ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008/2

PAPER 2

NOVEMBER 2008 SESSION 2 hours 30 minutes

Additional materials:
- Answer paper
- Geometrical instruments
- Graph paper (3 sheets)
- Mathematical tables
- Plain paper (1 sheet)

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 **three** 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.

Electronic calculators must not be used.

All working must be clearly shown. It should be done 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 to three significant figures. Answers in degrees should be given 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 may be used to evaluate explicit numerical expressions.

This question paper consists of 11 printed pages and 1 blank page.

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Section A [64 marks]

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

1 (a) Express $3\frac{2}{5} - 2\frac{13}{20}$ as a single fraction in its lowest terms. [2]

(b) Remove the brackets and simplify

$$3(a+2c) - 4(2a-c).$$ [2]

(c) Solve the equation

$$\frac{4x-5}{7} = 1\frac{3}{4}.$$ [3]

(d) Find the number of circular rings each of diameter 6,3 cm which can be made from a wire 19.8 m long.
$\left(\text{Use } \pi = \frac{22}{7}\right)$. [4]

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2 (a) Factorise completely

(i) $2x^2 + ax - 2bx - ab$,

(ii) $3 - 12y^2$. [4]

(b) It is given that P(4; 8) and R(−4; −2) are points on the Cartesian plane. Find

(i) $\overrightarrow{PR}$ as a column vector,

(ii) $\left|\overrightarrow{PR}\right|$. [3]

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(c) Two cyclists, Alice and John, started a journey at the same time from two villages which are 27 km apart. Alice cycled at x km/h and John cycled at $2x$ km/h. They travelled towards each other and met after $\frac{3}{4}$ hour.

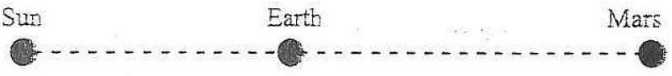
(i) Write down, in terms of x, the distance that Alice travelled in $\frac{3}{4}$ hour.

(ii) Form an equation in x and solve it.

(iii) Hence write down the numerical value of John's speed. [4]

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3 (a)



In the diagram, the Sun, Earth and Mars are in a straight line. It is given that the Earth is 1.496×10^8 km from the Sun and Mars is 2.279×10^8 km from the Sun.

(i) Write down 1.496×10^8 in ordinary form.

(ii) Find, in standard form, the distance of Mars from the Earth. [3]

(b) In a certain year, a paint manufacturer mixed 27 litres of white paint with 9 litres of red paint to produce 36 litres of **pink** paint. If one litre of the white paint cost \$36 800 and the average cost of the **pink** paint was \$33 575 per litre, calculate the cost of one litre of the red paint then. [3]

(c) (i) Solve the simultaneous inequalities

$$2x - 6 < 5x + 3 \leq 3x + 11$$

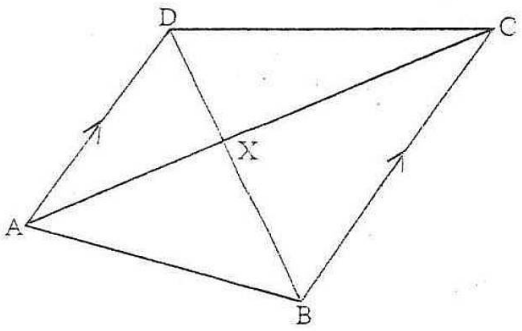
giving your answer in the form $a < x \leq b$ where a and b are integers.

(ii) Write down the least possible value of x. [4]

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4 (a)



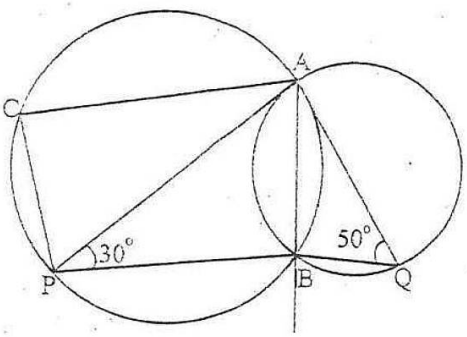
In the diagram, ABCD is a quadrilateral in which AD is parallel to BC and AC and BD intersect at X such that the ratio BX: XD = 3: 2. Given that $\Delta ABX = 9\ cm^2$ in area,

(i) calculate the area of ΔADX,

(ii) name, in correct order, the triangle which is similar to ΔBCX,

(iii) hence calculate the area of ΔBCX. [5]

(b)



In the diagram, AP and AQ are tangents to the circles ABQ and ABPC respectively. Given that $A\hat{P}B = 30°$ and $A\hat{Q}B = 50°$,

calculate

(i) $B\hat{A}P$,

(ii) $B\hat{A}Q$,

(iii) reflex $P\hat{B}Q$,

(iv) $A\hat{C}P$.

