Zimbabwe School Examinations Council

General Certificate Of Education Ordinary Level

MATHEMATICS PAPER 1 EXAMS

The Following Exams Are Covered For Paper 1

NOV 2011- JUNE 2016 Examination

PAPER EXAMS

THE FOLLOWING EXAMS ARE COVERED FOR PAPER

1. NOV 2011
2. JUNE 2012
3. NOV 2012
4. JUNE 2013
5. NOV 2013
6. JUNE 2014
7. NOV 2014
8. JUNE 2015
9. NOV 2015
10. JUNE 2016

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4030/1

PAPER 1

JUNE 2016 SESSION 2 hours 30 minutes

Candidates answer on the question paper.
Additional materials:
Geometrical instruments

Allow candidates 5 minutes to count pages before the examination.

THIS BOOKLET SHOULD NOT BE PUNCHED OR STAPLED AND PAGES SHOULD NOT BE REMOVED.

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and your Centre number and Candidate number on the top right corner of every page of this paper.

Answer **all** questions.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Write your answers in the spaces provided on the question paper using **black** or **blue** pens.

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.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

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

This question paper consists of 30 printed pages.

©ZIMSEC J2016

[Turn over

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

1 Evaluate

(a) $1,4 + 0,04$,

(b) $5\frac{1}{4} \div 3\frac{1}{2}$.

Suggested solution

1 (a) $1,4 + 0,04 = 1,44$

(b) $5\frac{1}{4} \div 3\frac{1}{2} = \frac{21}{4} \div \frac{7}{2}$

$= \frac{21}{4} \times \frac{2}{7}$

$= \frac{3}{2}$

$= \mathbf{1\frac{1}{2}}$

2 (a) Express 31,095 correct to

(i) 2 decimal places,

(ii) 2 significant figures.

(b) Express $\frac{7}{30}$ as a recurring decimal fraction.

Suggested solution

2 (a) (i) $31,095 = \mathbf{31,10}$ (2 decimal places)

(ii) $31,095 = \mathbf{31}$ (2 significant figures)

(b) $\frac{7}{30} = 2,333333333.....$

$= \mathbf{2,\dot{3}}$

3 (a) It is given that 0; 1; 8; 27; __; .... is a pattern.

State the next term of the pattern.

(b) A length h measured to 1 decimal place is given as 9,5 cm.

State its limits.

Suggested solution

3 (a) Clearly, the pattern of numbers is a sequence of cubes of numbers.

So. $0;\ 1;\ 8;\ 27...... = 0^3\ ;1^3\ ;2^3;\ \ 3^3;\ \ 4^3.....$

i.e the next number is $4^3 = 4 \times 4 \times 4$

$= \mathbf{64}$

(b) $9.45 \leq h < 9.5$

4 (a) Factorise completely $x^2 - \frac{1}{36}$.

(b) Remove brackets and simplify $(4a+b)(5a-3b)$.

Suggested solution

4 (a) $x^2 - \frac{1}{36} = x^2 - \left(\frac{1}{6}\right)^2$. using the difference of 2 squares.

$= \left(x - \frac{1}{6}\right)\left(x + \frac{1}{6}\right)$

(b) $(4a + b)(5a - 3b) = 4a(5a - 3b) + b(5a - 3b)$

$= 20a^2 - 12ab + 5ab - 3b^2$

$= \mathbf{20a^2 - 7ab - 3b^2}$

5 Solve the simultaneous equations:

$6y - 3x = 1$

$3x + y = 13$

Suggested solution

5 $6y - 3x = 1$ ______ ①
$3x + y = 13$ ______ ②.

Method 1 (*Elimination Method*)

Rearranging equation ②, we get,

$6y - 3x = 1$ ______ ①
$y + 3x = 13$ ______ ②.

①+②: $6y + y = 13 + 1$

$7y = 14$

$\mathbf{y = 2}$

Using②, $2 + 3x = 13$

$3x = 13 - 2$

$3x = 11$

$x = \frac{11}{3}$

$\mathbf{x = 3\frac{2}{3}}$

Method 2 (***Substitution Method***)

$6y - 3x = 1$ ______ ①

$3x + y = 13$ ______ ②.

Using ② and making y subject of the equation, we have,

$$y = 13 - 3x,$$

Substituting into ①, gives,

$$6(13 - 3x) - 3x = 1$$
$$78 - 18x - 3x = 1$$
$$78 - 21x = 1$$
$$21x = 77$$
$$3x = 11$$
$$x = \frac{11}{3}$$

Using ②, $3\left(\frac{11}{3}\right) + y = 13$

$$11 + y = 13$$
$$y = 2$$

6 It is given that $\xi = \{0; 1; 2; 3; 4; 5; 6; 7; 8; 9\}$, A is a set of prime numbers and B is a set of factors of 12.

(a) List the elements of

(i) A,

(ii) $A \cap B$.

(b) Find $n(A \cup B)'$.

Suggested solution

6 (a) (i) $A = \{2;\ 3;\ 5;\ 7\}$

(ii) $B = \{1;\ 2;\ 3;\ 4;\ 6\}$

$\therefore\ A \cap B = \{2;\ 3\}$

(b) $A \cup B = \{1;\ 2;\ 3;\ 4;\ 5;\ 6;\ 7\}$

$(A \cup B)' = \{0;\ 8;\ 9\}$

$n(A \cup B)' = 3$

7 (a) Expand 1234_5 in powers of 5.

(b) Evaluate $1011_2 + 111_2$, giving the answer in base 2.

Suggested solution

7 (a) $1234_5 = 5^3 \times \mathbf{1} + 5^2 \times \mathbf{2} + 5^1 \times \mathbf{3} + 5^0 \times \mathbf{4}$

(b) $1\,0\,1\,1_2 + 1\,1\,1_2 = \mathbf{1\,0\,0\,1\,0_2}$

8 (a) Express 0.5 litres in cm^3.

(b) A woman earning $275 had her salary increased by 5%.

Calculate her new salary.

Suggested solution

8 (a)

$$1 \text{ litre} = 1000\ cm^3$$

$$0,5 \text{ litre} = 0,5 \times 1000\ cm^3$$

$$= \frac{1}{2} \times 1000\ cm^3$$

$$= \mathbf{500\ cm^3}$$

(b)

$$\text{Her new salary} = 105\% \times \$275$$

$$= \frac{105}{100} \times \$275$$

$$= \mathbf{\$288,75}$$

9 If $f(x) = \frac{1}{x^2}$, $x \neq 0$, find

(a) $f(-3)$,

(b) the values of x when $f(x) = 1$

Suggested solution

9 (a)

$$f(x) = \frac{1}{x^2} \qquad \text{where} \quad x \neq 0$$

$$f(-3) = \frac{1}{(-3)^2} = \frac{1}{(-3) \times (-3)}$$

(b)

$$f(x) = 1$$

$$\frac{1}{x^2} = 1$$

$$x^2 = 1$$

$$x^2 - 1 = 0$$

$$(x+1)(x-1) = 0$$

Either $\quad x + 1 = 0 \quad$ or $\quad x - 1 = 0$

i.e. $\quad x = -1 \quad$ or $\quad x = 1$

10 Given that $x = aq^2 + bq^2$, express q in terms of a, b and x.

Suggested solution

10

$x = aq^2 + bq^2$, factorising q^2

$x = q^2(a + b)$, dividing both sides by $(a + b)$

$q^2 = \frac{x}{a+b}$ taking square roots both sides

$\sqrt{q^2} = \pm\sqrt{\frac{x}{a+b}}$ noting that $\sqrt{q^2} = q$, gives

$$q = \pm\sqrt{\frac{x}{a+b}}$$

11 If V varies jointly as h and as the square of r,

(a) write down the equation connecting V, r, h and a constant c.

(b) find c if $V = 440$, $r = 2$ and $h = 35$.

Suggested solution

11 (a) $V \propto hr^2 \implies V = chr^2$, where c is a constant.

(b)

$$440 = c \times 35 \times 2^2$$

$$440 = c \times 140$$

$$44 = c \times 14$$

$$c = \frac{22}{7}$$

$$c = 3\frac{1}{7}$$

12 (a) Solve the inequality, $-2(2x-7) \geq 38$.

(b) Illustrate the solution set in **(a)** on the number line in the answer space

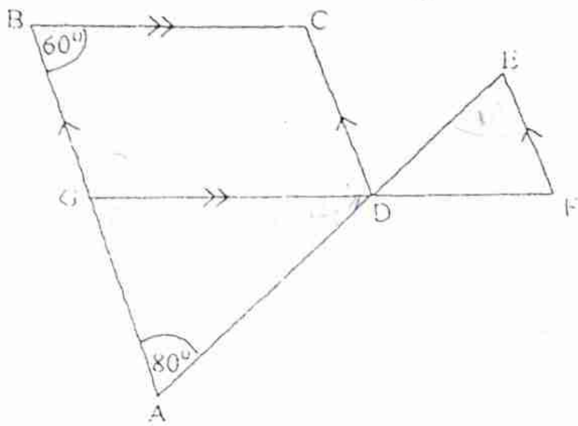
Suggested solution

12 (a)

$$-2(2x-7) \geq 38$$
$$2x-7 \leq -19$$
$$2x \leq 7-19$$
$$2x \leq -12$$
$$\boldsymbol{x \leq -6}$$

(b) The solution set is illustrated as shown below.

13



In the diagram AB, DC and FE are parallel. BC is parallel to GF. $G\hat{B}C = 60°$ and $B\hat{A}D = 80°$

Find

(a) $B\hat{G}D$.

(b) $A\hat{D}G$.

(c) $D\hat{E}F$

Suggested solution

13 (a) $B\hat{G}D = 180° - 60° = \mathbf{120°}$ (Allied ∠'s)

$= 40°$

(c) $D\hat{E}F = 80°$ (Z ∡'s)

14 Given that $r = 9 \times 10^6$, evaluate, leaving the answers in standard form.

(a) $2r$

(b) r^2

(c) $\sqrt{r}$

<u>*Suggested solution*</u>

14 (a) $2r = 2 \times 9 \times 10^6$

$= 18 \times 10^6$

$= 1{,}8 \times 10^1 \times 10^6$

$= 1{,}8 \times 10^{1+7}$

$= 1{,}8 \times 10^7$

(b) $r^2 = (9 \times 10^6)^2$

$= (9 \times 10^6) \times (9 \times 10^6)$

$= 9 \times 9 \times 10^6 \times 10^6$

$= 81 \times 10^{6+6}$

$= 8{,}1 \times 10^1 \times 10^{12}$

$= 8{,}1 \times 10^{1+12}$

$= \mathbf{8{,}1 \times 10^{13}}$

(c) $\sqrt{r} = \sqrt{9 \times 10^6}$

$= \sqrt{9} \times \sqrt{10^6}$ since $\sqrt{mn} = \sqrt{m}\sqrt{n}$

$= 3 \times (10^6)^{\frac{1}{2}}$

$= 3 \times 10^{6 \times \frac{1}{2}}$

$= 3 \times 10^3$

15 The table shows the sizes of shoes worn by pupils in a class

shoe size	5	6	7	8	9
frequency	6	14	12	8	2

Find

(a) the total number of pupils in the class,

(b) the modal shoe size,

(c) the median shoe size.

Suggested solution

15 (a) Total number of pupils = $6 + 14 + 12 + 8 + 2 = 42$

(b) *Size 6*

(c) *Size 7*

16 The equation of a straight line, l, is $3x - 5y = 30$.

Find

(a) the gradient of the line l,

(b) the equation of a line parallel to line l passing through a point $(-5; 3)$, in the form $y = mx + c$.

Suggested solution

16 (a) $3x - 5y = 30,$ rearranging the equation gives.

$$3x = 30 + 5y$$

$$5y = 3x - 30$$

$$y = \frac{3}{5}x - \frac{30}{5}$$

$$y = \frac{3}{5}x - 6 \qquad \therefore \qquad \text{Gradient} = \frac{3}{5}$$

(b) Recalling that, parallel lines have equal gradients, we have.

$$\frac{y-3}{x-(-5)} = \frac{3}{5}$$

$$y - 3 = \frac{3}{5}(x + 5). \qquad \text{expanding the brackets termwise}$$

$$y - 3 = \frac{3}{5}x + \frac{3}{5}\times 5$$

$$y - 3 = \frac{3}{5}x + 3$$

$$y = \frac{3}{5}x + 6, \qquad \text{as required.}$$

17 The scale of a map is given as 1: 250 000.

Find

(a) the distance on the ground, in km, represented by a length of 5 cm on the map.

(b) the actual area in km^2, represented by an area of 6 cm^2 on the map.

Suggested solution

17 (a)

$$1\ cm = 250\ 000\ cm$$
$$= 2\ 500\ m$$
$$= 2{,}5\ km$$
$$1\ cm = 2{,}5\ km$$
$$5\ cm = 5 \times 2{,}5\ km$$
$$= \mathbf{12,5\ km}$$

(b)

$$\text{Scale factor} = 1 : 2{,}5$$
$$\text{Area scale factor} = 1^2 : 2{,}5^2$$

So, $1\ cm^2 = 6{,}25\ km^2$

and $6\ cm^2 = 6 \times 6{,}25\ km^2$

$$= \mathbf{37,5\ km^2}$$

18 The size of each interior angle of a regular polygon is 135°.

(a) Find

(i) the size of each exterior angle.

(ii) the order of rotational symmetry of the regular polygon.

(b) State the special name of the regular polygon.

Suggested solution

18 (a) (i) Size of each exterior angle $= 180° - 135° = \mathbf{45°}$

(ii) Order of rotation $= \frac{360°}{45°} = \mathbf{8}$

(b) **Octagon**

19	Simplify $\frac{1}{a^2 - 3a + 2} \div \frac{1}{1-a}$

<u>*Suggested solution*</u>

19 $$\frac{1}{a^2 - 3a + 2} \div \frac{1}{1-a} = \frac{1}{a^2 - a - 2a + 2} \times \frac{1-a}{1},$$ factorising denominator

$$= \frac{1-a}{a(a-1) - 2(a-1)}$$

$$= \frac{-(a-1)}{(a-1)(a-2)}$$

$$= \frac{-1}{a-2}$$

$$= \frac{(-1)}{(-1)} \times \frac{(-1)}{(a-2)}$$

$$= \frac{1}{2-a}$$

20 A motorist left Masvingo for Beitbridge at 2102. The motorist spent 1 hour 30 minutes mending a puncture and 3 hours driving. The motorist's average speed for the journey was 64 km/h.

(a) Express 2102 as a time on the 12 hour clock.

(b) Find the arrival time in Beitbridge in 24 hour notation.

(c) Calculate the distance between Masvingo and Beitbridge.

<u>*Suggested solution*</u>

20 (a) $9.02pm$

(b) 22 32

(c) Distance = Speed × Total Time

$$= 64 \frac{km}{hr} \times 4\frac{1}{2}\ hrs$$

$$= \mathbf{288\ km}$$

21 The matrix $\mathbf{A} = \begin{pmatrix} -2 & 14 \\ 2 & x \end{pmatrix}$ and $|\mathbf{A}| = -2$.

(a) Find the value of x

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

<u>*Suggested solution*</u>

21 (a)

$|A| = -2$

$\left|\begin{pmatrix} -2 & 14 \\ 2 & x \end{pmatrix}\right| = -2$

$-2x - 2 \times 14 = -2$

$-2x - 28 = -2$

$-2x = 28 - 2$

$-2x = 26$

$x = -13$

(b) $A = \begin{pmatrix} -2 & 14 \\ 2 & -13 \end{pmatrix}$

$A^{-1} = \frac{1}{-2}\begin{pmatrix} -13 & -14 \\ -2 & -2 \end{pmatrix}$

$= \frac{1}{2}\begin{pmatrix} 13 & 14 \\ 2 & 2 \end{pmatrix}$

$= \begin{pmatrix} 6.5 & 7 \\ 1 & 1 \end{pmatrix}$

---

22 (a) Given that $\log_b M = x$, express M in terms of b and x.

(b) Evaluate

(i) $\log_4 \frac{1}{64}$

(ii) $\frac{\log 81}{\log 27}$

Suggested solution

22 (a) $\log_b M = x \implies M = b^x$ by definition of Theorem of logarithms

(b) (i) $\log_4 \frac{1}{64} = \log_4 \frac{1}{4^3}$,

$= \log_4 4^{-3}$

$= -3 \times \log_4 4$, recalling that $\log_a b^c = c \times \log_a b$

$= -3 \times 1$, since $\log_4 4 = 1$.

$= -3$

(ii) $\frac{\log 81}{\log 27} = \frac{\log 3^4}{\log 3^3}$

$= \frac{4 \times \log 3}{3 \times \log 3}$

$= \frac{4}{3}$

$= 1\frac{1}{3}$

23 Two unbiased coins, coin 1 and coin 2 are tossed and the outcomes recorded in a table

(a) Complete the outcome table given, where H is a head and T is a tail

		Coin 1	
		H	T
Coin 2	H	HH	
	T		TT

(b) Using the table or otherwise find the probability of getting

(i) 2 heads.

(ii) different outcomes.

(iii) at least one tail.

Suggested solution

23 (a) The completed table of outcomes is shown below,

		Coin 1	
		H	T
Coin 2	H	HH	TH
	T	HT	TT

(b) (i) P(2 Heads) $= P(HH) = \frac{1}{4}$

(ii) P(Different outcomes) $= P(TH) + P(HT) = \frac{1}{4} + \frac{1}{4}$

$$= \frac{1}{2}$$

(iii) P(At least one tail) $= P(TT) + P(TH) + P(HT)$

$$= \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$$

$$= \frac{3}{4}$$

24 (a) On a certain day, US$100 was exchanged for R880

Calculate the equivalent value of R165 in US$ on that day.

(b) An object starts from rest and accelerates uniformly until its speed is 90 km/h in 5 seconds.

(i) Express 90 km/h in m/s.

(ii) Calculate the acceleration of the object in m/s^2.

Suggested solution

24 (a) Let US$X be the equivalent value of R165 on that day.

US$100: R880

US$X : R165, by *Simple proportion.*

thus, $\frac{X}{100} = \frac{165}{880}$

$$X = 100 \times \frac{165}{880}$$

$$X = 18,75$$

Hence, **US$18,75** is equivalent to **R165.**

(b) (i) $90 \text{ km/h} = 90 \times \frac{1\,000}{3\,600} \text{ m/s}$

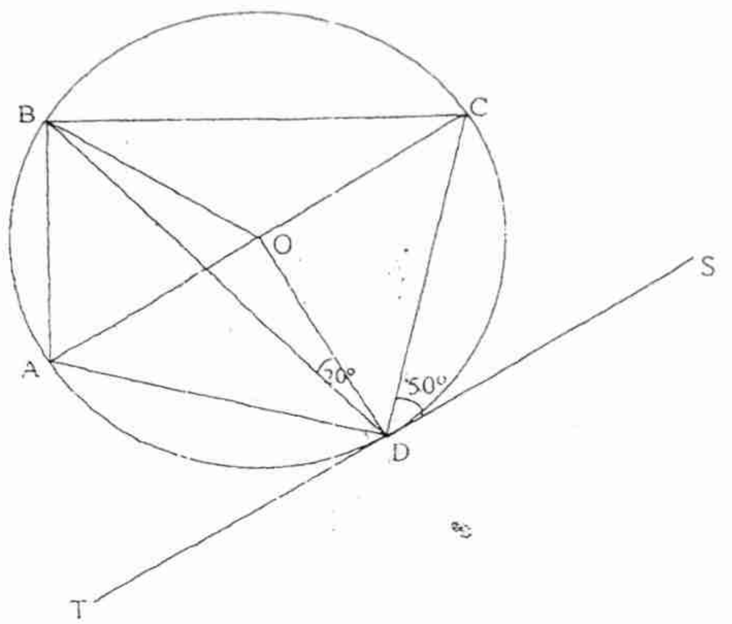
$$= \mathbf{25 \text{ m/s}}$$

(ii) **Acceleration** $= \frac{\text{velocity}}{\text{time}}$

$$= \frac{25 \text{ m/s}}{5 \text{ s}}$$

$$= \mathbf{5 \text{ m/s}^2}$$

25



In the diagram, points A, B, C and D are on the circumference of a circle with centre O. $C\hat{D}S = 50°$ and $B\hat{D}O = 20°$. Line TS is a tangent to the circle at D.

Calculate

(a) $D\hat{B}C$.

(b) $D\hat{O}C$.

(c) $O\hat{D}C$

(d) $A\hat{B}D$.

(e) $D\hat{A}C$.

Answer (a) $D\hat{B}C$ = 50° [1]

(b) $D\hat{O}C$ = 100° [1]

(c) $O\hat{D}C$ = 40° [1]

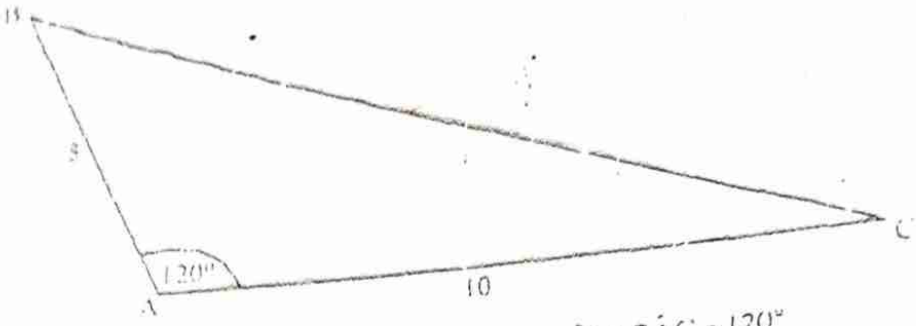
(d) $A\hat{B}D$ = 40° [1]

(e) $D\hat{A}C$ = 50° [1]

27 (a) Point Q is on a bearing of S35°E from point P.

Calculate the three figure bearing of P from Q.

(b)



In the diagram AB = 5 cm, AC = 10 cm and $B\hat{A}C = 120°$

Using as much of the information given below as is necessary, calculate the

(i) area of triangle ABC.

(ii) length of BC, leaving the answer in surd form.

($\tan 60° = 1,73$ $\sin 60° = 0,86$ $\cos 60° = 0,50$)

Suggested solution

27 (a)

The three figure bearing of P from Q = $360^0 - 35^0 = 325^0$

(b) (i) Area of triangle ABC $= \frac{1}{2} \times b \times c \times \sin A$

$= \frac{1}{2} \times 10\ cm \times 5\ cm \times \sin 120^0$

$= 25\ cm^2 \times \sin 60^0$

$= 25 \times 0{,}86\ cm^2$

$= \mathbf{21{,}5\ cm^2}$

(ii) $BC^2 = b^2 + c^2 - 2bc \times \text{Cos}120°$, using the ***Cosine Rule***.

$= 10^2 + 5^2 - 2 \times 10 \times 5 \times (-\text{Cos}\ 60°)$

$= 125 - 100 \times (-0{,}5)$

$= 125 + 100 \times 0{,}5$

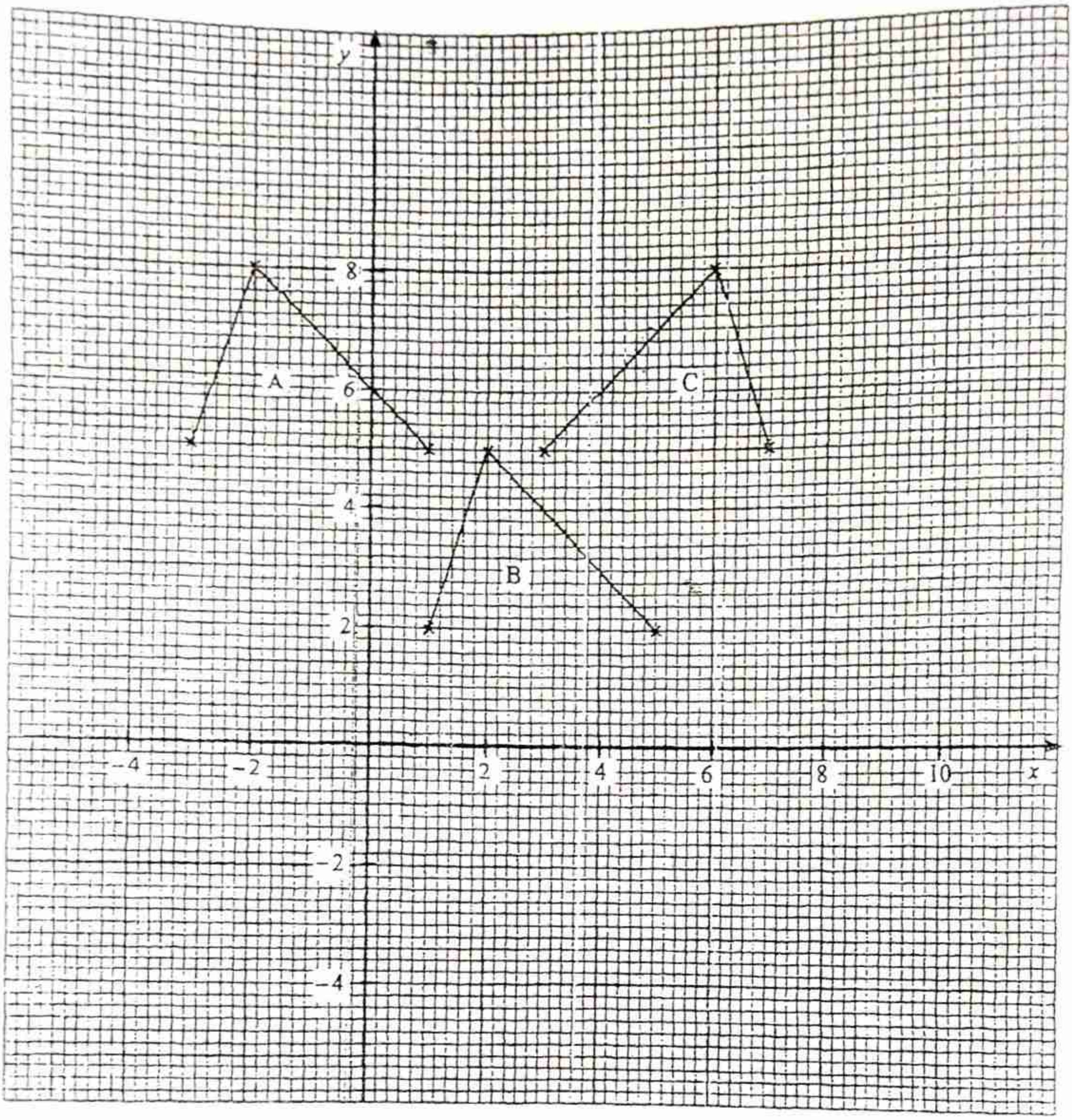
$= 175$

$BC = \sqrt{175}$

$= \sqrt{25 \times 7}$ recalling that $\sqrt{m \times n} = \sqrt{m} \times \sqrt{n}$

$= \sqrt{25} \times \sqrt{7}$

$= 5\sqrt{7}$



The diagram shows triangles A, B and C.

28 (a) Triangle B is the image of A under a Translation $T = \begin{pmatrix} p \\ q \end{pmatrix}$

(i) State the values of p and q

(ii) Find $|T|$

(b) Triangle C is the image of triangle A under a transformation M.

Describe fully transformation M.

Suggested solution

28 (a) (i) $p = 4$ and $q = -3$

(ii) $|T| = \sqrt{4^2 + (-3)^2}$

$= \sqrt{16 + 9}$

$= \sqrt{25}$

$= 5$

(b) **Reflection, in the line $x = 2$.**

Surname	Forename(s)	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS

PAPER 1

4008/1

NOVEMBER 2015 SESSION

2 hours 30 minutes

Candidates answer on the question paper.
Additional materials:
Geometrical instruments

Allow candidates 5 minutes to count pages before the examination.

This booklet should not be punched or stapled and pages should not be removed.

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and your Centre number and Candidate number on the top right corner of every page of this paper.

Answer **all** questions.
Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.
Write your answers in the spaces provided on the question paper using **black** or **blue** pens.
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.
Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

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

This question paper consists of 28 printed pages.

[Turn over

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

1 **(a)** Find the value of $\frac{8}{0,04}$.

(b) Simplify $1\frac{1}{2} - \frac{4}{7} \div \frac{2}{3}$ giving the answer as a fraction in its simplest form.

Suggested solution

1 (a) $\frac{8}{0.04} = \frac{8 \times 100}{0.04 \times 100}$

$= \frac{800}{4}$

$= 200$

(b) $1\frac{1}{2} - \frac{4}{7} \div \frac{2}{3} = \frac{3}{2} - \left(\frac{4}{7} \times \frac{2}{3}\right)$

$= \frac{3}{2} - \frac{6}{7}$

$= \frac{21 - 12}{14}$

$= \frac{9}{14}$

Answer (a) 200

(b) $\frac{9}{14}$

2 Given that $p = -4$, $q = 3$ and $r = -1$, evaluate

(a) $\frac{p+q}{r}$.

(b) $\sqrt{p^2q - r}$.

Suggested solution

2 (a) $\frac{p+q}{r} = \frac{-4+3}{-1} = \frac{-1}{-1} = 1$

(b) $\sqrt{p^2q - r} = \sqrt{(-4)^2 \times 3 - (-1)}$

$= \sqrt{16 \times 3 + 1} = \sqrt{49} = 7$

Answer (a) 1

(b) 7

3 In an athletics competition, under 20 boys compete in a 5 000 m race, while under 16 boys compete in a 3 000 m race.

(a) Calculate the difference in the distances they run giving the answer in standard form.

(b) A lap is 400 m long.

Find the number of laps in the 5 000 m race.

Suggested solution

3 (a) Difference in distance $= 5\ 000\ \text{m} - 3\ 000\ \text{m}$

$= 2\ 000\ \text{m}$

$= 2 \times 10^3\ \text{m}$

Number of laps $= \dfrac{5\ 000\ \text{m}}{400\ \text{m}}$

$= \dfrac{50}{4}$

$= 12\frac{1}{2}$ laps

Answer (a) 2×10^3 m

(b) $12\frac{1}{2}$ laps

4 It is given that $\overrightarrow{OP} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$ and $\overrightarrow{OQ} = \begin{pmatrix} 12 \\ -5 \end{pmatrix}$ where O is the origin.

(a) Express $\overrightarrow{PQ}$ as a column vector.

(b) Find

(i) $|\overrightarrow{OQ}|$,

(ii) the co-ordinates of M, the midpoint of PQ.

Suggested solution

4 (a)

$$\overline{PQ} = \overline{OQ} - \overline{OP}$$
$$= \begin{pmatrix} 12 \\ -5 \end{pmatrix} - \begin{pmatrix} -2 \\ 7 \end{pmatrix}$$
$$= \begin{pmatrix} 14 \\ -12 \end{pmatrix}$$

(b) (i)

$$|\overline{OQ}| = \sqrt{12^2 + (-5)^2}$$
$$= \sqrt{144 + 25}$$
$$= \sqrt{169}$$
$$= 13$$

(ii) Midpoint coordinates $= \left(\frac{-2+12}{2} ; \frac{7+(-5)}{2}\right)$

$$= \left(\frac{10}{2} ; \frac{2}{2}\right)$$
$$= (5 ; 1)$$

Answer	**(a)**		$\begin{pmatrix} 14 \\ -12 \end{pmatrix}$
	(b)	**(i)**	13
		(ii)	(5 ; 1)

---

5 (a) Express $1 \times 3^5 + 2 \times 3^3 + 3$ as a number in base 3.

(b) Convert 101_{10} to a number in base 9.

(c) Evaluate $203_7 - 154_7$ giving the answer in base 7.

Suggested solution

5 (a) $1 \times 3^5 + 2 \times 3^3 + 3 = 1 \times 3^5 + 0 \times 3^4 + 2 \times 3^3 + 0 \times 3^2 + 1 \times 3^1 + 0 \times 3^0$

$$= 102010_3$$

(b)

9	101		
9	11	r	2
9	1	r	2
	0	r	1

Thus, $101_{10} = 122_9$

(c)

$$\begin{array}{r} 203_7 \\ -154_7 \\ \hline 16_7 \end{array}$$

Answer (a) 102010_3

(b) 122_9

(c) 16_7

6 Solve the simultaneous equations:

$2x + 3y = 28$

$x + 5y = 35$

Suggested solution

Method 1. (Elimination Method)

$2x + 3y = 28$ ——— ① × 1

$x + 5y = 35$ ——— ② × 2

$2x + 3y = 28$ ——— ③

$2x + 10y = 70$ ——— ④

④ − ③: $7y = 42$

$y = 6$

Using ③, $2x + 3 \times 6 = 28$

$2x + 18 = 28$

$2x = 28 - 18$

$2x = 10$

∴ $x = 5$

Answer $x = 5$ and $y = 6$

Method 2. (Substitution Method)

$2x + 3y = 28$ ——— ①

$x + 5y = 35$ ——— ②

Using ②, $x + 5y = 35$

$x = 35 - 5y$

or

substituting into ①: $2(35 - 5y) + 3y = 28$

$70 - 10y + 3y = 28$

$70 - 7y = 28$

$10 - y = 4$

$y = 6$

Using ② $\quad x + 5 \times 6 = 35$

$$x + 30 = 35$$

$$x = 5$$

Answer $\quad x = 5$ **and** $y = 6$

---

7 Solve the equation:

$$\frac{2y+5}{3y-2} = \frac{9}{4}$$

Suggested solution

7. $\dfrac{2y+5}{3y-2} = \dfrac{9}{4}$, cross multiplication by denominators gives,

$4(2y+5) = 9(3y-2)$, removing brackets, we get,

$8y + 20 = 27y - 18$, collecting y's & constants to one side.

