rectangle is $12\,\text{cm}^2$.

Form an equation in x and show that it reduces to $2x^2 + x - 15 = 0$.

[2]

(b) Solve $2x^2 + x - 15 = 0$.

Answer $x =$ ..... or ..... [2]

(c) Find the perimeter of the rectangle.

Answer ..... cm [1]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/11**

Paper 1 **May/June 2011**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

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The total of the marks for this paper is 80.

DC (KN/DJ) 35441/4

UNIVERSITY of CAMBRIDGE International Examinations

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1 Evaluate

(a) $52.3 \times 10 - 3.76 \times 100$,

Answer ..... [1]

(b) $20 - 8 \div 2 + 1$.

Answer ..... [1]

---

2 **(a)** Express 18% as a fraction in its lowest terms.

Answer ..... [1]

(b) Write down an irrational number between 3 and 4.

Answer ..... [1]

---

3 Evaluate

(a) $\frac{2}{3} + \frac{3}{10}$,

Answer ..... [1]

(b) $1\frac{3}{5} \div 3$.

Answer ..... [1]

---

4 Write down

(a) a square number that is a factor of 75,

Answer ..... [1]

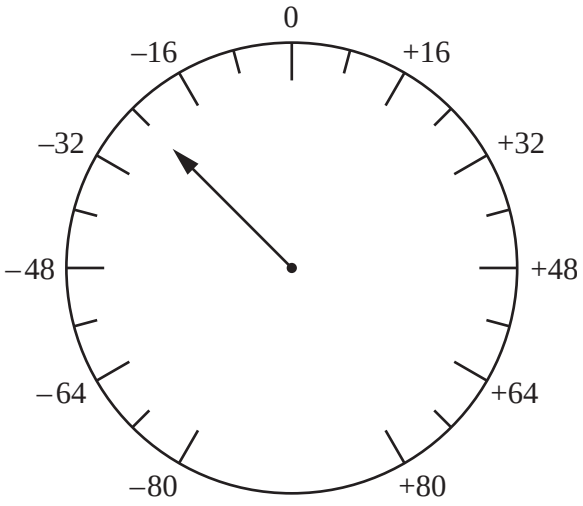
(b) a cube number that is a multiple of 24.

Answer ..... [1]

---

5 An instrument is used to measure the height of an object above sea level.
The height, in metres, is shown on the dial.

(a) What is the reading on the dial?



Answer ..... m [1]

(b) The object moves from position A, where the dial reads −54, to position B, where the dial reads + 48.

What is the difference in height between A and B?

Answer ..... m [1]

---

6 Evaluate

(a) $8^{\frac{2}{3}}$,

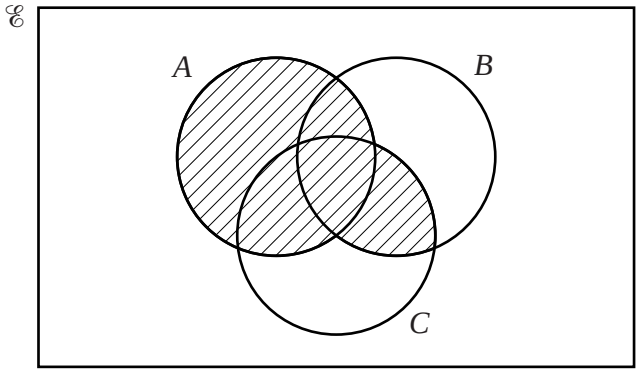
Answer ..... [1]

(b) $\left(\frac{1}{6}\right)^{-2}$.

Answer ..... [1]

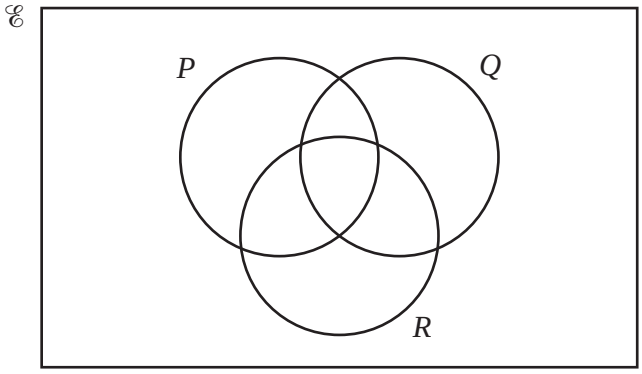
---

7 **(a)** Using set notation, describe the shaded region in the Venn diagram.



Answer ..... [1]

(b) In the Venn diagram, shade the region represented by $P' \cap (Q \cup R)$.



[1]

8 **(a)** A bag contains red and blue pens in the ratio 2 : 7.
There are 18 red pens in the bag.

How many blue pens are in the bag?

Answer ..... [1]

(b) A box contains apples and oranges.
The ratio of apples to oranges is 2 : 3.

What percentage of the fruit are oranges?

Answer ..... % [1]

---

9 Factorise completely

(a) $12ab^2 - 8a^2b$,

Answer ..... [1]

(b) $2x^2 + 3x - 20$.

Answer ..... [2]

---

10 **(a)** Sara sets out on a journey at 10 50.
She travels 65 km at an average speed of 20 km/h.

At what time does she complete her journey?

