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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

GENERAL CERTIFICATE OF EDUCATION
ORDINARY LEVEL

MATHEMATICS
4008

Past Question Papers and Expected Answers

JUNE 1999 - NOVEMBER 2001

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Centre Number	Candidate Number

Candidate Name _____

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
General Certificate of Education Ordinary Level

MATHEMATICS 4008/1, 4028/1

PAPER 1

Friday **4 JUNE 1999** Morning 2 hours 30 minutes

Candidates answer on the question paper.
No additional materials are required.

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.

Mathematical tables, slide rules and calculators may 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

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For Examiner's Use

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

1 **(a)** Find the exact value of

(i) 5,4 x 0,06,

(ii) 16,5 - 4,96.

(b) Express 840m as a fraction of 2,1km, giving your answer in its simplest form.

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

(ii)..... [1]

(b)..... [1]

---

2 **(a)** **(i)** Express 0,008478 correct to two decimal places.

(ii) Express 0,008478 in standard form.

(b) Write down, correct to the nearest integer, $\sqrt{402}$.

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

(ii)..... [1]

(b)..... [1]

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3 Given that $l = -4, m = -3$ *and* $n = 5$, *find the value of*

(a) lmn,

(b) $3l - m$,

(c) $2n^2$.

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

(b)..... [1]

(c)..... [1]

---

4 Express $2 \times 5^2 + 3$as a number in

(a) base five,

(b) base two.

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

(b)..... [2]

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7

In the diagram, AD is the diameter of the circle $ABCD$. Chords BC and CD are equal and $C\hat{A}B = 33°$. The side CD is produced to E.

Calculate

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

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

(c) $A\hat{D}E$.

Answer (a) $B\hat{A}D$ = ...° [1]

(b) $B\hat{C}D$ = ...° [1]

(c) $A\hat{D}E$ = ...° [1]

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For Examiner's Use

8 (a) At the begining of an examination the clock in the examination room was set to read 2 p.m. The examination ended at 5 pm.

Find the angle, in degrees, through which

(i) the hour hand turns during the examination,

(ii) the minute hand turns during the examination.

(b) Calculate the obtuse angle between the hour hand and the minute hand of a clock at 12.30 p.m.

Answer (*a*) (i) .....° [1]

(ii) .....° [1]

(*b*) .....° [1]

---

9 The table shows the results of the games played by the Gweru Giraffes last season and the points awarded in the League Table.

	Won	Drawn	Lost
Number of games	20	4	6
Points awarded per game	x	2	0

(a) Given that they gained a total of 108 points, calculate the value of x.

(b) The Chinhoyi Cheetahs played the same number of games as the Gweru Giraffes. They drew 6 games and won twice as many games as they lost. Calculate the number of points they gained.

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

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

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10 The following notice was displayed at an airport:

Temperatures (°C) at Air Zimbabwe International Destinations. Date: 3/1/99.

Destination	Minimum	Maximum
Frankfurt	– 11	– 3
Larnaca	9	20
London	– 5	0
Rome	10	13

(a) At which destination

(i) was the lowest temperature recorded,

(ii) was the greatest range of temperatures recorded?

(b) On 4th January the minimum temperature recorded in Frankfurt was 3 °C lower than on 3rd January.

Calculate the minimum temperature in Frankfurt on 4th January.

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

(ii) ..... [1]

(*b*) ..... °C [1]

---

11 All the lengths on a scale drawing are one eighth of their actual lengths.

Calculate

(a) the actual length of a line represented by a line 5.6 cm long on the scale drawing,

(b) the area on the scale drawing which represents an actual area of 896 cm^2.

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

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

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12

The circle ACD has centre O and radius 13 cm.
The chord ABC is perpendicular to the straight line DOB and has a total length $AC = 24$ cm.

(a) Calculate the length of OB.

(b) Write down, as a fraction, the value of $\cos A\hat{O}D$.

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

(*b*) $\cos A\hat{O}D =$ ..... [1]

---

13 Write down a simple geometrical reason why it is not possible to draw

(a) **(i)** a quadrilateral $ABCD$ with angles 70°, 107°, 50° and 100°,

(ii) a triangle LMN with sides 11,4 cm, 5,2 cm and 4,7 cm.

(b) What are complementary angles?

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

(ii) ..... [1]

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

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For Examiner's Use

14 (a) Write down the order of rotational symmetry of an equilateral triangle.

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

(b) On the diagram in the answer space, shade the image of *ABCD* so that the resulting complete shape, has *BC* as a line of symmetry.

Answer (*b*)

[1]

(c) On the diagram in the answer space, shade the image which is the reflection of the shaded shape in the line *PQ*.

Answer (*c*)

[1]

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15 Express

(a) 1,75 hectares in square metres,

(b) 2 cubic metres in litres,

(c) 3,85 hours in hours and minutes.

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

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

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

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For Examiner's Use

16 **(a)** Solve the inequality $-7 < 2 - 3x \leqslant 5$.

(b) Illustrate your answer to part **(a)** on the number line in the answer space.

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

(*b*)

[1]

17 A man estimates that each side of a square floor has a length of 4 metres, correct to the nearest metre.

Find the difference between the largest and smallest possible calculated values of the area of the floor.

Answer ..... m^2 [3]

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18 Solve the equations

(a) $\frac{3h}{5} + 4 = 13$,

(b) $y(y + 3) - 2(y + 3) = 0$.

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

(*b*) $y =$ ..... or ..... [2]

---

19 **Evaluate**

(a) $3^4 \div 5^2$, **giving your answer as an exact decimal,**

(b) $\log_3 45 - \log_3 5$.

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

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

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20

Take π to be $\frac{22}{7}$.

The diagram shows a pattern used in dressmaking. It consists of six equal circles of radius 3,5 cm inscribed in a rectangle. The sides of the rectangle are tangents to the circles which touch other circles as shown.

Calculate

(a) the area of the rectangle,

(b) the area of the shaded region.

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

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

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22

The diagram shows the graph of $f(x) = (2x - 1)(x - 2)(x + 3)$.

(a) Find the coordinates of

(i) A,

(ii) B.

(b) The point $P(-2, m)$ lies on the curve. Calculate the value of m.

Answer (*a*) (i) A is (....., ...) [1]

(ii) B is (....., ...) [1]

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

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23 A survey is carried out to find the number of minutes each member of a class takes to finish a multiple choice test. The diagram below is an incomplete histogram used to illustrate the results of the survey.

Another way to represent the same information is shown below.

Time (t)	$0 < t \leq 20$	$20 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 45$
Frequency	x	10	16	9

(a) Find the value of x.

(b) Complete the given histogram.

(c) Write down the modal time interval.

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

(*b*) (on the diagram) [2]

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

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24 The strength, S, of a beam of metal varies jointly as the square of its depth, D, and the inverse of its length, L.

(a) Write down a formula for S in terms of D, L and a constant, k.

(b) Given that $S = 18$ when $D = 3$ and $L = 5$, find the value of k.

(c) Calculate the value of D when $S = 20$ and $L = 6$. leaving your answer in surd form.

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

(*b*) $k =$ ..... [2]

(*c*) $D =$ ..... [2]

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25

In the diagram, P, Q and R represent points on level ground with $PQ = 30$ m, $PR = 24$ m, $P\hat{R}Q = 87°$ and $Q\hat{P}R = 40°$. The bearing of Q from P is 042°.

Use as much of the information given below as is necessary.

(a) Calculate

(i) the bearing of R from Q,

(ii) how far Q is north of P.

(b) R is the base of a vertical mast RT.
The angle of elevation of the top of the mast, T, from P is also 42°.
Calculate the height of the mast RT.

[sin 42° = 0,67; cos 42° = 0,74; tan 42° = 0,90.]

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

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

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

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26 In 1999 a television set had a marked price of \$7370.00.

(a) Mr Mogo paid cash and was allowed 15% discount. Calculate the discount.

(b) Mr Dube bought the television set through a lay-by scheme. In this scheme he paid an initial deposit of $\frac{5}{8}$ of the marked price and then 3 equal monthly instalments, before he collected the television set. Calculate each monthly instalment.

(c) The marked price in 1999 was a result of a 10% increase over the marked price of the previous year. Calculate the marked price of the television set in 1998.

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

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

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

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27 **(a)**

1	2	3	4	.....	10	.....	n
1	3	5	7	.....	x	.....	y

Table 1

Consider the pattern of the numbers shown in Table 1 above, which is incomplete.

(i) Write down the value of x.

(ii) Express y in terms of n.

(b) Table 2 shows the first lines of another pattern

Line	Terms	Sum of terms
1	1	1
2	1, 3	4
3	1, 3, 5	9
4	1, 3, 5, 7	.....
7	.....	.....

Table 2

(i) Complete line 4 in Table 2 above.

(ii) Complete line 7 in Table 2 above.

(iii) Write down the sum of the terms in line 30 of the table.