$18 + 20 = 27y - 8y$ simplifying terms

$38 = 19y$

$\therefore \quad y = 2$

Answer $\quad y = 2$

---

8 Make a the subject of the formula $\dfrac{1}{a} + \dfrac{1}{b} = 3$.

Suggested solution

8 (a) Method 1

$\dfrac{1}{a} + \dfrac{1}{b} = 3$ cross multiplication by common denominator ab

$\dfrac{ab}{a} + \dfrac{ab}{b} = 3ab$, simplifying term by term, gives,

$b + a = 3ab$, collecting a's to one side

$$b = 3ab - a, \qquad \text{factorising } a,$$

$$b = a(3b - 1), \qquad \text{dividing both sides by } 3b - 1$$

$$a = \frac{b}{3b - 1}$$

Method 2

$$\frac{1}{a} + \frac{1}{b} = 3 \qquad \text{rearranging the equation}$$

$$\frac{1}{a} = 3 - \frac{1}{b} \qquad \text{[illegible] a fraction gives,}$$

$$\frac{1}{a} = \frac{3b - 1}{b} \qquad \text{inverting fractions}$$

$$\frac{a}{1} = \frac{b}{3b - 1}$$

so $$a = \frac{b}{3b - 1}$$

Answer $a = \dfrac{b}{3b - 1}$

---

9 When baking scones, a baker mixes **six** cups of flour, **one** cup of sugar, **two** cups of water and **half** a cup of milk, together with other ingredients.

(a) Express the quantities of flour, sugar, water and milk as a ratio in its simplest form.

(b) Calculate the number of cups of water needed if the baker uses four cups of flour.

Suggested solution

9 (a) $6 : 1 : 2 : \frac{1}{2}$

$12 : 2 : 4 : 1$

(b) Let x be the number of cups of water needed

i.e. $$\frac{x}{4} = \frac{4}{12} \qquad \Rightarrow \qquad \frac{x}{4} = \frac{1}{3}$$

$x = \frac{4}{3}$

$x = 1\frac{1}{3}$

Answer	(a)	12:2:4:1
	(b)	$1\frac{1}{3}$

10 The probability that Sihle will bring a calculator is $\frac{5}{6}$ while the probability that Yemurai will bring a calculator is $\frac{3}{5}$.

Giving the answer as a fraction in its simplest form, find the probability that.

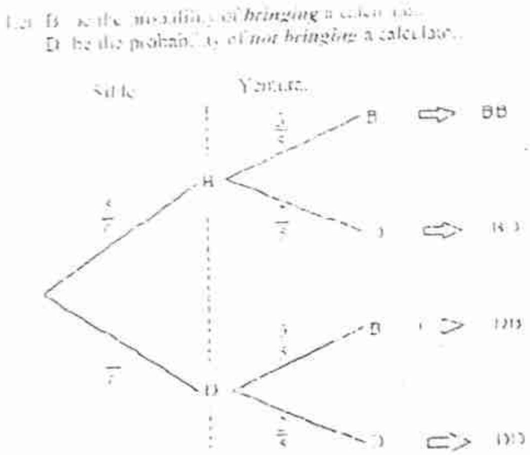
(a) Sihle will **not** bring a calculator for the lesson,

(b) only one of them will bring a calculator for the lesson.

Suggested solution

10 (a) P(Sihle will not bring a calculator) = $1 - \frac{5}{6} = \frac{1}{6}$

(b) A probability tree diagram is used to illustrate the solution as shown below.



P(only one bring calculator) = P(Sihle B and Yemurai D or Sihle D and Yemurai B)

= P(BD) + P(DB),

$= \frac{5}{6} \times \frac{2}{5} + \frac{1}{6} \times \frac{2}{5}$

$= \frac{1}{3} + \frac{1}{10}$

$= \frac{10 + 3}{30}$

$= \frac{13}{30}$

Answer	(a)	$\frac{1}{6}$
	(b)	$\frac{13}{30}$

---

11 (a) Write down the special name given to a polygon with five sides.

(b) State, for a regular five sided polygon,

(i) the number of lines of symmetry,

(ii) the order of rotational symmetry.

<u>Suggested solution</u>

11 (a) Pentagon

(b) (i) 5

(ii) 5

Answer	(a)	Pentagon	
	(b)	(i)	5
		(ii)	5

---

12 Solve the inequality $2 - x \leq 2x - 1 < 11$, giving your answer in the form $a \leq x < b$, where a and b are integers.

<u>Suggested solution</u>

12. $2 - x \leq 2x - 1 < 11$, Separating inequalities we get

$2 - x \leq 2x - 1$ and $2x - 1 < 11$

$2 + 1 \leq 2x + x$ $2x < 11 + 1$

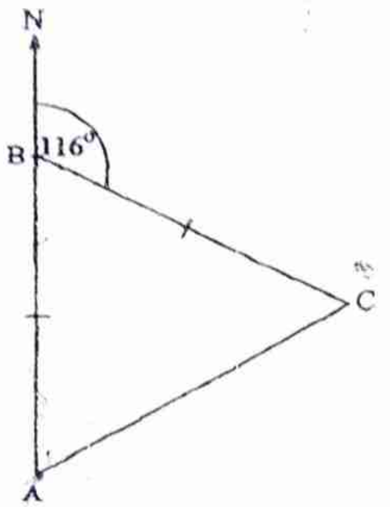
$3 \leq 3x$ $\qquad 2x < 12$

$1 \leq x$ $\qquad x < 6,$ $\qquad$ combining inequalities,

$1 \leq x < 6$

Answer $1 \leq x < 6$

13



In the diagram, A, B and C are positions of 3 boreholes where BA = BC. The borehole at C has a bearing of 116° from the borehole at B.

Calculate

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

(b) the bearing of the borehole at A from the borehole at C.

Suggested solution

13 (a) $A\hat{C}B = \dfrac{116^0}{2} = 58^0$

(b) Bearing of the borehole at A form borehole at C $= 180^0 + (116^0 - 68^0)$

$= 228^0$

Answer **(a) 58**

(b) 228

14 (a) If $\log_{10} 7 = 0,8451$, evaluate

(i) $\log_{10} 0,07$.

(ii) $\log_{10} 49$.

(b) Evaluate $\log_2 \left(\frac{1}{64}\right)$.

Suggested solution

14 (a) (i) $\log_{10} 0,07 = \log_{10} \frac{7}{100}$

$= \log_{10}7 - \log_{10}100$

$= \log_{10}7 - \log_{10}10^2$

$= \log_{10}7 - 2\log_{10}10$ But $\log_{10}10 = 1$

$= 0,8451 - 2$

$= -1,1549$

(ii) $\log_{10} 49 = \log_{10}7^2$

$= 2 \times \log_{10}7$

$= 2 \times 0,8451$

$= 1,6902$

(b) $\log_2 \left(\frac{1}{64}\right) = \log_2 \left(\frac{1}{2^6}\right)$

$= \log_2 2^{-6}$

$= -6 \times \log_2 2$ recall that $\log_2 2 = 1$

$= -6 \times 1$

$= -6$

Answer	(a)	(i)	$-1,1549$
		(ii)	$1,6902$
	(b)		-6

15 The table shows part of Ms Dube's payslip for a particular month.

Earnings	$	Deductions	$
transport allowance	100,00	pension contribution	6,00
housing allowance	129,00	union subscription	10,00
		medical aid	8,00
		Insurance	17,50
basic salary	275,00	total deductions	______
net salary	______		

(a) Calculate

(i) the total deductions,

(ii) the net salary.

(b) Express the pension contribution as a percentage of her basic salary.

Suggested solution

15. (a) (i) Total deductions = \$6 + \$10 + \$8 + \$17,50 = \$41.50

(ii) Net salary = Gross salary − Total deductions

= \$100 + \$ 129 + \$275− \$14,50

= \$504,00− \$ 41,50

= \$462,50

(b) Pension contribution percentage = $\frac{6}{275} \times 100\%$

$= 2\frac{2}{11}\%$

$= 2,1818181818181 8\%$

$= 2,18\%$ (3 significant figures)

Answer (a) (i) \$41,50

(ii) \$462.50

(b) 2, 18%

16 (a) Evaluate $81^{\frac{3}{4}}$.

(b) Find x if $9^{x-1} \times 3^{3x-2} = 3$.

Suggested solution

16 (a)

Method 1

$81^{\frac{3}{4}} = (\sqrt[4]{81})^3$

$= (3)^3$

$= 3 \times 3 \times 3$

$= 27$

Method 2

$81^{\frac{3}{4}} = (3^4)^{\frac{3}{4}}$

$= 3^{4 \times \frac{3}{4}}$

$= 3^3 = 3 \times 3 \times 3$

$= 27$

(b)

$9^{x-1} \times 3^{3x-2} = 3$

$(3^2)^{x-1} \times 3^{3x-2} = 3$ but $(x^a)^b = x^{a \times b}$

$3^{2 \times (x-1)} \times 3^{3x-2} = 3,$ noting that $x^a \times x^b = x^{a+b}$

$3^{(2x-2)+(3x-2)} = 3^1,$ equating powers of base 3

$2x - 2 + 3x - 2 = 1$

$5x - 4 = 1,$

$x = 1$ by inspection.

Answer (a) 27

(b) $x = 1$

17 Given that y is inversely proportional to $(x-1)^2$ and that $y = 2$ when $x = 7$,

(a) express y in terms of x,

(b) calculate the values of x when $y = 8$.

Suggested solution

17 (a) $y \propto \frac{1}{(x-1)^2} \Rightarrow y = \frac{k}{(x-1)^2}$, where k is a constant

When $x = 7$; $y = 2$

i.e $2 = \frac{k}{(7-1)^2}$, or $2 = \frac{k}{6^2}$,

So, $k = 2 \times 6^2$

$k = 72$

Hence, $y = \frac{72}{(x-1)^2}$, as required.

(b) Method 1

When $x = x$, $y = 8$

i.e $8 = \frac{72}{(x-1)^2}$, dividing by common factor 8,

$1 = \frac{9}{(x-1)^2}$, rearranging the equation,

$(x-1)^2 = 9$. taking square roots both sides.

$\sqrt{(x-1)^2} = \pm\sqrt{9}$

$x - 1 = \pm 3$

$x = 1 \pm 3$

Either $x = 1 - 3$ or $x = 1 + 3$

Thus $x = -2$ or $x = 4$

Method 2

when $x = x$, $y = 8$

i.e $8 = \frac{72}{(x-1)^2}$, dividing by common factor 8.

$1 = \frac{9}{(x-1)^2}$, rearranging the equation.

$(x-1)^2 = 9$. expanding brackets.

$(x-1)(x-1) = 9$

$x(x-1) - 1(x-1) = 9$

$x^2 - x - x + 1 = 9$

$x^2 - 2x + 1 - 9 = 0$

$x^2 - 2x - 8 = 0$, a quadratic in x

$x^2 - 4x + 2x - 8 = 0$, factorising terms,

$x(x-4) + 2(x-4) = 0$

Either $(x + 2)(x - 4) = 0$

i.e. $x + 2 = 0$ or $x - 4 = 0$

$x = -2$ or $x = 4$

Answer (a) $y = \frac{72}{(x-1)^2}$,

(b) **Either** $x = -2$ **or** $x = 4$

18 A luxury coach leaves Bulawayo for Harare every morning at 7.30 am and arrives in Harare at 1.00 pm.

(a) Express the departure time as a time in the 24 hour notation.

(b) Calculate the total time taken to travel from Bulawayo to Harare.

(c) Calculate the average speed of the bus to the nearest whole number if the distance from Bulawayo to Harare is 439 km.

Suggested solution

18 (a) 07 30

(b) Total time taken = Arrival time – Departure time

= 13 00 – 07 30

= 5 30

= 5 hours 30 mins

(c) $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$

$= \frac{439 \text{ km}}{5,5 \text{ hr}}$

$= 79,81818181818182$ km/hr

$= 80$ km/hr (nearest whole number)

Answer (a) **07 30**

(b) **5hr30mins**

(c) **80 km/hr**

19 **Factorise completely**

(a) $cg - dg - ch + dh$.

(b) $5d^2 - d - 4$.

Suggested solution

19 (a) $cg - dg - ch + dh = g(c-d) - h(c-d)$

$= (c-d)(g-h)$

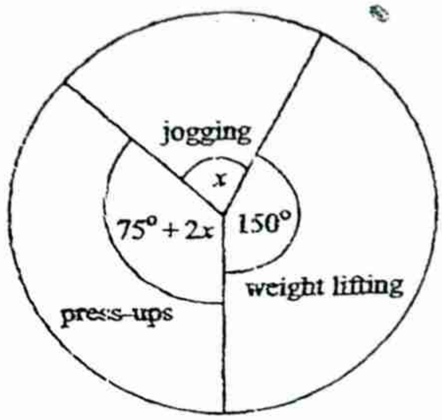
(b) $5d^2 - d - 4 = 5d^2 - 5d + 4d - 4$

$= 5d(d-1) + 4(d-1)$

$= (5d+4)(d-1)$

Answer (a) $(c-d)(g-h)$
(b) $(5d+4)(d-1)$

20



The pie chart shows the distribution of an athlete's daily exercise programme.

(a) Calculate the value of x.

(b) If the athlete spent 18 minutes jogging, calculate

(i) the time the athlete spent on weight lifting,

(ii) the total time spent exercising.

Suggested solution

20 (a) $x + 150° + 75° + 2x = 360°$

$3x + 225° = 360°$

$x + 75° = 120°$

$x = 45°$

(b) (i) Let w be the time (in minutes) spent on weight lifting

$18 \equiv 45°$

$w \equiv 150°$

i.e $\frac{w}{18} = \frac{150°}{45°}$

or $w = 18 \times \frac{10}{3}$

$\Longrightarrow$ $w = 60$ minutes

(ii) total time spent = time for jogging + time for press-ups + time for weight lifting

$= 18 + (30 + 2 \times 18) + 60$ minutes

$= 144$ mins

Answer	(a)		$x = 45°$
	(b)	(i)	60 mins
		(ii)	144 mins

21

In the diagram, PQR is an isosceles triangle such that PQ = PR = 7 cm and $P\hat{R}Q = 35°$.

Using as much of the information given below as is necessary, calculate

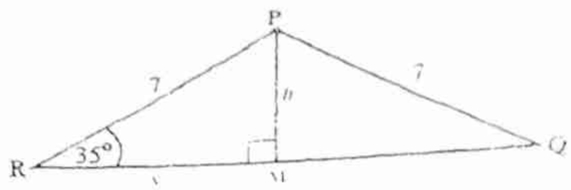
(a) QR,

(b) the area of triangle PQR.

sin35° = 0,57	**cos35° = 0,82**	**tan35° = 0,70**
sin70° = 0,94	**cos70° = 0,34**	**tan70° = 2,75**

Suggested solution

21 (a)



Let M be the midpoint of QR
Let x be the distance MR
Let h be the height of triangle MPR

$$\frac{x}{7} = \cos 35°$$

$$x = 7 \times \cos 35°$$

$$x = 7 \times 0{,}82$$

$$x = 5{,}74$$

Hence, $QR = 2 \times 5{,}74$

$$= 11{,}48\ cm$$

(b) $Area = 2 \times \frac{1}{2}\, ab \sin c$

$$= 5{,}74 \times 7 \times \sin 35°$$

$$= 23{,}0224692096\ cm^2$$

Answer	(a)	11,48 cm
	(b)	23,0 cm^2

22 It is given that,

$\xi = \{x : 31 \le x < 37$ **and x is an integer**$\}$ **has subsets** P, Q and R such that

$P = \{x : x$ **is a multiple of** $3\}$,

$Q = \{x : x$ **is a factor of** $99\}$ **and**

$R = \{x : x$ is a prime number$\}$.

(a) List all the elements of R.

(b) Write down $n(P \cup R)'$.

(c) List all elements of $(P \cup Q \cup R)'$.

Suggested solution

22 $\xi = \{31;\ 32;\ 33;\ 34;\ 35;\ 36\}$; $P = \{33;\ 36\}$; $Q = \{33\}$ and $R = \{31\}$

(a) $R = \{31\}$

(b) $P \cup R = \{31;\ 33;\ 36\}$; $(P \cup R)' = \{32;\ 34;\ 35\}$

$n(P \cup R)' = 3$

(c) $(P \cup Q \cup R)' = \{32;\ 34;\ 35\}$

23 A map is drawn to a scale of 1 : 75 000.

(a) Calculate in km the actual distance between two towns which are 40 cm apart on the map.

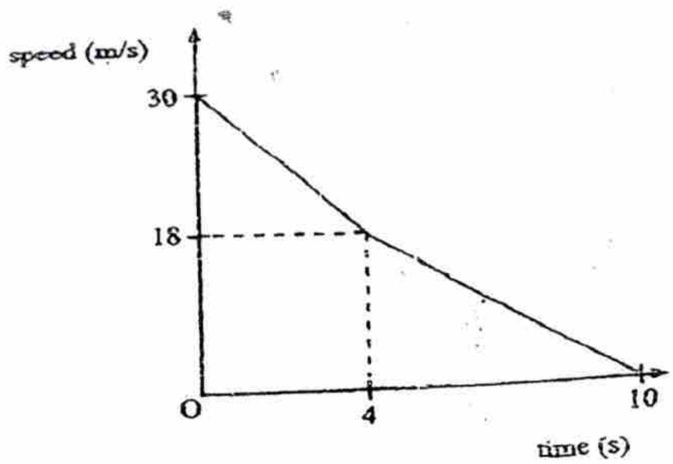
(b) An airport has an actual area of 22,5 km^2.

Calculate in cm^2 the area of the airport on the map.

Suggested solution

(a) 1 : 75 000
40 : more by simple proportion

34



In the diagram, a moving object decelerates from a speed of 30 m/s to a speed of 18 m/s in 4 seconds and further decelerates from a speed of 18 m/s to rest in 6 seconds.

Calculate

(a) the speed of the object after the first 2 seconds,

(b) the total distance covered by the object in the 10 seconds.

Solution

(a) $a = \frac{v-u}{t} = \frac{18-30}{4} \implies a = -3ms^{-2}$

$v = u + at$

$v = 30 + (-3)(2)$

$v = 30 - 6$

$= 24ms^{-1}$

(b) Distance = Area under the graph

= Area of triangle 1 + Area of rectangle + Area triangle 2

$= \frac{1}{2} \times 4 \times 12 + 18 \times 4 + \frac{1}{2} \times 6 \times 18$

$= 24 + 72 + 54$

$= 150\ m$

Answer (a) $24ms^{-1}$

(b) 150m

$\frac{40}{1} \times 75\,000$

$= 3\,000\,000\ cm$

$= \frac{3\,000\,000}{1\,000\,000}$

$= 3\ km$

(b) $1cm : \frac{75\,000\ cm}{1\,000\,000}$

$1cm^2 : 0{,}075km^2$

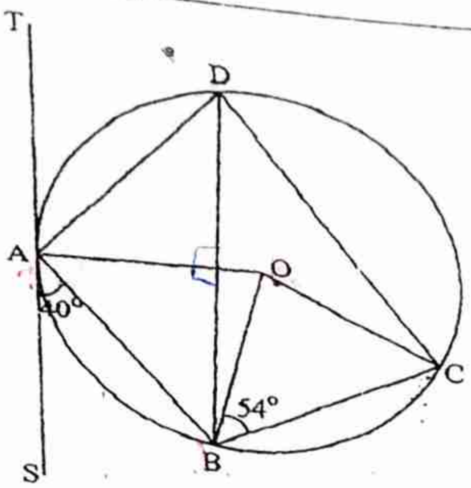
$1cm^2 : 0{,}005625km^2$

mnre: $22{,}5km^2$

$\frac{22{,}5\ km^2}{0{,}005625km^2} \times 1cm^2$

$= 4000cm^2$

Answer	(a)	3 km
	(b)	$4000cm^2$



In the diagram, O is the centre of the circle. TAS is a tangent to the circle at A. $B\hat{A}S = 40°$ and $O\hat{B}C = 54°$.

Calculate,

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

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

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

(d) reflex $A\hat{O}C$

Suggested solution

26 (a) $OAB = 90° - 40° = 50°$

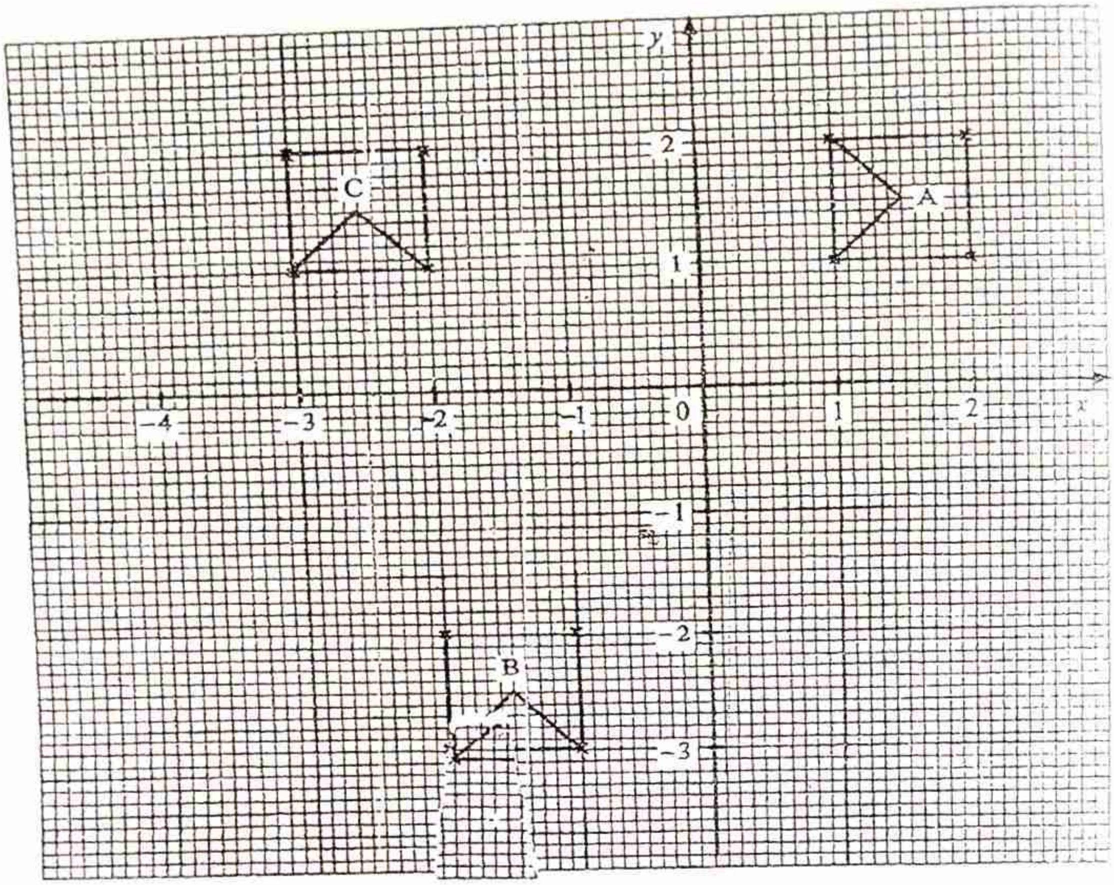
(b) $A\hat{O}B = 80°$

(c) $A\hat{D}C = 180° - (50° + 54°) = 76°$

(d) $reflex\ A\hat{O}C = 76°$

Answer		
	(a)	50°
	(b)	80°
	(c)	76°
	(d)	76°

25



The diagram shows three shapes A, B and C on a Cartesian plane.

(a) Describe completely the single transformation which maps shape A onto shape B.

(b) Shape B is mapped onto shape C by a transformation P. Describe fully the transformation P.

27 If $\mathbf{F} = \begin{pmatrix} 3 & x \\ -4 & -6 \end{pmatrix}$, $\mathbf{G} = \begin{pmatrix} 3 & -2 \\ 2 & -1 \end{pmatrix}$ and $\mathbf{H} = \begin{pmatrix} 7 \\ 1 \end{pmatrix}$,

find

(a) $\mathbf{F} + 3\mathbf{G}$ in terms of x,

(b) the value of x if the determinant of $\mathbf{F}$ is -14,

(c) $\mathbf{GH}$.

Suggested solution

27 (a)

$$F + 3G = \begin{pmatrix} 3 & x \\ -4 & -6 \end{pmatrix} + 3\begin{pmatrix} 3 & -2 \\ 2 & -1 \end{pmatrix}$$

$$= \begin{pmatrix} 3 & x \\ -4 & -6 \end{pmatrix} + \begin{pmatrix} 9 & -6 \\ 6 & -3 \end{pmatrix}$$

$$= \begin{pmatrix} 12 & x-6 \\ 2 & -9 \end{pmatrix}$$

(b)

$$\text{Det}(F) = -14$$

$$3(-6) - x(-4) = -14$$

$$-18 + 4x = -14$$

$$4x = 18 - 14$$

$$4x = 4$$

$$x = 1$$

(c)

$$GH = \begin{pmatrix} 3 & -2 \\ 2 & -1 \end{pmatrix}\begin{pmatrix} 1 \\ 7 \end{pmatrix}$$

$$= \begin{pmatrix} 3 \times 1 + (-2) \times 7 \\ 2 \times 1 + (-1) \times 7 \end{pmatrix}$$

$$= \begin{pmatrix} 3 - 14 \\ 2 - 7 \end{pmatrix}$$

$$= \begin{pmatrix} -11 \\ -5 \end{pmatrix}$$

Answer

(a) $\begin{pmatrix} 12 & x-6 \\ 2 & -9 \end{pmatrix}$

(b) $x = 1$

(c) $\begin{pmatrix} -11 \\ -5 \end{pmatrix}$

Surname	Forename(s)	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008/1

PAPER 1

JUNE 2015 SESSION 2 hours 30 minutes

Candidates answer on the question paper.
Additional materials:
Geometrical instruments

Allow candidates 5 minutes to count pages before the examination.

This booklet should not be punched or stapled and pages should not be removed.

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and your Centre number and Candidate number on the top right corner of every page of this paper.

Answer all questions.
Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.
Write your answers in the spaces provided on the question paper using **black** or **blue** pens.
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.
Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE

This question paper consists of 28 printed pages.

[Turn over

NEITHER MATHEMATICAL TABLES NOR SLIDE RULES NOR CALCULATORS MAY BE USED IN THIS PAPER

1 Express 0,0978

(a) correct to two decimal places,

(b) correct to 2 significant figures,

(c) in standard form.

Suggested Solution

1 (a) $0.0978 = 0.10$ (2 decimal places)

(b) $0.0978 = 0.098$ (2 significant figures)

(c) $0.0978 = 9{,}78 \times 10^{-2}$ (standard form)

Answer (a) 0.10 [1]
(b) 0.098 [1]
(c) $9{,}78 \times 10^{-2}$ [1]

2 **(a)** Evaluate $39{,}6 \div 0{,}09$.

(b) Simplify $\left(\frac{2}{3}-\frac{1}{2}\right)\times\frac{3}{4}$, giving the answer in its lowest terms.

Suggested Solution

2 (a)

$$39.6 \div 0.09 = \frac{39.6}{0.09} = \frac{39.6}{0.09} \times \frac{100}{100}$$

$$= \frac{3960}{9}$$

$$= 440$$

(b)

$$\left(\frac{2}{3}-\frac{1}{2}\right) \times \frac{3}{4} = \left(\frac{4-3}{6}\right) \times \frac{3}{4}$$

$$= \frac{1}{6} \times \frac{3}{4}$$

$= \frac{1}{2} \times \frac{1}{4}$

$= \frac{1}{8}$

Answer (a) 440 [1]

(b) $\frac{1}{8}$ [2]

---

3 A jet plane leaves Harare for Praia at 2323. The journey takes 5 hours 33 minutes and Praia's time is 2 hours behind Harare's time.

(a) Express 2323 in 12-hour notation.

(b) Find the time in Praia when the jet arrives.

Suggested Solution

3 (a) $2323 = 11.23pm$

(b)

	Harare time	2323
+	flight time	533
	Arrival time	0456
−	Harare time	2 00
	Praia time	0256

Answer (a) 11.23pm [1]

(b) 0256 [2]

---

4 **(a)** Write down $1\times2^4+1\times2^3+1\times2^1$ as a number in base 2.

(b) Given that $a=-3$, $b=3$ and $c=-1$,

evaluate $\left(\frac{c-a}{b-a}\right)^2$, giving the answer as a common fraction in its lowest terms.

Suggested Solution

4 (a) $1\times2^4+1\times2^3+1\times2^1 = 1\times2^4+1\times2^3+0\times2^2+1\times2^1+0\times2^0$

$= 11010_2$

(b) $$\left(\frac{c-a}{b-a}\right)^2 = \left(\frac{-1-(-3)}{3-(-3)}\right)^2 = \left(\frac{-1+3}{3+3}\right)^2$$

$$= \left(\frac{2}{6}\right)^2 = \left(\frac{1}{3}\right)^2$$

$$= \frac{1}{3} \times \frac{1}{3}$$

$$= \frac{1}{9}$$

Answer (a) 11010_2 [1]

(b) $\frac{1}{9}$ [2]

5 (a) Find $\sqrt[3]{0,027}$.

(b) The size of each interior angle of a regular polygon is $168°$.

Find the number of sides of the polygon.

Suggested Solution

5 (a) $$\sqrt[3]{0.027} = (0,027)^{\frac{1}{3}} = \left(\frac{27}{1\,000}\right)^{\frac{1}{3}}$$

$$= \left(\frac{3^3}{10^3}\right)^{\frac{1}{3}} = \left(\frac{3}{10}\right)^{3\times\frac{1}{3}}$$

$$= \frac{3}{10}$$

$$= \mathbf{0.3}$$

(b) $$(n-2)\times 180^0 = 168^0 n$$

$$180°n - 360^0 = 168^0 n$$

$$12°n = 360^0$$

$$\boldsymbol{n = 30\ sides}$$

6 Given that $\mathbf{a} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$.

(a) express $\mathbf{a} - \mathbf{b}$ as a column vector,

(b) find $|\mathbf{b}|$.

Suggested Solution

6 (a)

$$\vec{a} - \vec{b} = \begin{pmatrix} -1 \\ -2 \end{pmatrix} - \begin{pmatrix} -3 \\ -4 \end{pmatrix}$$

$$= \begin{pmatrix} -1 + 3 \\ -2 + 4 \end{pmatrix}$$

$$= \begin{pmatrix} 2 \\ 2 \end{pmatrix}$$

(b)

$$|\vec{b}| = \sqrt{(-3)^2 + (-4)^2}$$

$$= \sqrt{9 + 16}$$

$$= \sqrt{25}$$

$$= 5$$

Answer (a) $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$ [1]

(b) 5 [2]

7 A is a set of perfect square numbers less than 50 and B is a set of even numbers not greater than 20.

Given that the elements of sets A and B are whole numbers,

(b) find $n(A \cap B)$.

Suggested Solution

7 (a)

A = {1; 4 ; 9; 16 ; 25 ; 36 ; 49 }

B = {2; 4; 6; 8; 10; 12; 14; 16; 18; 20}

$A \cap B = \{4; 16\}$

$n(A \cap B) = 2$

Answer (a) $\{1\ 4 ; 9; 16 ; 25 ; 36 ; 49\}$ [2]
(b) 2

8 Solve the equation $\frac{3}{x} = x - 2$.

Suggested Solution

8

$$\frac{3}{x} = x - 2$$

$$3 = x(x - 2)$$

$$3 = x^2 - 2x$$

$$x^2 - 2x - 3 = 0$$

$$x^2 - 3x + x - 3 = 0$$

$$x(x - 3) + (x - 3) = 0$$

$$(x - 3)(x + 1) = 0$$

Either $x - 3 = 0$ or $x + 1 = 0$

$\therefore\ x = 3$ or $x = -1$

Answer $x = 3$ or $x = -1$ [3]

9 (a) If B is East of A, state the three figure bearing of A from B.

(b) Express 33,55° in degrees and minutes.