Answer ..... [2]

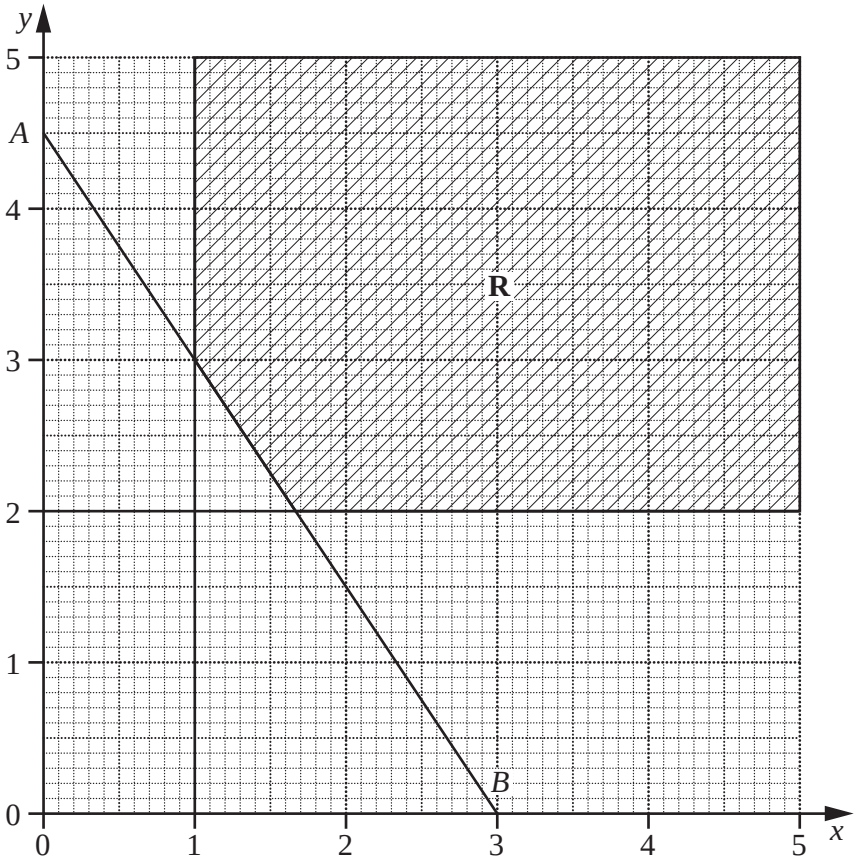
(b) Kevin takes T minutes to travel to work.
Jane travels the same distance to work but goes 10% faster than Kevin.

Find an expression, in terms of T, for the number of minutes that Jane takes to travel to work.

Answer ..... [1]

---

11 In the diagram below, the equation of the line AB is $2y = 9 - 3x$.



(a) What is the gradient of AB ?

Answer ..... [1]

(b) The shaded region **R** is defined by five inequalities.
Two of these are $x \leqslant 5$ and $y \leqslant 5$.

Write down the other three inequalities.

Answer .....

.....

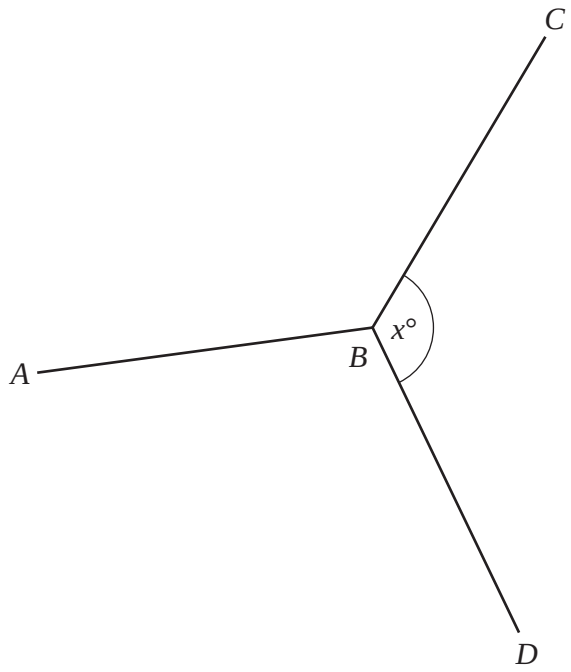
..... [2]

12 **(a)** Show that the interior angle of a regular decagon is 144°.

[1]

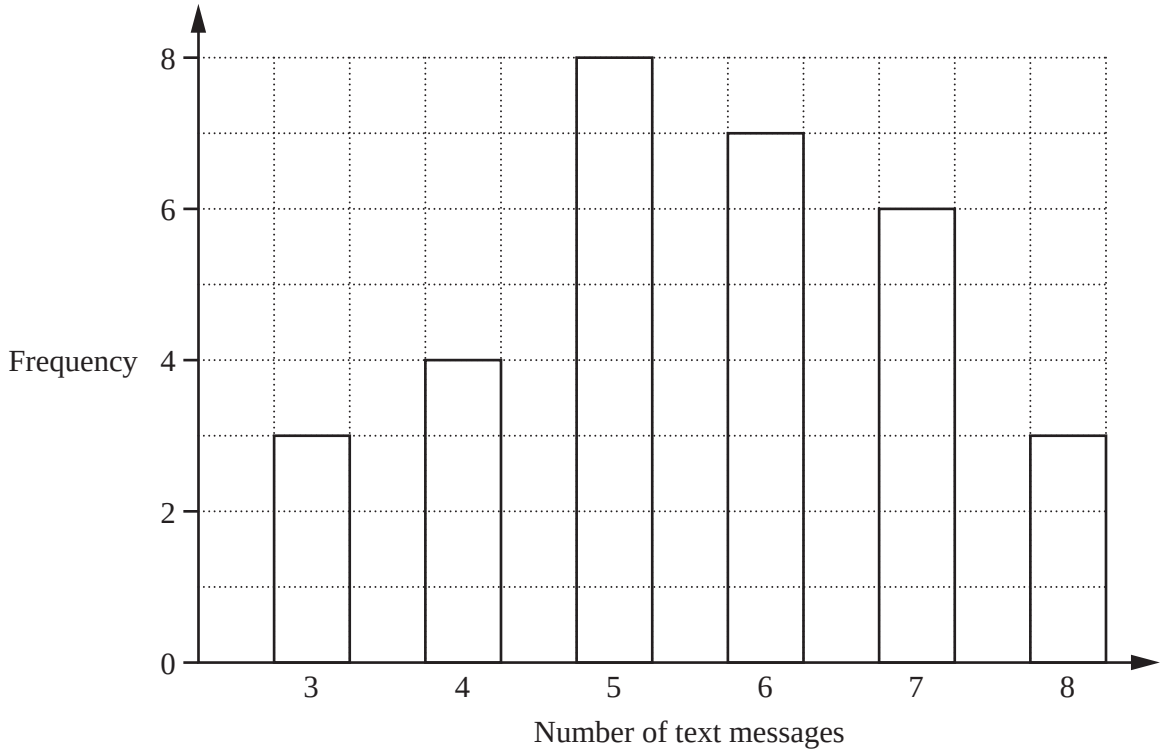
(b) *AB* and *BC* are two sides of a regular decagon.
AB and *BD* are two sides of a regular hexagon.