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

(ii) $y =$ ..... [2]

(b) (i) (in the table) [1]

(ii) (in the table) [2]

(iii) ..... [1]

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MATHS **JUNE 1999**

4008/1

POSSIBLE ANSWERS

1. (a) (i) 0,324 or $\frac{324}{1000}$ or equivalent fraction (i) 11,54 or $11\frac{54}{100}$ or equivalent fraction (b) $\frac{2}{5}$

2. (a) (i) 0,1 (ii) $8{,}478 \times 10^{-3}$ (b) 20

3. (a) 60 (b) -9 (c) 50

4. (a) 203_5 or 203_{five} (b) $110\ 101_2$ or $110\ 101_{two}$

5. (a) (i) 8 (ii) 400 (b) Heptagon

6. (a) (i) 1306 or 1.06pm (b) 235

7. (a) 66 (b) 114 (c) 123

8. (a) (i) 90 (ii) 1080 (b) 165

9. (a) 5 (b) 92

10. (a) (i) Frankfurt (ii) Larnaca (b)

11. (a) 44,8 (b) 14

12. (a) 5 (b) $\frac{-5}{13}$

13. (a) (i) the sum of the angles is less than 360°
(ii) the sum of the two shorter sides is less than the third side
(b) two angles which add up to 90°

14. (a) 3 (b)

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(c)

15. (a) 17 500 (b) 2 000 (c) 3hours 51 minutes

16. (a) $-1 \leq x < 3$ or
$-1 \leq x$ and $x < 3$

(b)

17. 7,11

18. (a) 15 (b) 2 or −3

19. (a) 3,24 (b) 2

20. (a) 294 (b) 63

21. (a) 40 (b) $\frac{2}{3}$

22. (a) (i) (-3;0) (ii) (0;6) (b) 20

23. (a) 4 (b) rectangle of height1,8 and interval $30 < t \leq 45$

c) $30 < t \leq 40$

24. a) $\frac{kD}{L}$ (b) 10 (c) $2\sqrt{3}$ or $\sqrt{12}$

25. a) (i) 169° (ii) 22,2 (b) 21,6

26. a) 1105,5 (b) 921,25 (c) 6700

27. (a) (i) 19 (ii) 2n-1
(b) (i) 16 (ii) 1,3,5,7,9,11,13=49 (iii) 900

EG/ C: 4008/1/J99

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MATHEMATICS 4008/2

PAPER 2

Wednesday **9 JUNE 1999** Morning 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)** Evaluate $2\frac{1}{2} - \frac{3}{5} \div \frac{2}{3}$. [2]

(b) Tendai is paid \$12,40 an hour for a basic week of 40 hours. He is paid \$18,60 an hour for overtime. Calculate his pay for a week in which he works for 48 hours. [3]

(c) There are 1500 pupils at Fundo Secondary School. One third of the pupils are girls.

(i) Find the number of boys.

(ii) Given that $\frac{1}{8}$ of the boys are studying Agriculture, express the number of boys studying Agriculture as a percentage of the total number of pupils at the school. [4]

(d) Calculate the simple interest earned on \$1200 invested at a rate of 15% per annum for 6 months. [2]

---

2 **(a)** **(i)** Factorise completely $ax + x - 3a - 3$.

(ii) Factorise $2x^2 - 7x + 3$.

(iii) Write down the L.C.M. of

$ax + x - 3a - 3$ and $2x^2 - 7x + 3$. [5]

(b) Given that $2p = \sqrt[3]{6q + 5}$,

(i) find the value of p when $q = 20$,

(ii) express q in terms of p. [5]

(c) Simplify $\frac{2}{x-1} - \frac{3}{x+5}$. [3]

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MATHEMATICS 4008/2

PAPER 2

Wednesday **9 JUNE 1999** Morning 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

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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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3 Answer this question on a single sheet of graph paper.

The table below shows the number of pupils from each form who went on a trip to Great Zimbabwe.

Form	Number of pupils
1	25
2	16
3	75
4	64

(a) Using a 1 cm-wide bar to represent each form and a vertical scale of 2 cm to represent 10 pupils, draw a labelled bar chart for the given data. [3]

(b) For these pupils, find

(i) the modal form,

(ii) the mean number per form.

[3]

(c) If two pupils are chosen at random from those who went on the trip, find the probability that they were both in Form 3. [2]

(d) Given that the total number of pupils at the school was 1080, find, as a single fraction in its lowest terms, the probability that a pupil chosen at random from the whole school, went on the trip and was in either Form 2 or Form 4. [2]

---

4 (a) Find the value of r for which the matrix $\begin{pmatrix} r & 24 \\ -4 & 3 \end{pmatrix}$ is singular. [2]

(b) Given that $\begin{pmatrix} 3 & 2 \\ 1 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 16 \\ 7 \end{pmatrix}$,

calculate the values of x and y. [3]

(c) W, X, Y and Z are four points with coordinates $(-2, 3)$, $(4, 6)$, $(8, 1)$ and $(1, -2)$ respectively.

(i) Find $\overrightarrow{XY}$ as a column vector.

(ii) Find $|\overrightarrow{XY}|$.

(iii) Calculate the gradient of WX.

(iv) Find the equation of the line parallel to WX which passes through Z.

[6]

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5 **Answer the whole of this question on a sheet of plain paper.**
Use ruler and compasses only for all constructions and show clearly all the construction lines and arcs.

(a) **(i)** Construct a quadrilateral $ABCD$ in which $AB = 9{,}0$ cm, $D\hat{A}B = 90°$, $A\hat{B}C = 60°$, $AD = 7{,}5$ cm and $BC = 6{,}3$ cm. [4]

(ii) Measure and write down the size of $B\hat{C}D$. [1]

(b) **On the same diagram** construct

(i) the locus of points that are 5,0 cm from B, [2]

(ii) the locus of points that are equidistant from DA and DC. [2]

(c) Mark and label points X and Y which are 5,0 cm from B and equidistant from DA and DC. [2]

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6 In a survey ,200 people were asked which of the three meats - beef, chicken or pork - they liked. The results are displayed in the table below

Type of Meat	Number of people
Beef	80
Chicken	120
Pork	50
Beef and Chicken	60
Chicken and Pork	46
Pork and Beef	32
All three	28
None of the three	h

Some of this information is shown in the incomplete Venn diagram below.

Write down the values of

(i) d,

(ii) e,

(iii) f,

(iv) g,

(v) h,

[5]

(b) How many people liked exactly two types of meat. [1]

(c) Calculate the number of people who did not like any of the meats as a fraction of the total number surveyed. Give your answer as a fraction in its lowest terms. [2]

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Section B [36 marks]

Answer **three** *questions in this section.*

7.

The diagram shows a rectangle and a right-angled triangle. The lengths of the sides of the rectangle M are $(x + 4)$ cm and $(7 - x)$ cm. The lengths of two of the sides of the triangle N are x cm and $(3x + 1)$ cm as shown

(a) Write down an expression, in terms of x, for the area of

(i) rectangle M

(ii) rectangle N

[2]

(b) Given that the area of rectangle M is twice the area of triangle N, form an equation in x and shows that it reduces to

$$2x^2 - x - 14 = 0.$$ [3]

(c) Solve the equation in **(b)**, giving your answers correct to 3 significant figures. [5]

(d) Write down the dimensions of rectangle M correct to the nearest millimetre. [2]

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8

Triangle ABC has vertices $A(-3, 2)$, $B(-1, 2)$ and $C(-1, 3)$.
Triangle $A_1B_1C_1$ has vertices $A_1(-2, -3)$, $B_1(-2, -1)$ and $C_1(-3, -1)$.

(a) (i) Describe fully the single transformation that maps $\triangle ABC$ onto $\triangle A_1B_1C_1$. [2]

(ii) Write down the matrix that represents this transformation. [2]

(b) Triangle ABC is mapped onto triangle $A_2B_2C_2$ by a transformation which is represented by the matrix $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$.

(i) Find the coordinates of A_2, B_2 and C_2. [2]

(ii) Write down the matrix which represents the transformation which maps $\triangle A_2B_2C_2$ onto $\triangle ABC$. [1]

(iii) Find the matrix which represents the transformation which maps $\triangle A_2B_2C_2$ onto $\triangle A_1B_1C_1$. [2]

(c) Triangle $A_3B_3C_3$ has vertices $A_3(3, 2)$, $B_3(5, 2)$ and $C_3(8, 3)$.
Describe fully the single transformation that maps $\triangle ABC$ onto $\triangle A_3B_3C_3$. [3]

[Turn over

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9 **(a)**

In the diagram, AB is parallel to DE and AE is parallel to PQ.
ACE and $BCPD$ are straight lines and $AC = PQ$.

(i) Explain why triangles ABC and EDC are similar.

(ii) Given that $AC = \frac{1}{4}AE$ and that the area of triangle ABC is 2 square units, find the area of $PQEC$.

[4]

(b)

In the diagram, $JKLM$ is a quadrilateral, $JM = 5$ m, $KM = 8$ m and $M\hat{J}K = 50°$.