[6]

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

$$n + \frac{2n}{6n+5}.$$ [2]

(b) Make m the subject of the formula

$$a = \frac{m-5}{3m-2}.$$ [3]

(c) Given that $\mathrm{A} = \begin{pmatrix} 3 & 5 \\ -2 & 7 \end{pmatrix}$ and $\mathrm{B} = \begin{pmatrix} 5 & y \\ y & 3 \end{pmatrix}$ find

(i) A^2,

(ii) the two possible values of y given that the determinant of the matrix B is $5y + 1$. [5]

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6 **Answer the whole of this question on a sheet of plane paper.**

Use ruler and compasses only for all construction and show clearly all construction lines and arcs.

(a) On a **single** diagram, construct

(i) a line OP, 9 cm long,

(ii) a circle centre O and radius 3.5 cm,

(iii) the locus of points which are equidistant from O and P.

(iv) the circle whose diameter is OP to cut the circle centre O at R and Q,

(v) the two tangents to the circle centre O from the point P. [7]

(b) OP represents a certain locus. Describe this locus **fully**. [2]

(c) A point T lies inside the quadrilateral PQOR and is such that it is nearer PQ than PR and nearer O than P. Given also that OT ≥ 3.5 cm, show by shading clearly the region in which T lies. [2]

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Section B [36 marks]

Answer any three questions in this section.

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

Mass (m kg)	$35 < m \leq 45$	$45 < m \leq 50$	$50 < m \leq 55$	$55 < m \leq 60$	$60 < m \leq 70$
Frequency	p	11	13	8	3
Frequency density	0,5	2.2	2,6	q	0.3

The table gives the masses, m kg, of a group of students at a teachers' college.

(a) Find the value of p and the value of q. [2]

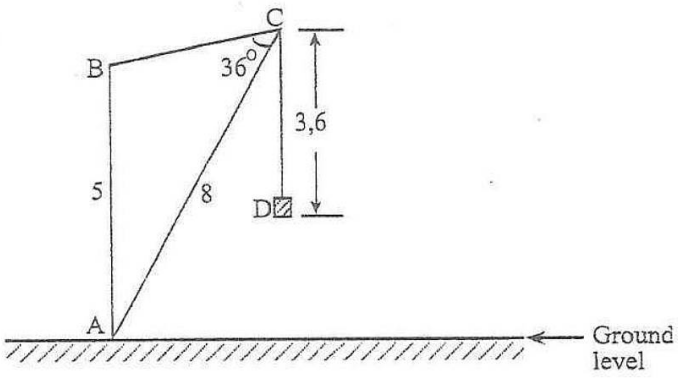
(b) Using a horizontal scale of 2 cm to represent 5 kg and a vertical scale of 4 cm to represent 1 unit of frequency density, draw a histogram of the data. [4]

(c) Calculate an estimate of the mean mass of the students in the group whose masses are greater than 45 kg. [3]

(d) Two students are chosen at random from the whole group. Find the probability that each of them has a mass which is greater than 50 kg. [3]

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8 (a)

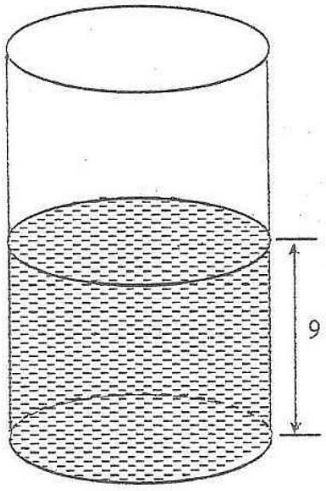


In the diagram, ABC is a crane lifting a load D. AB and BC are beams and ACD is a string. Given that the vertical beam AB = 5 m, AC = 8 m, CD = 3,6 m and $B\hat{C}A$ calculate

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

(ii) the height of D above the ground level. [6]