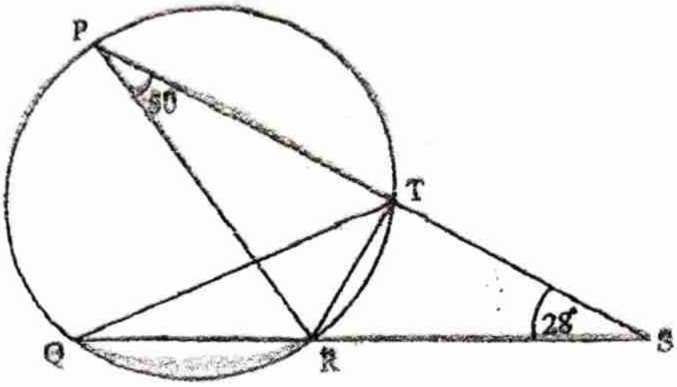
Suggested Solution

9 (a) 270°

(b) 33.55^0

Answer (a) 270 [1]
(b) 33.55^0 [2]

10



In the diagram P, Q, R and T are points on the circumference of a circle. PTS and QRS are straight lines. PR is a diameter, $Q\hat{S}P = 28°$ and $R\hat{P}S = 50°$.

Calculate (a) $P\hat{R}T$,

(b) $Q\hat{T}S$;

(c) $Q\hat{T}R$.

Suggested Solution

10 (a) $P\hat{R}T = 90^0$

(b) $Q\hat{T}S = 180^0 - (50^0 + 28^0) = 102^0$

(c) $Q\hat{T}R = 102 - 90 = 12^0$

Answer (a) $P\hat{R}T = 90^0$

(b) $Q\hat{T}S = 102^0$

(c) $Q\hat{T}R = 12^0$

11 **Solve the simultaneous equations:**

$$3x - y = 7 \;;$$
$$y = 5 - x$$

Suggested Solution

11 Method 1 (Substitution Method)

$$3x - y = 7 \quad \text{①}$$
$$y = 5 - x \quad \text{②}$$

Substituting ② into ①

$$3x - (5 - x) = 7$$
$$3x - 5 + x = 7$$
$$4x = 5 + 7$$
$$4x = 12$$
$$x = 3$$

Using ①, $3(3) - y = 7$

$$9 - y = 7$$
$$y = 2$$

Using ②, $y = 5 - 3$

$$y = 2$$

<u>Method 2 (Elimination Method)</u>

$3x - y = 7$ ____________ ①

$y = 5 - x$ ____________ ②

Rearranging ① and ②

$3x - y = 7$ ____________ ①

$\underline{x + y = 5}$ ____________ ②

①+②: $4x = 12$

$$x = 3$$

Using②, $3(3) - y = 7$

$$9 - y = 7$$
$$y = 2$$

Answer $x = 3$

$y = 2$

12	It is given that y varies directly as the square root of z. **(a)** Write down the equation connecting y, z and a constant k. **(b)** Find k when $y = 3$ and $z = 4$. **(c)** Find y when $z = 16$.

<u>Suggested Solution</u>

12 (a) $y \propto \sqrt{z} \implies y = k\sqrt{z}$, where k is a constant.

(b) When $y = 3,\ z = 4$

$3 = k\sqrt{4}$ or $3 = k \times 2$

$k = \frac{3}{2}$

(c) When $y = y$, $z = 16$

So; $y = \frac{3}{2} \times \sqrt{16}$

$= \frac{3}{2} \times 4$

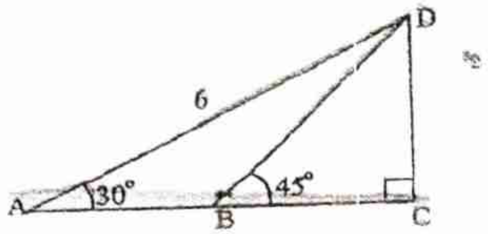
$= 6$

Answer (a) $y = k\sqrt{z}$ [1]

(b) $k = \frac{3}{2}$ [1]

(c) $y = 6$ [1]

3



Triangle ACD is right angled at C.

AD = 6 cm, $D\hat{B}C = 45°$ and $D\hat{A}C = 30°$. ABC is a straight line.

Using the information below, calculate

(a) CD,

(b) AB, giving the answer correct to 1 decimal place.

sin 30° = 0,50;	**cos 30° = 0,87;**	**tan 30° = 0,58;**
sin 45° = 0,71;	**cos 45° = 0,71;**	**tan 45° = 1,00;**

Suggested Solution

13 (a) $\sin 30° = \frac{CD}{6cm}$

Method 1

14 (a)

$$(2a)^{-2} \times 3a^2 = 2^{-2}a^{-2} \times 3a^2$$
$$= 2^{-2} \times 3 \times a^{-2} \times a^2$$
$$= \frac{3}{2^2} \times a^{-2+2}$$
$$= \frac{3}{4} \times a^0 = \frac{3}{4} \times 1$$
$$= \frac{3}{4}$$

Method 2

$$(2a)^{-2} \times 3a^2 = \frac{1}{(2a)^2} \times 3a^2$$
$$= \frac{3a^2}{2a \times 2a}$$
$$= \frac{3a^2}{2 \times 2 \times a \times a}$$
$$= \frac{3}{4}$$

(b)

$$\log 8 \div \log 4 = \frac{\log 8}{\log 4}$$
$$= \frac{\log 2^3}{\log 2^2}$$
$$= \frac{3\log 2}{2\log 2}$$
$$= \frac{3}{2}$$
$$= 1\frac{1}{2}$$

Answer (a) $\frac{3}{4}$

(b) $1\frac{1}{2}$

$6 \times \sin 30^0 = CD$

$CD = 6 \times 0.50cm$

$CD = 3cm$

(b) using ΔABC, $6^2 = 3^2 + AC^2$

$AC^2 = 6^2 - 3^2$

$AC^2 = (6-3)(6+3)$

$AC^2 = 27$

$AC = \sqrt{27}$

$= \sqrt{9 \times 3}$

$= \sqrt{9}\sqrt{3}$

$AC = 3\sqrt{3}$

$\tan 45^0 = \frac{DC}{BC}$

$BC\ cm \times \tan 45^0 = DC\ cm$

$BC\ cm \times 1.00 = 3cm$

$BC = 3$

$AB = AC - BC$

$= 3\sqrt{3} - 3$

$= 3(\sqrt{3} - 1)$

$= 3(0.732050808)$

$= 2.196152423$

$AB = 2.2cm$ (1decimal place)

Answer (a) 3cm [1]

(b) 2.2cm [2]

14 Simplify

(a) $(2a)^{-3} \times 3a^2$;

(b) log8 + log4.

15 Given that $\mathbf{A} = \begin{pmatrix} x-1 & 2 \\ x+1 & -1 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 3 & 4 \end{pmatrix}$.

Find in terms of x

(a) the determinant of A in its simplest form,

(b) BA in its simplest form.

Suggested Solution

15 (a)

$$|A| = -1(x-1) - 2(x+1)$$
$$= -x + 1 - 2x - 2$$
$$= 1 - 2 - x - 2x$$
$$= -1 - 3x$$
$$= -(1 + 3x)$$

$$BA = (3 \quad 4)\begin{pmatrix} x-1 & 2 \\ x+1 & -1 \end{pmatrix}$$
$$= (3(x-1) + 4(x+1) \quad 3 \times 2 - 4 \times 1)$$
$$= (3x - 3 + 4x + 4 \quad 6 - 4)$$
$$= (3x + 4x + 4 - 3 \quad 2)$$
$$= (7x + 1 \quad 2)$$

Answer (a) $-(1 + 3x)$
(b) $(7x + 1 \quad 2)$

16 (a) On a day when the exchange rate was R9,03 to 1 USD, a trader exchanged 600 USD for rands.

Find the amount, in rands, the trader received.

(b) Given that $f = \dfrac{mv - mu}{t}$, express m in terms of f, v, u and t.

Suggested Solution

16 (a)

$$R9.03 = US\$1$$

$Rx = US\$600$

$x = 9.03 \times 600$

$x = 5\ 418$

$\therefore US\ \$600 = R5\ 418$

(b) $f = \frac{mv - mu}{t}$, multiplying by t, we get.

$ft = m(v - u)$, rearranging the equation,

$m(v - u) = ft$ dividing by $v - u$ both sides

$m = \frac{ft}{v-u}$

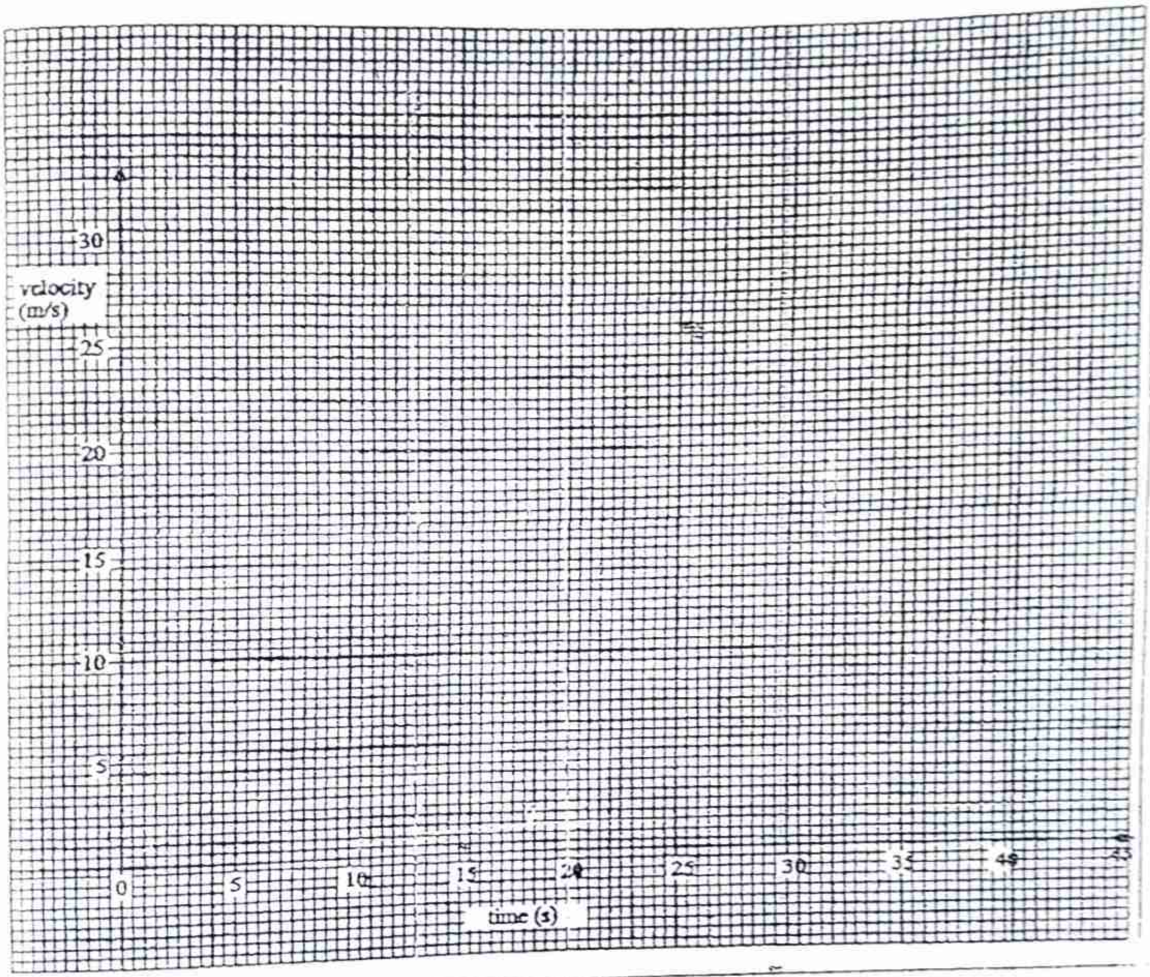
Answer (a) R 5 418 [2]

(b) $m = \frac{ft}{v-u}$ [2]

17 An object starts from rest and accelerates at 4 m/s^2 for 5 seconds until it reaches a speed of 20 m/s. It then travels at this speed for 30 seconds, after which it decelerates uniformly and comes to rest in a further 10 seconds.

(a) Draw a velocity-time graph on the grid.

(b) Calculate the total distance travelled.



Suggested Solution

17 (a) distance travelled = area of trapezium

$= \frac{1}{2}(a + b)h$

$= \frac{1}{2}(30 + 45) \times 20$

$= 55 \times 10$

$= 550m$

Answer (a) on the distance [2]

(b) 550m [2]

18 9 white and 6 yellow identical tennis balls are placed in a box. Kuda picks balls at random one at a time.

Find the probability that the first and second balls picked are

(a) both white,

(b) of different colours.

Suggested Solution

18 (a) $P(both\ white) = \frac{9}{15} \times \frac{8}{14} = \frac{72}{210} = \frac{12}{35}$

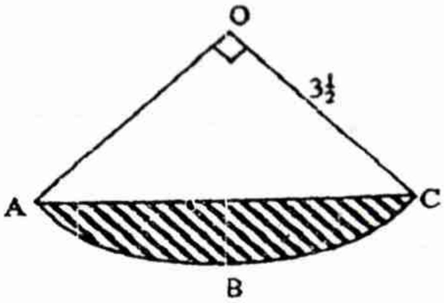
(b) $P(different\ colours) = \frac{9}{15} \times \frac{5}{14} + \frac{6}{15} \times \frac{8}{14} = 2 \times \frac{54}{210} = \frac{54}{105}$

$= \frac{18}{35}$

Answer (a) $\frac{12}{35}$ [2]

(b) $\frac{18}{35}$ [2]

19



Take π to be $\frac{22}{7}$

In the diagram OABC is a sector of a circle centre O and radius $3\frac{1}{2}$ cm.

(a) State the name given to the shaded region.

(b) Calculate the area of the shaded region.

Suggested Solution

19 (a) Minor segment

(b) Area of shaded region = Area of minor segment OABC = Area of ΔOAC

Area of shaded region $= \frac{\theta}{360^0} \times \pi r^2 - \frac{1}{2} b \times h$

$= \frac{90^0}{360^0} \times \frac{22}{7} \times 3,5^2 - \frac{1}{2} \times 3,5 \times 3.5$

$= \left(\frac{1}{4} \times \frac{22}{7} - \frac{1}{2}\right) \times (3,5)^2$

$= \frac{1}{2} \times \left(\frac{11}{7} - 1\right) \times (3,5)^2$

$= \frac{1}{2} \times \frac{4}{7} \times 3,5 \times 3,5$

$= 2 \times 0.5 \times 3.5$

$= 3.5$

Answer (a) minor segment [2]

(b) 3.5 [2]

20 A rural district council increases the value of land by 5 % every year.
If the value of a piece of land is \$ 4 600,
calculate its value in 2 years' time.

Suggested Solution

20

Method 1

Year 1 = 105% × \$4 600

$= \frac{105}{100} \times \$4\ 600$

$= \$105 \times 46$

$= \$4\ 830$

Year 2 = 105% × \$4 830

$= \frac{105}{100} \times \$4\ 830$

$= \frac{\$105}{10} \times 483$

$= \$5\ 071.50$

Method 2

Value in 2 years time $= (1.05)^2 \times \$4\ 600$

$= \$5071.50$

Answer 5071.50 [4]

21 Simplify $\frac{x^2 - y^2}{x^2 + xy} \div \frac{2y - 2x}{xy}$.

Suggested Solution

21

$\frac{x^2 - y^2}{x^2 + xy} \div \frac{2y - 2x}{xy} = \frac{(x-y)(x+y)}{x(x+y)} \div \frac{2(y-x)}{xy} = \frac{x-y}{x} \times \frac{xy}{2(y-x)}$

$= \frac{y(x-y)}{2(y-x)}$

$= \frac{-y(y-x)}{2(y-x)}$

$= -\frac{y}{2}$

Answer $-\dfrac{y}{2}$ [4]

22 (a) Solve the equation $3-(2n-5)=32$.

(b) Express $\dfrac{7x+2}{5}-\dfrac{5x+3}{6}$ as a single fraction in its simplest form.

Suggested Solution

22 (a)

$$\begin{aligned}3-(2n-5)&=32\\3-2n+5&=32\\8-2n&=32\\4-n&=16\\n&=-12\end{aligned}$$

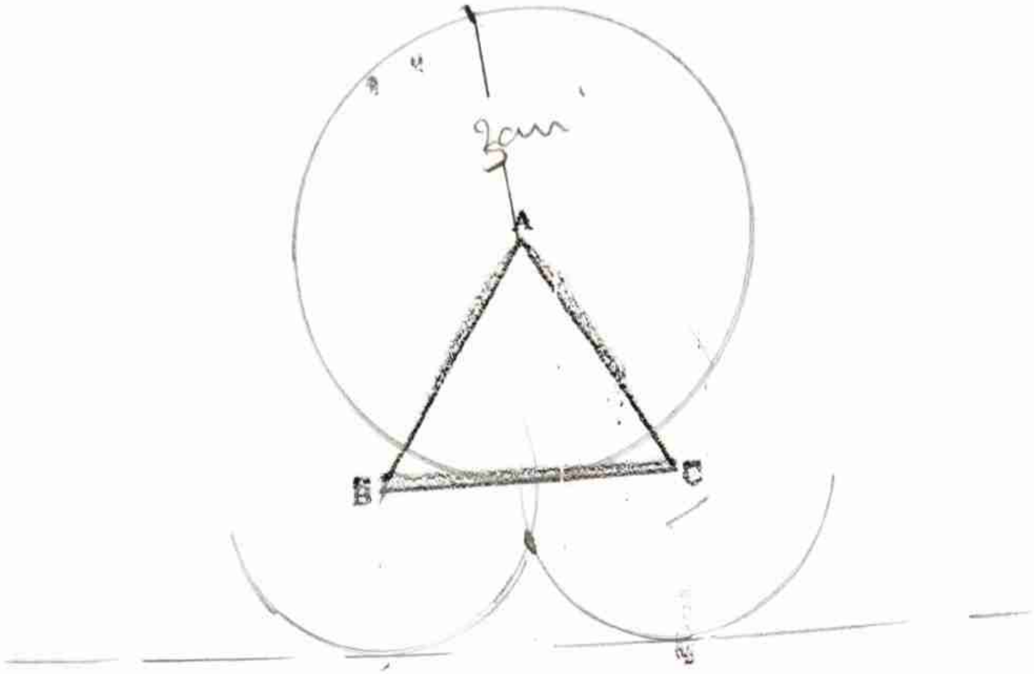
(b)

$$\begin{aligned}\frac{7x+2}{5}-\frac{5x+3}{6}&=\frac{6(7x+2)-5(5x+3)}{30}\\&=\frac{42x+12-25x-15}{30}\\&=\frac{42x-25x+12-15}{30}\\&=\frac{17x-3}{30}\end{aligned}$$

Answer (a) $n=-12$ [2]

(b) $\dfrac{17x-3}{30}$ [2]

23



(a) On the diagram construct using ruler and compasses only, the locus of points which are

(i) 2 cm from BC and on the same side of BC as A,

(ii) 3 cm from A.

(b) Mark and label two points P and Q which are 2 cm from BC and 3 cm from A.

Suggested Solution

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

4028/1R

MATHEMATICS

PAPER 1

NOVEMBER 2014 SESSION 2 hours 30 minutes

Candidates answer on the question paper
Additional materials:
Geometrical instruments
Allow candidates 5 minutes to count pages before the examination

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and your Centre number and Candidate number on the top right corner of every page of this paper.

Answer all questions.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Write your answers in the spaces provided on the question paper using **black** or **blue** pens.

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.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE

This question paper consists of 26 printed pages.

[Turn over

5 (a) Write down the smallest prime number.

(b) Express 5 292 as a product of its prime factors in index form.

Suggested solution

5 (a) Smallest prime number $= 2$

(b)

2	5292
2	2646
3	1323
3	441
3	147
7	49
7	7
	1

Thus, $5292 = 2 \times 2 \times 3 \times 3 \times 3 \times 7 \times 7$

$= 2^2 \times 3^3 \times 7^2$,

(in index form) as required

Answer (a) 2
(b) $2^2 \times 3^2 \times 7^2$

6 The population of town A is $4{,}5 \times 10^4$ and that of town B is $3{,}9 \times 10^4$.

(a) Calculate the difference between the two populations.

(b) The population of town A is 125 % greater than what it was forty years ago.

Calculate the population of town A forty years ago. Give the answer in standard form.

Suggested solution

6 (a) Population difference = Population of town A − Population of town B

$= 4{,}5 \times 10^4 - 3{,}9 \times 10^4$

$= (4{,}5 - 3{,}9) \times 10^4$ factorising 10^4

$= 0{,}6 \times 10^4$

26 The scale of the plan of a house is 1:500.

(a) Find the length of a room on the plan which measures 8 m.

(b) Calculate the actual height of a wall which is represented by 3,6 cm on the plan.

(c) Find the actual area of a room which has an area of 1,6 cm^2 on the plan.

Suggested Solution

26 (a)

1 : 500 *given ratio*

$1cm: 500cm$ *actual*

1cm: 5 m

But $x\ cm : 8cm$

$\therefore \frac{x\ cm}{1\ cm} = \frac{8m}{5m}$

$x = 1\frac{3}{5}$

$x = 1.6$

Length of room = $1.6cm$

(b) 1cm :5m

3.6cm : x m

$\frac{x\ m}{5m} = \frac{3.6cm}{1cm}$

$xm = 3.6 \times 5$

$= 18m$

(c) 1cm : 5m

$(1cm)^2 : (5m)^2$

$1cm^2 : 25m^2$

$1.6cm^2 : xm^2$

$\frac{x^2}{25m^2} = \frac{1.6cm^2}{1\ cm}$

$x = 1.6 \times 25$

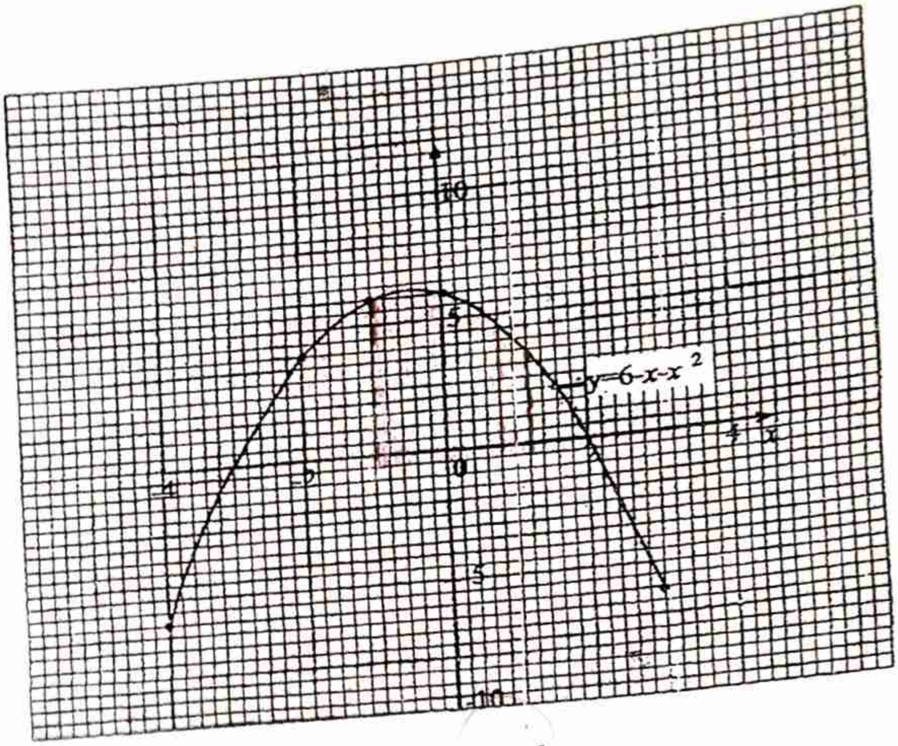
$x = 40m^2$

Answer (a) 1.6cm

(b) 18m

(c) $40m^2$

27



The diagram shows the graph of $y = 6 - x - x^2$.

Use the graph to

(a) solve the equation $6 - x - x^2 = 0$,

(b) state the equation of the line of symmetry of the curve,

(c) estimate the maximum value of the function,

(d) estimate the area bounded by the curve, the x-axis, the lines $x = -1$ and $x = 1$.

Suggested Solution

Answer (a) $x = 2$ or $x = -3$ [2]

(b) $x = -\frac{1}{2}$ [1]

(c) $y = 6.25$ [1]

(d) $7\frac{2}{3}$ $units^2$ [2]

$= 6 \times 10^{-1} \times 10^4$

$= 6 \times 10^{-1+4}$

$= 6 \times 10^3$

$= 6 \times 1\,000$

$= 6\,000$

(b) $125\% = 4{,}5 \times 10^4$ (Present population of town A)

$100\% = A$ (lasts 40 years population of town A)

Thus, $A = \frac{100}{125}\% \times 4{,}5 \times 10^4$

$A = 0{,}8 \times 4{,}5 \times 10^4$

$= 3{,}6 \times 10^4$

Answer: **(a)** 6 000

(b) $3{,}6 \times 10^4$

---

7 **(a)** If $32 = 2^m$, find the value of m.

(b) Simplify $\left(\frac{1}{27}\right)^{\frac{2}{3}}$.

Suggested solution

7 (a) $32 = 2^m$

$2^5 = 2^m$

$m = 5$

(b) $\left(\frac{1}{27}\right)^{\frac{2}{3}} = \left(\frac{1}{3^3}\right)^{\frac{2}{3}} = (3^{-3})^{\frac{2}{3}}$

$= 3^{-3\times\frac{2}{3}}$ since $(a^b)^c = a^{bc}$

$= 3^{-2}$

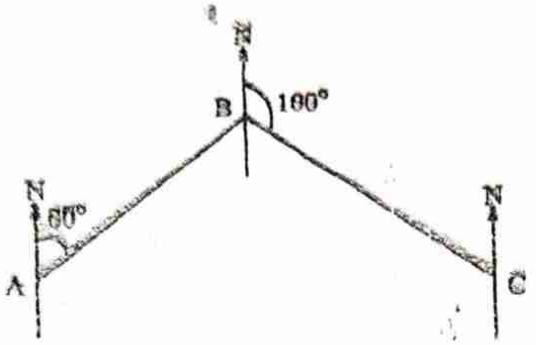
$= \frac{1}{3^2}$

$= \frac{1}{9}$

Answer **(a)** $m = 5$ [5]

(b) $\frac{1}{9}$ [2]

8



In the diagram, the bearing of B from A is 060° and the bearing of C from B is 100°.

(a) Find the bearing of B from C.

(b) If AB and BC are adjacent sides of a regular polygon, find the number of sides of the polygon.

Suggested solution

8 (a) Bearing of B from C = 100° + 180° = 280°

(b) $A\hat{B}C = 140°$ interior angle of a polygon.

Let n be the number of sides

$(n - 2)180° = 140°n$

$180°n - 360° = 140°n$

$180° - 140°n = 360°$

$40°n = 360°$

$n = 9$

Answer (a) 280°
(b) $n = 9$

9 It is given that w is inversely proportional to f and when $f = 20$, $w = 150$.

(a) Find an equation connecting f and w.

(b) Find the value of f when $w = 60$.

Suggested solution

9 (a) $w \propto \frac{1}{f} \implies w = \frac{k}{f}$, where k is a constant.

When = 20, $w = 150$, we have

$$150 = \frac{k}{20}$$

$$k = 150 \times 20$$

$$k = 3\,000$$

Hence, $w = \frac{3\,000}{f}$, is the formula connecting f and w

(b) When $f = f$, $w = 60$

$$\therefore 60 = \frac{3\,000}{f}$$

$$f = \frac{3\,000}{60}$$

$$f = 50$$

Answer (a) $w = \frac{3\,000}{f}$

(b) $f = 50$

10 Express $\frac{6x+5}{7} - \frac{4x-6}{21}$ as a single fraction in its simplest form

Suggested solution

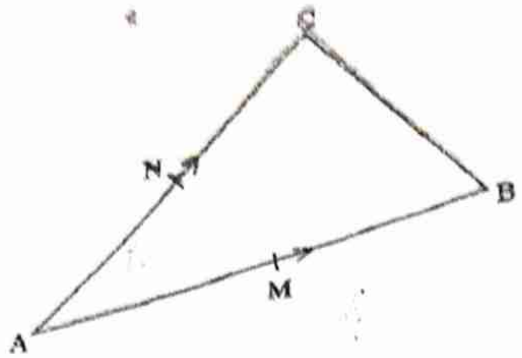
10
$$\frac{6x+5}{7} - \frac{4x-6}{21} = \frac{3(6x+5)-(4x-6)}{21}$$

$$= \frac{18x + 15 - 4x + 6}{21}$$

$$= \frac{14x+21}{21}$$

$$= \frac{7(2x+3)}{21}$$

13



$\overrightarrow{AB} = \begin{pmatrix} 14 \\ 6 \end{pmatrix}$ and $\overrightarrow{AC} = \begin{pmatrix} 12 \\ 8 \end{pmatrix}$. M and N are the mid-points of AB and AC respectively.

(a) Find

(i) $\overrightarrow{MN}$;

(ii) $\overrightarrow{BC}$;

(b) Explain why MN is parallel to BC.

Suggested solution

(i)

$$\overrightarrow{MN} = \overrightarrow{AN} - \overrightarrow{AM}$$

$$= \tfrac{1}{2}\overrightarrow{AC} - \tfrac{1}{2}\overrightarrow{AB}$$

$$= \tfrac{1}{2}\begin{pmatrix} 14 \\ 6 \end{pmatrix} - \tfrac{1}{2}\begin{pmatrix} 12 \\ 8 \end{pmatrix}$$

$$= \begin{pmatrix} 7 \\ 3 \end{pmatrix} - \begin{pmatrix} 6 \\ 4 \end{pmatrix}$$

$$= \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

(ii)

$$\overrightarrow{BC} = \overrightarrow{AC} - \overrightarrow{AB}$$

$$= \begin{pmatrix} 12 \\ 8 \end{pmatrix} - \begin{pmatrix} 14 \\ 6 \end{pmatrix}$$

$= \begin{pmatrix} -2 \\ 2 \end{pmatrix}$

(b) $\overrightarrow{BC} = \begin{pmatrix} -2 \\ 2 \end{pmatrix}$

$= -2\begin{pmatrix} 1 \\ -1 \end{pmatrix}$

$= -2\overrightarrow{MN}$

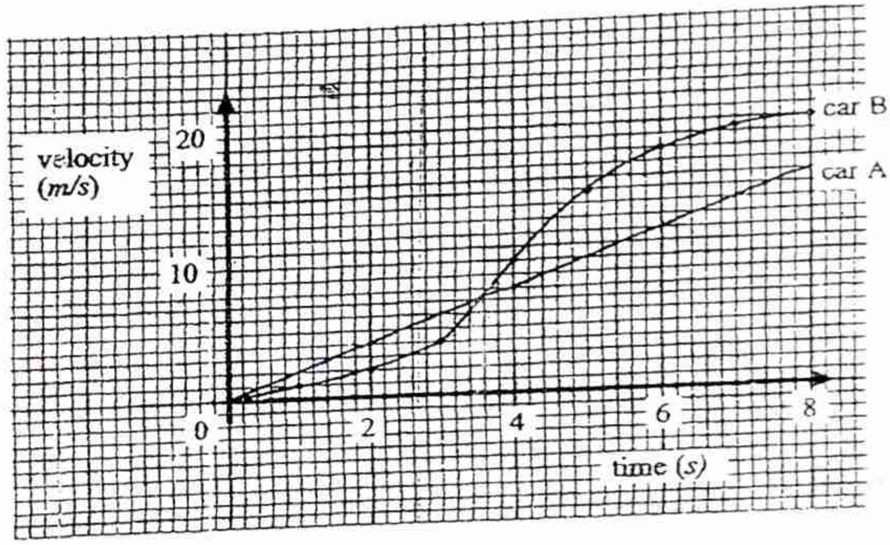
Since $\overrightarrow{BC} = -2\overrightarrow{MN}$, have equal direction vectors, thus MN is parallel to BC

Answer (a) (i) $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$

(ii) $-2\begin{pmatrix} 1 \\ -1 \end{pmatrix}$

(b) **equal direction vectors**

15



The diagram shows the velocity-time graphs of two cars. Car A and car B start moving from the same point at the same time.

Find the

(a) acceleration of car A,

(b) time the two cars have equal velocities,

(c) distance covered by car A in the 8 seconds,

(d) average velocity of car A during the 8 seconds.

18 Given that $f(x) = x^2 - 5x - 12$, find

(a) $f(-2)$,

(b) the values of x for which $f(x) = 12$.