(i) Calculate $J\hat{K}M$. [3]

(ii) Given also that $M\hat{K}L = 95°$ and $KL = 11$ m, calculate the length of ML. [5]

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10 **(a)** Working 8 hours a day, 45 men could do a job in 12 days. How many men, working at the same rate, working $7\frac{1}{2}$ hours a day, should be employed to do the job in 9 days? [3]

(b)

Take π to be 3,142

A cylindrical hole of radius 3 cm was drilled completely through a metal cube of side 15 cm in a direction perpendicular to one of the faces of the cube, as shown above.

(i) Calculate the volume of the metal removed. [2]

(ii) Express the volume of the metal removed as a percentage of the volume of the original cube. [2]

(iii) Calculate the volume of the remaining metal. [2]

(iv) All the metal removed was melted and made into 45 identical solid spheres. Calculate the radius of each sphere, giving your answer correct to the nearest tenth of a millimetre. [3]

[Volume of sphere $= \frac{4}{3}\pi r^3$]

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11 Answer the whole of this question on a single sheet of graph paper

The velocity, v m/s of a ball after time, t seconds, is given by

$$v = 4 + 5t - t^2$$

The table below gives some corresponding values of v and t.

t (s)	0	1	2	3	4	5	6
v (m/s)	4	8	10	10	8	4	p

(a) Calculate the value of p. [1]

(b) Taking 2 cm to represent 1 second, draw a horizontal axis for $0 \leq t \leq 6$.
Taking 2 cm to represent 2 m/s, draw a vertical axis for $-4 \leq v \leq 12$.
Draw the graph of $v = 4 + 5t - t^2$ for $0 \leq t \leq 6$. [4]

(c) Use the graph to estimate

(i) the time at which $v = 0$,

(ii) the maximum speed reached by the ball,

(iii) the distance covered by the ball in the first 2 seconds. [4]

(d) **(i)** By drawing a tangent, find the gradient of the graph when $t = 4$.

(ii) State briefly what this gradient represents. [3]

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

There were x rows of Ordinary seats and y rows of Superior seats for a school play.

(a) Each row of Ordinary seats had 25 seats and each row of Superior seats had 20 seats.

Fire regulations limit the total number of seats to 400.

Write down an inequality which expresses this restriction and show that it reduces to

$$5x + 4y \leqslant 80.$$ [2]

(b) There is space in the hall for no more than 18 rows of seats.

The Headmaster insisted that there were at least 5 rows of Ordinary seats.

Write down two further inequalities, other than $x \geqslant 0$ and $y \geqslant 0$, which express these restrictions. [2]

(c) The point (x, y) represents x rows of Ordinary seats and y rows of Superior seats.

Using a scale of 2 cm to represent 2 rows on each axis, draw x- and y-axes taking values of x and y from 0 to 20.

Construct, and indicate clearly by shading the **unwanted** regions, the region in which (x, y) must lie. [4]

(d) All of the seats were occupied.

Write down the coordinates of the points which represent the largest permitted audience. [2]

(e) Each Ordinary seat cost 40 cents and each Superior seat cost \$1.

Write down, in terms of x and y, an expression for the total income, in dollars. [1]

(f) Find the greatest possible income, given that all the conditions are satisfied. [1]

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MATHEMATICS **JUNE 1999**

4008/4028/02

POSSIBLE ANSWERS

1. (a) $2\frac{1}{2} - \frac{3}{5} \div \frac{2}{3}$

$= 2\frac{1}{2} - \frac{3}{5} \times \frac{3}{2}$

$= \frac{5}{2} - \frac{9}{10}$ M1

$= 1{,}6$ or $1\frac{3}{5}$ A1

(b) Total pay $= 12{,}40 \times 40 + 18{,}60 \times 8$ M2
$= \$644{,}80$ A1

(c) (i) No. of boys $= \frac{2}{3} \times 1\ 500$ M1
$= 1\ 000$ A1

(ii) No. doing agric $= \frac{1}{8} \times 1\ 000$

% of total $= \frac{1}{8} \times \frac{1000}{1500} \times 100$ M1

$= 8\frac{1}{3}$ or 8,333% A1

(d) $I = \frac{1200 \times 15 \times 6}{100 \times 12}$ M1

$= \$90$ A1

[11]

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2 (a) (I) $x(a+1) - 3(a+1)$ or $a(x-3) + x - 3$ M1

$= (x-3)(a+1)$ A1

(ii) $2x^2 - 7x + 3 = (2x-1)(x-3)$ B2

(iii) LCM $= (a+1)(x-3)(2x-1)$ B1

(b) (i) $2p = \sqrt[3]{6 \times 20 + 5}$

$2p = 5$ M1

$p = 2\frac{1}{2}$ or 2,5 or $\frac{5}{2}$ A1

(ii) $(2p)^3 = 6q + 5$ M1

$6q = 8p^3 - 5$ M1

$q = \frac{8p^3 - 5}{6}$ A1

(c) $\frac{2(x+5) - 3(x-1}{(x-1)(x+5)}$ M1

$= \frac{2x + 10 - 3x + 3}{(x-1)(x+5)}$ MAI

$= \frac{13 - x}{(x-1)(x+5)}$ AI[13]

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3. Refer to graph

(a) Correct rectangular bars B3

(b) (i) Modal form = Form 3 B1

(ii) Mean = $\frac{25+16+75+64}{4}$ M1

= 45 A1

(c) $p(two\ form\ 3s) = \frac{75}{180} \times \frac{74}{179}$ $M1$

$= \frac{185}{1074}\ or\ 0{,}1722$ $A1$

(d) $p(F2\ or\ F4/trip) = \frac{16+64}{1080}$ $M1$

$= \frac{2}{27}$ $A1$ [10]

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4. (*a*) $3r-(-4)\times 24=0$ — *M*1

$r=-32$ — *A*1

(b) $3x+2y=16$

$x-y=7$

$3x-3y=21$ or $2x-2y=14$

$5y=-5$ or $5x=30$ — M1

$y=-1$ — A1

$x=6$ — A1

(*c*) (*i*) $\overrightarrow{XY}=\begin{pmatrix}8\\1\end{pmatrix}-\begin{pmatrix}4\\6\end{pmatrix}=\begin{pmatrix}4\\-5\end{pmatrix}$ — *B*1

(*ii*) $\left|\overrightarrow{XY}\right|=\sqrt{4^2+(-5)^2}$ — *M*1

$=6{,}403$ — *A*1

(*iii*) *grad of WX* $=\dfrac{6-3}{4-(-2)}=\dfrac{1}{2}$ — *B*1

(iv) Equation of line is

$y--2=\dfrac{1}{2}(x-1)$ — *M*1

$2y=x-5$ — *A*1[11]

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5.	(a)	(i)	Refer to diagram BÂD =90°±2° with correct construction arcs seen	C1
			$A\hat{B}C$ = 60°±2° with correct construction arcs seen.	C1
			Quadrilateral ABCD with AB = 9±0,2 cm, AD = 7,5±0,2 cm,BC = 6,3 ±0,2 cm, BÂD = 90°±2° and $A\hat{B}C$ = 60°±2°	Q2
		(ii)	BĈD = 139°±2°	B1
	(b)	(i)	Complete circle centre B	M1
			Correct circle centre B radius 5±0,2cm	A1
		(ii)	Ruled bisector of AC at least 3cm long	B1
			Correct construction arcs	B1
	(c)		Points X and Y labelled at intersection of circle and bisector	B1 B1 [11]

6.	(a)	(i)	d	=	32	B1
		(ii)	e	=	18	B1
		(iii)	f	=	16	B1
		(iv)	g	=	0	B1
		(v)	h	=	60	B1
	(b)		4+32+18=54			B1
	(c)		$\frac{60}{200}$			$M1$
			$\frac{3}{10}$			$A1$[8]

7	(a)	(i)	Area of M = $(x+4)(7-x)$	B1
		(ii)	$Area\ of\ N = \frac{1}{2}x(3x+1)$	$B1$
	(b)		$(x+4)(7-x) = 2(\frac{1}{2}x)(3x+1)$	$M1$
			$7x - x^2 - 4x + 28 = 3x^2 + x$	
			$3x^2 + x^2 + x + 4x - 7x - 28 = 0$	$MA1$
			$4x^2 - 2x - 28 = 0$	
			$2x^2 - x - 14 = 0$	$A1$

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Alternatively by completing the square

$(x-\frac{1}{4})^2$ B1

$\sqrt{\frac{113}{16}}$ $or 2{,}66$ B1

$x=\frac{1}{4}\pm 2{,}66$ B1

(c) $$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$=\frac{1\pm\sqrt{(-1)^2-4(2)(-14)}}{2\times 2}$$

$$=\frac{1\pm\sqrt{113}}{4}$$ $B1B1$

$B1$

$x=2{,}91\ or\ -2{,}41$ $B1B1$

$=2{,}91 or -2{,}41$ B1B1

(d) Length = $x+4=6{,}9$ B1

Width = $7-x=4{,}1$ B1

[12]