Work out the value of *x*.



Answer $x =$ ..... [2]

13 Jamil recorded the number of text messages sent by the students in his class on one day. The results are shown in the bar chart.



Use the bar chart to find

(a) the number of students in Jamil's class,

Answer ..... [1]

(b) the median number of text messages sent,

Answer ..... [1]

(c) the modal number of text messages sent.

Answer ..... [1]

14 **(a)** By writing each number correct to one significant figure, estimate the value of

$$\frac{7.84 \times 326}{0.18}.$$

Answer ..... [2]

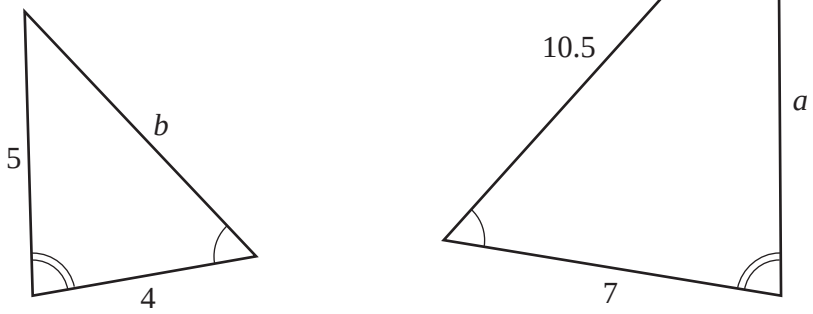
(b) An athlete ran a race in 9.58 seconds, correct to the nearest hundredth of a second.

What is the shortest possible time that the athlete could have run the race?

Answer .....seconds [1]

---

15 The two triangles below are similar.
The lengths are in centimetres.



Calculate a and b.

Answer a = ...

b = ... [3]

---

16 Solve

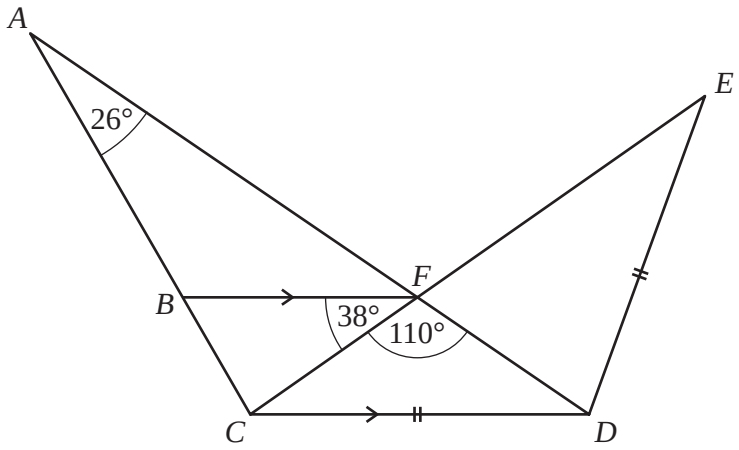
(a) $3x \geqslant 2 - 5x$,

Answer x ..... [1]

(b) $\frac{5x}{x+1} - \frac{2}{x-1} = 8$.

Answer x = ... or ..... [3]

17



In the diagram, *ACD* and *ECD* are triangles with *CD* = *DE*.
AD and *EC* intersect at *F*.
B is the point on *AC* such that *BF* is parallel to *CD*.
$B\hat{A}F = 26°$, $B\hat{F}C = 38°$ and $C\hat{F}D = 110°$.

Find

(a) $F\hat{C}D$,

Answer $F\hat{C}D =$ ..... [1]

(b) $E\hat{D}C$,

Answer $E\hat{D}C =$ ..... [1]

(c) $A\hat{B}F$,

Answer $A\hat{B}F =$ ..... [1]

(d) $B\hat{C}F$.

Answer $B\hat{C}F =$ ..... [1]

18 The first four terms, u_1, u_2, u_3 and u_4, in a sequence of numbers are given by

$$\begin{aligned} u_1 &= 1 \times 2 + 3^2 = 11 \\ u_2 &= 2 \times 3 + 4^2 = 22 \\ u_3 &= 3 \times 4 + 5^2 = 37 \\ u_4 &= 4 \times 5 + 6^2 = 56. \end{aligned}$$

(a) Evaluate u_5.

Answer ..... [1]

(b) Write down an expression, in terms of n, for the nth term, u_n, of the sequence.

Answer ..... [1]

(c) Given that $u_n = An^2 + Bn + C$, find the values of A, B and C.

Answer $A =$ .....

$B =$ .....

