ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS
PAPER 2

4004/2

NOVEMBER 2022 SESSION

2 hours 30 minutes

Additional materials:
Mathematical Instruments
Mathematical Tables
Non programmable Electronic Calculator
Plain Paper (1 sheet)
Graph Paper (4 sheets)
Answer Paper .

Time 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all questions** in Section A and **any four questions** from Section B.

Write your answers on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

All working must be clearly shown on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given correct to three significant figures. Answers in degrees should be given correct to one decimal place.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
Mathematical tables and Non-programmable electronic calculators may be used to evaluate explicit numerical expressions.
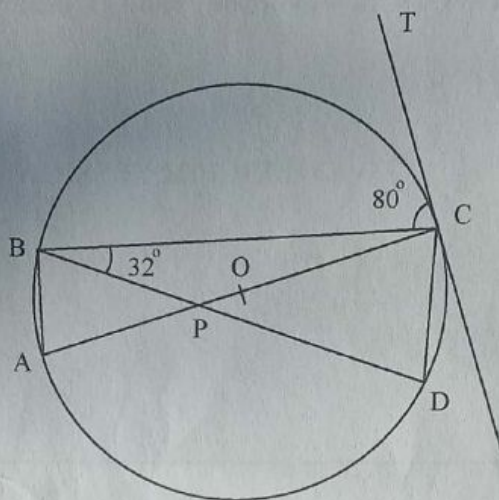

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Section A [52 Marks]

Answer all questions in this section.

1.

In the diagram above A, B, C and D are points on the circumference of a circle centre O.
TC is a tangent to the circle at C.
AC and BD intersect at P.
$B\hat{C}T = 80°$ and $C\hat{B}D = 32°$.

Calculate

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

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

(c) $C\hat{P}D$,   [2]

(d) $A\hat{O}D$.   [3]

2   (a)   Factorise $(m - n)(4m + 2n) - (m - n)^2$.   [2]

(b)   The average mass of 11 players is 81 kg.
When one player is removed the average mass becomes 80, 1 kg.
Calculate the mass of the removed player.   [2]

(c)   Maria uses 40% of her pocket money to buy shoes.
She uses 30% of the remainder to buy a dictionary.
Find the percentage of her pocket money that is left.   [2]

(d)   Solve the equation
$$\frac{4-x}{x} = \frac{x}{2}.$$ [4]

3   **(a)**   The total surface area, A cm^2, of a cone is given by the formula
$$A = \pi r^2 + \pi r l$$
where r is the base radius of the cone and l is the slant height,

   (i)   Make l the subject of the formula.   [2]

   (ii)   Find l when A = 121, 44 cm^2, $r = 4,2 \ cm \ and \ \pi = \dfrac{22}{7}$.   [2]

   (b)   The time T minutes taken for a meeting is partly constant and partly varies as the square of N, the number of members present.

   (i)   Express T in terms of N and the constants h and k.   [1]

   (ii)   If there are 4 members present, the meeting lasts 30 minutes.
   If there are 6 members the meeting lasts 45 minutes.
   Find the values of h and k.   [3]

   (iii)   Find the time that the meeting will take if there are 7 members present.   [2]

4   **(a)**   Simplify $1\dfrac{7}{8} - \left(1\dfrac{1}{2}\right)^2$.   [3]

   (b)   Remove brackets and simplify $(2x - y)(3x + 2y)$.   [2]

   (c)   Express 0, 8125 as a fraction in its lowest terms.   [2]

   (d)   **(i)**   Express 5832 as a product of its prime factors in index form.   [1]

   (ii)   Hence find $\sqrt[3]{5832}$.   [1]

   (e)   Express $\dfrac{2}{x-4} + \dfrac{2}{x^2 - 9x + 20}$ as a single fraction in its simplest form.   [3]
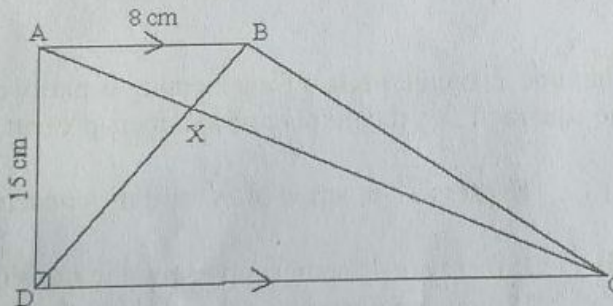
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(a) Given that matrix $A = \begin{pmatrix} 3 & 9 \\ 1 & 4 \end{pmatrix}$ and matrix $B = \begin{pmatrix} 5 & 1 \\ -4 & 2 \end{pmatrix}$,

find

(i) AB, [2]