8. (a) (i) Rotation M1

90° anticlockwise about the origin or
270° clockwise about the origin A1

(ii) $$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} -3 & -1 & -1 \\ 2 & 2 & 3 \end{pmatrix}=\begin{pmatrix} -2 & -2 & -3 \\ -3 & -1 & -1 \end{pmatrix}$$

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$-3a + 2b = -2$

$-a + 2b = -2 \therefore a = 0$ and $b = -1$

$-3c + 2d = -3$

$-c + 2d = -1,\ c = 1$ and $d = 0$

$\therefore$ Matrix is $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ B2

(b) (i) $\begin{pmatrix} -2 & 0 \\ 0 & 2 \end{pmatrix}\begin{pmatrix} -3 & -1 & -1 \\ 2 & 2 & 3 \end{pmatrix}$ M1

$A_2(6;-4),\ B_2(2;-4),\ C_2(2;-6)$ A1

(ii) Inverse of $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix} = \frac{1}{4}\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$

or $\frac{-1}{2}\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ B1

(iii) $\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 6 & 2 & 2 \\ -4 & -4 & -6 \end{pmatrix} = \begin{pmatrix} -2 & -2 & -3 \\ -3 & -1 & -1 \end{pmatrix}$ M1

$6a - 4b = -2$
$2a - 4b = -2 \therefore a = 0$ and $b = ½$
$6c - 4d = -3$
$2c - 4d = -1 \therefore c = -\frac{1}{2}$ and $d = 0$

$\therefore$ matrix $= \begin{pmatrix} 0 & \frac{1}{2} \\ -\frac{1}{2} & 0 \end{pmatrix}$ A1

(c) Shear M1
x -axis invariation A1
shear factor 3 A1

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(ii) $\frac{424,2}{15 \times 15 \times 15} \times 100$ M1

$= 12,6\%$ A1

(iii) Volume of metal remaining =15x15x15 -424,2 M1

=2950,8 cm³ A1

(iv) Volume of one sphere $= \frac{\pi \times 3 \times 3 \times 15}{45}$ M1

$\frac{4}{3}\pi r^3 = \frac{\pi \times 3 \times 3 \times 15}{45}$ M1

$r = 1,31cm$ A1

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11 Refer to graph

(a) p =–2 B1

(b) The 6 given points together with (6-2) correctly Plotted. P3

Correct smooth curve, not grossly thick passing through the 7 correct points C1

(c) (i) v = o when t =5,7±0,1 seconds B1

(ii) Maximum speed = 10,3±0,2 m/s B1

(iii) Distance covered in first 2 seconds is 15,3±0,2 m B2

(d) (i) Correct tangent drawn at $x = 4$ M1

gradient = -3±0,2 A1

(ii) retardation/deceleration/decreasing speed. B1

[12]

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12. Refer to graph

(a) $25x + 20y \leq 400$ M1

Correct reduction to $5x + 4y \leq 80$ A1

(b) $x + y \leq 18$ B1
$x \geq 5$ B1

(c) Line $5x + 4y = 80$ correctly drawn L1
Line $x + y = 18$ correctly drawn L1

Line $x = 5$ correctly drawn L1

Correct region bounded by solid lines R1

(d) (8;10) or (12;5) B2

(e) $\frac{40}{100} \times 25x + 1 \times 20y$
$= 10x + 20y$ B1

(f) Greatest income = 8 x10+10 x 20
=$280 B1
[12]

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Centre Number	Candidate Number

Candidate Name _____

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS **4008/1, 4028/1**

PAPER 1

Wednesday **10 NOVEMBER 1999** 2 hours 30 minutes

Candidates answer on the question paper.
No additional materials are required.

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.

Mathematical tables, slide rules and electronic calculators may 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 10 printed pages and 1 blank page.

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

1 Express 0,07̇2

(a) as a fraction in its lowest terms,

(b) as a percentage,

(c) in standard form.

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

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

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

---

2 Find the value of

(a) 5,08 + 0,946,

(b) $\sqrt{0{,}0081}$,

(c) 5,6 – 7,5.

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

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

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

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3 **(a)** Simplify $2m(3m + n) - 5m^2$.

(b) Given that $f(x) = 3 - 5x$, find

(i) $f(4)$,

(ii) $f(7a)$.

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

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

(ii) ..... [1]

4

In the diagram, the lines ABC and PQR are parallel. The triangle AQB is equilateral. Given that $Q\hat{R}B = 37°$, calculate

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

(b) $A\hat{Q}R$,

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

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

(*b*) $A\hat{Q}R$ = ... [1]

(*c*) $Q\hat{B}R$ = ... [1]

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5 $ABCD$ is a rhombus whose diagonals meet at O.

State

(a) the number of lines of symmetry of the rhombus,

(b) the order of rotational symmetry of the rhombus,

(c) the size of $A\hat{O}B$.

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

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

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

---

6 A solid rectangular block measuring 6 m × 5 m × 2 m is made up of metal whose density is 7850 kg/m^3.

(a) Find the mass of the block in tonnes.

(b) Convert 7850 kg/m^3 to g/cm^3.

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

(*b*) ..... g/cm^3 [1]

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7 The cost of 5 rulers is \$11,25. The cost of 3 rulers and a pen is \$9,35.
Calculate the cost of

(a) a ruler,

(b) a pen.

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

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

---

8 The minimum temperatures recorded in degrees Celsius on six consecutive days were as follows:

6, 3, -2, 6, -1, 0,

(a) Write down

(i) the lowest temperature recorded.

(ii) the modal temperature.

(b) Calculate the median temperature.

Answer (*a*)(i) ..... °C [1]

(ii) ..... °C [1]

(*b*) ..... °C [1]

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9 Solve the simultaneous equations

$$3x + 2y = -14,$$

$$3x - 5y = 56.$$

Answer $x =$ .....

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

10 The exchange rate on a certain day was 3,8 dollars for 1 rand.

Calculate the equivalent of

(a) 150 rands in dollars,

(b) 304 dollars in rands.

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

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

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11 Solve the equation $x^2 - 5x + 1 = 0$, giving your answers in surd form.

Answer $x =$ ..... or ..... [3]

12 In the diagram, Q is due north of R.
PQR is an isosceles triangle with $PQ = PR$ and $Q\hat{P}R = 36°$.

(a) Calculate, giving each answer in three-figure notation,

(i) the bearing of Q from P,

(ii) the bearing of P from R.

(b) Calculate reflex $Q\hat{P}R$.

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

(ii) ..... [1]

(*b*) reflex $Q\hat{P}R$ ..... [1]

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13

In the diagram, $ABCD$ is a cyclic quadrilateral.
DC produced meets AB produced at E.
Given that $BC = BE$, $A\hat{B}C = 84°$ and $D\hat{A}C = 19°$, calculate

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

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

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

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

(*b*) $A\hat{D}C$ = ... [1]

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

---

14 **(a)** **(i)** Solve the inequality $3x - 5 > 21$.

(ii) Write down the smallest integer value of x for which $3x - 5 > 21$.

(b) Illustrate the inequality $-4 < x \leqslant 2$ on the number line shown in the answer space below.

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

(ii) ..... [1]

(*b*)

[1]

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15 The scale on a map is such that 6 cm on the map represents 1,5 km on the ground. Calculate

(a) the length, in kilometres, of a road which measures 42 cm on the map,

(b) the area on the map, in square centimetres, that represents a lake of area 8 km^2.

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

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

---

16 **(a)** Evaluate $234_5 + 142_5$, giving your answer in base 5.

(b) Subtract 28 minutes 27 seconds from 58 minutes 4 seconds, giving the answer in minutes and seconds.

(c) Convert 2 days, 6 hours and 27 minutes to minutes.

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

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

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

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For Examiner's Use

17 Find the value of

(a) $7^2 + 4^0$,

(b) $\sqrt[3]{2^6 \times 27}$.

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

(b) ..... [2]

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18

The diagram above shows points $P(4, 8)$, $Q(9, 3)$ and $S(12, 10)$.

(a) Write down $\overrightarrow{PQ}$ in column vector form.

(b) Mark and label on the diagram

(i) the point R such that $PQRS$ is a parallelogram.

(ii) the point T, the image of S, under a clockwise rotation of 90° about P.

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

(*b*)(i) on diagram [1]

(ii) on diagram [1]

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Examiner's Use

For Examiner's Use

19 **(a)** Measured correct to the nearest centimetre, the sides of a kite are 15 cm and 12 cm. Find the smallest possible perimeter of the kite.

(b) Estimate, correct to one significant figure, the value of $\frac{94{,}6}{0{,}0627}$.

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

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

20 There are 500 pupils at a school.
Given that one in every four pupils rides to school, calculate

(a) the number of pupils who ride to school,

(b) the probability that

(i) a pupil chosen at random does not ride to school.

(ii) two pupils chosen at random ride to school.