$C =$ ..... [2]

19 **(a)** Vicky's fingernail grows one nanometre in one second.
One nanometre is 1×10^{-9} metres.
Vicky calculates how much her fingernail grows in one hour.

Find this length, in standard form, giving your answer

(i) in metres,

Answer ..... m [1]

(ii) in millimetres.

Answer ..... mm [1]

(b) It is given that $2 \times 10^3(d + 3 \times 10^2) = 8 \times 10^6$.

Find d.

Answer d = ... [2]

20 It is given that $h(x) = 2x - 5$ and $g(x) = \frac{3}{x-2}$.

Find

(a) h(4),

Answer ..... [1]

(b) $g^{-1}(x)$,

Answer ..... [2]

(c) the value of t such that $h(t) = g(3)$.

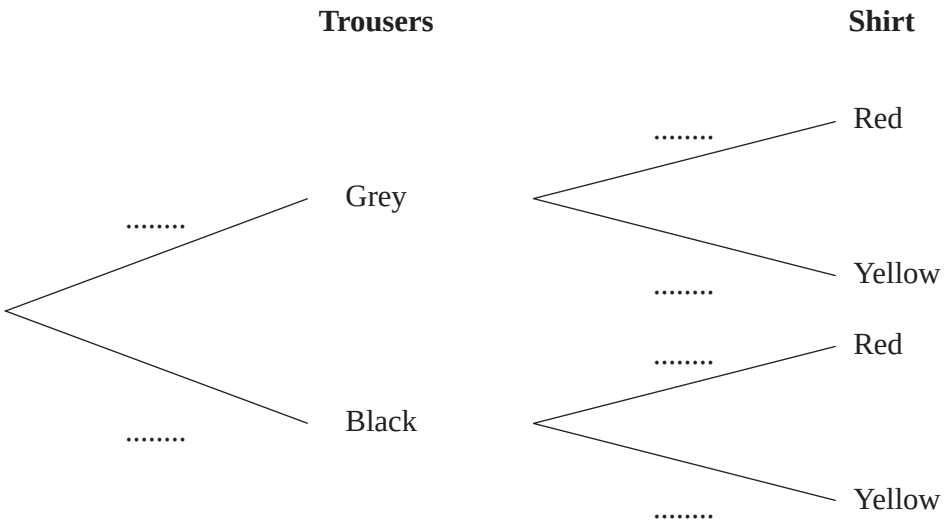
Answer $t =$ ..... [2]

21 Kelvin chooses a pair of trousers and a shirt to wear for college.
He chooses grey trousers or black trousers.
He chooses a red shirt or a yellow shirt.

The probability that he chooses grey trousers is $\frac{1}{3}$.

The probability that he chooses a red shirt is $\frac{4}{5}$.
His choice of shirt is independent of his choice of trousers.

(a) Complete the tree diagram.



[2]

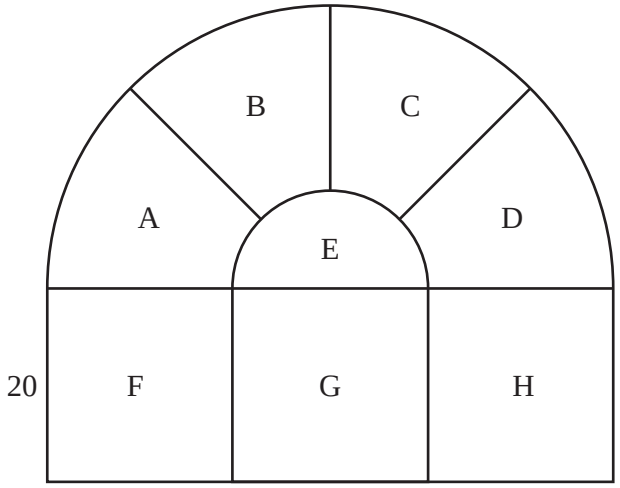
(b) What is the probability that Kelvin chooses grey trousers and a red shirt?

Answer ..... [1]

(c) What is the probability that Kelvin does **not** choose either black trousers or a red shirt?

Answer ..... [2]

22 The diagram shows a window made up of a large semicircle and a rectangle.
The large semicircle has 4 identical sections, A, B, C, D, and a small semicircle, E.
The rectangle has three identical square sections, F, G and H.
The side of each square is 20 cm.



Find an expression, in the form $a + b\pi$, for

(a) the area of the whole window,

Answer ..... cm^2 [2]

(b) the perimeter of section B.

Answer .....cm [3]

23 **(a)** Construct, using ruler and compasses only, triangle ABC with sides $AB = 9\,\text{cm}$, $BC = 8\,\text{cm}$ and $AC = 6\,\text{cm}$.
The line AB has been drawn for you.

[2]

(b) Construct the locus of points, inside the triangle ABC, which are

(i) equidistant from AB and BC, [1]

(ii) 4 cm from A. [1]

(c) Shade the region, inside triangle ABC, containing the points that are nearer to BC than AB **and** more than 4 cm from A. [1]

Question 24 is printed on the following page.