Suggested solution

18 (a)

$$f(x) = x^2 - 5x - 12$$

$$f(-2) = (-2)^2 - 5(-2) - 12$$

$$= (-2)(-2) + 10 - 12$$

$$= 4 + 10 - 12$$

$$= 2$$

(b)

$$f(x) = 12$$

$$x^2 - 5x - 12 = 12$$

$$x^2 - 5x - 12 - 12 = 0$$

$$x^2 - 5x - 24 = 0$$

$$x^2 - 8x + 3x - 24 = 0$$

$$x(x - 8) + 3(x - 8) = 0$$

$$(x - 8)(x + 3) = 0$$

Either $x - 8 = 0$ or $x + 3 = 0$

$x = 8$ or $x = -3$

Answer	(a)	$f(-2) =$ 2		[2]
	(b)	$x = 8$	or $x = -3$	[4]

19 Represent the following inequalities on the Cartesian plane in the answer space.

(a) $y > -6$

(b) $x \geq 2$

(c) $x + y \leq 0$

Suggested solution

20 It is given that $n(\xi) = 14$, $n(P) = 7$, $n(P \cap Q) = 2$ and $n(P \cup Q) = 11$.

(a) Show this information on the Venn diagram in the answer space.

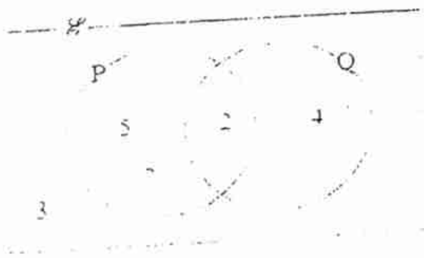
(b) Find

(i) $n(Q)$,

(ii) $n(Q \cup P')$.

Suggested solution

20 (a) The Venn diagram



(b) (i) $n(Q) = 2 + 4 = 6$

(ii) $n(Q \cup P') = 4 + 3$

$= 7$

Answer (b)(i) $n(Q) = 6$

(ii) $n(Q \cup P') = 7$

21 It is given that $\mathbf{A} = \begin{pmatrix} 2 & 3 \\ -4 & -1 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} x+1 & 2 \\ 2x-3 & 3 \end{pmatrix}$.

$$\mathbf{C} = \begin{pmatrix} 4 & 3 & -2 \\ -1 & -2 & 5 \end{pmatrix} \text{ and } \mathbf{D} = \begin{pmatrix} 7 \\ -3 \end{pmatrix}.$$

(a) Write down the order of matrix **C**.

(b) Express **AD** as a single matrix.

(c) Find x such that **B** has no inverse.

Suggested solution

21 (a) 2×3

(b) $\mathbf{AD} = \begin{pmatrix} 2 & 3 \\ -4 & -1 \end{pmatrix}\begin{pmatrix} 7 \\ -3 \end{pmatrix}$

$= \begin{pmatrix} 2 \times 7 + 3 \times (-3) \\ -4 \times 7 + (-1) \times (-3) \end{pmatrix}$

$= \begin{pmatrix} 14 - 9 \\ -28 + 3 \end{pmatrix}$

$= \begin{pmatrix} 13 \\ -25 \end{pmatrix}$

(c) If **B** has no inverse, then $|\mathbf{B}| = 0$.

i.e. $3(x+1) - 2(2x-3) = 0$

$3x + 3 - 4x + 6 = 0$

$-x + 9 = 0$

$x = 9$

Answer	(a)	2×3	[1]
	(b)	$\begin{pmatrix} 13 \\ -25 \end{pmatrix}$	
	(c)	$x = 9$	

22 A bag has green, red and blue balls. The balls are identical except for colour. Anna picks a ball at random and puts it back.

The table shows the probabilities that Anna picks any of the balls.

colour	green	red	blue
probability	0,55	0,25	x

(a) Find x.

(b) If there are 20 red balls in the bag, find the number of the green balls in the bag.

(c) Complete the probability tree diagram in the answer space.

Suggested solution

22 (a)

$$0,55 + 0,25 + x = 1$$

$$0,8 + x = 1$$

$$x = 0,2$$

(b) Let G be the number of green balls

$0,25 = 20$
$0,55 = G$

$\frac{G}{20} = \frac{55}{25}$

$G = \frac{11}{5} \times 20$

$G = 44$

(c)

Answer (a) 0,20 [1]

$$x + 3y = 41$$

(c) $x + y = 17$ ———— ①

$x + 3y = 41$ ———— ②

② − ①: $2y = 24$

$y = 12$

Using ①, $x + 12 = 17$

$x = 5$

Answer (a) $x + y = 17$

(b) $x + 3y = 41$

(c) $x = 5$ and $y = 12$

Surname	Forename(s)	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4028/1

PAPER 1

JUNE 2014 SESSION 2 hours 30 minutes

Candidates answer on the question paper.
Additional materials:
Geometrical instruments

Allow candidates 5 minutes to count pages before the examination.

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and your Centre number and Candidate number on the top right corner of every page of this paper.

Answer **all** questions.
Check that all the pages are in the [illegible] ask the invigilator for a replacement if there are duplicate or missing pages.
Write your answers in the spaces provided on the question paper [illegible]
[illegible] questions it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE

This question paper consists of 24 printed pages.

[Turn over

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

1 Express 2046.489 correct to

(a) the nearest ten,

(b) 2 decimal places,

(c) 2 significant figures.

Suggested solution

1 (a) $2046.489 = 2\,050$ (nearest ten)

(b) $2046.489 = 2\,046.49$ (2 decimal places)

(c) $2046.489 = 2\,000$ (2 sf)

Answer	(a)	2050	[1]
	(b)	2046.49	[1]
	(c)	2000	[1]

2 Evaluate, giving your answers as common fractions in their lowest terms.

(a) $\frac{3}{5} + \frac{1}{7}$,

(b) $\frac{5}{8} \times \frac{32}{45}$,

(c) $\frac{5}{24} \div \frac{1}{3}$.

Suggested solution

2 (a) $\frac{3}{5} + \frac{1}{7} = \frac{21+5}{35} = \frac{26}{35}$

(b) $\frac{5}{8} \times \frac{32}{45} = \frac{1}{1} \times \frac{4}{9} = \frac{4}{9}$

(c) $\frac{5}{24} \div \frac{1}{3} = \frac{5}{24} \times \frac{3}{1} = \frac{5}{8}$

14 (a) $4m = 7n$ or $\frac{m}{n} = \frac{7}{4}$

i.e $m : n = 7 : 4$

(b) $\$1 = R8$

$x = R333$

So $x = \frac{\$1 \times R333}{R8}$

$= \$41.625$

$= \$41.63$

---

answer (a) 7 : 4 [1]

(b) \$41.63 [2]

---

15 Factorise completely

$$3x^3y - 12xy^3.$$

Suggested solution

15 $3x^3y - 12xxy^3 = 3xy(x^2 - 4y^2)$

$= 3xy(x^2 - 2^2y^2)$, noting that $a^cb^c = (ab)^c$

$= 3xy(x^2 - (2y)^2)$ recall that $a^2 - b^2 = (a-b)(a+b)$

$= 3xy(x - 2y)(x + 2y)$

Answer $3xy(x - 2y)(x + 2y)$

---

16 Solve the equation

$$\left(y + \frac{1}{4}\right)^2 = \frac{9}{16}.$$

Suggested solution

16 $\left(y + \frac{1}{4}\right)^2 = \frac{9}{16}$, taking square roots both sides,

$y + \frac{1}{4} = \pm\sqrt{\frac{9}{16}}$

$y + \frac{1}{4} = \pm\frac{3}{4}$

and $f(0) = p$

So, $(0-1)(0+6) = p$

$\therefore$ $p = (-1) \times (6)$

$\Longrightarrow$ $p = -6$

(b) $yk = ax - bk,$ collecting k terms to one side.

$yk + bk = ax,$ factorising k

$k(y + b) = ax,$ dividing both sides by $(y + b)$

$$k = \frac{ax}{y+b}$$

Answer (a) $p = -6$ [1]

(b) $k = \frac{ax}{y+b}$ [2]

10 (a) Express $3^4 + 3^2 + 3$ as a number in base 3.

(b) Evaluate

(i) $143_8 + 57_8$ giving your answer in base 8,

(ii) $4_5 - 2_3 + 1_2$ giving your answer in base 10.

Suggested solution

10 (a) $3^4 + 3^2 + 3 = 1 \times 3^4 + 0 \times 3^3 + 1 \times 3^2 + 1 \times 3^1 + 0 \times 3^0$

$= 1\ 0\ 1\ 1\ 0_3$

(b) $143_8 + 57_8 = 222_8$

(c) $4 - 2 + 1 = 7_{10}$

$2 + 1 = 3_{10}$

Answer (a) $1\ 0\ 1\ 1\ 0_3$ [1]

(b) (i) 222_8 [2]

(ii) 3_{10} [1]

$y = -\frac{1}{4} \pm \frac{3}{4}$

Either $y = -\frac{1}{4} - \frac{3}{4}$ or $y = -\frac{1}{4} + \frac{3}{4}$

i.e $y = -\frac{4}{4}$ or $y = \frac{2}{4}$

$\therefore$ $y = -1$ or $y = \frac{1}{2}$

Answer $y = \frac{1}{2}$ **or** $y - 1$ [3]

17 (a) Simplify $(32x^{10})^{\frac{1}{5}}$.

(b) Given that $\frac{2^{-2} \times 2^{c}}{2^{4}} = 2^3$, find the value of c.

Suggested solution

17 (a)

$(32x^{10})^{\frac{1}{5}} = 32^{\frac{1}{5}} \times (x^{10})^{\frac{1}{5}}$, noting that $(ab)^c = a^c \times b^c$

$= (2^5)^{\frac{1}{5}} \times x^{10\times\frac{1}{5}}$ since $(a^b)^c = a^{bc}$

$= 2^{5\times\frac{1}{5}} \times x^2$

$= 2^1 \times x^2$

$= 2x^2$

(b) Method 1

$\frac{2^{-2}\times 2^c}{2^4} = 2^3$

$2^{-2+c} = 2^3 \times 2^4$

$2^{c-2} = 2^{3+4}$

$2^{c-2} = 2^7$

$c - 2 = 7$

$c = 9$

Method 2

$\frac{2^{-2}\times 2^c}{2^4} = 2^3$

$2^{c-2} \div 2^4 = 2^3$

$2^{c-2-4} = 2^3$

$2^{c-6} = 2^3$

$c - 6 = 3$

$c = 9$

Answer (a) $2x^2$

(b) $c = 9$

18 It is given that $\mathbf{P} = \begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}$ and $\mathbf{Q} = 2\mathbf{P} - \mathbf{I}$ where $\mathbf{I}$ is the identity matrix.

Find

(a) $\mathbf{P}^{-1}$,

(b) $\mathbf{Q}$.

Suggested solution

18 (a)

$$\text{Det}(\mathbf{P}) = 2 \times 1 - 1 \times 1 = 2 - 1 = 1$$

$$\mathbf{P}^{-1} = \frac{1}{\det(\mathbf{P})}\begin{pmatrix} 1 & -1 \\ -1 & 2 \end{pmatrix}$$

$$= \frac{1}{1}\begin{pmatrix} 1 & -1 \\ -1 & 2 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & -1 \\ -1 & 2 \end{pmatrix}$$

(b)

$$\mathbf{Q} = 2\mathbf{P} - \mathbf{I}$$

$$\mathbf{Q} = 2\begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix} - \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

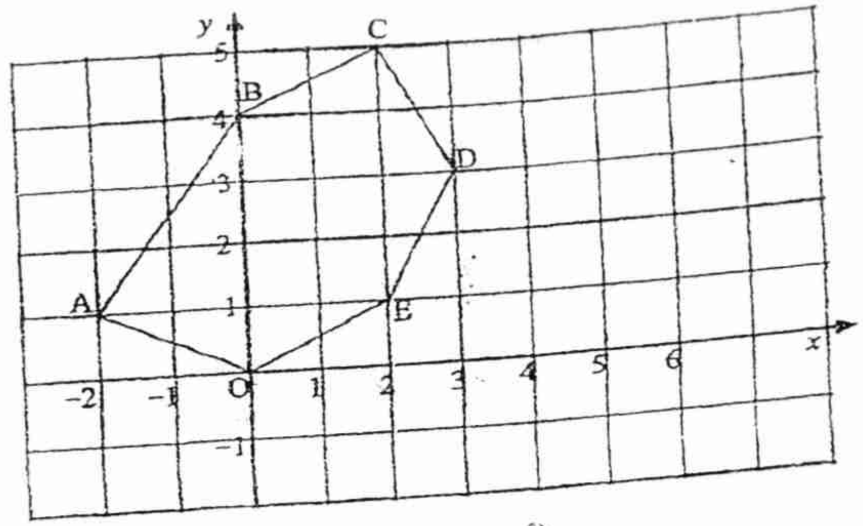
$$\mathbf{Q} = \begin{pmatrix} 4 & 2 \\ 2 & 2 \end{pmatrix} - \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

$$\mathbf{Q} = \begin{pmatrix} 3 & 2 \\ 2 & 1 \end{pmatrix}$$

Answer (a) $\mathbf{P}^{-1} = \begin{pmatrix} 1 & -1 \\ -1 & 2 \end{pmatrix}$ [2]

(b) $\mathbf{Q} = \begin{pmatrix} 3 & 2 \\ 2 & 1 \end{pmatrix}$ [2]

19



In the diagram, OABCDE is a hexagon.

(a) Express as column vectors

(i) $\overrightarrow{OE}$,

(ii) $\overrightarrow{OA} + \overrightarrow{AD}$.

(b) Describe **fully** the **single** transformation which maps side BC onto side OE.

Suggested solution

19 (a) (i) $\overrightarrow{OE} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$ (ii) $\overrightarrow{OA} + \overrightarrow{AD} = \begin{pmatrix} -2 \\ 1 \end{pmatrix} + \begin{pmatrix} 5 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$

(b) Reflection in the line $y = \frac{1}{2}x + 2$

Answer (a) (i) $\overrightarrow{OE} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$

(ii) $\overrightarrow{OA} + \overrightarrow{AD} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$

(b) Reflection, in the line $y = \frac{1}{2}x + 2$

20 All lengths on a map are $\frac{1}{500}$ of their actual lengths.

Calculate

(a) the actual length of line represented on the map by a line 7,3 cm,

(b) the area on the map which represents an actual area of 525 m^2, giving your answer in cm^2.

Suggested solution

20 (a)

$1 : 500$
$7{,}3 : x$

$x = \frac{7.3}{1} \times 500$

$x = 7.3 \times 500$

$= 3650.0cm$

$= 36.5m$

(b)

$1 : 500$

$1m^2 : (50m)^2$
$x : 525m^2$

$\frac{x}{1} = \frac{525}{50}$

$x = 21m^2$

$= 21 \times 10\,000\ cm^2$

$= 210\,000\ cm^2$

Answer	(a)	36.5m	[1]
	(b)	$210\,000\ cm^2$	[3]

21 Evaluate

(a) $\frac{\log_5 64}{\log_5 4}$,

(b) $1 + \log_3 9$.

Suggested solution

21 (a)

$$\frac{\log_5 64}{\log_5 4} = \frac{\log_5 4^3}{\log_5 4^1}$$

$$= \frac{3 \times \log_5 4}{1 \times \log_5 4}$$

$$= 3$$

(b)

$$1 + \log_3 9 = 1 + \log_3 3^2$$

$$= 1 + 2\log_3 3$$

$$= 1 + 2(1) \qquad \text{since } \log_a a = 1$$

$$= 3$$

Answer (a) 3 [2]

(b) 3 [2]

22 In the answer space below, is a line segment AB which is 7 cm long.

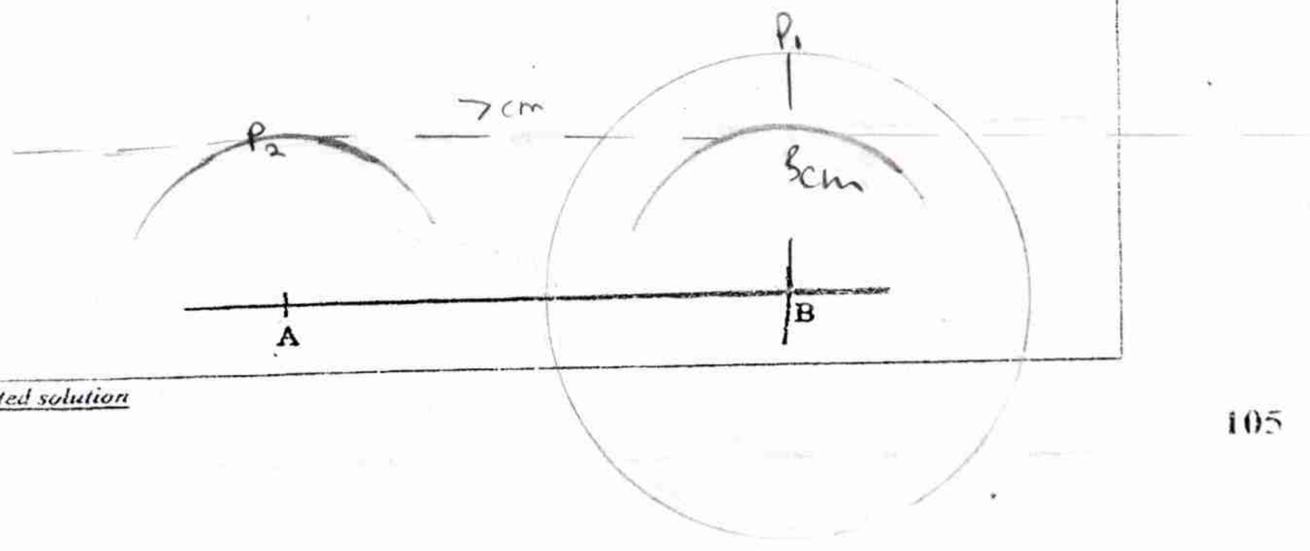
(a) Using ruler and compasses only, construct the locus of points

(i) 3 cm from B,

(ii) above AB, which are 2 cm from line AB.

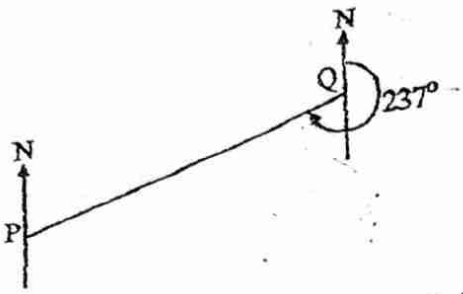
(b) (i) Mark and label P_1 and P_2, points which are 3 cm from B and 2 cm from line AB.

(ii) Measure the distance P_1P_2.

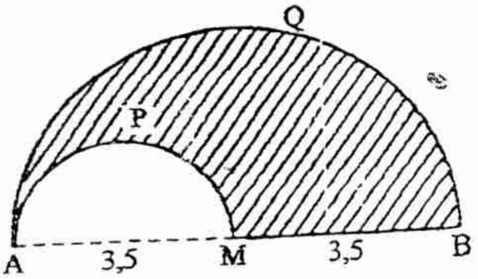


Suggested solution

23 **(a)**



In the diagram, P and Q are points on level ground. The bearing of P from Q is 237°. Find the bearing of Q from P.



(b) The diagram shows two semi circles APM and AQB. AM = MB = 3,5 cm. Taking π to be $\frac{22}{7}$, calculate the perimeter of the shaded region.

Suggested solution

23 (a) Bearing of Q from P $= 237^0 - 180^0 = 057^0$

(b) Perimeter of shaded region $= arc\ length\ APM + arc\ length\ AQB + 3.5cm$

$$= \frac{1}{2} \times \pi \times 3.5\ cm + \pi \times 3.5\ cm + 3.5\ cm$$

$$= \frac{1}{2} \times \frac{22}{7} \times 3.5\ cm + \frac{22}{7} \times 3.5\ cm + 3.5\ cm$$

$$= \frac{11}{2}\ cm + 22 \times 0.5cm + 3.5cm$$

$$= 20\ cm$$

Answer (a) **057^0** [2]

(b) **20 cm** [3]

24

age in years	11	12	13	14	15
no of pupils	3	10	8	6	3

The ages of pupils in a class of 30 are shown in the table.

(a) Two pupils are chosen at random from the class, find the probability that one is aged 11 years and the other is aged 14.

(b) Calculate the mean age of the pupils.

Suggested solution

24 (a) P(one is 11 and the other is 14) $= \frac{3}{30} \times \frac{6}{29} + \frac{6}{30} \times \frac{3}{29}$

$= \frac{1}{10} \times \frac{6}{29} + \frac{1}{5} \times \frac{3}{29}$

$= \frac{3}{5\times29} + \frac{3}{5\times29}$

$= 2 \times \frac{3}{145}$

$= \frac{6}{145}$

(b) Mean $= \frac{(3\times11)+(10\times12)+(13\times8)+(14\times6)+(15\times3)}{30}$

$= \frac{33+120+104+84+45}{30}$

$= \frac{386}{30}$

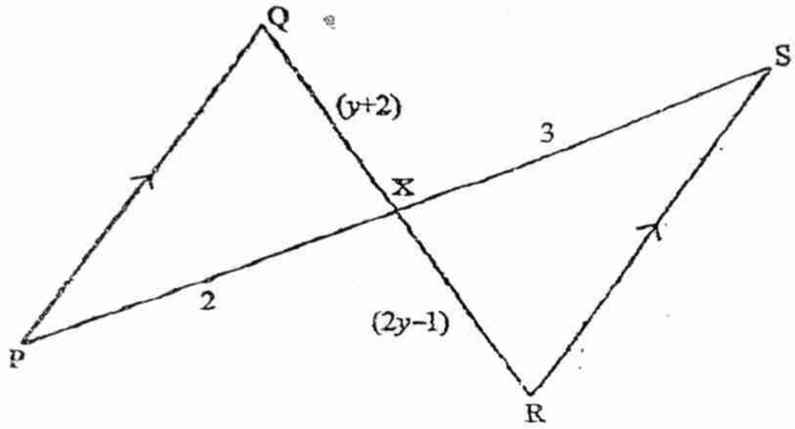
$= 12.86666666$

$= 12.9$ (3 significant figures)

Answer (a) $\frac{6}{145}$ [2]

(b) 12.9 [3]

25



In the diagram, PQ is parallel to RS. PS and QR intersect at X. It is given that PX = 2 cm, SX = 3 cm, QX = $(y+2)$ cm and RX = $(2y-1)$ cm

(a) Name the triangle which is similar to triangle PQX.

(b) Using your results in **(a)**, find the value of y.

(c) Write down the lengths of QR.

Suggested solution

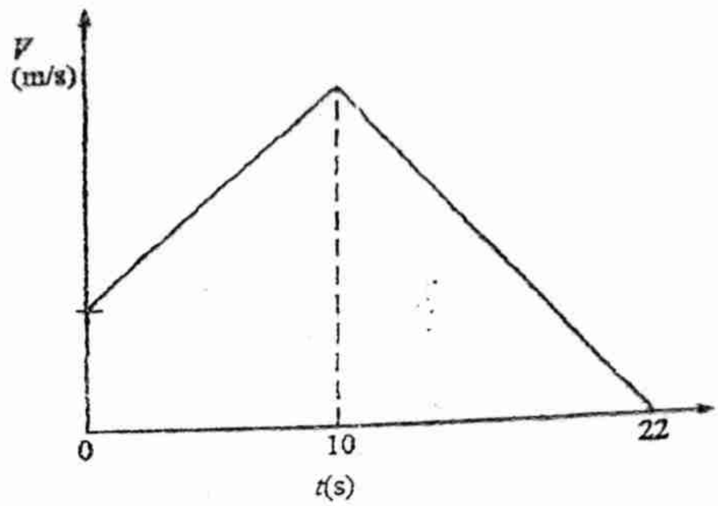
25 (a) Triangle SRX

(b)
$$\frac{PQ}{SR} = \frac{QX}{RX} = \frac{PX}{SX}$$
$$\frac{y+2}{2y-1} = \frac{2}{3}$$
$$3(y+2) = 2(2y-1)$$
$$3y + 6 = 4y - 2$$
$$6 + 2 = 4y - 3y$$
$$8 = y$$

(c)
$$QR = (y+2) + (2y-1)$$
$$= (8+2) + (2(8) - 1)$$
$$= 10 + (16 - 1)$$
$$= 25$$

Answer			
	(a)	SRX	[1]
	(b)	$y = 8$	[3]
	(c)	QR = 25	[1]

26



The diagram is the velocity-time graph of an object which accelerated uniformly for 10 seconds. During this time the velocity, V m/s, at time t seconds from the start, was given by $V = 6 + 2t$. It then decelerated uniformly to rest in a further 12 seconds.

Calculate

(a) the velocity of the object when $t = 0$,

(b) the deceleration of the object,

(c) the distance covered by the object in the 22 seconds.

(d) the average speed of the object for the whole journey

Suggested solution

26 (a) $v = 6 + 2t = 6 + 2 \times 0 = 6$

(b) $v = 6 + 2t = 6 + 2 \times 10 = 26$

$$\text{Deceleration} = \frac{\text{change in velocity}}{\text{change in time}}$$

$$= \frac{26}{22 - 10} = \frac{26}{12}$$

$$= 2\tfrac{1}{6} \text{ m/s}$$

(c) Distance covered = Area of trapezium + Area of triangle

$= \frac{1}{2} \times (6 + 26) \times 10 + \frac{1}{2} \times 12 \times 26$

$= 32 \times 5 + 6 \times 26$

$= 160 + 156$

$= 316$

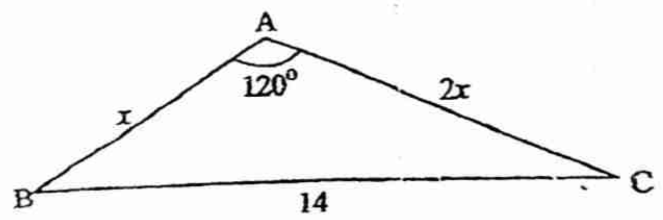
(d) Average speed $= \frac{\text{Distance travelled}}{\text{Time taken}}$

$= \frac{316}{22}$

$= 14\frac{4}{11}\ m/s$

Answer	(a)	6 m/s	[1]
	(b)	$2\frac{1}{6} m/s^2$	[2]
	(c)	316 m	[2]
	(d)	$14\frac{4}{11}$ m/s	[1]

27



In the diagram, ABC is a triangle in which AB = x cm, AC = $2x$ cm, BC = 14 cm and $B\hat{A}C = 120°$.

Using as much of the information given below as is necessary, calculate

(a) the value of x, leaving your answer in surd form,

(b) the area of triangle ABC.

[$\sin 60° = 0{,}87$; $\cos 60° = 0{,}5$; $\tan 60° = 1{,}73$]

Suggested solution

27 $x^2 + (2x)^2 - 2 \times x \times 2x\cos 120° = 14^2$

$$x^2 + 4x^2 - 4x^2 \times (-\cos 60°) = 196$$

$$5x^2 - 4x^2 \times \left(-\frac{1}{2}\right) = 196$$

$$5x^2 + 2x^2 = 196$$

$$7x^2 = 196$$

$$x^2 = \frac{196}{7}$$

$$x = \sqrt{28}$$

$$x = \sqrt{4 \times 7}$$

$$x = \sqrt{4} \times \sqrt{7}$$

$$x = 2\sqrt{7}$$

Area of $\triangle$ ABC $= \frac{1}{2} \times 2\sqrt{7} \times 2 \times 2\sqrt{7} \times \sin 120°$

$= \sqrt{7} \times 4\sqrt{7} \times \sin 60°$

$= 4 \times 7 \times 0{,}86$

$= 24{,}08$

Answer	**(a)**	$2\sqrt{7}$	[4]
	(b)	**24, 08**	[2]

Surname	Forename(s)	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

4008/1

MATHEMATICS

PAPER 1

2 hours 30 minutes

NOVEMBER 2013 SESSION

Candidates answer on the question paper.
Additional materials:
Geometrical instruments

Allow candidates 5 minutes to count pages before the examination.

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and your Centre number and Candidate number on the top right corner of every page of this paper.
Answer all questions.
Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.
Write your answers in the spaces provided on the question paper using black or blue pens.
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.
Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE

This question paper consists of 27 printed pages and 1 blank page.

[Turn over

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

1 Evaluate, giving each answer as a fraction in its lowest terms.

(a) $\frac{1}{5} + \frac{1}{6}$,

(b) $\frac{2}{5} \div 4$,

(c) $\frac{3}{4} - \frac{1}{4} \times \frac{2}{3}$.

Suggested solution

1 (a) $\frac{1}{5} + \frac{1}{6} = \frac{6+5}{30} = \frac{11}{30}$

(b) $\frac{2}{5} \div 4 = \frac{2}{5} \div \frac{4}{1} = \frac{2}{5} \times \frac{1}{4}$

$= \frac{1}{5} \times \frac{1}{2}$

$= \frac{1}{10}$

(c) $\frac{3}{4} - \frac{1}{4} \times \frac{2}{3} = \frac{3}{4} - \left(\frac{1}{4} \times \frac{2}{3}\right)$

$= \frac{3}{4} - \frac{1}{6}$

$= \frac{9-2}{12}$

$= \frac{7}{12}$

Answer (a) $\frac{11}{30}$

(b) $\frac{1}{10}$

(c) [illegible]

2 Evaluate $\frac{(0,3)^3 \times 0,02}{0,0008}$, giving your answer in standard form.

Suggested solution

2 (a) $\frac{(0,3)^3 \times 0,02}{0,0008} = \frac{(0,3 \times 0,3 \times 0,3) \times 0,02}{0,0008}$

$= \frac{0,027 \times 0,02}{0,0008}$

$= \frac{0,00054}{0,0008}$

$= \frac{54}{8}$

$= 6,75$

$= 6,75 \times 1$

$= 6,75 \times 10^0$

Answer $6,75 \times 10^0$ [3]

3 (a) The temperature inside a freezer is – 8° C. During a power cut the temperature rose by 12° C. Find the temperature after the rise.

(b) Write down the next two terms in the following sequence; $1; \frac{1}{2}; \frac{1}{4}; \frac{1}{8}; ---$.

Suggested solution

3 (a) $-8° + 12° = 12° - 8° = 4°$

(b) $1; \frac{1}{2}; \frac{1}{4}; \frac{1}{8}; \ldots\ldots = \frac{1}{2^0}; \frac{1}{2^1}; \frac{1}{2^2}; \frac{1}{2^3}; \frac{1}{2^4}; \frac{1}{2^5}$

The next two terms are: $\frac{1}{2^4} = \frac{1}{2 \times 2 \times 2 \times 2} = \frac{1}{16}$ and $\frac{1}{2^5} = \frac{1}{2 \times 2 \times 2 \times 2 \times 2} = \frac{1}{32}$

Answer (a) 4° [1]

(b) $\frac{1}{16}$; $\frac{1}{32}$ [2]

4 (a) Write 3,35 minutes in minutes and seconds.

(b) If 1 kilometre is $\frac{5}{8}$ of a mile, convert 75 miles to kilometres.

Suggested solution

4 (a) 3,35 minutes = 3 minutes $\frac{35}{100} \times 60$ seconds

= 3 minutes and 21 seconds

(b) let x be the number of kilometres

$1 \text{ km} = \frac{5}{8}$ miles

$x = 75$ miles

$\frac{x}{1} = \frac{75}{5/8}$

$x = \frac{75 \times 8}{5}$

$x = 120$

Answer (a) 3 minutes 21 seconds [1]

(b) 120 km [2]

5 A shopper spent $\$\frac{c}{d}$ on one item and half of that amount on each of three other items.

Find how much she spent altogether.

Suggested solution

5

$$\frac{c}{d} + 3\left(\frac{1}{2}\,\frac{c}{d}\right) = \frac{c}{d} + \frac{3c}{2d}$$

$$= \frac{2c + 3c}{2d}$$

$$= \frac{5c}{2d}$$

Answer $\frac{5c}{2d}$

6 Simplify (a) $\frac{(3^3)^4}{27^3}$,

(b) $(4x^2y^6)^{\frac{1}{2}}$,

(c) $x^0 + x^{-2}$.

Suggested solution

(a) $\frac{(3^3)^4}{27^3} = \frac{(3\times 3\times 3)^4}{27^3}$

$= \frac{27^4}{27^3}$

$= 27^4 \div 27^3$

$= 27^{4-3}$

$= 27$

(b) $(4x^2y^6)^{\frac{1}{2}} = (4 \times x^2 \times y^6)^{\frac{1}{2}}$, using $(a \times b \times c)^d = a^d \times b^d \times c^d$

$= 4^{\frac{1}{2}} \times (x^2)^{\frac{1}{2}} \times (y^6)^{\frac{1}{2}}$

$= (2^2)^{\frac{1}{2}} \times (x^2)^{\frac{1}{2}} \times (y^6)^{\frac{1}{2}}$

$= 2^{2\times\frac{1}{2}} \times x^{2\times\frac{1}{2}} \times y^{6\times\frac{1}{2}}$

$= 2 \times x \times y^3$

$= 2xy^3$

(c) Method 1

$x^0 \div x^{-2} = x^{0-(-2)}$, since $x^a \div x^b = x^{a-b}$

$= x^2$

Method 2

$x^0 \div x^{-2} = 1 \div \frac{1}{x^2}$ recall that $x^0 = 1$ and $x^{-a} = \frac{1}{x^2}$

$= 1 \times \frac{x^2}{1}$

$= x^2$

Answer (a) 27 [1]
(b) $2xy^3$ [1]
(c) x^2 [1]

7 (a) Express $\frac{7}{8}$ as a decimal fraction.