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

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

(ii) ..... [2]

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21 Two of the angles of a pentagon are $3x°$ and $11x°$ respectively. Their sum is 168°.

(a) Calculate the sizes of the two angles.

(b) Given that the remaining three angles are in the ratio of 3 : 4 : 5, calculate the size of the largest of these angles.

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

..... [1]

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

---

22 **(a)** Given that $\frac{2}{x-3p} = \frac{5}{q}$, express x in terms of p and q.

(b) Express $\frac{5m}{8} - \frac{2m+3}{4}$ as a single fraction in its simplest form.

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

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

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23

In the diagram $D\hat{B}C = 90°$, $A\hat{D}B = B\hat{D}C$, $AD = 15$ cm, $DB = 8$ cm and $DC = 10$ cm.

(a) Calculate BC.

(b) Find $\cos B\hat{D}C$.

(c) Calculate AB^2.

Answer (*a*) $BC =$ ..... cm [1]

(*b*) $\cos B\hat{D}C =$ ..... [1]

(*c*) $AB^2 =$ ..... cm^2 [2]

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24 **(a)** If the matrix $\begin{pmatrix} 30 & 0 \\ 0 & \frac{15}{4}x \end{pmatrix}$ represents an enlargement, with the origin as centre, find the value of x.

(b) The matrix $\begin{pmatrix} y^2 & 2 \\ 18 & 1 \end{pmatrix}$ is singular.

Calculate the two possible values of y.

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

(*b*) y = ... or ..... [3]

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Examiner's Use

For Examiner's Use

25 A bus left Bulawayo for Kwekwe with 60 passengers. It passes through Gweru (its only stop) where it picked up 27 passengers and dropped off n passengers.

(a) Write down, in terms of n, the number of passengers in the bus as it left Gweru.

(b) Given that it arrived in Kwekwe with $2n$ passengers, form an equation in n and use it to find the value of n.

(c) Did the bus gain or lose passengers in Gweru? Explain your answer.

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

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

$n =$ ..... [1]

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

Explanation: .....

.....

..... [1]

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26 A cyclist starts a 30 km journey at 09 00. She maintains an average speed of 20 km/h for the first three-quarters of an hour and then rests. Subsequently she continues her journey at an average speed of 25 km/h, arriving at her destination at 11 00.

(a) Calculate the distance covered in the first three-quarters of an hour.

(b) Calculate, in hours, the time taken to cover the last part of the journey.

(c) Calculate, in minutes, the duration of her rest.

(d) The graph shown in the answer space is an incomplete distance-time graph for the cyclist. **Complete** the graph.

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

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

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

(*d*) on graph [2]

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27 It is given that $\log_{10}50 = 1{,}69897$ correct to five decimal places.

(a) Write down $\log_{10}50$ correct to 4 decimal places.

(b) Evaluate, giving each answer correct to **4 decimal places**,

(i) $\log_{10}5$,

(ii) $\log_{10}25$.

(c) Evaluate, giving the answer correct to **3 decimal places**, $\log_{10}2$.

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

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

(ii) ..... [1]

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

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28

In this question take π to be 3,14.

The diagram shows the right angled triangle *ABC*
The sector *AQRS*is drawn inside it such that *BRC* is a tangent to the sector at *R*
Given that *AB* =15cm, AC = 20 cm and *BC* =25 cm, calculate

(a) the area of the triangle *ABC,*

(b) the radius, *AR*,of the sector *AQRS,*

(c) the area of the shaded region.

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

(b) *AR*=.....cm [2]

(c) .....cm [3]

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4008/1

POSSIBLE ANSWERS

1. (a) $\frac{9}{125}$ (b) 7,2% or $7\frac{2}{10}$% or $7\frac{1}{5}$% (c) $7{,}2 \times 10^{-2}$

2. (a) 6,026 or $6\frac{26}{1000}$ (b) 0,09 or $\frac{9}{10}$ (c) -1,9 or $-1\frac{9}{10}$ $6\frac{13}{500}$

3. (a) $m^2 + 2mn$ (b) (i) -17 (ii) 3–35a

4. (a) 37° (b) 120° (c) 83°

5. (a) 2 or two (b) 2 or two (c) 90°

6. (a) 471 (b) 7,85 or $7\frac{85}{100}$ or $7\frac{17}{20}$

7. (a) 2,25 (b) 2,60

8. (a) (i) -2 (ii) 6 (b) $1\frac{1}{2}$ or 1,5 or $\frac{3}{2}$

9. (a) x = 2 and y = -10

10. (a) 570 (b) 80

11. $\frac{5+\sqrt{21}}{2}$ or $\frac{5-\sqrt{21}}{2}$

12. (a) (i) 072° (b) 288° (c) 324°

13. (a) 42° (b) 96° (c) 23°

14. (a) (i) $x > 8\frac{2}{3}$ (ii) 9 (b)

15. (a) $10\frac{1}{2}$ or 10,5 (b) 128

16. (a) 431_5 0r 431_5 (b) 29 min 37s (c) 3 267

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17. (a) 50 (b) 12

18. (a) $\begin{pmatrix} 5 \\ -5 \end{pmatrix}$ (b) R(17:5) (c) T (6;0)

19. (a) 52 (b) 2000

20. (a) 125 (b) (i) $\frac{3}{4}$ or 0,75 (ii) $\frac{31}{499}$

21. (a) 36^0 ;132^0 (b) 155^0

22. (a) $\frac{2q+15p}{5}$ (b) $\frac{m-6}{8}$

23. (a) 6 (b) $\frac{4}{5}$ or 0,8 (c) 97

24. (a) 8 (b) 6 or -6

25. (a) 87- n (b) 87-n = 2n
n =29 (c) It lost.
Picked up 27 and
dropped off 29.

26. (a) 15 (b) $\frac{3}{5}$ or 0,6 (c) 39

(d)

27. (a) 1,6 990 (b) (i) 0,6 990 (ii) 1,3 979 (c) 0,301

28. (a) 150 (b) 12 (c) 36,96

A:4008-1-n99cs

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008/2

PAPER 2

Thursday **11 NOVEMBER 1999** 2 hours 30 minutes

Additional materials:
- Answer paper
- Geometrical instruments
- Graph paper (2 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 and working 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)** Evaluate $5\frac{1}{3} \times \frac{3}{4} - \frac{1}{2}$. [2]

(b) Given that $p = 3w^2 - xy$, find the value of p when $w = -2$, $x = 6$ and $y = -3$. [2]

(c) During a sale the price of a radio was reduced by 28% to \$486.
Calculate the original price of the radio. [3]

(d) When \$4400 amounts to \$5786 in 18 months, find the rate of simple interest per annum. [4]

---

2 **(a)** Factorise completely

(i) $3a - ab - 2b + 6$, [2]

(ii) $3x^2 - 147$. [2]

(b) **(i)** Show that the equation $\frac{y}{y-1} - \frac{1}{3} = \frac{5}{y+1}$ reduces to

$$y^2 - 6y + 8 = 0.$$ [4]

(ii) Solve the equation $y^2 - 6y + 8 = 0$. [2]

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3

(a) In the diagram, TB is a diameter of the circle. The chords TA, TC and TD are drawn so that $A\hat{T}B = B\hat{T}C = C\hat{T}D = 25°$.

(i) State the reason why $AB = BC = CD$. [1]

(ii) Calculate

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

(b) $T\hat{C}D$, [2]

(c) $A\hat{D}T$. [2]

(b) In a **semicircle** of radius 17 cm two chords are drawn parallel to the diameter. Given that the chords are of lengths 30 cm and 16 cm, calculate the perpendicular distance between them. [3]

---

4 **(a)** It is given that $\overrightarrow{OP} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$, $\overrightarrow{PQ} = \begin{pmatrix} 12 \\ a \end{pmatrix}$ and $\overrightarrow{OQ} = \begin{pmatrix} 5b \\ -b \end{pmatrix}$.

(i) Find the value of a and the value of b. [3]

(ii) Calculate $|\overrightarrow{OP}|$. [1]

(b) **Answer the whole of this question on a sheet of plain paper.**

Use ruler and compasses only. All construction lines and arcs must be clearly shown.

(i) Construct, on a **single** diagram,

(a) a triangle XYZ in which $XY = 9{,}5$ cm, $Y\hat{X}Z = 45°$ and $XZ = 6{,}3$ cm, [3]

(b) the locus of points equidistant from X and Y, [1]

(c) the locus of points equidistant from Y and Z, [1]

(d) the circle passing through X, Y and Z. [2]

(ii) Measure and write down the radius of the circle in **(b)(i)(d)**. [1]

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5 **(a)** Find the LCM of $9a^2b^3$ and $15a^5b$. [2]

(b)

In the diagram, $ABCD$ is a trapezium in which $DC = 6{,}4$ cm, $BD = 9$ cm, $AB = 2DC$ and $B\hat{D}C = 34°$.

Find

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

(ii) the area of triangle ABD. [3]

(c) The table below shows part of Mr Banda's telephone bill for January.