(ii) B^{-1} the inverse of matrix B. [3]

(b) Solve the inequality $x - 3 < 2x + 1 \leq 5 - x$.
Leave the answer in the form $a < x \leq b$ where a and b are constants. [3]

(c)

In the diagram above ABCD is a trapezium in which AB is parallel to DC.
AB = 8 cm and AD = 15 cm.
AC and BD intersect at X such that BX : XD = 3 : 5.
The area of ABCD is 180 cm^2.
Calculate the

(i) length of DC, [2]

(ii) area of triangle BXC. [3]

Section B [48 Marks]

Answer any *four* questions from this section.

Each question carries *12* marks.

6   Answer the whole of this question on a sheet of plain paper.
Use ruler and compasses only for all constructions.
Show clearly all construction lines and arcs.
All constructions should be in a single diagram.

(a)   Construct a triangle ABC such that AB = 10cm, $A\hat{B}C = 30°$ and
$B\hat{A}C = 120°.$ [5]

(b)   Measure and write down the length of BC.   [1]

(c)   Construct a perpendicular from C to meet BA produced at D.   [2]

(d)   Construct the locus of points which are

(i)   equidistant from A and B,   [2]

(ii)   6 cm from point A.   [1]

(e)   A point E is not more than 6 cm from A but nearer B than A.
On the diagram show by shading clearly the region in which E must lie.   [1]

7   The table below shows times taken to complete a race by 50 athletes.

Time (t minutes)	$t \le 5$	$5 < t \le 8$	$8 < t \le 10$	$10 < t \le 12$	$12 < t \le 14$	$14 < t \le 16$	$16 < t \le 18$	$18 < t \le 20$
Frequency	0	3	5	14	16	7	4	1

(a)   Calculate an estimate of the mean time for the race.   [3]

(b)   Below is a cumulative frequency table for the same times of the 50 athletes.

Time (t minutes)	$t \le 5$	$t \le 8$	$t \le 10$	$t \le 12$	$t \le 14$	$t \le 16$	$t \le 18$	$t \le 20$
Cumulative Frequency	0	3	8	22	m	45	n	50

(i)   Find the value of m and the value of n.   [2]

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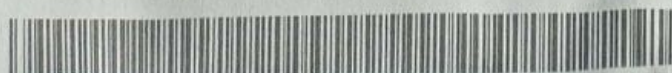
(ii) **Answer this part of the question on a sheet of graph paper.
Use a scale of 2 cm to 2 minutes on the time axis and 2cm to 5 units
on the cumulative frequency axis.**

Draw a cumulative frequency curve for the athletes times. [4]

(c) Use the graph to estimate the

[2]

(i) median time for the race,

(ii) approximate number of athletes who completed the race in 9 minutes
and under. [1]

**Answer the whole of this question on a sheet of graph paper.
Use a scale of 2cm to 2 units on both axes for the range**
$-6 \leq x \leq 4$ and $-6 \leq y \leq 8$

(a) Triangle P has vertices at (2; 1), (3; 3) and (1; 5).
Draw and label triangle P. [1]

(b) Triangle Q is the image of triangle P under a translation through vector
$\begin{pmatrix} -6 \\ -7 \end{pmatrix}$.

Draw and label triangle Q. [3]

(c) Triangle R with vertices at (1; 5), (3; 6) and (1; 7) is the image of triangle P
under a transformation X.

(i) Draw and label triangle R. [1]

(ii) Describe fully transformation X. [3]

(d) Triangle S is the image of triangle P under a one way stretch of stretch
factor -2 with the y axis invariant.

(i) Calculate the coordinates of the vertices of triangle S. [3]

(ii) Draw and label triangle S. [1]

9   Answer the whole of this question on a sheet of graph paper.
     Use a scale of 2cm to 1 unit on the x axis and 2cm to 5 units on the y axis.
     The table below is for values of the function $y = 6x - x^2 - x^3$.