(b) A car loses 55% of its value after four years.

If it cost \$8 500 when new, find its value after the four years.

Suggested solution

7 (a) $\frac{7}{8} = 0,875$

(b) If a car loses 55% after 4 years, then its value after 4 years is 45%. Thus,

$45\%\ of\ \$8\,500 = \frac{45}{100} \times \$8\,500$

$= \$\frac{9}{20} \times 8\,500$

$= \$3\,825$

Answer	(a)	0,875	[1]
	(b)	\$3 825	[2]

8 (a) Simplify $5m - 2(x - 3m)$.

(b) Solve the equation $\frac{x+5}{7} = \frac{3}{2}$.

Suggested solution

8 (a) $5m - 2(x - 3m) = 5m - 2x + 6m$

$= 5m + 6m - 2x$

$= 11m - 2x$

(b) $\frac{x+5}{7} = \frac{3}{2}$

$2(x + 5) = 7 \times 3$

$2x + 10 = 21$

$2x = 21 - 10$

$2x = 11$

$x = \frac{11}{2}$

Answer	(a)	$11m - 2x$	[1]
	(b)	$x = 5\frac{1}{2}$ or 5,5	[2]

(b) 23 and 29

Answer (a) $x = -10$ or $x = 4$ [3]
(b) 23 and 29 [1]

13 (a) Simplify $\frac{x^2 + 3x + 2}{x + 2}$.

(b) Find the order of rotational symmetry of a right-angled isosceles triangle.

Suggested solution

13 (a)

$$\frac{x^2 + 3x + 2}{x + 2} = \frac{x(x+1) + 2(x+1)}{x+2}$$

$$= \frac{(x+1)(x+2)}{x+2}$$

$$= x + 1$$

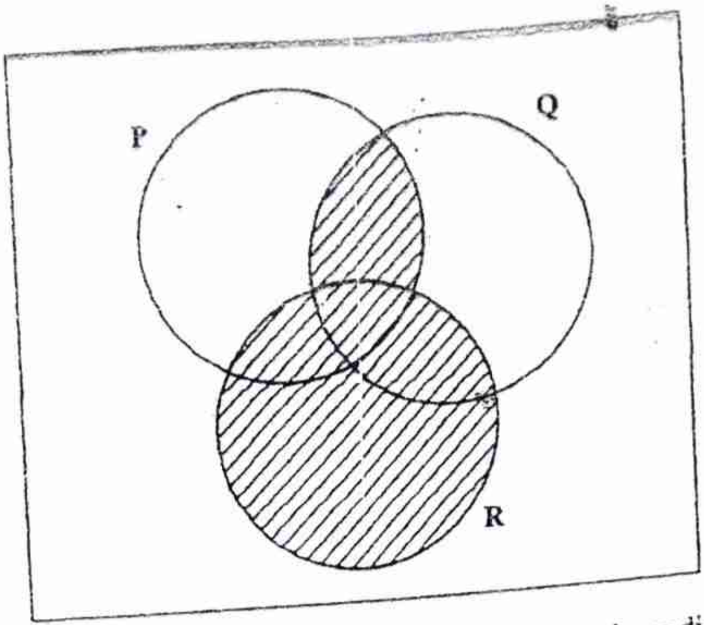
(b) Rotational order = 2

14 (a) Given that $n(A) = 10$ and $n(B) = 15$, find the greatest possible value of

(i) $n(A \cup B)$,

(ii) $n(A \cap B)$.

(b)



Use set notation to describe the shaded region in the above diagram in terms of sets P, Q and R.

Suggested solution

14

Answer (a) (i) 25

(ii) 10

(b) $(P \cap Q) \cup R$

15 Given that $\mathbf{A} = \begin{pmatrix} -2 & -1 \\ 6 & 2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 0 & -1 \\ 4 & 3 \end{pmatrix}$.

Find (a) $3\mathbf{A} - \mathbf{B}$,

(b) $\mathbf{B}^2$.

Suggested solution

15 (a)

$$3\mathbf{A} - \mathbf{B} = 3\begin{pmatrix} -2 & -1 \\ 6 & 2 \end{pmatrix} - \begin{pmatrix} 0 & -1 \\ 4 & 3 \end{pmatrix}$$

$$= \begin{pmatrix} 3 \times -2 & 3 \times -1 \\ 3 \times 6 & 3 \times 2 \end{pmatrix} - \begin{pmatrix} 0 & -1 \\ 4 & 3 \end{pmatrix}$$

$$= \begin{pmatrix} -6 & -3 \\ 18 & 6 \end{pmatrix} - \begin{pmatrix} 0 & -1 \\ 4 & 3 \end{pmatrix}$$

$$= \begin{pmatrix} -6 - 0 & -3 - (-1) \\ 18 - 4 & 6 - 3 \end{pmatrix} = \begin{pmatrix} -6 & -3 + 1 \\ 14 & 3 \end{pmatrix}$$

$$= \begin{pmatrix} -6 & -2 \\ 14 & 3 \end{pmatrix}$$

(b)

$$\mathbf{B}^2 = \mathbf{B} \times \mathbf{B}$$

$$= \begin{pmatrix} 0 & -1 \\ 4 & 3 \end{pmatrix} \times \begin{pmatrix} 0 & -1 \\ 4 & 3 \end{pmatrix}$$

$$= \begin{pmatrix} 0 + (-1 \times 4) & (0 \times -1) + (-1 \times 3) \\ (4 \times 0) + (3 \times 4) & (4 \times -1) + (3 \times 3) \end{pmatrix}$$

$$= \begin{pmatrix} 0 - 4 & 0 - 3 \\ 0 + 12 & -4 + 9 \end{pmatrix}$$

$$= \begin{pmatrix} -4 & -3 \\ 12 & 5 \end{pmatrix}$$

Answer (a) $\begin{pmatrix} -6 & -2 \\ 14 & 3 \end{pmatrix}$ [2]

(b) $\begin{pmatrix} -4 & -3 \\ 12 & 5 \end{pmatrix}$ [2]

/rite down the largest four-digit number in base eight.

(b) Convert 111_8 to a number in base two.

(c) Find the sum of 444_5 and 21_5 giving your answer in base five.

Suggested solution

16 (a) 7777_8

(b) $8^2 \times 1 + 8^1 \times 1 + 8^0 \times 1 = 64 \times 1 + 8 \times 1 + 1 \times 1$

$= 64 + 8 + 1$

$= 73_{10}$

2	73		
2	36	r	1
2	18	r	0
2	9	r	0
2	4	r	1
2	2	r	0
2	1	r	0
	0	r	1

(c)

$$\begin{array}{r} 4^{+1}4^{+1}4_5 \\ +\quad 2\ 1_5 \\ \hline 1\ 0\ 2\ 0_5 \end{array}$$

Answer	**(a)**	**7777_8**	[1]
	(b)	**1001001_2**	[2]
	(c)	**1020_5**	[1]

17 A rugby team scored the following points in 12 matches 21; 18; 3; 12; 15; 18; 42; 18; 24; 6; 12; 3. For the 12 matches,

find

(a) the mode,

(b) the mean.

(c) In the next match, the team scored 55 points.

Write down the median score for the 13 matches.

Suggested solution

17 (a) Rearranging the points in ascending order gives

3; 3; 6; 12; 15; **18**; **18**; **18**; 21; 24; 42

The mode = **18**

(b) The mean $= \frac{3+3+6+12+12+12+15+18+18+18+21+24+42}{12}$

$= \frac{192}{12}$

$= \mathbf{16}$

(c) 3;3;6;12;12;15;**18**;18;18;21;24;42;55

The median = **18**

Answer	**(a)**	18	[1]
	(b)	16	[2]
	(c)	18	[1]

18 The scale of a map is 1:10 000.

(a) Two hills are 4,5 cm apart on the map.

Find the actual distance between the hills, giving your answer in kilometres.

(b) Two towns are 80 km apart.

Find the distance between them on the map, giving your answer in centimetres.

Suggested solution

18 (a) $1\ km = (1\ 000 \times 100)\ cm$

$= 100\,000\ cm$

$1\ cm: 10\,000\ cm$ by *simple proportion*

$4{,}5\ cm = more$

$= \frac{4,5}{1} \times 10\,000\ cm$

$= 45\,000\ cm$

But $1\ km = 100\,000\ cm$

$less = 45\,000\ cm$

$= \frac{45\,000}{100\,000} \times 1\ km$

$= 0{,}45\ km$

(b) $0{,}1km = 1cm$

$80km = x$

$0{,}1x = 80$

$\mathbf{x = 800cm}$

Answer (a) $0{,}45\ km$ [2]

(b) $800\ cm$ [2]

19 The temperature $T°$ C at a height of H metres above sea level, is given by the formula $T = 20 - \frac{H}{150}$.

(a) Calculate the temperature at 4 500 metres.

(b) Make H the subject of the formula.

(c) Find the height at which the temperature is 12° C.

Suggested solution

19 (a) $T = 20 - \frac{H}{150}$, where $H = 4\,500$

$T = 20 - \frac{4\,500}{150}$

$T = 20 - 30$

$\mathbf{T = -10°C}$

(b) $T = 20 - \frac{H}{150}$

$T + \frac{H}{150} = 20$

$$\frac{H}{150} = 20 - T$$

$$H = 150 \times (20 - T)$$

(c) $H = 150 \times (20 - 12)$

$= 150 \times 8$

$= 1\,200$

answer	(a)	$-10°C$	[1]
	(b)	$H = 150(20 - T)$	[2]
	(c)	1200 metres	[1]

20 The number of revolutions, n, of a wheel over a fixed distance varies inversely as the circumference, C cm, of the wheel.

(a) Write down an equation involving n, C and a constant k.

(b) If a wheel of circumference 80 cm makes 10 revolutions, find the number of revolutions made by a wheel of circumference 200 cm.

Suggested solution

20 (a) $n \propto \frac{1}{C} \implies n = \frac{k}{C}$, where k is a constant.

(b) When $C = 80$, $n = 10$,

$\therefore \quad 10 = \frac{k}{80}$

$10 \times 80 = k$

$k = 800$

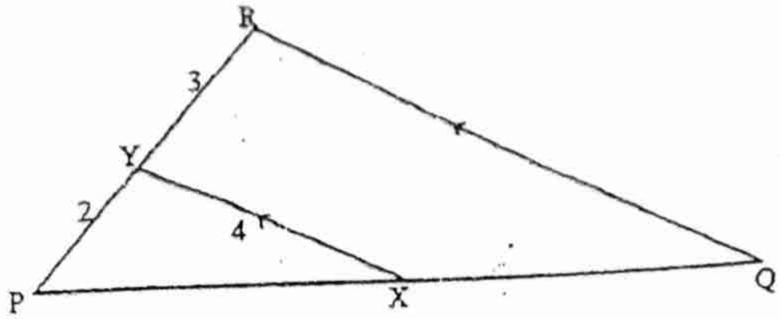
Thus. $n = \frac{800}{C}$

When $C = 200$, $n = n$

Hence, $n = \frac{800}{200} \implies n = 4$

Answer	(a)	$n = \frac{k}{C}$	[1]
	(b)	$n = 4$	[3]

21



In the diagram, XY is parallel to QR, PY = 2 cm, YR = 3 cm and XY = 4 cm.

Find

(a) the length of QR,

(b) the ratio $\frac{\text{area } \Delta PXY}{\text{area } \Delta PQR}$.

Suggested solution

21 (a) $\Delta PQR \sim \Delta PXY$ $\therefore$ $\frac{QR}{XY} = \frac{PR}{PY}$, by definition of ratio of corresponding sides,

Hence, $\frac{QR}{4} = \frac{5}{2}$ or $QR = 10$

(b) $\frac{\text{area of } \Delta PXY}{\text{area of } \Delta PQR} = \left(\frac{2}{5}\right)^2 = \frac{4}{25}$

Answer (a) **10 cm** [2]

(b) $\frac{4}{25}$ [2]

22 Tendai and Vimbai take a driving test. The probability that Tendai will pass is $\frac{3}{5}$ and the probability that Vimbai will pass is $\frac{2}{3}$.

(a) State which one of them is more likely to pass.

(b) Calculate the probability that

(i) they both fail,

(ii) only one of them will pass.

Suggested solution

22 (a) P(Tendai will pass)$= \frac{3}{5} = 0.6$ and P(Wimbai will pass) $\frac{2}{3} = 0.666666\ldots = 0,\dot{6}$

Clearly, Vimbai is more likely to pass.

(b) (i) P(Both fail) = P(Tendai fail)× P(Vimbai fail)

$= \left(1-\frac{3}{5}\right) \times \left(1-\frac{2}{3}\right)$

$= \frac{2}{5} \times \frac{1}{3}$

$= \frac{2}{15}$

(ii) P(Only one will pass)=

=(P(Tendai passes and Vimbai fail or Tendai fail and Vimbai passes)

=(P(Tendai passes and Vimbai fail) + (Tendai fail and Vimbai passes)

$= \left(\frac{3}{5}\right)\left(\frac{1}{3}\right) + \left(\frac{2}{5}\right)\left(\frac{2}{3}\right)$

$= \frac{3}{15} + \frac{4}{15}$

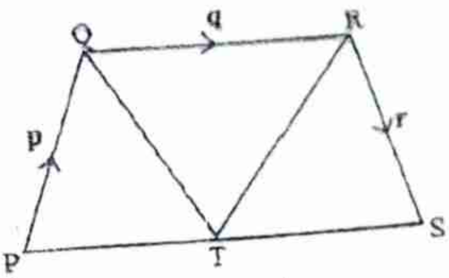
$= \frac{7}{15}$

Answer (a) **Vimbai is likely to pass**

(b) (i) $\frac{2}{15}$

(ii) $\frac{7}{15}$

23



In the diagram $\overrightarrow{PQ} = \mathbf{p}$, $\overrightarrow{QR} = \mathbf{q}$ and $\overrightarrow{RS} = \mathbf{r}$. Triangles PQT, QTR and TRS are equilateral.

Express

(i) $\overrightarrow{PS}$ in terms of

1. p, q and r,

2. q only.

(ii) p in terms of q and r.

Suggested solution

23 (i) 1 $\overrightarrow{PS} = \vec{p} + \vec{q} + \vec{r}$

2 $\overrightarrow{PT} = \overrightarrow{TS} = \overrightarrow{QR}$ (by definition of equilateral Δ)

$\overrightarrow{PS} = \overrightarrow{PT} + \overrightarrow{TS}$

$= \vec{q} + \vec{q}$

$= 2q$

(ii) $\overrightarrow{PQ} = \overrightarrow{PS} + \overrightarrow{SR} + \overrightarrow{RQ}$

$p = 2\vec{q} - \vec{r} - \vec{q}$

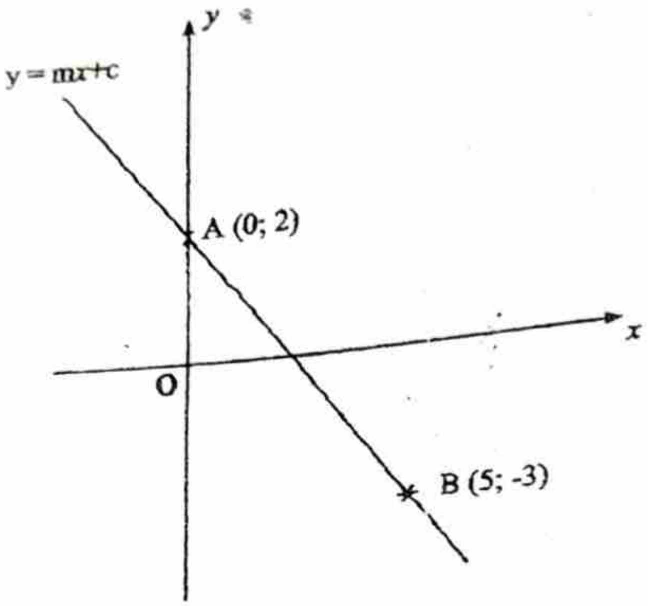
$p = q - r$

Answer (i) 1. $\overrightarrow{PS} = \vec{p} + \vec{q} + \vec{r}$ [1]

2. $2\vec{q}$ [2]

(ii) $\vec{q} - \vec{r}$ [2]

24



The diagram shows the graph of $y = mx + c$, which passes through the points A (0; 2) and B (5; −3).

(a) Find the value of

(i) c,

(ii) m.

(b) Calculate the length of AB, leaving your answer in surd form.

Suggested solution

24 (a) (i) $c = 2$ since c is the y intercept

(ii) $m = \frac{2-(-3)}{0-5} = \frac{5}{-5} = -1$ where m is the gradient

(b) Length AB = $|AB| = \sqrt{(0-5)^2 + (2-(-3))^2}$

$= \sqrt{(-5)\times(-5) + (2+3)^2}$

$= \sqrt{25+25}$

$= \sqrt{50}$

$= \sqrt{25 \times 2}$ recall that $\sqrt{a \times b} = \sqrt{a} \times \sqrt{b}$

$= \sqrt{25} \times \sqrt{2}$

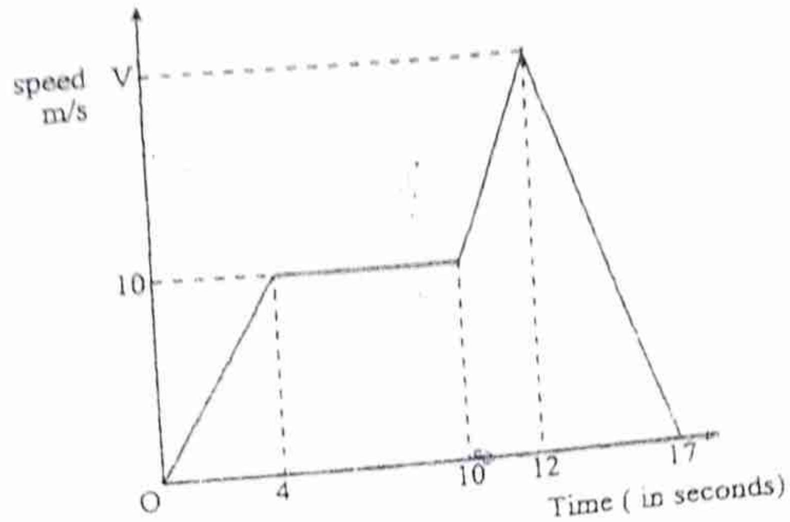
$= 5\sqrt{2}$

Answer **(a)** **(i)** **2**

(ii) **−1**

(b) $5\sqrt{2}$

25



The diagram represents the speed-time graph of a sprinter during an athletics training session.

(a) Calculate the distance the sprinter covers during the first 10 seconds.

(b) Given that the acceleration during the time interval from $t = 10$ to $t = 12$ is $5\ m/s^2$, find the value of V.

(c) Calculate the deceleration of the sprinter, from $t = 12$ to the time the sprinter stops running.

Suggested solution

25 (a) Distance = area of the trapezium

$= \frac{1}{2} \times (a + b) \times h$ (ADDITION FIRST)

$= \frac{1}{2} \times (6 + 10) \times 10,$

$= \frac{1}{2} \times 16 \times 10$

$= 80\ m$

(b) Acceleration = $\frac{\text{Change in Velocity}}{\text{Change in Time}}$

Acceleration = $\frac{v - v_1}{t_2 - t_1}$ but Acceleration = 5 m/s and v = velocity

$$5 = \frac{v - 10}{12 - 10}$$

$$5 = \frac{v - 10}{2}$$

$$10 = v - 10$$

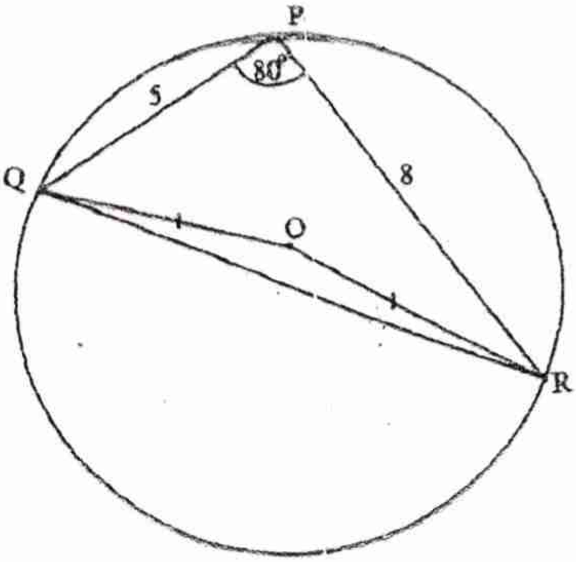
$$v = 20$$

i.e. velocity = 20 m/s

(c) Deceleration $= \frac{20-0}{17-12} = \frac{20}{5} = 4\ ms^{-2}$

Answer (a) 80 m
(b) 20 m/s
(c) $-4ms^{-2}$

26



The points P, Q and R lie on the circumference of a circle, centre O.
PQ = 5 cm, PR = 8 cm and $Q\hat{P}R = 80°$.

Using as much of the information given as is necessary, calculate

(a) the area of triangle PQR,

(b) the value of QR^2,

(c) find the reflex $Q\hat{O}R$.

$[\sin 80° = 0.985;\ \cos 80° = 0.174;\ \tan 80° = 5.67]$

Suggested solution

26 (a)

$$\text{Area} = \tfrac{1}{2} \times 5 \times 8 \sin 80°$$
$$= 20 \times 0{,}985$$
$$= 19{,}700$$

(b)

$$QR^2 = 5^2 + 8^2 - 2 \times 8 \times 5 \times \cos 80°,$$ using the *Cosine Rule*
$$= 25 + 64 - 80(0{,}174)$$
$$= 75{,}08$$

(c)

$$\text{reflex } Q\hat{O}R = 360° - 2(80°) = 200°$$

Using the theorem : angle subtended on the circumference is twice that subtended at centre

Answer **(a)** 19,700
(b) 75,08

Surname	Forename(s)	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS

4008/1

PAPER 1

JUNE 2013 SESSION

2 hours 30 minutes

Candidates answer on the question paper.
Additional materials:
Geometrical instruments

Allow candidates 5 minutes to count pages before the examination.

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and your Centre number and Candidate number on the top right corner of every page of this paper.

If you need additional working space, use the lined pages at the back and number your work correctly.

Answer **all** questions.

Check that all the pages are in the booklet and ask the invigilator for a replacement if there are duplicate or missing pages.

Write your answers in the spaces provided on the question paper using **black or blue** pens.

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.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the *examination room*.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE

This question paper consists of 26 printed pages and 2 lined pages.

[Turn over

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

1 (a) Subtract −2 from 2.

(b) Leaving your answer as a common fraction, find, in its lowest terms, the value of $\frac{8}{15} \div \frac{2}{3}$.

Suggested solution

1 (a) $2 - (-2) = 2 + 2 = 4$

(b) $\frac{8}{15} \div \frac{2}{3} = \frac{8}{15} \times \frac{3}{2} = \frac{4}{15} \times \frac{3}{1} = \frac{4}{5}$

Answer (a) 4 [1]

(b) $\frac{4}{5}$ [2]

2 (a) Express $3\frac{4}{5}$ as a decimal number.

(b) Find the exact value of $\frac{0,83 + 8,368}{0,42}$.

Suggested solution

2 (a) $3\frac{4}{5} = \frac{19}{5} = 3,8$

(b)

$$\begin{array}{r} 0,830 \\ +\ 8,368 \\ \hline 9,198 \\ \hline \end{array}$$

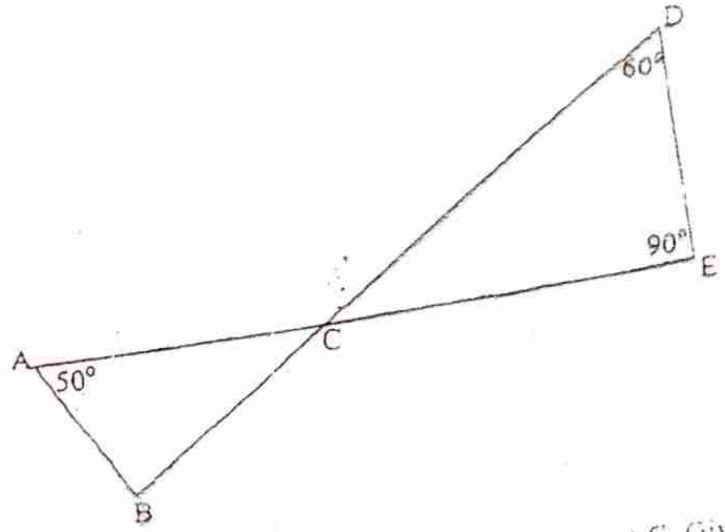
$\frac{9,198}{0,42} = \frac{919,8}{42} = 21\frac{9}{10}$

Answer (a) 3,8 [1]

(b) 21,9 [2]

3 (a) Find n such that $0,0075 = 7,5 \times 10^n$.

(b)



In the diagram ACE and BCD are straight lines intersecting at C. Given that $C\hat{E}D = 90°$, calculate $A\hat{B}C$.

Suggested solution

3 (a)
$$0,0075 = 7,5 \times 10^n$$
$$7,5 \times 10^{-3} = 7,5 \times 10^n,$$ comparing powers of 10.
$$n = -3$$

(b) $A\hat{C}B = 180° - (90° + 60°) = \mathbf{30°}$

$\therefore A\hat{B}C = 180° - (50° + 30°) = \mathbf{100°}$

Answer (a) $n = -3$ [1]
(b) 100° [2]

4 (a) Write down the square of 4.

(b) Evaluate $125^{\frac{1}{3}} \times \sqrt{144}$.

Suggested solution

4 (a) $4^2 = 4 \times 4 = \mathbf{16}$

(b)
$$125^{\frac{1}{3}} \times \sqrt{144} = (5^3)^{\frac{1}{3}} \times 12$$
$$= 5^{3 \times \frac{1}{3}} \times 12$$
$$= 5^1 \times 12$$
$$= \mathbf{60}$$

Answer (a) 16 [1]
(b) 60 [2]

Express (a) $3\ m^2$ in cm^2.

(b) 32,5 m/s in km/h.

Suggested solution

but $1\ m = 100\ cm$

(a) $3\ m^2 = 3 \times m \times m,$

$= 3 \times 100\ cm \times 100\ cm$

$= \mathbf{30\ 000\ cm^2}$

(b) $3{,}25\ m/s = \frac{3{,}25\ m}{s}$

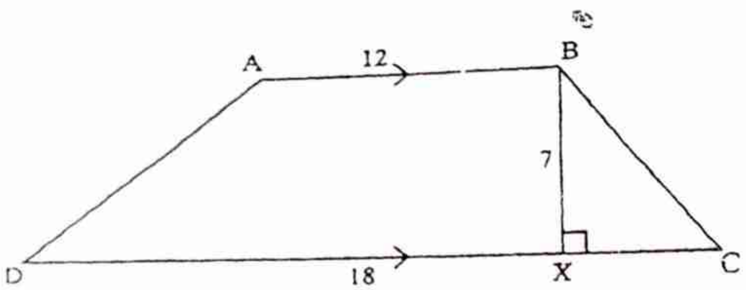
$= \frac{3{,}25}{1000} \times \frac{3600}{1}\ km/h$

$= 11{,}7\ km/h$

Answer (a) **$30\ 000\ cm^2$** [1]

(b) **$11{,}7\ km/h$** [2]

6



In the diagram, ABCD is a quadrilateral in which AB is parallel to DC, AB = 12 cm, CD = 18 cm, BX = 7 cm and $B\hat{X}C = 90°$.

(a) State the special name given to the quadrilateral ABCD.

(b) Calculate the area of the quadrilateral.

Suggested solution

6 (a) TRAPEZIUM

(b) $\text{Area} = \frac{1}{2}(AB + CD) \times BX$

$= \frac{1}{2} \times (12\ cm + 18\ cm) \times 7cm$

$= \frac{1}{2} \times (30\ cm) \times 7\ cm$

$= 105cm^2$

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

(b) 105 cm²

7 Simplify $\frac{x^2+7x+6}{x^2-36}$.

Suggested solution

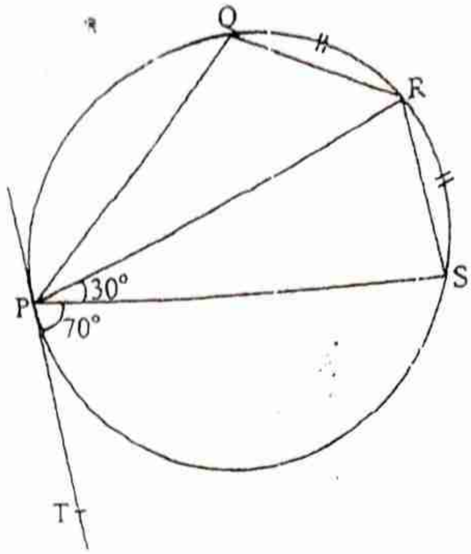
7 $$\frac{x^2+7x+6}{x^2-36} = \frac{x^2+x+6x+6}{x^2-6^2} = \frac{x(x+1)+6(x+1)}{(x-6)(x+6)}$$

$$= \frac{(x+6)(x+1)}{(x-6)(x+6)}$$

$$= \frac{(x+1)}{(x-6)}$$

Answer $\frac{(x+1)}{(x-6)}$ [3]

8



In the diagram P, Q, R and S are points on the circumference of a circle and arcs QR and RS are equal. TP is a tangent to the circle at P. $T\hat{P}S = 70°$ and $R\hat{P}S = 30°$

Calculate (a) $Q\hat{P}R$,

(b) $P\hat{R}S$,

(c) $P\hat{Q}R$.

Suggested solution

(a)	$Q\hat{P}R = 30°$	(∡'s subtended by equal chords & arcs)
(b)	$P\hat{R}S = T\hat{P}S = 70°$	(∡ in alternate segment)
(c)	$P\hat{Q}R = T\hat{P}R$	(∡ in alternate segment)
	$= 70° + 30°$	
	$= 100°$	

Answer	(a)	30°	[1]
	(b)	70°	[1]
	(c)	100°	[1]

9 E varies directly as the square of V.

(a) Express E in terms of V and a constant m.

(b) Given that $E = 3$ when $V = 2$ find m.

Suggested solution

9 (a) $E \propto V^2 \implies E = mV^2$, where m is a constant.

(b) When $V = 2$, $E = 3$ we get

$$3 = m \times 2^2$$

$$3 = 4m$$

$$m = \frac{3}{4}$$

Answer	(a)	$E = mV^2$	[1]
	(b)	$m = \frac{3}{4}$	[2]

10 Evaluate **(a)** $(-3)^0$,

(b) $\left(\frac{16}{81}\right)^{-\frac{3}{4}}$.

Suggested solution

10 (a) $(-3)^0 = 1$

(b)

$$\left(\frac{16}{81}\right)^{-\frac{3}{4}} = \left(\frac{81}{16}\right)^{\frac{3}{4}}$$

$$= \frac{81^{\frac{3}{4}}}{16^{\frac{3}{4}}}$$

$$= \frac{\left(\sqrt[4]{81}\right)^3}{\left(\sqrt[4]{16}\right)^3}$$

$$= \frac{(3)^3}{(2)^3}$$

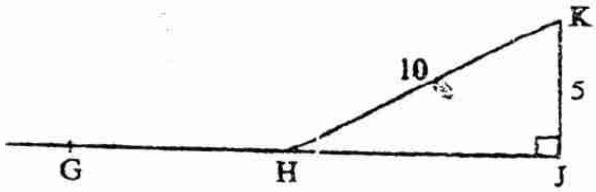
$$= \frac{3 \times 3 \times 3}{2 \times 2 \times 2}$$

$$= \frac{27}{8}$$

$$= 3\frac{3}{8}$$

Answer	(a)	1	[1]
	(b)	$3\frac{3}{8}$	[2]

11



In the diagram GHJ is a straight line. $H\hat{J}K = 90°$, JK = 5 cm and HK = 10 cm.

(a) Find $\sin G\hat{H}K$,

(b) Calculate HJ leaving your answer in surd form.