January monthly rental	$ .....
Cost of metered calls from 010561 to 012777	$ 886,40
(..... units at ..... cents per unit.)	
Sub total	$ 910,40
Sales tax at $17\frac{1}{2}$ %	$ .....
Total amount due	$ .....

Calculate

(i) the January monthly rental, [1]

(ii) the number of units used, [1]

(iii) the charge per unit in cents, [1]

(iv) the sales tax, [1]

(v) the total amount due. [1]

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6 **(a)** An agriculture class picked tomatoes.
x pupils picked more than 49 tomatoes,
$3x$ pupils picked fewer than 51 tomatoes and
5 pupils picked exactly 50 tomatoes.

It is given that

ξ = the set of pupils in the agriculture class,

A = the set of pupils who picked more than 49 tomatoes,

B = the set of pupils who picked fewer than 51 tomatoes.

(i) Illustrate this information on a clearly labelled Venn diagram. [3]

(ii) Given that the total number of pupils who picked tomatoes was 47, find x. [2]

(b) There are 30 red balls and x yellow balls in a bag. A ball is drawn at random from the bag.

(i) Write down, in terms of x, an expression for the probability that the ball drawn is yellow. [1]

(ii) Given that this probability is $\frac{7}{13}$, find x. [2]

(c) The sets P and Q are such that $n(P) = 6$, $n(Q) = 9$ and $P \cap Q \neq \varnothing$. Find

(i) the smallest possible value of $n(P \cup Q)$, [1]

(ii) the largest possible value of $n(P \cup Q)$. [2]

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Section B [36 marks]

Answer **three** questions in this section.

Each question in this section carries 12 marks.

7 **(a)**

In the diagram, O is the origin. PQ is a straight line with a gradient of -3 and Q is the point $(4, 0)$.

(i) Find the coordinates of P. [1]

(ii) PQ is now reflected in the y-axis to the line PR (not shown), R being the point where the line meets the x-axis.
Find the equation of PR. [3]

(b) $\begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}$ is the matrix representing a transformation V and $\begin{pmatrix} 2 & 1 \\ -1 & 1 \end{pmatrix}$ is the matrix representing a transformation W.

(i) Calculate the coordinates of the image of $(3, -2)$ under the transformation VW. [3]

(ii) Find the coordinates of a point whose image under the transformation W is $(1, 2)$. [3]

(iii) Describe completely the transformation V. [2]

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

Using a scale of 2 cm to represent 2 units on both axes, draw the x and y-axes for the ranges $0 \leqslant x \leqslant 14$ and $-2 \leqslant y \leqslant 16$.

(a) Show the region in which all the inequalities given below are satisfied, by shading the **UNWANTED** regions.

(i) $y \geqslant 2$,

(ii) $y \leqslant 2x$,

(iii) $2y - x \geqslant -2$,

(iv) $5y + 8x \leqslant 80$.

[8]

(b) Using the unshaded region in **(a)** calculate

(i) the maximum value of the expression $5x - 3y$, [2]

(ii) the minimum value of the expression $5x - 3y$. [2]

---

9 Three points L, M and N are on horizontal ground with M due east of L.
The bearing of N from L is 048° and from M is 325°.
$LN = 11$ km and $MN = 9$ km.

(a) Calculate

(i) $L\hat{N}M$, [2]

(ii) LM. [4]

(b) At midday Peter set out to walk from L towards N at an average speed of 5 km/h.
Calculate the time at which he arrived at N. [3]

(c) At N he changed the direction of his walk to due east until he reached a point D which is due north of M.

Calculate DM. [3]

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(iii) Area of // gram =ΔPST + trap PQRT

=ΔPST +ΔVPQ-ΔVRT

$= 3^2 \times 4 + 4^2 \times 4 - 4$ M1

=36+64-4 M1

$=96\ cm^2$ A1

[12]

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Centre	22,5	35	45	55	70	90
Height	3	2	5,5	4	1,5	0,5

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(a) Correct corresponding densities
3; 2; 5,5; 4; 1,5; 1 B3

Rectangles with centres and heights as in Table (see graph) H3

(b) Table with correct values.

Mark (x)	*f*	*x-45*	*f(x-45)*
35	20	-10	-200
45	55	0	0
55	40	10	400
70	30	25	750
		Total =	387,5

B3
B1

Mean = $45 + \frac{387,5}{200}$ M1

=46,9 A1

[12]

12 (a) (i) $x \alpha \frac{y}{z^2}$

$x = \frac{ky}{z^2}$ B1

(ii) $k = \frac{xz^2}{y}$

$= \frac{15 \times 3^2}{27}$

=5 B1

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(iii) $Z = \sqrt{\frac{ky}{x}}$

$= \sqrt{\frac{5 \times 294}{30}}$ M1

$= \pm 7$ A1

b) (i) $a = 25$ B1

$b = 16$ B1

$c = 41$ B1

$d = 15$ B2

(ii) $t = (n - 1)^2 + n^2$ M2

$= 2n^2 - 2n + 1$ A1

[12]

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Centre Number | Candidate Number

Candidate Name: _____

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS **4008/1, 4028/1**

PAPER 1

Friday **2 JUNE 2000** Morning 2 hours 30 minutes

Candidates answer on the question paper.
No additional materials are required.

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.
Mathematical tables, slide rules and calculators may 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

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

For Examiner's Use

1 Express

(a) 2,5 mm as a fraction of 50 cm in its lowest terms,

(b) 0,84 as a percentage,

(c) 1,4 m^2 in cm^2.

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

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

(c) ..... cm^2 [1]

---

2 Evaluate

(a) $5^{2/3} \times 5^{1/3}$,

(b) $16^{3/4}$,

(c) $\left(-\frac{1}{3}\right)^{-2}$

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

(b) ..... [1]

(c) ..... [1]

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For Examiner's Use

3 Given that $\sqrt{7} = 2{,}646$ and $\sqrt{70} = 8{,}367$, calculate

(a) $\sqrt{7000}$,

(b) $\sqrt{0{,}07}$.

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

(b).....[2]

---

4 Expand and simplify

(a) $(x - 3)^2$,

(b) $5(4x - 7) - 6(3x - 2)$.

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

(b).....[2]

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For Examiner's Use

5 (a) Given that the bearing of B from A is 138°, write down the bearing of A from B, expressing your answer as a three-figure bearing.

(b) The road from A to B is represented on a map, drawn to a scale of 1:50 000, by a line of length 12 cm.

Find the length, in kilometres. of the road.

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

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

---

6 (a) Express $2^5 + 2^4 + 2^2 + 1$ as a number in base 2.

(b) Given that $31_n = 16_{10}$, for some base n,

(i) form an equation in n,

(ii) find the value of n.

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

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

(ii) n = ... [1]

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For Examiner's Use

7 Mary drew the pie chart shown to illustrate the time she spent on her homework in one week.

(a) Calculate the value of x.

(b) She spent 75 minutes doing Science.

Calculate the total time, in hours, she spent doing her homework.

(c) Find the percentage of the time she spent on English.

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

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

(c) .....% [1]

4008/1/4028/1 J200

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For Examiner's Use

8 Solve the simultaneous equations

$$2x + 3y + 5 = 0$$

$$3x - 2y = 12$$

Answer $x =$ .....

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

---

9 ABCDEFGHI is a regular nonagon with centre O.

(a) State the order of rotational symmetry of the nonagon.

(b) Calculate

(i) the size of one of the interior angles of the nonagon,

(ii) $B\hat{O}F$

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

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

(ii) $B\hat{O}F$.....[1]

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For Examiner's Use

10 Evaluate

(a) $\log_{10}16 \div \log_{10}2$,

(b) $2\log_{10}5 + \log_{10}36 - \log_{10}9$.

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

(b).....[2]

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For Examiner's Use

11 There are two types of factory machines available for sale.

Their required floor spaces and prices are shown in the table below.

Type of machine	Floor space needed per machine (m^2)	Price per machine ($)
A	3	20 000
B	2	45 000

A factory manager decides to buy x machines of type A and y machines of type B, where $x \geq 0$ and $y \geq 0$.

(a) If there is 40 m^2 of floor space available, write down an inequality in x and y.

(b) If the manager has \$400 000 to spend, write down, in its simplest form, another inequality in x and y.

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

(b) ..... [2]

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For Examiner's Use

12 A bag contains 6 red balls and 9 green balls which are all identical except for colour.

(a) Find, as a fraction in its lowest terms, the probability that a ball, taken at random from the bag, is red.

(b) The ball is returned into the bag.

Two balls are then taken at random, one after the other without replacement, from the bag.

Find the probability that they are of different colours.

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

(b).....[2]

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For Examiner's Use

13 **(a)** Given that $x + y = 12$ and $x^2 - y^2 = 30$, evaluate $x - y$

(b) Solve the equation

$(t - 6)^2 = 25$.