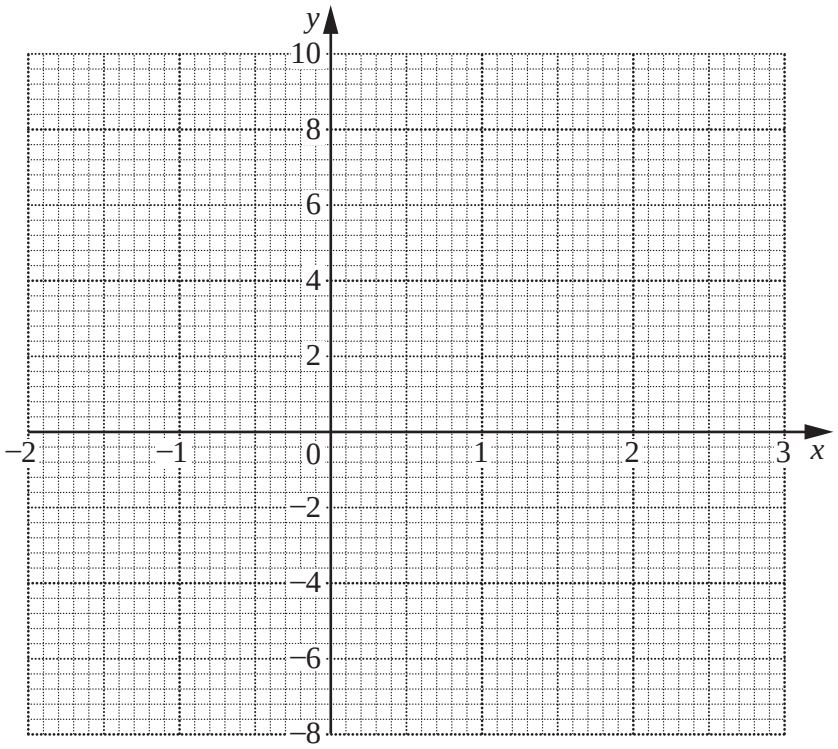
24 The variables x and y are connected by the equation $y = x^3 - 6x$.

(a) Complete the table of values.

x	−2	−1	0	1	2	3
y		5	0		−4	9

[2]

(b) On the axes below, draw the graph of $y = x^3 - 6x$ for $-2 \leqslant x \leqslant 3$.



[2]

(c) Use your graph to find

(i) two solutions of the equation $x^3 - 6x = 0$,

Answer $x =$ ..... or ..... [2]

(ii) the least value of y when x is positive.

Answer $y =$ ..... [1]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/22 Paper 2, maximum raw mark 100

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International Examinations

Abbreviations

cao correct answer only
cso correct solution only
dep dependent
ft follow through after error
isw ignore subsequent working
oe or equivalent
SC Special Case
www without wrong working

SECTION A

Qu.	Answers	Mark	Comments
1	**(a) (i)** $\frac{1}{10x}$ cao	1	
	(ii) $\frac{11x-12}{x(x-3)}$ final answer	2	M1 for $\frac{4(x-3)+7x}{x(x-3)}$
	(b) (i) ¼ or 0.25	1	
	(ii) $c = 2$ cao $d = 1.5$ oe	2	If 0, B1 for $\left(f^{-1}(x)=\right)\frac{4x+3}{2}$
	(iii) g = ½ or 0.5	2	M1 for $\frac{2g-3}{4} = -g$
2	**(a) (i)** $c = \frac{2A}{h} - d$ or $\frac{2A-hd}{h}$ final answer	2	M1 for $c + d = \frac{2A}{h}$ or $\frac{1}{2}hc = A - \frac{1}{2}hd$ oe or SC1 for $c = \frac{A}{\frac{1}{2}h} - d$
	(ii) 3	1	
	(b) (i) 102	2	M1 for 31.5 and 19.5 used
	(ii) 322	3	M2 for (32.5 × 20.5)–(25.5 × 13.5) or M1 for (32.5 × 20.5) or (25.5 × 13.5)
3	**(a)** $\frac{1}{3}$	1	
	(b) (i) $\frac{1}{20}$	2	M1 for $\frac{1}{6}\times\frac{3}{5}\times\frac{2}{4}$ seen
	(ii) $\frac{3}{20}$	2	SC1 for $\frac{5}{36}$ M1 for $\left(\frac{3}{6}\times\frac{2}{5}\times\frac{1}{4}\right)+\left(\frac{3}{6}\times\frac{2}{5}\times\frac{2}{4}\right)$ seen

4	**(a) (i)** $(u_n) = 3n + 1$ oe	1	
	(ii) 61	1ft	ft their u_n with $n = 20$
	(b) (i) $(v_n) = 17 - 2n$ oe	1	
	(ii) (k =) 49 cao	1	
5	**(a)** 11 30 cao	1	
	(b) 39 minutes	1	
	(c) 8 km	1	
	(d) 24 km/h	1	
	(e) park and shopping centre	1	
	(f) Salim and 9 minutes	2	B1 for 12 27 or 1 hour 12 minutes seen or 1.2 hours or 72 minutes or for line from (11.15,0) to (12.15,15)
6	**(a)** (£)1350	1	
	(b) (£)225	1ft	ft their **(a)** 6
	(c) 108°	1ft	ft $\frac{405}{\text{their}\mathbf{(a)}} \times 360$ or $\frac{405}{\text{their}\mathbf{(b)}} \times 60$
	(d) (£)300	2	SC1 for 120° or £450 seen.
	(e) (£)199.80	2	B1 for (£)70.20 or M1 for $(1 - 0.26) \times 270$ oe
	(f) 9(%)	3	M2 for figs $\frac{3645}{405}$ or $\frac{11745}{405}$ or $\frac{28755}{405}$ seen SC1 for 81 or 324 seen
	(g) (£)250	2	M1 for 108 % 270 soi
7	**(a) (i)** 2	1	
	(ii) (a) $\mathbf{q} - \mathbf{r}$	1	
	(b) $2\mathbf{p} - \mathbf{q} - \mathbf{r}$	1	
	(c) $1\frac{1}{2}\mathbf{p} - \mathbf{r}$	1	
	(d) $\frac{1}{2}\mathbf{p} - \mathbf{q} + \frac{1}{2}\mathbf{r}$	1	
	(b) (i) 45°	1	
	(ii) 95°	1ft	ft 140 – their **(b)(i)**
	(iii) 80°	1ft	ft 125 – their **(b)(i)**