Suggested solution

11 (a) $\sin G\hat{H}K = \sin(180° - K\hat{H}J) = \sin K\hat{H}J$

$$= \frac{5}{10}$$

$$= \frac{1}{2}$$

(b) $HJ^2 + JK^2 = HK^2$, using *Pythagoras theorem*

$$HJ^2 + 5^2 = 10^2$$

$$HJ^2 + 25 = 100$$

$$HJ^2 = 75$$

$$HJ = \sqrt{75}$$

$$= \sqrt{25 \times 3}$$

$$= \sqrt{25} \times \sqrt{3}$$

13 (a)

$$3x + 2y = 18$$
$$2y = -3x + 18$$
$$y = -\frac{3}{2}x + \frac{18}{2}$$
$$y = -\frac{3}{2}x + 9$$

Gradient, $m = -\frac{3}{2}$

(b) Method 1

Recall that parallel lines have equal gradients

Using, $y = mx + c$, with $x = -2, y = 3$ and $m = -\frac{3}{2}$

i.e $3 = -\frac{3}{2}(-2) + c \implies 3 = 3 + c \implies c = 0$

$$y = -\frac{3}{2}x$$

$\implies 3x + 2y = 0$

Method 2

Using, $\frac{y - y_1}{x - x_1} = m$, with $(x_1; y_1) = (-2; 3)$ and $m = -\frac{3}{2}$

i.e $\frac{y-3}{x-(-2)} = -\frac{3}{2}$

$$\frac{y-3}{x+2} = -\frac{3}{2}$$
$$2(y - 3) = -3(x + 2)$$
$$2y - 6 = -3x - 6$$
$$3x + 2y = 6 - 6$$
$$3x + 2y = 0$$

Answer (a) $-\frac{3}{2}$ or $-1\frac{1}{2}$ [1]

(b) $3x + 2y = 0$ [2]

14 Given that $h\begin{pmatrix}3\\5\end{pmatrix} + k\begin{pmatrix}2\\-1\end{pmatrix} = \begin{pmatrix}14\\6\end{pmatrix}$, find the scalars h and k.

Suggested solution

14

$$h\begin{pmatrix}3\\5\end{pmatrix} + k\begin{pmatrix}2\\-1\end{pmatrix} = \begin{pmatrix}14\\6\end{pmatrix}$$
$$\begin{pmatrix}3h\\5h\end{pmatrix} + \begin{pmatrix}2k\\-k\end{pmatrix} = \begin{pmatrix}14\\6\end{pmatrix}$$
$$\begin{pmatrix}3h + 2k\\5h - k\end{pmatrix} = \begin{pmatrix}14\\6\end{pmatrix}$$

$= 5 \times \sqrt{3}$

$= 5\sqrt{3}$

Answer	(a)	$\frac{1}{2}$	[1]
	(b)	$5\sqrt{3}$	[2]

12 Given that $\mathbf{M} = \begin{pmatrix} 5 & 5 \\ 3 & x \end{pmatrix}$ and $\mathbf{N} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$

find (a) the determinant of **M** in terms of x,

(b) the modulus of the vector **N**,

(c) the value of x given that $\det \mathbf{M} = |\mathbf{N}|$.

Suggested solution

12 (a) $\text{Det}(\mathbf{M}) = 5x - 5 \times 3 = 5x - 15$

(b) $|\mathbf{N}| = \sqrt{3^2 + 4^2}$

$= \sqrt{9 + 16}$

$= \sqrt{25}$

$= 5$

(c) $\det \mathbf{M} = |\mathbf{N}|$

$5x - 15 = 5,$ divi[illegible]oss the equation.

$x - 3 = 1$

$x = 4$

Answer	(a)	$\det \mathbf{M} = 5x - 15$	[1]
	(b)	$\|\mathbf{N}\| = 5$	[1]
	(c)	$x = 4$	[4]

13 (a) Write down the gradient of the line whose equation is $3x + 2y = 18$.

(b) Find the equation of the straight line which is parallel to the line $3x + 2y = 18$ and passes through $(-2; 3)$.

Suggested solution

Method 1 (Substitution Method)

$3h + 2k = 14$ ——— ①
$5h - k = 6$ ——— ②

From ② $5h - k = 6$, or $5h - 6 = k$

Substituting into ① gives,

$$3h + 2(5h - 6) = 14$$
$$3h + 10h - 12 = 14$$
$$13h = 14 + 12$$
$$13h = 26$$
$$h = 2$$

from ① $3(2) + 2k = 14$

$$6 + 2k = 14$$
$$3 + k = 7$$
$$k = 4$$

Method 2 (Elimination Method)

$3h + 2k = 14$ ——— ①×1
$5h - k = 6$ ——— ②×2

$3h + 2k = 14$ ——— ③
$10h - 2k = 12$ ——— ④

③+④: $13h = 26$

$$h = 2$$

Using ② $3(2) + 2k = 14$

$$6 + 2k = 14$$
$$3 + k = 7$$
$$k = 4$$

Answer $h = 2$ [2]
$k = 4$ [2]

15 Given that $\log_{10} 3 = 0,4771$ and $\log_{10} 5 = 0,6991$, find

(a) $\log_{10} 1\frac{2}{3}$,

(b) $\log_{10} 30$.

Suggested solution

15 (a) $\log_{10} 1\frac{2}{3} = \log_{10} \frac{5}{3}$, but $\log\left(\frac{A}{B}\right) = \log A - \log B$

$= \log_{10} 5 - \log_{10} 3$

$= 0,6991 - 0,4771$

$= \mathbf{0,222}$

(b) $\log_{10} 30 = \log_{10}(3 \times 10)$ recalling that $\log AB = \log A + \log B$

$= \log_{10} 3 + \log_{10} 10$

$= 0,4771 + 1$ Since $\log_{10} 10 = 1$

$= \mathbf{1,4771}$

Answer	(a)	**0,222**
	(b)	**1,4771**

21 A trader bought a tonne of goods worth $2 500.

(a) Calculate the cost price per kilogram.

(b) If the goods were later sold at $2,10 per kilogram. Calculate the percentage loss.

(c) Find the value of $n^4 - 4n$ if $n = 3$

Suggested solution

21 (a) $\text{Cost/kg} = \frac{2\,500}{1\,000}$

$= \mathbf{\$2,50}$

(b) Amount at $2,10/kg $= \$2,10 \times 100$

$= \$2100$

Percentage loss $= \frac{\$2\,500 - \$2\,100}{\$2\,500} \times 100\%$

$= \frac{4}{25} \times 100\%$

$= \mathbf{16\%}$

(c) $n^4 - 4n = 3^4 - 4(3)$ given that $n = 3$

$= 3 \times 3 \times 3 \times 3 - 12$

$= 81 - 12$

$= 69$

Answer	**(a)**	$2,50	[1]
	(b)	16%	[2]
	(c)	69	[2]

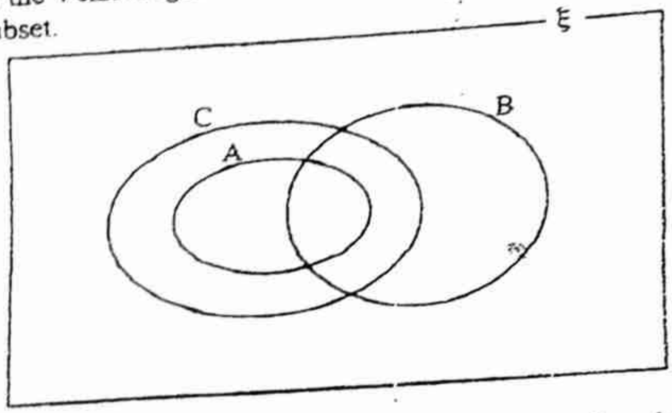
22 Given that $\xi = \{x : 1 \leq x \leq 15, x \text{ is an integer}\}$,

$A = \{x : x \text{ is a multiple of } 4\}$,

$B = \{x : x \text{ is a perfect square}\}$

and $C = \{x : x \text{ is a multiple of } 2\}$.

(a) In the Venn diagram in the working space, fill in the members of each subset.



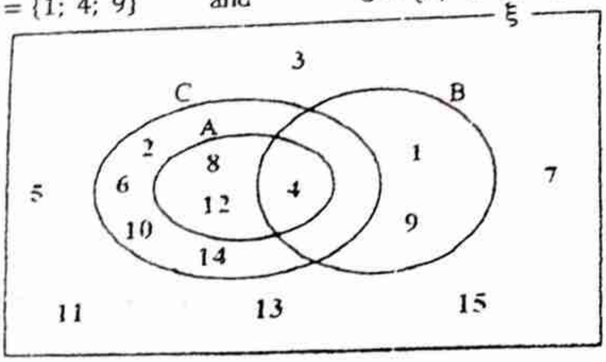
(b) (i) Write down the relationship between sets A and C in set notation.

(ii) Find $n(A \cap B \cap C)$.

uggested solution

2 (a) $\xi = \{1;\ 2;\ 3;\ 4;\ 5; \ldots;\ 15\}$, $A = \{4;\ 8;\ 12\}$

$B = \{1;\ 4;\ 9\}$ and $C = \{2;\ 4;\ 6;\ 8;\ 10;\ 12;\ 14\}$



(b) (i) $A \subseteq C$

(ii) $n(A \cap B \cap C) = 1$

Answer	**(a)**	**Venn diagram**		[3]
	(b)	(i)	$A \subseteq C$	[1]
		(ii)	$n(A \cap B \cap C) = 1$	[1]

23 A teacher gave ball-point pens as prizes to pupils who passed his test. He had 2 boxes of pens. Box A had 6 blue, 4 green and 3 red pens while Box B had 6 blue and 4 green pens. Ben was asked to pick a pen from Box A and Laiza from Box B.

Find the probability that

(a) Ben picked a blue pen,

(b) both Ben and Laiza picked blue pens,

(c) both Ben and Laiza picked pens of the same colour.

Suggested solution

23 (a) P(Ben pick blue) $= \frac{6}{13}$

(b) P(Ben picked blue & Laiza picked blue) = P(Ben picked blue) × P(Laiza picked blue)

$= \frac{6}{13} \times \frac{6}{10}$

$= \frac{36}{130}$

$= \frac{18}{65}$

(c) P(Both Ben & Laiza picked pens of the same colours)

=P(Ben picked blue & Laiza picked blue) + P(Ben picked green & Laiza picked green)

$= \frac{6}{13} \times \frac{6}{10} + \frac{4}{13} \times \frac{4}{10}$

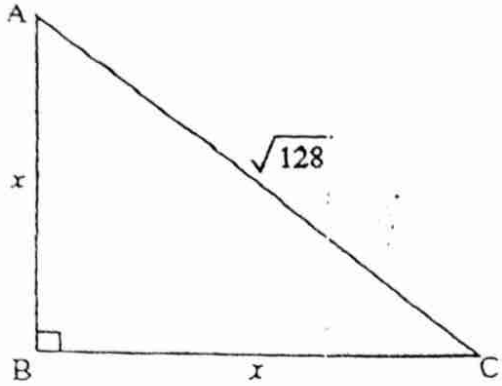
$= \frac{26}{65}$

$= \frac{2}{5}$

Answer	**(a)**	$\frac{6}{13}$	[1]
	(b)	$\frac{18}{65}$	[2]
	(c)		

24 (a) If n is an integer, calculate the greatest possible value of n which satisfies the inequality $3n - 25 < 2$.

(b)



In the diagram $AB = BC = x$ cm, $AC = \sqrt{128}$ cm and $A\hat{B}C = 90°$.

(i) Form an equation in x.

(ii) Find the value of x.

Suggested solution

24 (a)

$$3n - 25 < 2$$
$$3n < 2 + 25$$
$$3n < 27$$
$$n < 9$$
$$n = 8$$

(b) (i) $x^2 + x^2 = (\sqrt{128})^2$, by Pythagoras theorem

$$2x^2 = 128$$
$$x^2 = 64$$
$$x^2 - 64 = 0$$

(ii)

$$x^2 - 64 = 0$$
$$x^2 - 8^2 = 0$$
$$(x - 8)(x + 8) = 0$$ difference of two squares

Either $x - 8 = 0$ or $x + 8 = 0$

i.e $x = -8$ or $x = 8$

Hence $x = 8$ but $x > 0$

Answer	(a)		$n = 8$	[2]
	(b)	(i)	$x^2 - 64 = 0$	[1]
		(ii)	$x = 8$	[3]

25 A class of 40 pupils from different families were asked how many pets they kept. The results are shown in the table.

number of pets per family	1	2	3	4
number of families	3	7	17	13

(a) (i) State the mode,

(ii) Calculate the mean number of pets per family.

(b) If the results in the table were shown on a pie chart, calculate the angle representing the number of pupils who kept **two** pets.

(c) Express the number of pupils who kept **three** pets as a percentage of the class.

Suggested solution

25 (a) (i) 3

(ii) $\text{Mean} = \frac{1\times3+2\times7+3\times17+4\times13}{40}$

$= \frac{120}{40}$

$= 3$

(b) $\text{Angle} = \frac{7}{40} \times 360 = 63°$

(c) $\text{Percentage} = \frac{17}{40} \times 100\% = 42,5\%$

Answer	**(a)**	**(i)**	3	[1]
		(ii)	3	[3]
	(b)		63°	[2]
	(c)		42, 5%	[3]

CANDIDATES ARE REQUIRED TO WRITE THEIR NUMBER IN THE BOX ON THE TOP RIGHT CORNER OF EVERY SHEET OF THIS SUBJECT

Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008/1

PAPER 1

REPLACEMENT PAPER

NOVEMBER 2012 SESSION 2 hours 30 minutes

Candidates answer on the question paper
Additional materials
Geometrical instruments

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name in the spaces at the top of this page.
Write your candidate number in the box on the top right corner of every page of this paper.
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.
Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE

This question paper consists of 28 printed pages.

[Turn over

15

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

) Express 754,96

(a) correct to

(i) one decimal place,

(ii) one significant figure,

(b) in standard form.

ggested solution

(a) (i) 755,0 (1 decimal place)

(ii) 800 (1 significant figure)

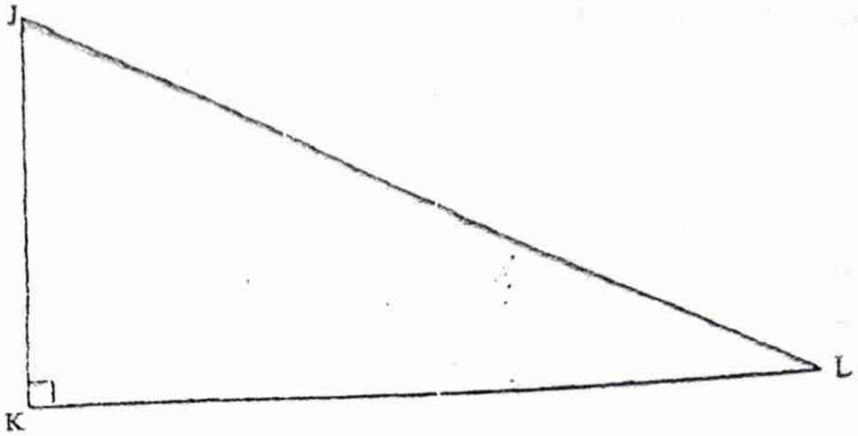
(b) $754,96 = 7.5496 \times 10^2$ (in standard form)

Answer (a) (i) 755,0

(ii) 800

(b) $754,96 = 7.5496 \times 10^2$

2



In the diagram, triangle JKL is right angled at K.

(a) Measure and write down

(i) the length of KL correct to the nearest centimetre,

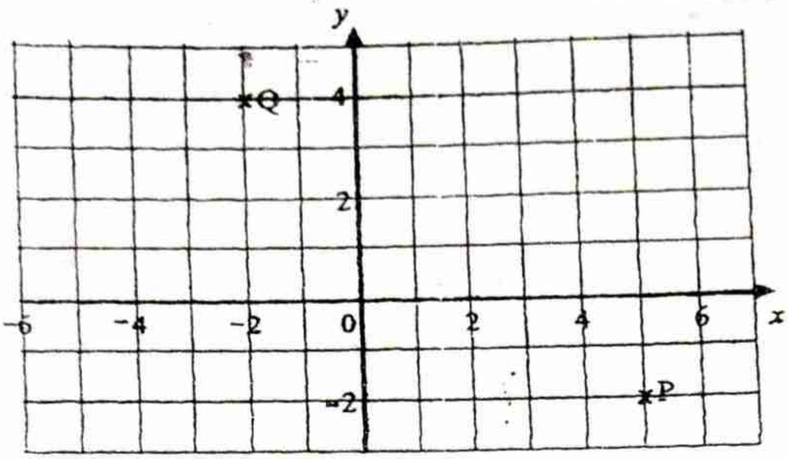
(ii) the size of angle KJL correct to the nearest degree.

(b) Write down the special name given to the side JL.

Suggested solution

Answer (a)		[1]
(b) (i)		[1]
(ii)	Hypotenuse	[1]

3



The points P and Q are shown on the grid.

(a) (i) Write down the coordinates of P.

(ii) Write $\overrightarrow{PQ}$ as a column vector.

(b) Given $\overrightarrow{QM} = \begin{pmatrix} 5 \\ -3 \end{pmatrix}$, draw $\overrightarrow{QM}$ on the grid.

Suggested solution

3 (a) (i) $P(x;\ y) = (5;\ -2)$

(ii)
$$\overrightarrow{PQ} = \overrightarrow{OQ} - \overrightarrow{OP}$$
$$= \begin{pmatrix} -2 \\ 4 \end{pmatrix} - \begin{pmatrix} 5 \\ -2 \end{pmatrix}$$
$$= \begin{pmatrix} -2-5 \\ 4-(-2) \end{pmatrix}$$
$$= \begin{pmatrix} -7 \\ 4+2 \end{pmatrix}$$
$$= \begin{pmatrix} -7 \\ 6 \end{pmatrix}$$

Answer (a) (i) (5 ; −2) [1]

(ii) $\begin{pmatrix} -7 \\ 6 \end{pmatrix}$ [1]

(b) **On diagram** [1]

4 Simplify

(a) $3\frac{3}{4} - 3 \times \frac{1}{2}$,

(b) $4x^2 - 3x(2x - 5)$.

Suggested solution

4 (a) $3\frac{3}{4} - 3 \times \frac{1}{2} = \frac{15}{4} - \frac{7}{2}$

$= \frac{15}{4} - \frac{14}{4}$

$= \frac{1}{4}$

(b) $4x^2 - 3x(2x - 5) = 4x^2 - 6x^2 + 15x$

$= -2x^2 + 15x$

$= 15x - 2x^2$

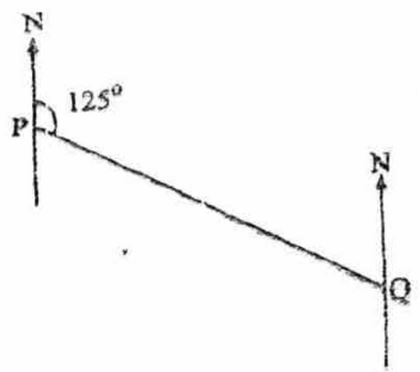
$= x(15 - 2x)$

Answer (a) $\frac{1}{4}$

(b) $x(15 - 2x)$

5 (a) Write down the supplement of 35^0.

(b)



The diagram shows the positions of two TV masts P and Q.
The bearing of Q from P is 125°. Find the 3-figure bearing of P from Q.

Suggested solution

5 (a) The supplement of $35° = 180^0 - 35^0 = 145^0$

(b) The bearing of P from Q = $180^\circ + 125^\circ = 305^\circ$

Answer (a) 145^0 [1]
(b) 305^0 [2]

7

6 Make y the subject of the formula $x = \sqrt{cy - d}$.

Suggested solution

6 $x = \sqrt{cy - d}$ but $\sqrt{x} = x^{\frac{1}{2}}$

$x = (cy - d)^{\frac{1}{2}}$

$x^2 = (cy - d)^{\frac{1}{2}\times 2}$, squaring both sides of the equation

$x^2 = (cy - d)^1$

$x^2 = cy - d$

$x^2 + d = cy$. rearranging

$cy = x^2 + d$ dividing both sides by c,

$y = \frac{1}{c}(x^2 + d)$

Answer $y = \frac{1}{c}(x^2 + d)$

7 Solve the simultaneous equations

$4x + 9y = 33$.

$2x - 3y = -6$.

Suggested solution

7 Using the *Elimination method*, we have,

$4x + 9y = 33$ ______ ① × 1
$2x - 3y = -6$ ______ ② × 3

$4x + 9y = 33$ ______ ③
$6x - 9y = -18$ ______ ④
③+④ : $10x = 15$

$2x = 3$

$x = \frac{3}{2}$

Using ②, $2\left(\frac{3}{2}\right) - 3y = -6$

$3 - 3y = -6$

$3 + 6 = 3y$

$3y = 9$

$y = 3$

Answer $y = 3$
$x = \frac{3}{2}$

8 Jojo works in the afternoons only for 5 days a week. He starts work at 1.15 pm and finishes at 7.45 pm.

(a) Express 7.45 pm as time in the 24 - hour notation.

(b) If he is paid $1.20 per hour, calculate his weekly wage.

Suggested solution

8 (a) 19 45

(b) $7.45\ pm - 1.15\ pm = 6\ hrs\ 30\ mins$

Weekly wage $= 6\frac{1}{2} \times \$1.20 \times 5\ days = \$\ \frac{13}{2} \times 1.20 \times 5$

$= \$39$

Answer (a) 19 45
(b) $39

9 Factorise completely

(a) $7pq - 14q$.

(b) $x^2 - 7x + 10$.

Suggested solution

9 (a) $7pq - 14q = 7(pq - 2q)$
$= 7q(p - 2)$

(b) $x^2 - 7x + 10 = x^2 - 2x - 5x + 10$

$= x(x-2) - 5(x-2)$

$= (x-2)(x-5)$

Answer	**(a)**	$7q(p-2)$
	(b)	$(x-2)(x-5)$

10 **(a)** Solve the inequality $4 - 5x < 19$.

(b) Represent your solution to **(a)** on a cartesian plane.

Suggested solution

10 (a) $4 - 5x < 19$

$-5x < 19 - 4$

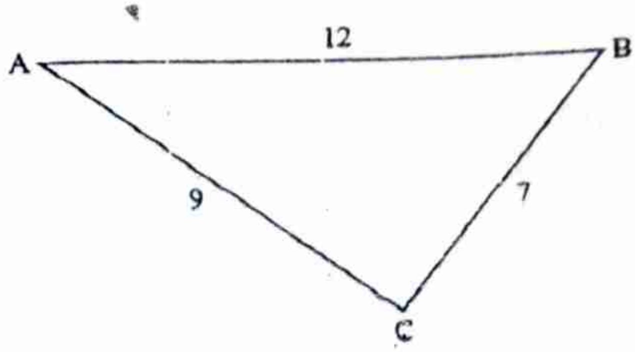
$-5x < 15$

$\frac{-5x}{-5} > \frac{15}{-5}$

$x > -3$

Answer	(a)	$x > -3$
	(b)	

11



In the diagram, AB = 12 cm, AC = 9 cm and BC = 7 cm.

Using as much of the information given below as is necessary

(a) express the ratio AC:AB in its simplest form,

(b) find the area of triangle ABC.

$[\sin \hat{A} = 0{,}58; \cos \hat{A} = 0{,}81; \tan \hat{A} = 0{,}71]$

Suggested solution

11 (a) $AC : AB = 9 : 12 = 3 : 4$

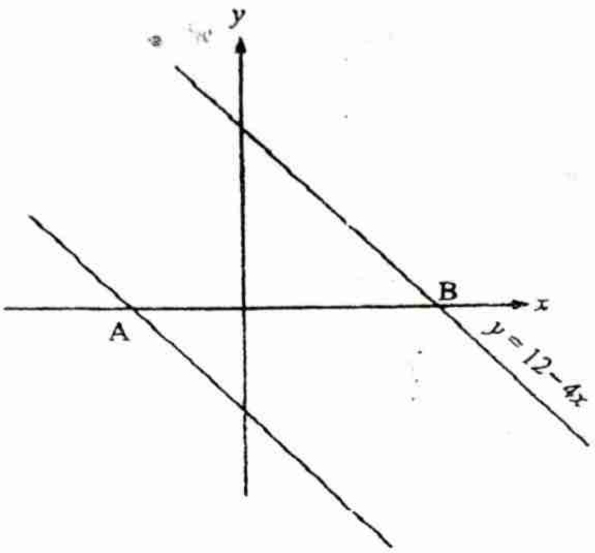
(b) Area $= \frac{1}{2} ab\ SinA$

$= \frac{1}{2} \times 9\ cm \times 12\ cm \times 0.58$

$= 36 \times 0.58\ cm^2$

$= 20.88\ cm^2$

Answer (a) $AC : AB = 3 : 4$
(b) $20.88\ cm^2$



In the diagram, the line through A is parallel to the line $y = 12 - 4x$ and the distance AB = 5 units.

(a) Write down the x-coordinate of B.

(b) Find the equation of the line through A parallel to the line $y = 12 - 4x$.

Suggested solution

12 (a) When $y = 0$, $12 - 4x = 0$

$4x = 12$

$x = 3$

(b) $y = -4x + c$ but $x = -2$, $y = 0$

$0 = -4 \times (-2) + c$

$0 = 8 + c$

$c = -8$

$y = -4x - 8$

Answer (a) $x = 3$

(b) $y = -4x - 8$

13 If $120_3 = 13_n + 10_n$, find the value of n.

Suggested solution

13 $120_3 = 13_n + 10_n \Rightarrow 120_3 = (13_n) + (10_n)$

$$1 \times 3^2 + 2 \times 3^1 + 0 \times 3^0 = (1 \times n^1 + 3 \times n^0) + (1 \times n^1 + 0 \times n^0)$$
$$9 + 6 + 0 = (n + 3 \times 1) + (n + 0)$$
$$15 = n + 3 + n$$
$$15 - 3 = 2n$$
$$2n = 12$$
$$n = 6$$

Answer $n = 6$

---

14 (a) Find the exact value of $\left(\frac{4}{3}\right)^{-2}$.

(b) Simplify $3^{-\frac{1}{2}} \times 9^{\frac{1}{4}}$.

Suggested solution

14 (a) $\left(\frac{4}{3}\right)^{-2} = \left(\frac{3}{4}\right)^{2}$

$= \frac{3^2}{4^2}$

$= \frac{9}{16}$

(b) $3^{-\frac{1}{2}} \times 9^{\frac{1}{4}} = 3^{-\frac{1}{2}} \times (3^2)^{\frac{1}{4}}$

$= 3^{-\frac{1}{2}} \times 3^{2 \times \frac{1}{4}}$ since $(x^a)^b = x^{a \times b}$

$= 3^{-\frac{1}{2}} \times 3^{\frac{1}{2}}$

$= 3^{-\frac{1}{2} + \frac{1}{2}}$ but $-\frac{1}{2} + \frac{1}{2} = 0$

$= 3^0$ recall that $x^0 = 1$

$= 1$

Answer (a) $\frac{9}{16}$ [1]

(b) 1 [2]

the mean becomes 51.

Find the value of x.

Suggested solution

Let y be the sum of 10 numbers,

So $$\frac{y}{10} = 54.6 \quad \Rightarrow \quad y = 54.6 \times 10$$

i.e $$y = 546$$

Now, $$\frac{546 + x + 6}{11} = 51$$

$$\frac{552 + x}{11} = 51$$

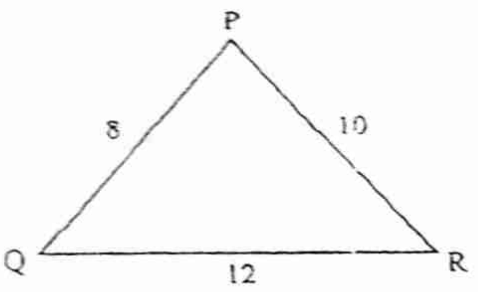
$$552 + x = 51 \times 11$$

$$552 + x = 561$$

$$x = 9$$

Answer $x = 9$ [3]

16



In the diagram, PQ = 8 cm, QR = 12 cm and PR = 10 cm.

Express $\cos \hat{P}$ as a common fraction.

Suggested solution

$$\cos \hat{P} = \frac{r^2 + q^2 - p^2}{2rq},$$ by definition of the Cosine rule.

$$= \frac{8^2 + 10^2 - 12^2}{2 \times 8 \times 10} = \frac{164 - 144}{160}$$

$$= \frac{20}{160}$$

$$= \frac{1}{8}$$

17 Given that $\mathbf{C} = \begin{pmatrix} 2 & -3 \\ 0 & 4 \end{pmatrix}$ and $\mathbf{D} = \begin{pmatrix} 5 & -2 \\ -7 & 1 \end{pmatrix}$, express as a single matrix

(a) $\mathbf{C} - 2\mathbf{D}$,

(b) $\mathbf{D}^2$.

Suggested solution

17 (a)

$$C - 2D = \begin{pmatrix} 2 & -4 \\ 0 & 4 \end{pmatrix} - 2\begin{pmatrix} 5 & -2 \\ -7 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 2 & -3 \\ 0 & 4 \end{pmatrix} - \begin{pmatrix} 10 & 4 \\ -14 & -2 \end{pmatrix}$$

$$= \begin{pmatrix} -8 & -7 \\ 14 & 4+2 \end{pmatrix}$$

$$= \begin{pmatrix} -8 & -7 \\ 14 & 6 \end{pmatrix}$$

$$D^2 = D \times D$$

$$= \begin{pmatrix} 5 & -2 \\ -7 & 1 \end{pmatrix}\begin{pmatrix} 5 & -2 \\ -7 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 5 \times 5 + (-2) \times (-7) & 5 \times (-2) + (-2) \times 1 \\ (-7) \times 5 + 1 \times (-7) & (-7) \times (-2) + 1 \times 1 \end{pmatrix}$$

$$= \begin{pmatrix} 25 + 14 & -10 - 2 \\ -35 - 7 & 14 + 1 \end{pmatrix}$$

$$= \begin{pmatrix} 39 & -12 \\ -42 & 15 \end{pmatrix}$$

Answer (a) $\begin{pmatrix} -8 & -7 \\ 14 & 6 \end{pmatrix}$ [2]

(b) $\begin{pmatrix} 39 & -12 \\ -42 & 15 \end{pmatrix}$ [2]

15 (a) Given that $\log 3 = 0.477$ and $\log 5 = 0.699$, find $\log 45$.

(b) Two sets A and B are such that $A \cap B \neq \phi$, $A \cup B = \xi$, $n(A) = 15$, $n(B) = 25$ and $n(A \cup B) = 30$.

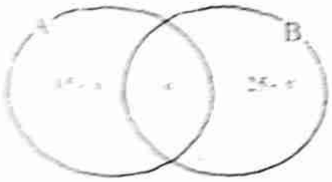
Find $n(A \cap B)$.

Suggested solution

15 (a)

$$\log 45 = \log 3 \times 3 \times 5.$$
$$= \log 3 + \log 3 + \log 5$$
$$= 2 \log 3 + \log 5$$
$$= 2 \times 0.477 + 0.699$$
$$= 0.954 + 0.699$$
$$= 1.653.$$

Using the Venn diagram below, we get,



Let $n(A \cap B) = x$ and $n(A \cup B) = 30$

$$15 - x + x + 25 - x = 30$$
$$40 - x = 30$$
$$x = 10$$

Hence, $n(A \cap B) = 10$

Answer (a) 1.653 [2]
(b) 10 [2]

19 (a) Express a scale of 2 cm to 5 m in the form $1 : n$, where n is a whole number.

(b) The radius of a circle, r cm, is given as 11 cm correct to the nearest whole number.

Find

(i) the limits between which r lies.

(ii) the least possible circumference of the circle in terms of π.

Suggested solution

19 (a) $2\ cm : 5\ m = 2\ cm : 500\ cm = 1 : 250$

(b) (i) $10.5 \le r < 11.4$

(ii) Least possible circumference $= 2\pi r$

$= 2 \times \pi \times 10.5$

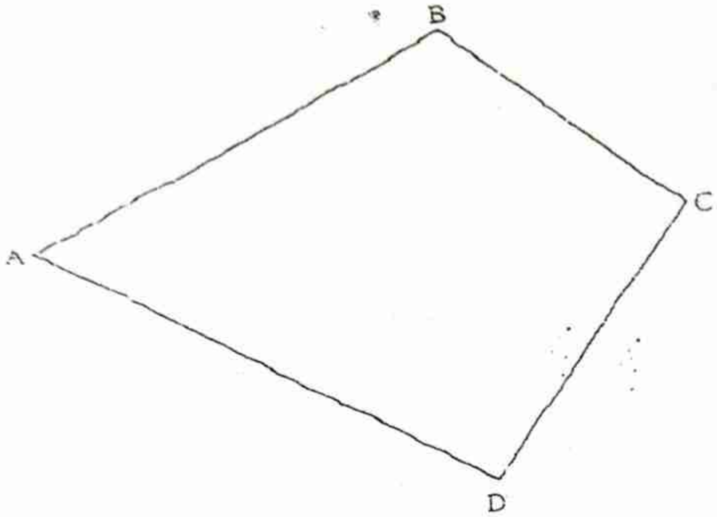
$= 2 \times 10.5\pi$

$= 21\pi$

Answer (a) $1 : 250$ [1]

(b) (i) $10.5 \le r < 11.4$ [1]

(ii) 21π cm [2]



(a) **In this question use ruler and compasses only.**

Leaving your construction lines and arcs, construct

(i) the perpendicular bisector of AB,

(ii) the locus of all points inside the quadrilateral ABCD which are 5 cm from D.