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

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

---

14 A tourist from England visited Zimbabwe bringing with him £ 2000(two thousand pounds) which he exchanged for Zimbabwean dollars at the rate of £ 1 to Z$30.

(a) Calculate the amount he received in Zimbabwean dollars.

(b) After visiting various resort centres in Zimbabwe he had spent Z$40 500.

He then exchanged the remainder of his money for pounds .

Find how many pounds he received.

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

(b) £.....[2]

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For Examiner's Use

15 Tafadzwa left Mutare at 1.10p.m by car and arrived in Masvingo $3\frac{1}{4}$ hours later. He rested for $\frac{1}{2}$ an hour and then travelled to Beit Bridge in $3\frac{1}{2}$ hours.

(a) Find the time, on the 24 hour clock, when Tafadzwa arrived in Beit Bridge.

(b) His average speed for the whole journey was 80km/h.

Find the distance from Mutare to Beit Bridge

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

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

16 **(a)** Express 5,9964 correct to 2 decimal places.

(b) Simplify $(3{,}5 \times 10^5) \div (7 \times 10^2)$, giving the answer in standard form.

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

(b) .....[2]

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For Examiner's Use

17 (a) Divide $3\frac{1}{2}$ by $5\frac{1}{4}$, giving the answer as a fraction in its lowest terms.

(b) Simplify $\frac{5 + 10}{5 \times 10}$ as far as possible.

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

(b) ..... [2]

18 (a) Express $\frac{3}{x-2} - \frac{2}{x}$ as a single fraction.

(b) Given that the matrix $\begin{pmatrix} y+2 & 3 \\ y-1 & 4 \end{pmatrix}$ has determinant 4, find the value of y.

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

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

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For Examiner's Use

19 **(a)** Solve the inequality $14 \geq 2 - 3x$.

(b) The length, l cm, of a side of a square is given as 6 cm, correct to 1 significant figure.

(i) Write down the upper bound of l.

(ii) The area of the square is A cm^2.

Calculate the least possible value of A.

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

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

(ii).....[2]

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For Examiner's Use

20. **In this question take π to be $\frac{22}{7}$.**

A circular cylinder has height 21 cm.
Its volume is 1650 cm^3.
Calculate

(a) the radius of the cylinder,

(b) the volume of a similar body of height 7cm.

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

(b).....cm^3 [2]

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21

For Examiner's Use

In the diagram, A, B and C are points on the circumference of a circle, centre 0.
TA and TB are tangents to the circle $ACB = 56$ and $CBO = 48°$
Calculate

(a) AÔB.

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

(c) CÂT.

Answer (a) AÔB .....^{0} [1]

(b) $A\hat{B}T$ .....^{0} [1]

(c) CÂT. .....^{0} [2]

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For Examiner's Use

22 (a) Given that $q = \ , = r\frac{1}{2} - 3$ and $t = 0$, evaluate qrt^5.

(b) The side of an equilateral triangle is 12 cm. Find the perpendicular height of the triangle in the form $m\sqrt{n}$, where m and n are integers and n is as small as possible.

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

(b) .....cm [3]

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For Examiner's Use

In the diagram, $AFGD$ is a straight line.
AB is parallel to ED and EF is parallel to GB.
$EF = 6$ cm, $AF = FG = GD = 5$ cm and $E\hat{F}D = 64^0$.

(a) Name, in correct order, two triangles which are congruent.

(b) **(i)** Using as much of the information given below as is necessary, calculate the area of triangle AGB.

(ii) Hence, or otherwise, find the area of triangle ABD.

[$\tan 64^0 = 2.05$; $\sin 64^0 = 0,90$; $\cos 64^0 = 0,44$.]

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

(b) (i) ΔAGB =..... cm^2 [2]

(ii) ΔABD = ...cm^2 [1]

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24

For Examiner's Use

Pattern 1 2 3 4

Identical sticks are used to make a sequence of triangular patterns.
The diagram shows the first four patterns in the sequence.

Pattern Number	Number of sticks in pattern	Number of small triangles formed	Number of sticks inside the pattern
1	3	1	0
2	9	4	3
3	18	9	9
4	30	16	18
5	x	y	z

The table above shows the number of sticks needed to form the patterns in the sequence, the number of triangles in each pattern and the number of sticks that lie inside the outer boundary of each pattern.

(a) By considering the number patterns in the table, write down the value of

(i) x,
(ii) y,
(iii) z.

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For Examiner's Use

(b) Find the number of sticks needed to make pattern 10 in the sequence.

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

(ii) y = ... [1]

(iii) z = ... [1]

(b) ..... [1]

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For Examiner's Use

25 Three companies, Comfort Cars, Reliable Services and Luxury Cruisers, offer cars for hire. Their charges are based either on the number of days for which a car is hired, or on the number of kilometres for which the car is driven, or both, as shown in the table below.

Company	Cost per day	Cost per kilometre
Comfort Cars	\$660	Nil
Reliable Services	Nil	\$4.50
Luxury Cruisers	\$300	\$2,50

(a) Mrs Tatenda hired a car for 2 days to drive 400km.

Find the cost if she hired the car from Luxury Cruisers.

(b) Mr Kudzai wishes to hire a car for 3 days.
He finds that Comfort Cars and Reliable Services would make equal charges.

Find the distance he intends to drive.

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

(b) .....km [3]

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26

For Examiner's Use

The diagram shows quadrilaterals A, B and C.

(a) Quadrilateral A is mapped onto quadrilateral D by a reflection in the line $x = 3$.

On the diagram draw and label quadrilateral D.

(b) A shear maps quadrilateral A onto quadrilateral B.

Describe **fully** this shear.

(c) Describe **fully** the **single** transformation which maps quadrilateral A onto quadrilateral C.

Answer (a) On diagram [1]

(b).....

..... [2]

(c).....

..... [2]

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For Examiner's Use

27

The diagram shows the velocity-time graph of a car during a period of 14 seconds. The car starts from rest and accelerates uniformly until it attains a velocity of 20m/s in 4 seconds.
It then retards uniformly to 8 m/s in 2 seconds.
The car then moves at this velocity for a further 6 seconds and finally retards uniformly until it comes to rest 2 seconds later.
Calculate

(a) the acceleration of the car during the first 4 seconds,

(b) the velocity of the car at the end of the 13th second,

(c) the distance travelled by the car during the last 7 seconds.

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

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

(c) ..... m [2]

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For Examiner's Use

28 Two points, A (5, 2) and B (-3, 8), lie on a straight line l and C (-2, 4), lies on another straight line m.

(a) Find

(i) the gradient of l,

(ii) $\overrightarrow{AB}$ as a column vector,

(iii) the length of the line AB.

(b) Given that m is parallel to l, find the equation of m in its simplest form.

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

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

(iii) ..... [2]

(b) ..... [2]

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MATHS JUNE 2000

4008/1

POSSIBLE ANSWERS

1.	(a)	$\frac{1}{200}$	(b)	84	(c)	14000
2.	(a)	5	(b)	8	(c)	9
3.	(a)	83,67	(b)	0,2646		
4.	(a)	x^2-6x+9	(b)	$2x-23$		
5.	(a)	318°	(b)	6		
6.	(a)	$110\ 101_2$ or $110\ 101_{two}$	(b) (i)	$3n+1=16$	(ii)	5
7.	(a)	40	(b)	9	(c)	$33\frac{1}{3}$ or 33,3
8.	(a)	$x=2$ and $y=-3$				
9.	(a)	9 or nine	(b) (i)	140°	(c)	160°
10.	(a)	4	(b)	2		
11.	(a)	$3x+2y \leq 40$	(b)	$4x+9y \leq 80$		
12.	(a)	$\frac{2}{5}$	(b)	$\frac{18}{35}$		
13.	(a)	2½ or 2,5	(b)	1 or 11		
14.	(a)	60 000	(b)	650		
15.	(a)	20 25	(b)	580		
16.	(a)	6,00	(b)	$5X10^2$		
17.	(a)	$\frac{2}{3}$	(b)	$\frac{3}{10}$		

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS **4028/2**

PAPER 2

Wednesday **7 JUNE 2000** Morning 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.

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 or electronic calculators may be used to evaluate explicit numerical expressions.

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[Turn over

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Section A [64 marks]

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

(a) Given that $y = \dfrac{a+b}{b}$,

(i) calculate the value of y when $a = 40$ and $b = 0{,}1$, [2]

(ii) express b in terms of y and a. [3]

(b) Given that $f(x) = 2x^2 + 7x$, calculate

(i) $f(3)$,

(ii) the values of x for which $f(x) = 4$. [4]

---

2 **(a)** Given that $\mathbf{P} = \begin{pmatrix} -4 & -7 \\ 1 & 3 \end{pmatrix}$ and $\mathbf{Q} = \begin{pmatrix} 2 & -3 \\ 4 & -1 \end{pmatrix}$, calculate the matrices

(i) $\mathbf{P} + 3\mathbf{Q}$, [2]

(ii) $\mathbf{Q}^2$, [2]

(iii) the inverse of **P**. [3]

(b) $\xi = \{x : 10 < x \leq 31\}$ where x is an integer.