SECTION B

8	**(a) (i)** $\begin{pmatrix} 3 & 2 \\ 1 & 4 \end{pmatrix}$	2	B1 for 3 correct terms
	(ii) $\begin{pmatrix} -1 & -2 \\ 1.5 & 2.5 \end{pmatrix}$ or $\frac{1}{2}\begin{pmatrix} -2 & -4 \\ 3 & 5 \end{pmatrix}$	2	B1 for $k\begin{pmatrix} -2 & -4 \\ 3 & 5 \end{pmatrix}$ k ½ or ½ × (2 × 2 matrix)
	(b) (i) Reflection	1	
	$y = 1$	1	
	(ii) Enlargement	1	
	Scale factor ½ Centre (–5,0)	1	
	(iii) (–2 , 3) (–4 , 5) (–4 , 7)	2	B1 for 2 correct vertices or for $\begin{pmatrix} -2 & -4 & -4 \\ 3 & 5 & 7 \end{pmatrix}$
	(iv) Rotation	1	
	90^o anticlockwise about (0,0)	1	
9	**(a)** –5, –6	1	
	(b) All points plotted correctly <u>and</u> a smooth curve – generous quadratic	2ft	B1 for 5 or more points correct ft from their table
	(c) (i) x = –2.2 to –2.35 and 1.65 to 1.85	1	
	(ii) –6.4 $mv < -6.0$	1	
	(iii) 8 to 10	2	M1 for tangent
	(d) (i) $2x^2 + 4x – 3x – 6 = 1 – 2x$ leading to $2x^2 + 3x – 7 = 0$	1	
	(ii) x = 1.27, –2.77	4	B3 for one solution or x = 1.26 to 1.3 **<u>and</u>** –2.76 to –2.8 or if in form $\frac{p \pm (or + or-)\sqrt{q}}{r}$ B1 for p = –3, r = 4 B1 for q = 65 or $\sqrt{q}$ = 8.06

10	**(a) (i)** $74.95 \rightarrow 75.05$	1	
	(ii) $336.5 \rightarrow 337.5$	3	M1 for $250^2 + 300^2 \pm 2 \times 250 \times 300\cos 75$ M1 for $\sqrt{152500 - 150000\cos 75}\left(= \sqrt{113677}\right)$
	(iii) $44.2 \rightarrow 44.3$	3	M2 for $\sin\theta = \dfrac{300\sin 75}{\text{their}337}$ SC1 for $(C\hat{S}B =)\ 45.7 \rightarrow 45.8$ seen
	(b) (i) $241 \rightarrow 241.5$	2	M1 for $\cos 15 = \dfrac{DB}{250}$ oe
	(ii) $12050 - 12100$	2ft	B1 for $\frac{1}{2} \times 200 \times 241 \times \sin 30$ ft $50 \times$ their **(b)(i)**
	(iii) 225	1	
11	**(a)** $\dfrac{7\pi r^2 H}{9}$	3	B1 for $\dfrac{2\pi r^2 H}{3}$ and B1 for $\dfrac{\pi r^2 H}{9}$
	(b) (i) $\sqrt{15^2 + 10^2} = 18(.0)$	2	M1 for $15^2 + 10^2$
	(ii) $62.8 \rightarrow 62.9$ or 20π	2	M1 for $2 \times \pi \times 10$
	(iii) $\theta = \dfrac{62.8 \times 360}{36\pi} = 200^\circ$	2	M1 for $\dfrac{\theta}{360} \times \pi \times 18 \times 2$ = their **(ii)**
	(iv) $2760 \rightarrow 2770$	3	M1 for $\dfrac{200}{360} \times \pi \times 18^2 (= 565.5)$ M1 for $30 \times$ their **(ii)** (= 1884)
12	**(a)** 220, 288, 312, 320	1	
	(b) (i) 7 correct plots and smooth ogive	3	B2 for 5 or 6 correct plots and smooth ogive or B1 for 5 or 6 correct plots
	(ii) (a) $83 \rightarrow 85$	1ft	ft from their graph
	(b) $13.5 \rightarrow 16.5$	2	M1 for readings at 80 and 240 seen
	(c) 15 to 19%	2	SC1 for $48 \rightarrow 60$ or $81 \rightarrow 85$ seen
	(iii) (a) 76 cao	1	
	(b) 25% cao	1	
	(c) More pupils took longer (so) previous test was probably harder	1	

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/21 Paper 2, maximum raw mark 100

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International Examinations

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SECTION A

Qu	Answers	Mark	Comments
1	**(a)** 37.35 and A	2	M1 for $315 \times 0.05 + 720 \times 0.03$
	(b) **(i)** \$0.05	1	
	(ii) Large and 0.0485 seen oe	1	
	(c) 890	3	M1 for $\frac{1134.75}{0.85}$ M1 for their $1335 - (375 + 70)$
2	**(a)** (7 , 9)	1	
	(b) **(i)** $y = 2x - 5$	2	M1 for gradient $\frac{(15+21)}{(10+8)}$ (= 2)
	(ii) Yes and $-9 = 2 \times -2 - 5$	1ft	ft correct conclusion from their equation with the working shown
	(c) **(i)** **(a)** (–5 , 0)	1	
	(b) $\left(\frac{4p-15}{3}, p\right)$	2	M1 for line through (4 , 9) and (6 , 6)
	(ii) (5 , 7 ½)	2	B1 for either x or y coordinate
3	**(a)** **(i)** 10.6 – 10.62	2	M1 for $\tan 37 = \frac{8}{QR}$
	(ii) 192	2	M1 for 4^3 seen
	(b) 6.40	2	M1 for $\frac{46.62}{0.45}$
	(c) 18	2	M1 for (k =) 90 oe or $\frac{3}{5} \times 30$