(b) Shade the region inside the quadrilateral ABCD which is nearer A than B and more than 5 cm from D.

... solution

F is inversely proportional to the square of d.

(a) Express F in terms of d and a constant k.

(b) Find

(i) the value of k when $F = 60$ and $d = 3$,

(ii) the value of F when $d = 6$.

... solution

22 (a) $F \propto \frac{1}{d^2} \implies F = \frac{k}{d^2}$, where k is a constant

(b) (i) When $F = 60$ and $d = 3$

$60 = \frac{k}{3^2}$,

$k = 60 \times 3^2 \implies k = 60 \times 9$

$k = 540$

(ii) $F = \frac{540}{d^2}$; is the formula connecting F and d

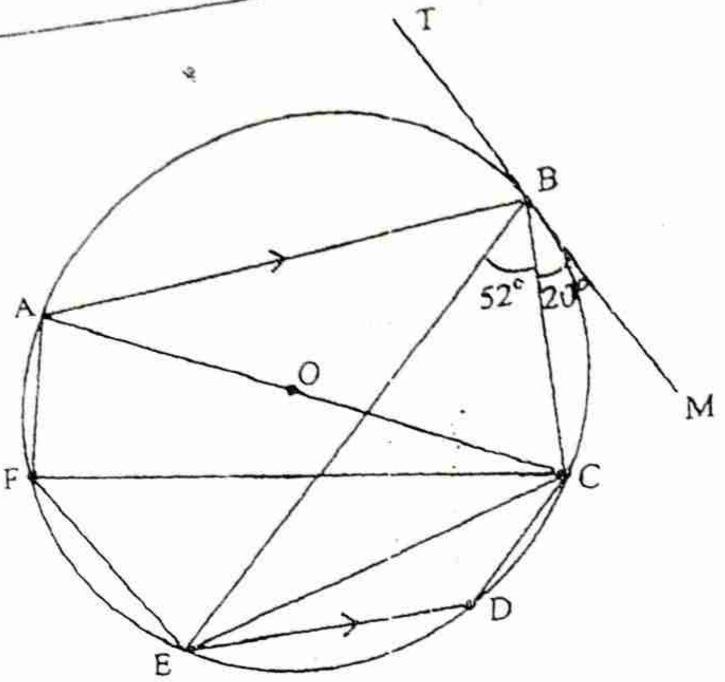
When $d = 6$, $F = F$

$\therefore \quad F = \frac{540}{6^2}, \implies F = \frac{540}{36}$.

$F = 15$

Answer	(a) $F = \frac{k}{d^2}$	[1]
	(b) (i) $k = 540$	[2]
	(ii) $F = 15$	[1]

23



ABCDEF is a circle centre O. TBM is a tangent to the circle at B. $E\hat{B}C = 52°$.
$C\hat{B}M = 20°$ and AB is parallel to ED.

Find

(a) $E\hat{F}C$.

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

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

(d) $C\hat{E}D$.

Suggested solution

(a) $E\hat{F}C = 52^0$ (∡ subtended by same chord EC)

(b) $B\hat{E}C = 20^0$ (∡ in an alternate segment)

(c) $A\hat{B}E = 38^0$ (complement of 52^0)

(d) $C\hat{D}E = 38^0 - 20^0 = 18^0$ (Z angles)

Answer (a) $E\hat{F}C = 52^0$

(b) $B\hat{E}C = 20^0$ [1]

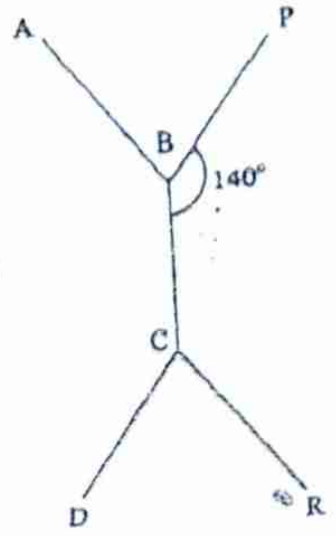
(c) $A\hat{B}E = 38^0$ [1]

(d) $C\hat{D}E = 18^0$ [1]

[2]

24 (a) Write down the special name of the regular polygon which has three lines of symmetry.

(b)



AB, BC and CD are sides of a regular 12-sided polygon.
PB, BC and CR are sides of a regular n-sided polygon and angle PBC = 140^0.

Find

(i) the value of n,

(ii) the size of angle DCR.

Suggested solution

24 (a) Equilateral triangle

(b) (i) Exterior ∡'s of a regular polygon add up to 360^0.

∡ of a polygon PBC and BCR is $180^0 - 140^0 = 40^0$

∴ Number of sides, $n = \frac{360^0}{40^0} = 9$

(ii) Method 1

$DCR = 360^0 - (140^0 + 150^0 = 70^0$

Method 2

Polygon ABCD = $\frac{360^o}{12} = 30^o$ and Polygon PBCR $= \frac{360^o}{9} = 40^o$

$\therefore DCR = 30^0 + 40^o = 70^0$

Answer (a) Equilateral triangle [1]
(b) (i) $n = 9$ [1]
(ii) 70^0 [2]

25 It is given that $f(x) = x^2 + 3x + 2$.

(a) Find

(i) $f(0)$,

(ii) the values of x for which $f(x) = 0$.

(b) Given also that the line of symmetry of the graph of $f(x) = x^2 + 3x + 2$ is $x = -1\frac{1}{2}$, find the coordinates of the turning point of this graph.

Suggested solution

25 (a) (i) $f(x) = x^2 + 3x + 2, \quad f(0) = 0^2 + 3(0) + 2 = 2$

(ii)
$$f(x) = 0$$
$$x^2 + 3x + 2 = 0$$
$$x^2 + x + 2x + 2 = 0$$
$$x(x+1) + 2(x+1) = 0$$
$$(x+1)(x+2) = 0$$

Either $x + 1 = 0$ or $x + 2 = 0$

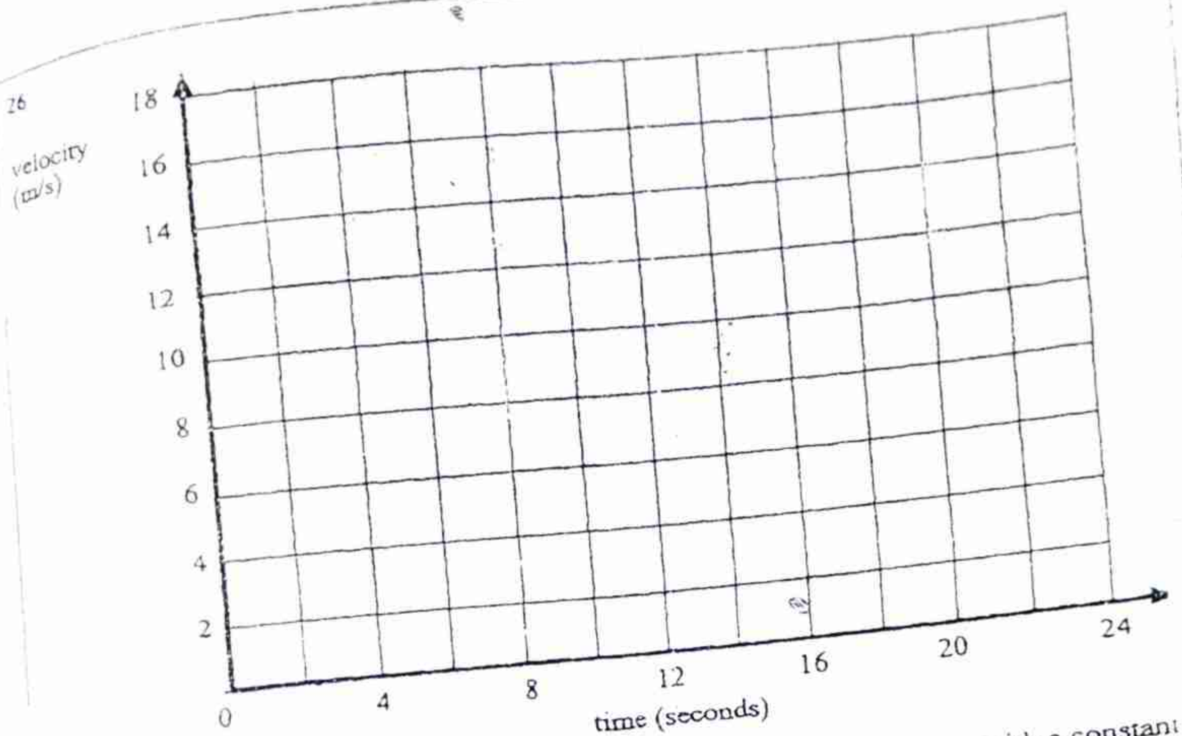
$x = -1$ or $x = -2$

(b) $f(x) = x^2 + 3x + 2$ but $x = -1\frac{1}{2} \implies x = -\frac{3}{2}$

$$f\left(-\frac{3}{2}\right) = \left(-\frac{3}{2}\right)^2 + 3\left(-\frac{3}{2}\right) + 2$$
$$= \frac{9}{4} - \frac{9}{2} + 2$$
$$= \frac{9 - 18 + 8}{4}$$
$$= -\frac{1}{4}$$

Answer (a) (i) $f(0) = 2$ [1]
(ii) $x = -1$ or $x = -2$ [2]
(b) $\left(-\frac{3}{2}\,;\,-\frac{1}{4}\right)$ [2]

26



A car decelerates from 18 m/s at 2 m/s^2 for 6 seconds. It then travels with a constant velocity for 10 seconds before it decelerates at h m/s^2 until it comes to rest in a further 8 seconds.

(a) Draw the velocity-time graph for the car on the grid above.

(b) Calculate the distance the car travels at constant velocity.

(c) Find the value of h.

Suggested solution

26 (a) Acceleration $= \frac{\text{Velocity}}{\text{Time}}$ i.e $2 = \frac{\text{Velocity}}{6}$

Velocity $= 2 \times 6$ m/s $= 12$ m/s

(b) Distance = speed × time = 6×10

$= 60$ m

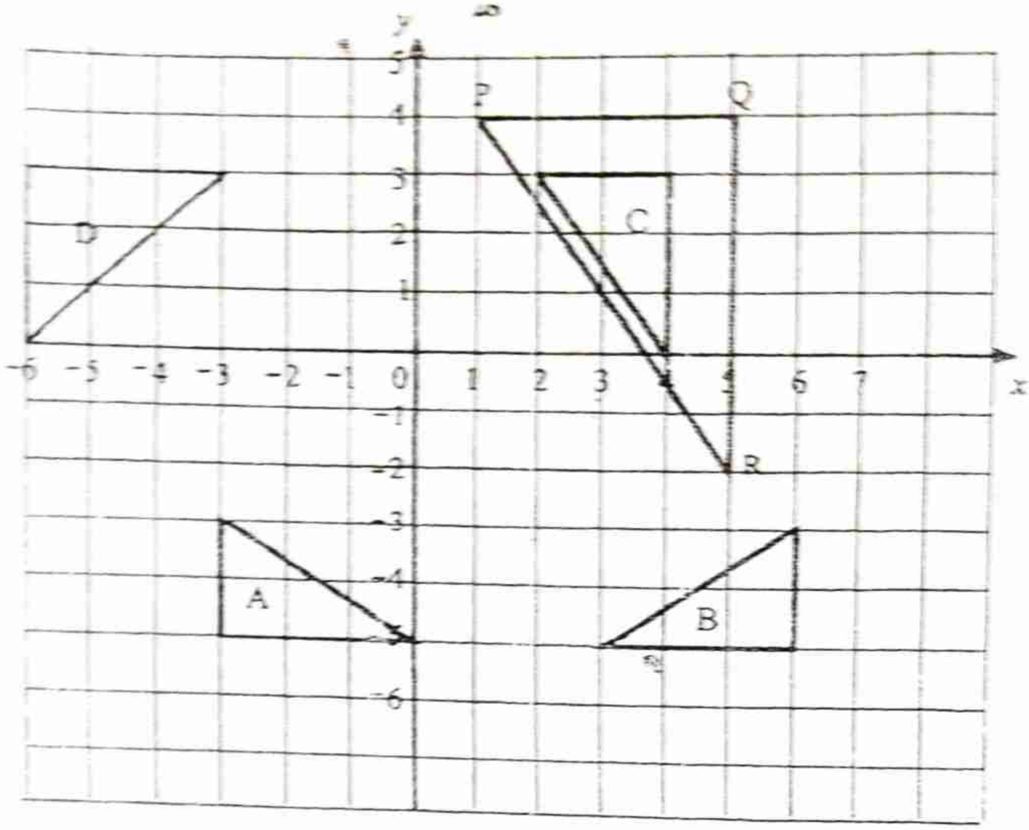
(c) $h = \frac{v}{8} = \frac{6}{8} = \frac{3}{4}$

Answer (a) On diagram

(b) 60m

(c) $\frac{3}{4}$

27



(a) Triangle A is mapped onto triangle B by a reflection.

Write down the equation of the line of reflection.

(b) Triangle B is mapped onto triangle C by an anticlockwise rotation through 90^0.

Write down the coordinates of the centre of rotation.

(c) Describe fully the **single** transformation which maps

(i) triangle C onto triangle D,

(ii) triangle PQR onto triangle C.

Suggested solution

27 (a) $x = 1\frac{1}{2}$

(b) $(1; -2)$

(c) (i) Stretch, scale factor $-1\frac{1}{2}$ and y-axis invariant.

(ii) Enlargement, scale factor $-\frac{1}{2}$ and centre $(3; 2)$

Candidate Name | Centre Number | Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

4008/1, 4028/1

MATHEMATICS

PAPER 1

2 hours 30 minutes

JUNE 2012 SESSION

Candidates answer on the question paper.

Additional materials:

Geometrical instruments

TIME 2 hours 30 minutes

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.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.

Mathematical tables, slide rules and calculators should not be brought into the examination room.

INFORMATION FOR CANDIDATES

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

FOR EXAMINER'S USE

This question paper consists of 29 printed pages and 3 blank pages.

[Turn over

[1]

Answer (a) $x = 1\frac{1}{2}$ [1]

(b) $(1; -2)$

(c) (i) **Stretch, scale factor** $-1\frac{1}{2}$ **and** y **-axis invariant** [3]

(ii) **Enlargement, scale factor** $-\frac{1}{2}$ **and centre** $(3; 2)$ [3]

1 Simplify $\dfrac{\frac{2}{3}+\frac{3}{4}}{1\frac{1}{6}}$.

Suggested solution

$$\frac{\frac{2}{3}+\frac{3}{4}}{1\frac{1}{6}} = \left(\frac{2}{3}+\frac{3}{4}\right) \div 1\frac{1}{6} = \left(\frac{8+9}{12}\right) \div \frac{7}{6}$$

$$= \frac{17}{12} \div \frac{7}{6}$$

$$= \frac{17}{12} \times \frac{6}{7}$$

$$= \frac{17}{2} \times \frac{1}{7} = \frac{17}{14}$$

Answer: $1\frac{3}{14}$ [3]

2 (a) Express the ratio 20 minutes : $1\frac{1}{3}$ hours, in its simplest form.

(b) Two partners, A and B, shared their profits from a business in the ratio 5 : 3.

If B received $4 800 000, calculate A's share.

Suggested solution

(a) 20 minutes : $1\frac{1}{3}$ hours = 20 minutes : 80 minutes = 1 : 4

(b) **Method 1**

Total for the ratios = 3 + 5 = 8

$\therefore \frac{3}{8}x = \$4\,800\,000$ or $x = \$\frac{8}{3} \times 4\,800\,000$

i.e. $x = \$12\,600\,000$

So, A's share $= \frac{5}{8} \times \$12\,800\,000$

$= 5 \times \$1\,600\,000$

$= \$8\,000\,000$

Method 2

3 : $ 4 800 00 for B's share

5 : $ x for A's share

$3 \times \$x = 5 \times \$4\,800\,000$

$\$x = \frac{5 \times \$4\,800\,000}{3}$

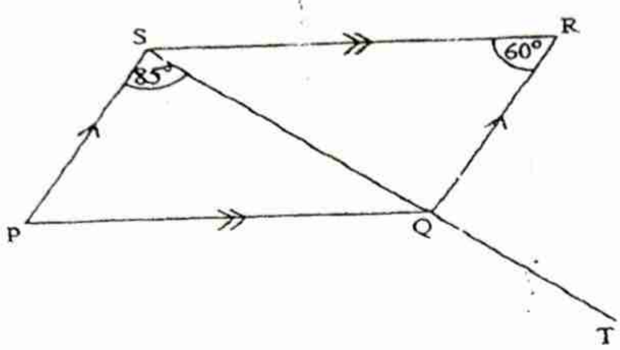
$\$x = \$8\,000\,000$

$\therefore$ A's share = $ 8 000 000

Answer: (a) 1 : 4 [1]

(b) $ 8 000 000 [2]

3



In the diagram, PQRS is a parallelogram. $P\hat{S}Q = 85°$, $S\hat{R}Q = 60°$ and SQT is a straight line. Find

(a) $P\hat{Q}R$,

(b) $R\hat{S}Q$,

(c) $R\hat{Q}T$

Suggested solution

From the diagram, $R\hat{Q}S = P\hat{S}Q$ (Z-angle of the parallelogram) $\therefore R\hat{Q}S = 85°$.

Using ΔQRS, $R\hat{S}Q = 180° - (85 + 60) = 35°$.

And so, $P\hat{Q}S = 35°$ (Z-angle of the parallelogram).

(a) $P\hat{Q}R = 35° + 85° = 120°$

(b) $R\hat{S}Q = 35°$

(c) $R\hat{Q}T = 180° - R\hat{Q}S$ (Angle on a straight line)

$= 180° - 85°$

$= 95°$

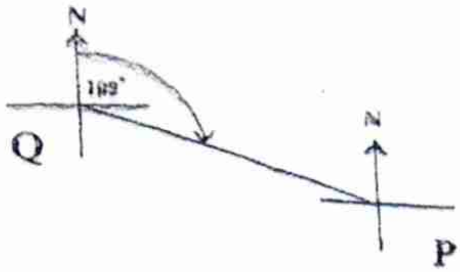
Answer: (a) $P\hat{Q}R = 120°$ [1]
(b) $R\hat{S}Q = 35°$ [1]
(c) $R\hat{Q}T = 95°$ [1]

4 The bearing of village P from village Q is 109°. Find

(a) the three figure bearing of Q from P,

(b) the compass bearing of Q from P.

Suggested solution



(a) Three figure bearing of Q from P $= 360° - (180° - 109°)$
$= 360° - 71°$
$= 289°$

(b) Compass bearing of Q from P $= N71°W$

Answer: (a) 289° [2]
(b) $N71°W$ [1]

5 (a) Solve $x - 3 \leq 3x + 10$.

(b) Given that x is an integer, write down the least value of x for which $x - 3 \leq 3x + 10$.

Suggested solution

(a) *Method 1*

$$x - 3 \leq 3x + 10$$
$$-3 \leq 3x - x + 10$$
$$-13 \leq 2x$$
$$2x \geq -13$$
$$x \geq -\frac{13}{2}$$
$$x \geq -6\tfrac{1}{2}$$

Method 2

$$x - 3 \leq 3x + 10$$
$$x - 3x - 3 \leq 10$$
$$-2x \leq 13$$
$$\frac{-2x}{-2} \geq \frac{13}{-2}$$

there is a change of sign when dividing by -2

$$x \geq -6\tfrac{1}{2}$$

Answer: (a) $x \geq -6\frac{1}{2}$ [2]
(b) $x = -6$ [1]

6 Make u the subject of the formula $T = \frac{mu^2}{K} - 5mg$.

$$T = \frac{mu^2}{K} - 5mg$$

$$T + 5mg = \frac{mu^2}{K}.$$ multiplying by K both sides gives

$$K \times (T + 5mg) = K \times \frac{mu^2}{K}$$

$$K(T + 5mg) = mu^2,$$ rearranging the equation we get

$$mu^2 = K(T + 5mg),$$ dividing by m we have

$$u^2 = \frac{K}{m}(T + 5mg),$$ taking square roots on both sides

$$u = \pm\sqrt{\frac{K}{m}(T + 5mg)}$$

Answer $u = \pm\sqrt{\frac{K}{m}(T + 5mg)}$ [3]

7 Express $5^2 + 3 \times 5 + 4$ as a number in

(a) base 5.

(b) base 8.

Suggested solution

$5^2 + 3 \times 5 + 4 = 25 + 15 + 4 = 44_{10}$

(a)

5	44	
5	8	R 4
5	1	R 3
5	0	R 1

(b)

8	44	
8	5	R 4
	0	R 5

Answer: (a) 134_5 [1]
(b) 54_8 [2]

Answer: 34.4 cm [3]

10 (a) A car uses l litres of petrol for every d kilometres travelled.

State the type of variation between l and d.

(b) Given that the car uses 5 litres to cover 60 kilometres, find the equation connecting l and d.

Worked solution

Direct Variation

$l \propto d$,

$l = kd$, where k is a constant of proportionality.

$5 = k60$, since $l = 5$ and $d = 60$.

$\frac{5}{60} = k$ or $k = \frac{1}{12}$

$l = \frac{1}{12}d$

Answer: (a) **Direct Variation** [1]

(b) $l = \frac{1}{12}d$ [2]

11 Evaluate

(a) $3m^{-5} \times 2m^{5}$,

(b) $\left(\frac{4}{9}\right)^{-1}$.

Worked solution

Method 1

$3m^{-5} \times 2m^{5} = 3 \times m^{-5} \times 2 \times m^{5}$

$= 3 \times 2 \times m^{-5} \times m^{5}$

$= 6 \times m^{-5+5}$

$= 6 \times m^{0}$

$= 6 \times 1$

Method 2

$3m^{-5} \times 2m^{5} = 3 \times m^{-5} \times 2 \times m^{5}$

$= 3 \times 2 \times \frac{1}{m^5} \times m^{5}$

$= 6 \times \frac{m^5}{m^5}$

$= 6 \times 1$

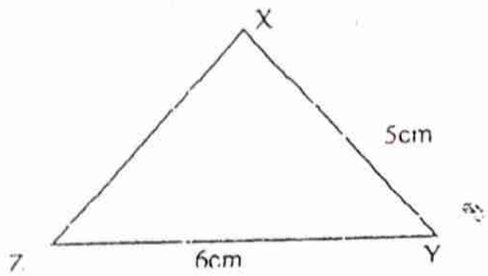
$= 6$

8 (a) State the order of rotational symmetry of a parallelogram.

(b) The triangle XYZ has $XY = 5$ cm and $YZ = 6$ cm.

Given that the triangle XYZ has only one line of symmetry, write down the two possible lengths of XZ.

Suggested solution



Answer: (a) 2 [1]

(b) 5 cm or 6 cm [2]

Suggested solution

min possible Width $7.1cm = 7.05cm$ and

min possible Length $10.2cm = 10.15cm$

min possible perimeter = 2(min possible Length + min possible Width)

$= 2(7.05\ cm + 10.15\ cm)$

$= 2 \times 17.20\ cm$

$= 34.40\ cm$

(b) *Method 1*

$\left(\frac{4}{9}\right)^{-\frac{1}{2}} = \frac{1}{\left(\frac{4}{9}\right)^{\frac{1}{2}}}$ since $x^{-a} = \frac{1}{x^{a}}$

$= 1 \div \left(\frac{4}{9}\right)^{\frac{1}{2}}$

$= 1 \div \left(\frac{2^2}{3^2}\right)^{\frac{1}{2}}$

$= 1 \div \frac{2^{2\times\frac{1}{2}}}{3^{2\times\frac{1}{2}}}$,   using $(x^a)^b = x^{ab}$

$= 1 \div \frac{2}{3}$

$= 1 \times \frac{3}{2}$

$= \frac{3}{2}$

Method 2

$\left(\frac{4}{9}\right)^{-\frac{1}{2}} = \left(\frac{9}{4}\right)^{\frac{1}{2}}$

$= \left(\frac{3^2}{2^2}\right)^{\frac{1}{2}}$

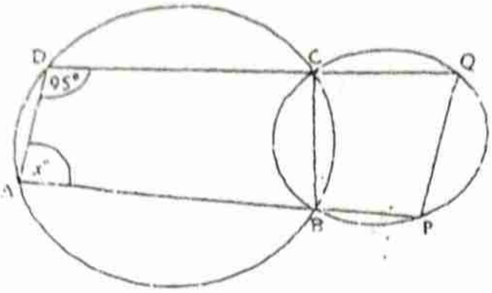
$= \frac{3^{2\times\frac{1}{2}}}{2^{2\times\frac{1}{2}}}$,   since $(x^a)^b = x^{ab}$

$= \frac{3}{2}$

Answer: (a) 6 [1]

(b) $1\frac{1}{2}$ [2]

12



In the diagram, ABCD and PBCQ are intersecting circles. DCQ and ABP are straight lines.

(a) Given that $A\hat{D}C = 95°$, calculate

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

(ii) $P\hat{Q}C$

(b) Given also that $D\hat{A}B = x°$, find an expression for $B\hat{P}Q$ in terms of x.

Suggested solution

(a) (i) $A\hat{B}C = 180° - 95°$ (opposite exterior angles)

$= 85°$

(ii) $P\hat{Q}C = 85°$ (opposite exterior angles)

(b) $B\hat{P}Q = B\hat{C}D$ (opposite exterior angles)

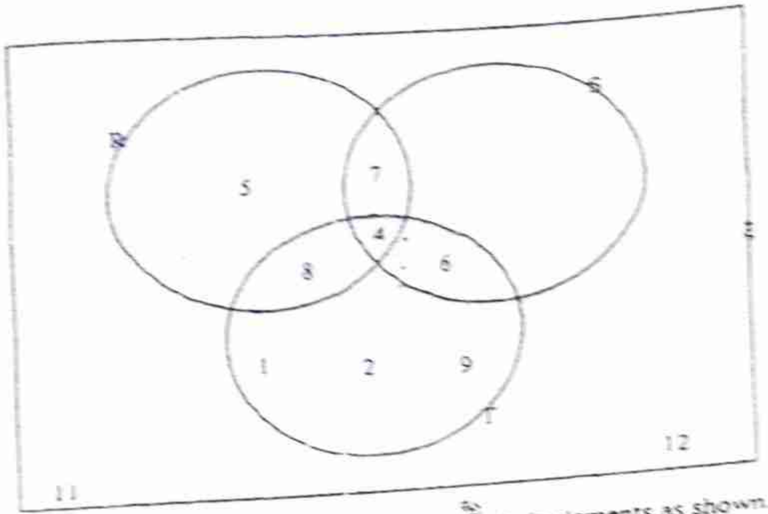
$= 180° - x°$

Answer: (a) (i) 85° [1]

(ii) 85° [1]

(b) $B\hat{P}Q = 180° - x°$ [1]

13



In the Venn diagram, R, S, T and ξ are sets with their elements as shown.

Use the Venn diagram to find

(a) $R' \cap S$,

(b) $(R \cap S) \cup (R \cap T)$,

(c) $n(R \cup S \cup T)'$.

Suggested solution

$\xi = \{1; 2; 4; 5; 6; 7; 8; 9; 11; 12\}$, $R = \{4; 5; 7; 8\}$ and $R' = \{1; 2; 6; 9; 11; 12\}$.

$S = \{4; 6; 7\}$ and $T = \{1; 2; 4; 6; 8; 9\}$ using the Venn Diagram.

(a) $R' \cap S = \{6\}$

(b) $R \cap S = \{4; 7\}$ and $R \cap T = \{4; 8\}$.

$\therefore (R \cap S) \cup (R \cap T) = \{4; 7; 8\}$

(c) $n(R \cup S \cup T)' = 2$

Answer:	(a)	$\{6\}$	[1]
	(b)	$\{4; 7; 8\}$	[1]
	(c)	2	[1]

14 Express ...

Suggested Solution

$\log_{10} x + 2\log_{10} y = 1$

$\log_{10} x + \log_{10} y^2 = 1$, using $A\log_{10}B = \log_{10}B^A$

$\log_{10}xy^2 = 1$, since $\log A + \log B = \log AB$

$xy^2 = 10$

Answer: $xy^2 = 10$ [3]

15 It is given that $\mathbf{p} = \begin{pmatrix} 6 \\ -8 \end{pmatrix}$, $\mathbf{q} = \begin{pmatrix} 3 \\ 5 \end{pmatrix}$ and $\mathbf{r} = \begin{pmatrix} m \\ n \end{pmatrix}$.

(a) Express $\mathbf{p} - 3\mathbf{q}$ as a column vector.

(b) Given that $\mathbf{p} + \mathbf{q} = 3\mathbf{r}$, find the value of m and the value of n.

Suggested Solution

(a)

$p - 3q = \binom{6}{-8} - 3\binom{3}{5}$

$= \binom{6}{-8} - \binom{9}{15}$

$= \binom{6-9}{-8-15}$

$= \binom{-3}{-23}$

(b)

$p + q = 3r$

$\binom{6}{-8} + \binom{3}{5} = 3\binom{m}{n}$

$\binom{6+3}{-8+5} = 3\binom{m}{n}$

$\binom{9}{-3} = 3\binom{m}{n}$

$3\binom{3}{-1} = 3\binom{m}{n}$

$\binom{3}{-1} = \binom{m}{n}$

Answer: (a) $\binom{-3}{-23}$ [1]

(b) $m = 3$ and $n = -1$ [2]

(a) (i) Uniform acceleration (ii) Constant velocity

(b) Distance = Area of the trapezium OABC.

$= \frac{1}{2}(AB + OC) \times V$

$= \frac{1}{2}(8 + 20) \times 40$

$= 28 \times 20$

$= 650$

Answer: (a)(i) **Uniform acceleration** [1]

(ii) **Constant velocity** [1]

(b) **650** metres [2]

18 The following entries show the number of bicycles sold per day in nine days.

6; 10; 12; 9; 14; 10; 15; 10; 12

Find

(a) the mode.

(b) the median.

(c) the next entry if the new mean on the tenth day is 12.

Suggested solution

Arranging the data in ascending order we get

6; 9; 10; 10; 10; 12; 12; 14; 15

(a) Mode = 10

(b) Median = 10

(c) Let x be the next entry.

$$\frac{6 + 9 + 10 + 10 + 10 + 12 + 12 + 14 + 15 + x}{10} = 12$$

$$\frac{98 + x}{10} = 12$$

$$98 + x = 120$$

16 (a) Convert

(i) the fraction $\frac{3}{8}$ to a percentage.

(ii) 9% to a decimal fraction.

(b) Simplify the expression $\sqrt{3}+\sqrt{12}$.

Suggested solution

(a) (i) $\frac{3}{8}\times 100\% = 0.375\times 100\% = 37{,}5\%$

(ii) $9\% = \frac{9}{100} = 0{,}09$

(b) $\sqrt{3}+\sqrt{12} = \sqrt{3}+\sqrt{4\times 3}$

$= \sqrt{3}+\sqrt{4}\times\sqrt{3},$ since $\sqrt{ab}=\sqrt{a}\times\sqrt{b}$

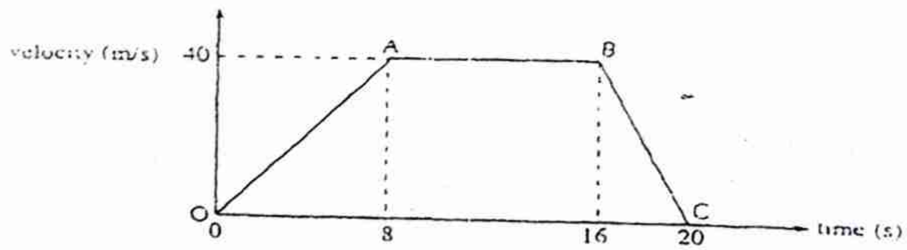
$= \sqrt{3}+2\sqrt{3},$ but $\sqrt{3}$ is a common factor

$= (1+2)\sqrt{3},$ by factorising $\sqrt{3}$

$= 3\sqrt{3}$

Answer: (a) (i)	37,5%	[1]
(ii)	0.09	[1]
(b)	$3\sqrt{3}$	[2]

17



In the diagram, O, A, B and C are four points on the velocity-time graph of an object.