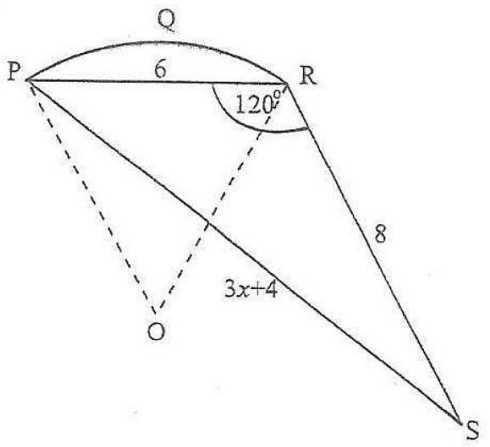
(b)



The diagram shows a vertical cylindrical container with water up to a height of 9 cm. The volume of the water in the container is 512 cm^3. A metal solid, of volume 217 cm^3, is lowered into the container until the solid is completely immersed in water. Calculate the height by which the water level rises in the container. Give your answer correct to the nearest millimetre. [6]

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Take π to be = 3,142

In the diagram, PQR is a segment of a circle of radius 6 cm and centre O.
PR = 6 cm, RS = 8 cm, PS = $(3x + 4)$ cm and $P\hat{R}S = 120°$.

(a) Calculate the area of the segment PQR. [4]

(b) (i) Form an equation in x and show that it reduces to $3x^2 + 8x - 44 = 0$.

(ii) Solve the equation $3x^2 + 8x - 44 = 0$ giving your answers correct to 2 decimal places. [8]

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

A stone is thrown into the air. Its height h metres after t seconds is given by the formula $h = 60 + 30t - 5t^2$.

Below is a table of values for $h = 60 + 30t - 5t^2$.

Time (t seconds)	0	1	2	3	4	5	6	7	8
Height h(metres)	60	85	100	p	100	85	60	q	−20

(a) Find the value of p and the value of q. [2]

(b) Using a horizontal scale of 2 cm to represent 1 second and a vertical scale of 2 cm to represent 20 metres, draw the graph of $h = 60 + 30t - 5t^2$ for $0 \leq t \leq 8$. [8]

(c) Use your graph to find

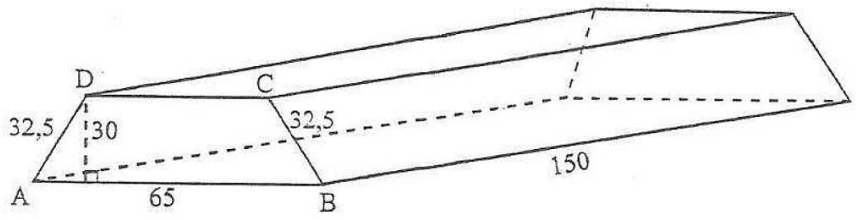
(i) the maximum height reached by the stone,

(ii) the velocity of the stone when $t = 2$,

(iii) the times when the stone is at a height of 80 m. [6]

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The diagram shows a wooden block of length 150 cm, whose cross-section , ABCD is a trapezium in which AB is parallel to DC. AB = 65 cm, AD = BC = 32,5 cm and the perpendicular height is 30 cm.

(a) Calculate

(i) the length CD given that the area of the trapezium is 1 575 cm^2,

(ii) the volume of the block,

(iii) the mass of the block given that the density of the wood of which it is made, is 0,72 g/cm^3,

(iv) the total surface area of the block. [10]

(b) The block is to be varnished. One litre of varnish covers an area of 2 000 cm^2 and is bought in 5-litre tins only. Calculate the number of tins of varnish that need to be bought to varnish the whole block. [2]

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12 **Answer the whole o f this question on a sheet of graph paper.**

A quadrilateral E with vertices (−8; −4), (−4; −4), (−6; −12) and (−10; −8) is the image of quadrilateral A with vertices (4; 2), (2; 2), (3; 6) and (5; 4).

Using a scale of 1 cm to represent 1 unit on both axes. draw the x and y axes for $-10 \leq x \leq 6$ and $-12 \leq y \leq 8$.

(a) (i) Draw and label clearly the quadrilateral E.

(ii) Draw and label clearly the quadrilateral A.

(iii) Write down the matrix which represents the transformation which maps E onto A. [5]

(b) Quadrilateral T with vertices (0; 6), (0; 4), (−4; 5) and (−2; 7) is the image of quadrilateral A under a certain transformation.

(i) Draw and label clearly the quadrilateral T.

(ii) Describe completely, the single transformation which maps A onto T. [4]

(c) A one-way stretch represented by $\begin{pmatrix} 1 & 0 \\ 0 & -1\frac{1}{2} \end{pmatrix}$ maps quadrilateral A onto quadrilateral S.

Draw and label clearly the quadrilateral S. [3]

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