4	**(a)** $4x + 5y + 4x + 5y = 1020$ leading to $4x + 5y = 510$ $6x + 3y + 6x + 3y + 4x + y + 4x + y = 1360$ leading to $5x + 2y = 340$	 1 1	
	(b) $x = 40,\ y = 70$	3	M1 for an attempt to make the coefficients of x or y equal M1 for subtracting the two equations
	(c) 0.56	2ft	M1 for figs 0.8 × 2.1 and figs 1.6 × 0.7 After 0, SC1 for answer figs 56 ft (2 × their x × their y) / 10 000
5	**(a) (i)** $\begin{pmatrix} -10 & -4 \\ 15 & 7 \end{pmatrix}$	2	B1 for 3 correct terms
	(ii) $\begin{pmatrix} -0.5 & -1 \\ 1.5 & 2 \end{pmatrix}$	2	B1 for ½ × (2 × 2 matrix) or for $\begin{pmatrix} -1 & -2 \\ 3 & 4 \end{pmatrix}$ soi
	(b) (i) 13	2	M1 for $12^2 + 5^2$ (= 169)
	(ii) $\begin{pmatrix} 8 \\ 6 \end{pmatrix}$	1	
	(c) (i) $\begin{pmatrix} -5 \\ 2 \end{pmatrix}$	1	
	(ii) (18 , 9)	1	
	(iii) 22	3ft	M1 for 12 × (their 9 – 3) M1 for an attempt to subtract area of 3 triangles
6	**(a) (i) (a)** Translation cao $\begin{pmatrix} 1 \\ -5 \end{pmatrix}$	1 1	
	(b) Enlargement cao Scale factor 3, Centre (6, 4)	1 1	
	(ii) (a) (–1 , –2) **(b)** (–1 , 0)	1 1	
	(b) (i) Kite	1	
	(ii) (1 , 3) (4 , 2)	1 1	Also (4, –1) is correct for 1

SECTION B

7	**(a)** 30.4 to 30.45	4	M1 for $16^2 + 20^2 \pm (2) \times 16 \times 20 \cos 115^o$ M1 for $\sqrt{656 - 640\cos 115}$ A1 for 926.(47….)
	(b) $16\cos 25^o$ oe	2	M1 for $\cos 25 = \frac{x}{16}$
	(c) **(i)** 28 www	2	M1 for $\frac{1}{2}(20 + AD) \times 14.5 = 348$
	(ii) ½ × 28 × 14.5 (= 203) or 348 – ½ 20 × 16 sin115	1	½ 30.4 × 28 sin28.5
	(iii) 28.4 to 28.5	3ft	M1 for ½ × 30.4 × 28 × sin *CAD* = 203 M1 for sin *CAD* = $\frac{203}{½ \times 30.4 \times 28}$ ft their *AC* and their *AD*
8	**(a)** **(i)** $y^2 + 18y + 81 = y^2 + y^2 + 10y + 25$ $y^2 - 8y - 56 = 0$	2	M1 for $(y + 9)^2 = y^2 + (y + 5)^2$ oe
	(ii) 12.5, –4.5	3	M1 for $y = \frac{8 \pm \sqrt{8^2 + 4 \times 56}}{2}$ soi A1 for one solution or 12.48(5)… and –4.48(5)…
	(iii) 21.5	1ft	ft 9 + their positive *y*
	(b) **(i)** **(a)** $Q\hat{O}S = 90 - x$ and conclusion	1	
	(b) $\frac{1}{2}(90 + x)$ oe cao	2	M1 for ½ (180 – (90 – *x*))
	(ii) **(a)** 3 × ½ (90 – *x*) = 2 × ½ (90 + *x*) leading to 180 + 2*x* = 270 – 3*x*	2	M1 for 3 × ½ (90 – *x*) = 2 × their *OQS*
	(b) 18	1	
9	**(a)** **(i)** Histogram with heights 0.14, 0.56 ,0.74, 0.42 and 0.2 widths 100, 50, 50, 50, 100	3	B2 for 4 correct columns or B1 for at least 1 correct column After 0, SC2 for "correct" histogram or SC1 for at least 3 "correct" columns (e.g. no vertical or horizontal scale)
	(ii) 14 – 16	1	
	(iii) 200 $m < 250$	1	
	(iv) $\frac{7}{20}$ cao	1	

	(b) (p =) 35	3	M1 for $\frac{125\times14+175p+225\times26}{40+p}=183$ M1 $183p - 175p = 1750 + 5850 - 7320$
	(c) **(i)** 1	1	
	(ii) $\frac{49k}{750k}$	2ft	M1 for $\frac{7}{20}\times\frac{14}{75}$ ft their $\frac{7}{20}$ and their 75
10	**(a)** 32	2	M1 for $\frac{200}{6.2}$
	(b) **(i)** 1.13	3	B2 for figs 1128…….(or 113) <u>or</u> M1 for fig 0.2 = πr^2 fig 5
	(ii) **(a)** 56.5 to 56.51	3	M1 for $\pi \times 1.9^2 \times 5$ M1 for their volume – 0.2
	(b) 53	2ft	M1 for $\frac{3000}{56.5}$ ft their 56.5 with rounding down to an integer
	(c) 12.9	2	M1 for $2 \times \pi \times 1.9$ (= 11.9)
11	**(a)** **(i)** 35	1	
	(ii) 360	1	
	(iii) 7	1	
	(b) **(i)** 10	1	
	(ii) (8.00 , 0) to (8.15 , 10) (8.15 , 10) to (8.23 , 22) (8.23 , 22) to (8.47 , 30)	2ft	B1 for 2 correct lines ft their 10 and their 10 + 12
	(iii) 20	2ft	M1 for $\frac{8}{24}(\times60)$ ft $\frac{18-\text{their}\,10}{24/(60)}$
	(c) **(i)** 12.29 cao	2	M1 for $\sin 55 = \frac{MK}{15}$ oe
	(ii) 247°	1	
	(iii) 10.2 to 10.7	1	