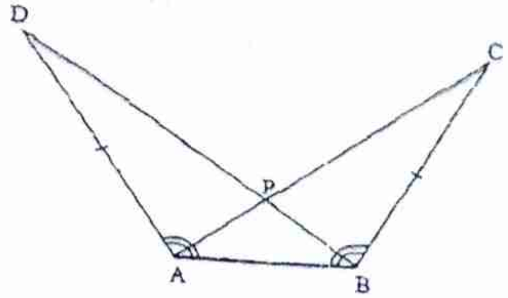
(a) Describe the motion of the object as illustrated on the section of the graph.

(i) O to A.

(ii) A to B

(b) Calculate the distance covered by the object during the 20 seconds.

20 (a)



In the diagram, $D\hat{A}B = A\hat{B}C$, $AD = BC$ and AC and BD intersect at P.

(i) Name the triangle that is congruent to triangle ABC.

(ii) State the case for congruency in (a)(i).

(b) The sides of a triangle X are 9 cm, 7 cm and 6 cm. The shortest side of a triangle Y, which is similar to triangle X, is 3 cm.

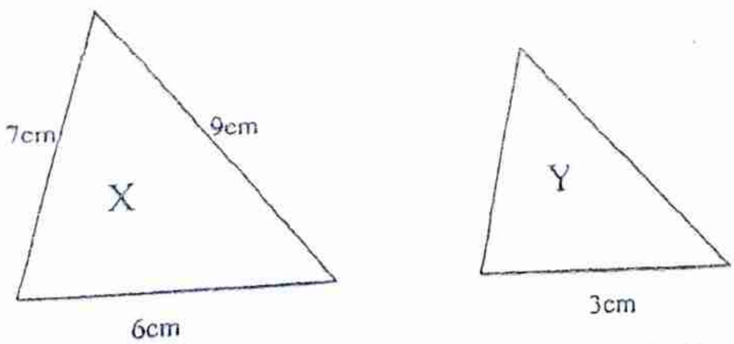
Write down the ratio, area of X : area of Y.

Suggested Solution

(a) (i) Triangle *BAD*

(ii) Side Angle Side (SAS)

(b)



Ratio of lengths = 6: 3 and Ratio of areas $= 2^2 : 1^2$

= 2: 1 = 4: 1

area of X: area of Y = 4: 1

Answer: (a) (i) ***BAD*** [1]

(ii) **Side Angle Side** [1]

(b) **4: 1** [2]

$x = 120 - 98$

$x = 22$

Answer: (a) **10** [1]
(b) **10** [1]
(c) **22** [2]

---

19 (a) Expand and simplify $(3x+2y)(2x-y)$.

(b) Factorise completely $20x^2 - 5y^2$.

Suggested solution

(a) $(3x + 2y)(2x - y) = 3x(2x - y) + 2y(2x - y)$

$= 6x^2 - 3xy + 4xy - 2y^2$

$= 6x^2 + xy - 2y^2$

(b) $20x^2 - 5y^2 = 5(4x^2 - y^2)$

$= 5(2^2x^2 - y^2)$ but $a^n b^n = (ab)^n$

$= 5[(2x)^2 - y^2]$ using $a^2 - b^2 = (a - b)(a + b)$

$= 5(2x - y)(2x + y)$

Answer: (a) $\mathbf{6x^2 + xy - 2y^2}$ [2]

(b) $\mathbf{5(2x - y)(2x + y)}$ [2]

Suggested solution

(a) $X = \frac{7\,965}{177}$

$= 45$ cents

(b) $Y = 15\% \times 9\,965$

$= \frac{15}{100} \times 9\,965$

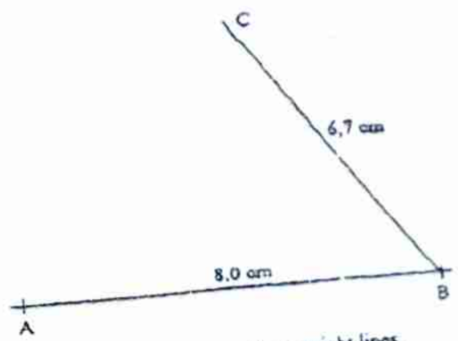
$= \$1\,494.75$

(c) $Z = 9\,965 + 1\,494.75$

$= \$11\,459.75$

Answer: (a) 45cents [2]
(b) $1 494.75 [2]
(c) $11 459.75 [1]

23



In the diagram, AB and CB are intersecting straight lines.

Use ruler and compasses only to construct on the diagram

(a) (i) the perpendicular bisector of BC,

(ii) a line on the same side of AB as C and is also 2,0 cm from AB.

(b) Mark the point X which is 2,0 cm from AB and equidistant from B and C.

Suggested Solution

(a) (i) on the diagram [2]
(ii) on the diagram [2]
(b) on the diagram [1]

24 (a) Solve the equation $\frac{2}{x+2} = \frac{1}{3}$.

(b) Given that $f(x) = x^2 + x$, find

(i) $f(3)$.

(ii) the values of x for which $f(x) = 0$.

Suggested Solution

(a)

$$\frac{2}{x+2} = \frac{1}{3}$$

inverting fractions gives

$$\frac{x+2}{2} = \frac{3}{1}$$

$$x + 2 = 3 \times 2$$

$$x + 2 = 6$$

$$x = 4$$

(b) (i) $f(x) = x^2 + x$, $f(3) = 3^2 + 3$

$$f(3) = 9 + 3,$$

$$\therefore f(3) = 12$$

(ii) $f(x) = 0 \implies x^2 + x = 0$, factorising x gives

$$x(x+1) = 0$$

either $x = 0$ or $x + 1 = 0$

or $x = -1$

Answer: (a) $x = 4$ [1]

(b) (i) 12 [2]

(ii) $x = 0$ or $x = -1$ [2]

2. (a)

$$P = \frac{0.00274 \times 3460}{(9.88+23.8)^2}$$

$$= \frac{0.003 \times 3}{(10.0 + 20.0)^2},$$ correct to one significant figure

(b)

$$\frac{0.003 \times 3}{(10.0 + 20.0)^2} = \frac{0.009}{(30)^2}$$

$$= \frac{0.009}{900}$$

$$= \frac{9}{900000}$$

$$= \frac{1}{100000}$$

$$= 0.00001$$

Answer:	(a)	$\frac{0.003 \times 3}{(10.0 + 20.0)^2}$	[2]
	(b)	0.00001	[1]

3 **(a)** Simplify $(27x^6)^{\frac{1}{3}}$.

(b) If $32^{-\frac{2}{5}} = 2^p$, find p.

Suggested solution

3. (a)

$$(27x^6)^{\frac{1}{3}} = 27^{\frac{1}{3}} \times (x^6)^{\frac{1}{3}}$$

$$= (3^3)^{\frac{1}{3}} \times x^{6 \times \frac{1}{3}}$$

$$= 3^{3 \times \frac{1}{3}} \times x^2$$

$$= 3^1 \times x^2$$

$$= 3x^2$$

(b)

$$32^{-\frac{2}{5}} = 2^p$$

$$(2^5)^{-\frac{2}{5}} = 2^p$$

$$2^{5\times -\frac{2}{5}} = 2^p, \quad \text{since } (a^b)^c = a^{bc},$$

$$2^{-2} = 2^p, \quad \text{equating powers of base 2 we get,}$$

$$p = -2$$

Answer: (a) $3x^2$ [1]
(b) $p = -2$ [2]

---

4 Evaluate $3.25 \times 10^4 \times 10^{-6}$ giving the answer

(a) in standard form,

(b) as a decimal fraction,

(c) as a common fraction in its lowest terms.

Suggested solution

(a) $3.25 \times 10^4 \times 10^{-6} = 3.25 \times 10^{4-6}$
$= 3.25 \times 10^{-2}$. (in standard form)

(b) $3.25 \times 10^4 \times 10^{-6} = 3.25 \times 10^{-2}$, using the previous result,

$= \frac{3.25}{10^2}$

$= \frac{3.25}{100}$

$= 0.0325$. (as a decimal fraction)

(c) $3.25 \times 10^4 \times 10^{-6} = 0.0325$, using the previous result,

$= \frac{325}{10000}$

$= \frac{13}{400}$ (As a common fraction in lowest terms)

Answer: (a) 3.25×10^{-2}
(b) 0.0325
(c) $\frac{13}{400}$

5 (a) **State the number of lines of symmetry of an equilateral triangle.**

(b) Factorise completely $3x^3 - 12x$.

Suggested solution

5. (a) 3

(b) $3x^3 - 12x = 3x(x^2 - 4)$

$= 3x(x^2 - 2^2)$. but $(a^2 - b^2) = (a - b)(a + b)$

$= 3x(x - 2)(x + 2)$

Answer:	(a)	3	[1]
	(b)	$3x(x - 2)(x + 2)$	[2]

6 Solve the simultaneous equations

$x - 6y = -4$,
$9x + 3y = -17$.

Suggested solution

6.
$x - 6y = -4$ ______ ①
$9x + 3y = -17$ ______ ②

Using the ***Substitution Method***, from ① we have

$x = 6y - 4$, substituting into ② gives.

$9(6y - 4) + 3y = -17$, removing brackets we get.

$54y - 36 + 3y = -17$, collecting like terms means.

$54y + 3y = 36 - 17$,

$57y = 19$

$y = \frac{1}{3}$

Using ① $x - 6y = -4$ but $y = \frac{1}{3}$

$$x - 6\left(\frac{1}{3}\right) = -4$$

$$x - 2 = -4$$

$$x = 2 - 4$$

$$x = -2$$

Answer: $y = \frac{1}{3}$

$x = -2$ [3]

7 A and B are sets. Write the following sets in their simplest form.

(a) $A \cap A'$

(b) $A \cup A'$

(c) $(A \cap B) \cup (A \cap B')$

Suggested solution

7. A and B are sets. So,

(a) $A \cap A' = \emptyset$

(b) $A \cup A' = \xi$

(c) $(A \cap B) \cup (A \cap B') = A$

Answer: (a) $\emptyset$ [1]

(b) ξ [1]

(c) A [1]

8 It is given that y varies inversely as the square of $(x-1)$. When $y = 2$, $x = 2$.

Find the value of y when $x = 4$.

Suggested solution

8

$$y \propto \frac{1}{(x-1)^2}$$

or

$$y = \frac{k}{(x-1)^2}$$

where k is a constant of proportionality.

When $x = 2$, $y = 2$,

i.e.

$$2 = \frac{k}{(2-1)^2}$$

$$2 = \frac{k}{1^2}$$

$$k = 2$$

Hence

$$y = \frac{2}{(x-1)^2}$$

Now, when $x = 4$,

$$y = \frac{2}{(4-1)^2}$$

$$y = \frac{2}{3^2}$$

$$y = \frac{2}{9}$$

Answer: $y = \frac{2}{9}$ [3]

9 (a) If A is a non-singular matrix, simplify $\mathbf{AA}^{-1}$

(b) If $\mathbf{B} = \begin{pmatrix} 1 & 3 \\ 5 & 2 \end{pmatrix}\begin{pmatrix} 2 \\ 6 \end{pmatrix}$, write down the order of matrix **B**.

Suggested solution

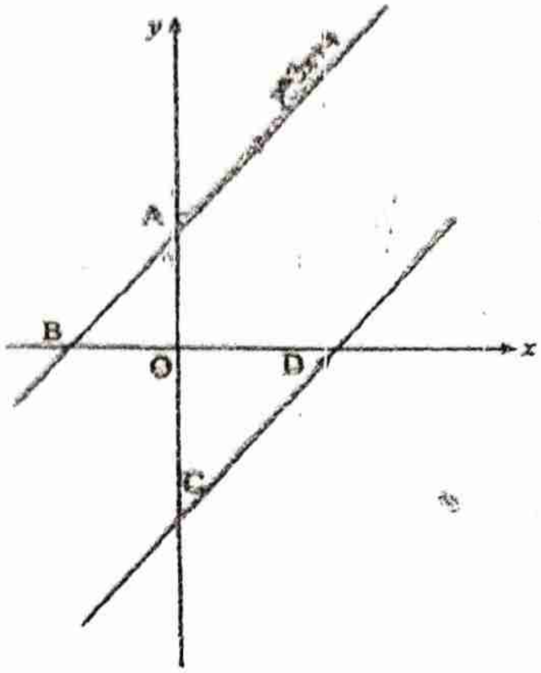
9 (a) $AA^{-1} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

(b) $(2 \times 2) \times (2 \times 1) \Rightarrow 2 \times 1$

Answer: (a) $\begin{pmatrix} \ldots \\ 0 \quad 1 \end{pmatrix}$ [.]

(b) 2×1 [2]

10



In the diagram AC is 10 units and BA is parallel to CD. BA is the line $y = 3x + 4$.

(a) Write down

(i) the value of y at C,

(ii) the equation of the line CD which is parallel to $y = 3x + 4$.

(b) Find the coordinates of the point D where the line in part **(a)(ii)** crosses the x-axis.

Suggested solution

10. (a) (i) the value of y at $C = 4 - 10$

$= -6$

(ii) $y = 3x - 6$

(b) when $y = 0$: $0 = 3x - 6$

$$3x = 6$$

$$x = 2$$

Hence, the coordinates of D are; $D(x;y) = (0;2)$

Answer:	**(a)**	(i)	$y = -6$	[1]
		(ii)	$y = 3x - 6$	[1]
	(b)		$D(x;y) = (0;2)$	[1]

11 **(a)** Evaluate $765_8 - 567_8$, giving your answer in base eight.

(b) Express $5^3 + 4$ as a number in base five.

(c) Convert 13_{10} to a number in base two.

Suggested solution

11. (b)

12 A rectangle is 9,1 cm long and 5,7 cm wide correct to one decimal place.

(a) State the least possible width of the rectangle.

(b) Find the limits within which the perimeter of the rectangle lies.

Suggested solution

12 (a) Width = $5.7\ cm$

Least possible width = $5,7\ cm - 0,5\ cm$

= $5,65\ cm$

(b) Lower bound = $(9,1\ cm + 5,7\ cm) - 0,5\ cm$

= $14,8\ cm - 0,5\ cm$

= $14,75\ cm$

Upper bound = $(9,1\ cm + 5,7\ cm) + 0,5\ cm$

= $14,8\ cm + 0,5\ cm$

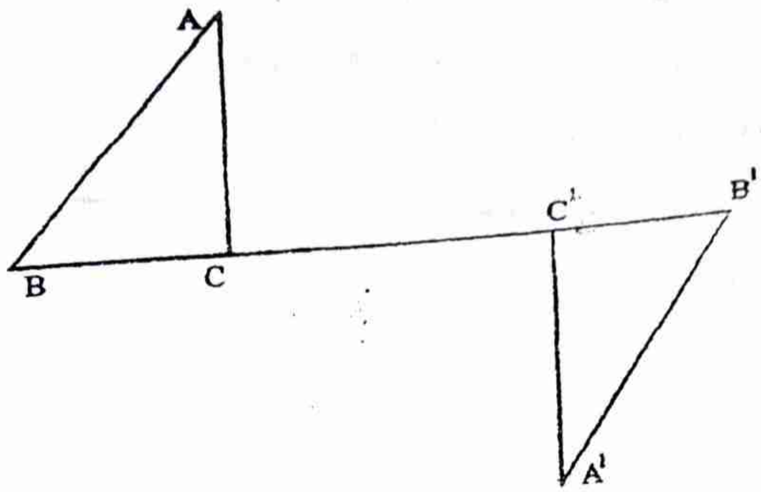
= $14,85\ cm$

Hence, $14.75\ cm \leq perimeter < 14.85\ cm$

Answer: (a) $5.65\ cm$ [1]

(b) $(14.75\ cm \leq perimeter < 14.85\ cm$ [2]

13



In the diagram ABC and A'B'C' are congruent triangles and BCC'B' is a straight line.

Describe fully a single transformation that maps triangle ABC onto triangle A'B'C'.

Suggested solution

13. Answer: Rotation through 180^0, clockwise (or anti-clockwise), about the midpoint of line $BCC'B'$. [3]

14 Solve the equations

(a) $\frac{2y}{3} - 9 = 0,$

(b) $x^2 - 5x - 6 = 0.$

Suggested solution

14 (a) $\frac{2y}{3} - 9 = 0$

$\frac{2y}{3} = 9$

$$2y = 3 \times 9$$

$$2y = 27$$

$$y = \frac{27}{2}$$

$$y = 13\frac{1}{2}$$

(b)

$$x^2 - 5x - 6 = 0$$

$$x^2 + x - 6x - 6 = 0$$

$$x(x + 1) - 6(x + 1) = 0$$

$$(x + 1)(x - 6) = 0$$

Either $x + 1 = 0$ or $x - 6 = 0$

$x = -1$ or $x = 6$

15 A car manufacturer makes a scale model of one of his real cars.

(a) The capacity of the fuel tank of the real car is 64 litres and that of the model car is 0.512 litres.

Find the ratio of the length of the real car: the length of model car.

(b) The area of the front window of the model is $0.0484\ m^2$. Find the area of the front window of the real car.

Suggested solution

(B) *Ratio of areas* $= 4^2 : 0.8^2$

$= 16 : 0.64$

let Am^2 *be the area of the real car*

$A : 0.0484m^2$

$$A = \frac{16 \times 0.0484}{0.64}$$

$$\frac{A}{16} = \frac{0.0484}{0.64} \qquad = \frac{16 \times 4.84}{64}$$

answer (a) 4:08 [2]

(b) 1.21 m^2 [2]

16 (a) Given that $y = m^2 - 4n^2$, find the value of y when $m = 4$ and $n = 2$.

(b) If $\frac{x}{a} + \frac{y}{b} = 1$, make x the subject.

Suggested solution

16. (a)

$$y = 4^2 - 4 \times 2^2$$
$$= 16 - 4 \times 4$$
$$= 16 - 16$$
$$= 0$$

(b)

$$\frac{x}{a} + \frac{y}{b} = 1$$
$$\frac{x}{a} = 1 - \frac{y}{b}$$
$$a\frac{x}{a} = a\left(1 - \frac{y}{b}\right)$$
$$x = a\left(1 - \frac{y}{b}\right)$$

Answer: (a) $y = 0$ [1]

(b) $x = a\left(1 - \frac{y}{b}\right)$ [3]

17 Evaluate

(a) $\log_3 9$.

(b) $\log_5\left(\frac{1}{25}\right)$.

(c) $\log_{29} 1$.

Suggested solution

17. (a) $log_3 9 = log_3 3^2$ but $log_3 3 = 1$

$= 2log_3 3$

$= 2 \times 1$

$= 2$

(b) $log_5\left(\frac{1}{25}\right) = log_5\left(\frac{1}{5^2}\right)$

$= log_5 5^{-2}$

$= -2 log_5 5$

$= -2 \times 1$ since $log_5 5 = 1$

$= -2$

(c) $log_{29} 1 = log_{29} 29^0$

$= 0 \times log_{29} 29$

$= 0$

Answer:	(a)	2	[1]
	(b)	−2	[2]
	(c)	0	[1]

18 On a map, a distance of 20 km is represented by a length of 40 cm. The scale of the map is 1: *n*.

(a) Calculate the value of *n*.

(b) The distance between two towns on the map is 70 cm. Calculate the actual distance in kilometres between the towns.

Suggested solution

18 (a) Observe that $1\ km = 1\ 000\ m = 100\ 000\ cm$

So, $40 : 20 \times 100\ 000$
$4 : 200\ 000$
$1 : 50\ 000$

(b) Let $D\ km$ be the distance between the two towns.
Using simple proportion, we have

$40\ cm : 20\ km$
$70\ cm : D\ km$

Method 1

$$\frac{D}{20\ km} = \frac{70\ cm}{40\ cm}$$

$$D = \frac{7}{4} \times 20\ km$$

$$= \frac{70}{2}\ km$$

$$= 35\ km$$

Method 2

$$1 : \frac{50\ 000}{100\ 000}$$

1 cm : 0,5 km

70 cm : D km

$$\frac{D}{0.5\ km} = \frac{70\ cm}{1\ cm}$$

$$D = 70 \times 0.5\ km$$

$$= 35\ km$$

Answer:	(a)	$n = 50\ 000$	[2]
	(b)	$35\ km$	[2]

19 **Study the pattern below.**

$3^2 - 1^2 = 8 = 4 \times 2$
$4^2 - 2^2 = 12 = 4 \times 3$
$5^2 - 3^2 = 16 = 4 \times 4$
$6^2 - p^2 = q = 4 \times 5$

(a) **Write down the value of**

(i) **p,**

(ii) **q.**

(b) **Write down the 10^{th} line of this pattern.**

Suggested solution

19.

Answer	(a)	(i)	$p = 4$	[1]
		(ii)	$q = 20$	[1]
	(b)		$12^2 - 10^2 = 44 = 4 \times 11$	[3]

(b) If $|b| = 4$, write down the value of $|\overrightarrow{QR}|$.

Suggested solution

21. (a) (i) $\overrightarrow{OP} = 3\bar{a} - \bar{b}$

(ii) $\overrightarrow{PR} = -4\bar{a} + 3\bar{b}$

(iii) $\overrightarrow{PR} - \overrightarrow{QR} = -4\bar{a} + 3\bar{b} - 3\bar{b}$

$= -4\bar{a} + 0$

$= -4\bar{a}$

(b) $\overrightarrow{QR} = 3\bar{b}$, taking the modulus sign || both sides we get,

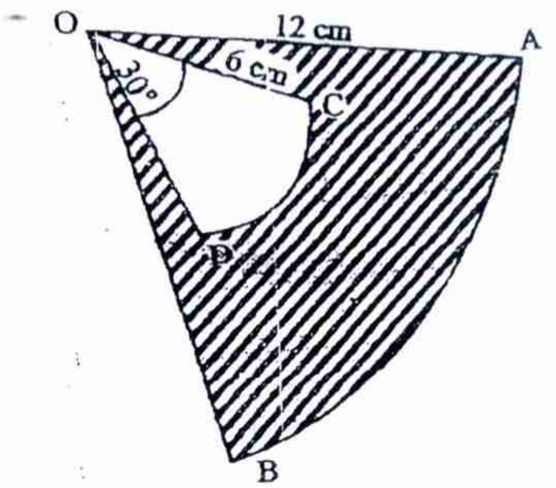
$|\overrightarrow{QR}| = 3|\bar{b}|$

$= 3 \times 4$ since: $|\bar{b}| = 4$

$= 12$

Answer:	**(a)**	**(i)**	$\overrightarrow{OP}$	=	$3\bar{a} - \bar{b}$	[1]
		(ii)	$\overrightarrow{PR}$	=	$-4\bar{a} + 3\bar{b}$	[1]
		(iii)	$\overrightarrow{PR} - \overrightarrow{QR}$	=	$-4\bar{a}$	[2]
	(b)		$\lvert\overrightarrow{QR}\rvert$	=	12	[1]

22



In the diagram, OAB is a sector of a circle centre O and radius 12 cm and angle AOB = 50°

OCD is a sector of a circle centre O and radius 6 cm and angle COD = 30°.

Calculate, in terms of π,

(a) the area of the shaded part,

(b) the perimeter of the shaded area AOCDOBA.

<u>*Suggested solution*</u>

22. (a) Area of shaded part $= $ Area of sector $AOB -$ Area of sector COD

$$= \frac{50^0}{360^0} \times \pi \times 12^2\ cm^2 - \frac{30^0}{360^0} \times \pi \times 6^2\ cm^2$$

$$= \frac{5}{36} \times \pi \times 12 \times 12\ cm^2 - \frac{1}{12} \times \pi \times 6 \times 6\ cm^2$$

$$= \left(\frac{5}{6} \times 2 \times 12 - \frac{1}{2} \times 6\right)\pi\ cm^2$$

$$= (20 - 3)\pi\ cm^2$$

$$= 17\pi\ cm^2$$

(b) Arc length DC $= \frac{30^0}{360^0} \times 2\pi \times 6$

$= \frac{1}{12} \times 12\pi$

$= \pi$

and Arc Length AB $= \frac{50^0}{360^0} \times 2\pi \times 12$

$= \frac{5}{36} \times 24 \times \pi$

$= \frac{20}{6}\pi$

$= \frac{10}{3}\pi$

Perimeter = OA + AB + OB + OD + DC + OC

$= 12cm + \frac{10\pi}{3}cm + 12cm + 6cm + \pi cm + 6cm$

$= 36\,cm + \frac{10\pi}{3}\,cm + \pi\,cm$

$= 36 + \frac{10\pi + 3\pi}{3}\,cm$

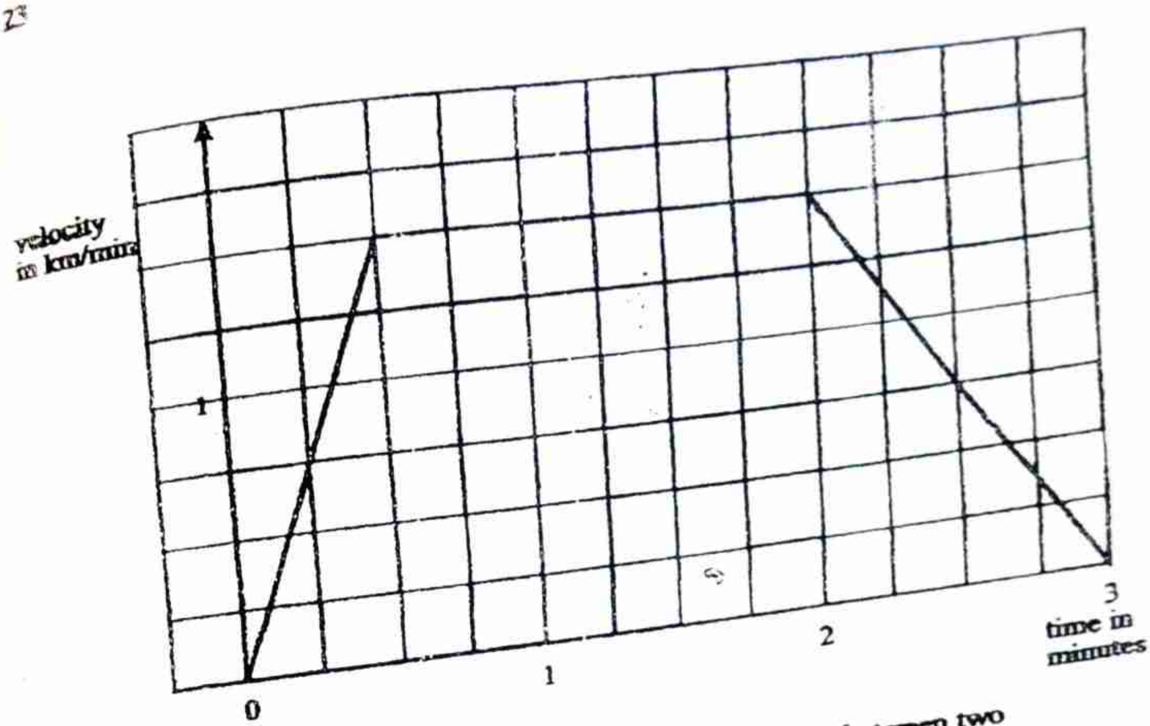
$= 36 + \frac{13\pi}{3}\,cm$

$= 36 + 4{,}3333333333\pi\,cm$

$= 36 + 4{,}\dot{3}\pi\,cm$

Answer:	(a)	$17\pi\ cm^2$	[3]
	(b)	$36 + 4{,}\dot{3}\pi\ cm$	[3]

23



The diagram is a velocity-time graph of a train journey between two stations.

Find

(a) the maximum speed of the train in km/h,

(b) the train's acceleration in the first half minute,

(c) the distance the train travels at maximum speed,

(d) the distance between the stations.

Suggested solution

23. (a) Maximum Speed $= \frac{\text{Speed}}{Time}$

$= 1\frac{1}{2}\ km/min$

$= \left(\frac{3}{2} \div \frac{1}{60}\right)\ km/h$

$= \left(\frac{3}{2} \times \frac{60}{1}\right)\ km/h$

(B) Acceleration $= \frac{\frac{3}{2} - 0}{0.5 - 0}$

$= \frac{3}{2} \div \frac{1}{2}$

$= \frac{3}{2} \times \frac{2}{1}$

$= 3km/min^2$

(c) Distance at max speed $=$ Area of the Square

$= 1.5^2$

$= 2.25\ km$

(d) Distance between Stations $=$ Area of trapezium

$= \frac{1}{2}(a + b) \times h$

$= \frac{1}{2}\left(\frac{3}{2} + 3\right) \times \frac{3}{2}$

$= \frac{3}{2}\left(\frac{3 + 6}{2}\right)$

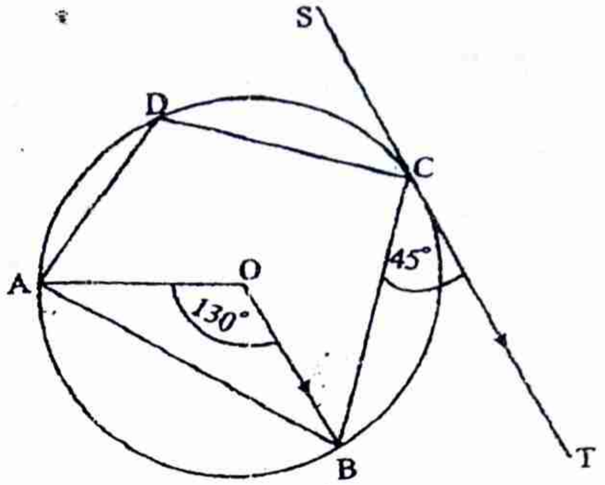
$= \frac{3}{2} \times \frac{9}{2}$

$= \frac{27}{4}$

$= 4.5\ km$

Answer:	(a)	$90\ km/h$	[2]
	(b)	$3km/min^2$	[2]
	(c)	$2.25\ km$	[1]
	(d)	$4.5\ km$	[1]

24



A, B, C and D lie on the circumference of a circle centre O.

SCT is a tangent to the circle at C and is parallel to OB.

$A\hat{O}B = 130°$ and $B\hat{C}T = 45°$

(a) Write down the geometrical word which completes the following statement "ABCD is a...... quadrilateral".

(b) Find the values of

(i) $O\hat{B}C$,

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

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

(iv) $O\hat{C}T$,

(v) reflex angle AOC.

Suggested solution

24. (a) Cyclic

(b) (i) $O\hat{B}C = 45^0$ — Z ∡'s

(ii) $O\hat{B}A = 25^0$ — Base ∡'s of isosceles ΔOAB

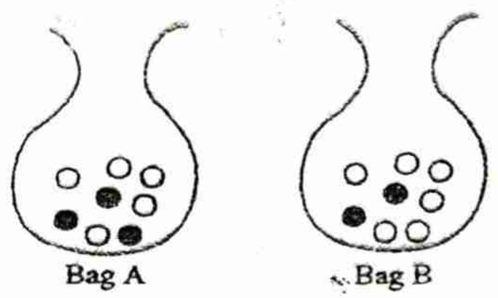
(iii) $A\hat{D}C = 110^0$ — Opp ∡'s of cyclic quadrilateral are supplementary.

(iv) $O\hat{C}T = 90^0$ — Tangent to radius OC.

(v) reflex angle $A\hat{O}C = 220^0$ — ∡ at the centre is twice ∡ at the circumference.

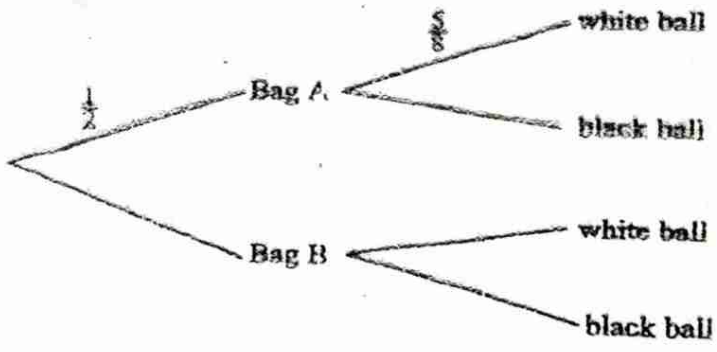
Answer:	(a)		cyclic	[1]
	(b)	(i)	$O\hat{B}C = 45^0$	[1]
		(ii)	$O\hat{B}A = 25^0$	[1]
		(iii)	$A\hat{D}C = 110^0$	[1]
		(iv)	$O\hat{C}T = 90^0$	[1]
	(v)	reflex angle	$A\hat{O}C = 220^0$	[1]

25



Denis must choose a bag from which he should pick a ball. The probability that he chooses Bag A is $\frac{1}{2}$.

Bag A contains 5 white and 3 black balls. Bag B contains 6 white and 2 black balls. The tree diagram below shows some of this information.



(a) Complete the probability tree diagram shown above.

(b) Find the probability that Denis chooses Bag A and then a white ball.

(c) Find the probability that Denis picks a white ball.

Suggested solution