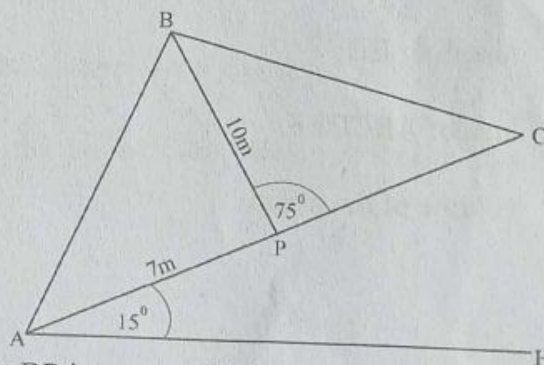| x	-4	-3	-2	-1	0	1	2	3
y	24	0	d	-6	0	4	0	e

(a)   Find the values of d and e.   [2]

(b)   Draw the graph of the function $y = 6x - x^2 - x^3$.   [4]

(c)   Find the gradient of the curve at the point where $x = -2$.   [2]

(d)   On the same axis draw the graph of $y = 2 - 2x$.   [1]

(e)   Use the graphs to solve the equation $6x - x^2 - x^3 = 2 - 2x$.   [3]

10   (a)   Find vectors a and b such that :

$$a + b = \begin{pmatrix} -2 \\ 6 \end{pmatrix}$$

$$2a - b = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$$

                                                                         [4]

(b)

In the diagram above BP is a post of height 10 m , standing on sloping ground
AC which is inclined to the horizontal ground AH at $15°$.
The post is supported by two ropes BA and BC fixed to the ground at A and
C respectively.
AP = 7m and $B\hat{P}C = 75°$.

(i)   Find the gradient of slope AC.
       Give the answer correct to 2decimal places.

                                                                         [1]

(ii)   Calculate $A\hat{P}B$.

                                                                         [2]

(iii) Calculate the length of the rope AB. [5]

11 **(a)** In a group of 55 teachers in a school 31 have cars, 27 have bicycles, x teachers have both a car and a bicycle and 6 have neither of the two.
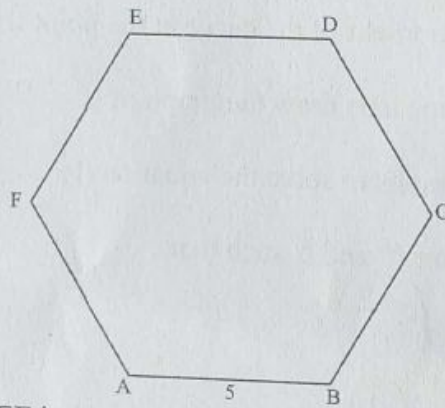
Let ξ = {Teachers in a school}
B = {Teachers with bicycles}
C = {Teachers with cars}

(i) Show the above information on a well labelled Venn diagram. [2]

(ii) Find the value of x. [2]

(b)

In the diagram ABCDEF is a regular hexagon. the length of each side is 5 cm.
It is the base of a hexagonal prism whose height is 12cm.
Calculate the

(i) length of BD, [3]

(ii) area of ABCDEF, [3]
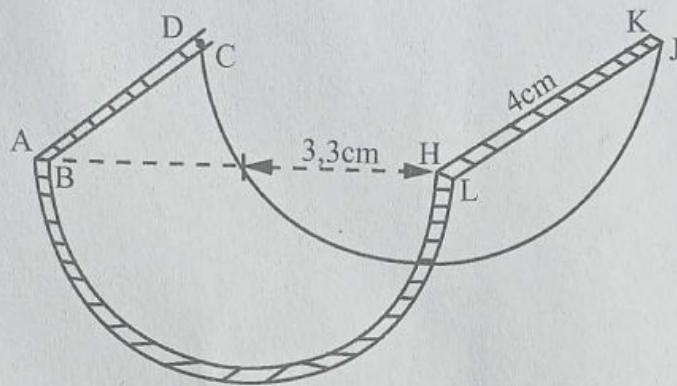
(iii) volume of the prism. [2]

12   (a)   Solve the equation $3x^2 - 5x - 10 = 0$.
Give the answers to 2 decimal places.   [5]

(b)

The diagram above shows a semi circular coupling ABCDHLJK made of a certain type of metal.
$AB = DC = HL = KJ = 2$mm and $AD = BC = HK = LJ = 4$cm.
The radius of the coupling is 3,3cm.
Take π to be $\dfrac{22}{7}$.

Calculate the

(i)   length of arc BH,   [2]

(ii)   volume of metal used in the coupling,   [3]

(iii)   mass of the metal used if the density of the metal is 7,92 g/cm^3.   [2]

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