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

4024 MATHEMATICS (SYLLABUS D)

4024/12 Paper 1, maximum raw mark 80

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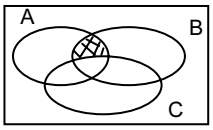
Qu	Answers	Mark	Part marks
1	**(a)** 7	1	
	(b) 0.52 oe	1	
2	**(a)** Any decimal n such that $0.2 < n < 0.25$	1	
	(b) 80	1	
3	**(a)** $\frac{7}{24}$ oe Final ans.	1	
	(b) $\frac{7}{18}$ cao	1	
4	**(a)** $(y) > 7.5$ oe	1	
	(b) –2, –1, 0, 1	1	
5	**(a)** $\begin{pmatrix} -2 \\ 10 \end{pmatrix}$	1	
	(b) 10	1	
6	$\frac{9\pi}{2} + 27$ oe	2	B1 for $\frac{\pi \times 3^2}{2}$ or $\frac{1}{2} \times 9 \times 6$ soi or for $\frac{\pi r^2}{2} + \frac{1}{2}bh$ with r, b and h clearly identified.
7	**(a)** $\frac{4}{9}$ oe	1	
	(b) 840	1	
8	12.5 oe	2	B1 for $y = kx^2$ or $(k =) \frac{1}{8}$ soi or $2 : 4^2 = y : 10^2$ oe

9	$y \quad 3$ $y \quad -2x$	2	C1 for either inequality correct or both statements y ( ) 3 and y ( ) $-2x$ given ( ) may contain =, < etc
10	18	2	B1 for attempt at $\sqrt[3]{8} : \sqrt[3]{27}$ or M1 for $12^3 : x^3 = 8 : 27$ oe
11	50	2	M1 for $\frac{35-21}{AD} = \cos\theta$ oe
12	**(a)** 	1	
	(b) **(i)** 2	1	
	(ii) 2, 3, 4, 5, 7	1	
13	**(a)** $2 (. 0) \times 10^{-5}$	1	
	(b) **(i)** 7.6×10^6, 2.1×10^7, 8.0×10^7, 1.2×10^8	1	
	(ii) 1.34×10^7	1	
14	**(a)** $2^2 \times 3^3$	1	
	(b) $(p =) 3$, $(q =) 2$, $(r =) 1$	2	C1 for two correct
15	**(a)** $3q(3p - 4q)$	1	
	(b) $(4p - 3)(2x + y)$	2	M1 for $4p(2x + y) - 3(2x + y)$ or $2x(4p - 3) + y(4p - 3)$ oe or B1 for the correct extraction of a common factor at any stage
16	**(a)** (0)57°	1	
	(b) 237°	1 ft	ft their **(a)** + 180
	(c) 237.5	1	
17	**(a)** 5.963	1	
	(b) 6999	1	
	(c) 381 cao	1	

18	**(a) (i)** Bisector of *SPQ* **(ii)** Perpendicular bisector of *QR* **(b)** Correct region shaded	1 1 1	
19	**(a)** 0.05 cao **(b)** 14 **(c)** 1000	1 1 2	 B1 for two of 200, 2 and 0.8 seen
20	**(a)** $20 < n \quad 40$ **(b)** 37.5	1 3	 B1 for $\sum fn$ and independent B1 for dividing by (5 + 20 + 10 + 5)
21	**(a)** 16 **(b)** 16 **(c)** $\frac{2y^4}{x}$	1 1 2	 C1 for two of 2, y^4 and x correct or B1 for $\frac{4y^8}{x^2}$ seen or $\frac{4^{\frac{1}{2}}xy^{\frac{9}{2}}}{x^2y^{\frac{1}{2}}}$ or better
22	**(a)** 140 **(b)** 70 **(c)** Congruency established	1 1ft 3	 ft $\frac{1}{2}$ their **(a)** B2 for *AB* = *CD* stated, *EAB* = *EDC* soi or *DCE* = *ABE* and *DEC* = *BEA* or B1 for any correct pair of equal angles.
23	**(a) (i)** 560 **(ii)** 76.8(0) **(b)** 150	1 2 2	 B1 for 19.2 or 3.2 oe soi B1 for figs $\frac{270}{1.8}$ seen

24	**(a)** (0.5, 4) oe	1	
	(b) 1.2 oe	1	
	(c) **(i)** 4	2	B1 for substitution of (–2,1) in $2y + 3x + k = 0$ SC1 for answer – 23 or any correct ft after substitution of (±2, ±1)
	(ii) –1.5 oe	1	
25	**(a)** $\frac{1}{13}$ oe	2	M1 for $10 – 6x + 3 = 3x + 1$ or better
	(b) $(x =)$ 5, $(y =) – 3$ oe	3	C2 for one correct with supporting working or both answers without working or M1 for correct method to eliminate one variable reaching such as $26x = k$, $hx = 130$, $13y = p$, $qy = –39$ or multiples of these.
26	**(a)** Correct reduction to $2x^2 + x – 15 = 0$	2	M1 for $(2x + 3)(x – 1) = 12$
	(b) 2.5 –3	2	C1 for one correct with supporting working or both with signs reversed or both correct and no working or B1 for $(2x – 5)(x + 3)$ or $\frac{-1 \pm \sqrt{1^2 - 4 \times 2 \times (-15)}}{2 \times 2}$ seen
	(c) 19	1ft	ft 6(their positive x) + 4