$A = \{x : x \text{ is prime}\}$.

$B = \{x : x \text{ is even}\}$.

$C = \{x : x \text{ is a multiple of } 5\}$.

(i) List all the elements of set A. [1]

(ii) Find **(a)** n(C), [1]

(b) $n(B \cup C)$. [2]

(iii) Express in set notation, using some or all of A, B and C, the set $\{15, 25\}$. [2]

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3 (a) Factorise completely

(i) $8p^3 - 18p$,

(ii) $as + 2at - 3s - 6t$. [4]

(b) If y varies directly as the cube of x and $y = 40$ when $x = 2$, find the value of y when $x = 3$. [3]

4

In the diagram, ABC is an acute angled triangle in which $AB = 12$ cm, $BC = 15$ cm and $C\hat{A}B = 58^0$.

(a) Calculate

(i) $A\hat{C}B$, [3]

(ii) the perpendicular distance from C to AB, [3]

(iii) AC. [2]

(b) Given that L lies on AC and that $AL = 6$ cm, calculate BL. [4]

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5 A salesman was paid his annual salary in twelve equal monthly amounts. In addition at the end of each year, he was paid a bonus which amounted to $3\frac{1}{2}$% of the value of his total annual sales.

Given that his annual salary was \$39 000 and that his total sales during the first year amounted to \$100 000, calculate

(a) his monthly salary, [1]

(b) his total income in the first year. [2]

During the second year his annual salary remained unchanged but his total income for the year amounted to \$44 145.

(c) Calculate his total sales during the second year. [4]

In the third year his annual salary was increased to \$46 800 and his bonus was also increased.

(d) Calculate

(i) the percentage increase in his annual salary, [2]

(ii) his new percentage bonus payment, given that his total income during the year was \$50 000 and his sales totalled \$80 000. [3]

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

Use ruler and compasses only for all constructions and show clearly all the construction arcs and lines in a single diagram.

A farmer has a field in the shape of a quadrilateral $ABCD$.

The field is bounded by two straight roads, AB and BC with $A\hat{B}C = 90^0$, and two straight fences CD and AD with $B\hat{C}D = 120^0$.
It is given that $AB = 70$ m, $BC = 90$ m and $CD = 50$ m.

(a) **(i)** Using a scale of 1 cm to represent 10 m, construct an accurate scale drawing of the field. [4]

(ii) Measure and write down $B\hat{A}D$. [1]

(b) The farmer has a well in the field which is equidistant from AB and BC and also equidistant from A and B.

Construct

(i) the locus of points which are equidistant from AB and BC, [2]

(ii) the locus of points which are equidistant from A and B. [2]

(c) **(i)** Mark and clearly label W, the position of the well in the field. [1]

(ii) Find the distance of the well from the corner D of the field. [1]

[Turn over

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Section B [36 marks]

Answer **three** questions in this section.

7 A car travels from Bulawayo to Harare by a route 440 km long, at an average speed of x km/h.

(a) Write down an expression, in terms of x, for the time, in hours, needed for the journey. [1]

(b) A mini-bus travels from Bulawayo to Harare by a different route, which is 8 km longer.

The average speed of the mini-bus is 4 km/h less than that of the car.

Write down an expression, in terms of x, for

(i) the average speed, in km/h, of the mini-bus, [1]

(ii) the time, in hours, needed for the journey by the mini-bus. [1]

(c) It is given that the mini-bus takes $\frac{1}{2}$ an hour longer than the car to travel from Bulawayo to Harare.

(i) Write down an equation which x must satisfy and show that it simplifies to

$$x^2 - 20x - 3520 = 0.$$ [3]

(ii) Solve this equation, giving the answers correct to 3 significant figures.

Hence find the average speed of the mini-bus, giving your answer correct to 3 significant figures. [6]

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8

In this question take π to be 3,142.

In the diagram AOB is a sector of a circle, centre O.
The radius of the circle = 6,5 cm and $A\hat{O}B = 120^0$.

(a) Calculate

(i) the length of the arc AB, [2]

(ii) the perimeter of the sector AOB, [1]

(iii) the area of the sector AOB. [2]

(b) If this sector is the cross-section of a solid of length 12 cm, calculate

(i) the volume of the solid, [2]

(ii) the density of the solid, given that its mass is 4192 g, [2]

(iii) the **total** surface area of the solid. [3]

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

Below is an incomplete table of values for the function

$$y = \tfrac{1}{2}x^2 - 2x + 3,$$

for values $-1 \le x \le 6$.

x	-1	0	1	2	3	4	5	6
y	a	3	1,5	1	1,5	3	5,5	b

(a) Calculate the values of a and b. [2]

(b) Using a scale of 2 cm to represent 1 unit on each axis, draw axes for values of x and y in the range $-1 \le x \le 6$ and $0 \le y \le 10$.

Plot the points represented by the values in the table and draw the graph of $y = \tfrac{1}{2}x^2 - 2x + 3$. [4]

(c) Use your graph to estimate

(i) the gradient of the curve when $x = 3$, [2]

(ii) the area of the region between the curve, the x-axis and the lines $x = 0$ and $x = 4$. [2]

(d) Hence, or otherwise, find the area of the region enclosed by the curve and the line $y = 3$. [2]

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

A farmer had 100 pigs. He weighed them and their masses were recorded and summarised as shown in Table 1 below.

Table 1

Mass (kg)	$40 < m \leq 60$	$60 < m \leq 70$	$70 < m \leq 80$	$80 < m \leq 90$	$90 < m \leq 100$	$100 < m \leq 140$
Number of pigs	12	14	18	22	14	20

Table 2 is part of a cumulative frequency table for the distribution.

Table 2

Mass (kg)	$m \leq 40$	$m \leq 60$	$m \leq 70$	$m \leq 80$	$m \leq 90$	$m \leq 100$	$m \leq 140$
Number of pigs	0	12	26	P	66	q	100

(a) Calculate the values of p and q. [2]

(b) Using a horizontal scale of 2 cm to represent 20 kg and a vertical scale of 2 cm to represent 20 pigs, draw a smooth cumulative frequency curve to illustrate this information. [4]

(c) Showing your method clearly on the graph, use your graph to estimate

(i) the median mass,

(ii) the number of pigs whose masses were more than 65 kg but less than 120 kg. [4]

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(d) The data in Table 1 may also be expressed in the form given in Table 3 below.

Table 3

Mass (kg)	$40 < m \leq 60$	$60 < m \leq 80$	$80 < m \leq 100$	$100 < m \leq 140$
Number of pigs	12	32	36	20

When a histogram is drawn to illustrate this information, the height of the column representing pigs with mass m in the interval $40 < m \leq 60$ is 2,4 cm.
Without drawing the histogram calculate the height of the column that represents values of m in the ranges

(i) $60 < m \leq 80$,

(ii) $100 < m \leq 140$. [2]

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

Triangle A has vertices at (1, 2), (2, 2) and (1, 4).
Triangle B has vertices at (-2, -1), (-4, -1) and (-2, -5).
Using a scale of 2 cm to represent 2 units on each axis, draw axes for values of x and y in the ranges $-6 \le x \le 8$ and $-10 \le y \le 8$.

(a) Draw and label triangles A and B. [2]

(b) Triangle B is the image of triangle A under a certain **single** transformation. Describe fully this transformation. [3]

(c) Triangle C is the image of triangle A under a two-way stretch in which the origin is invariant. The stretch has scale factor 3 parallel to the x-axis and scale factor -2 parallel to the y-axis.

Draw and label the triangle C. [3]

(d) The transformation **X** is represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ and maps triangle A onto triangle D.

(i) Find the coordinates of the vertices of D.

Draw and label the triangle D.

(ii) Describe **fully** the **single** transformation **X**. [4]

[Turn over

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12

In the diagram, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$.
The point C is such that AC = 3CB and the point D is such that OD = DA.

(a) Express, in terms of **a** and/or **b**, the vectors

(i) $\overrightarrow{AB}$,

(ii) $\overrightarrow{OD}$,

(iii) $\overrightarrow{AC}$,

(iv) $\overrightarrow{OC}$. [4]

(b) OC and BD meet at X. Given that $\overrightarrow{BX} = k\overrightarrow{BD}$, express $\overrightarrow{BX}$ in terms of **a**, **b** and k. Hence show that $\overrightarrow{OX} = \frac{1}{2}k\mathbf{a} + (1-k)\mathbf{b}$. [3]

(c) Given also that $\overrightarrow{OX} = h\overrightarrow{OC}$, express $\overrightarrow{OX}$ in terms of **a**, **b** and h. [1]

(d) Using these two expressions for $\overrightarrow{OX}$, find the values of h and k. [3]

(e) Find the numerical value of the ratio $BX : XD$. [1]

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MATHS **JUNE 2000**

4008-2

POSSIBLE ANSWERS

1. (a) (i) $y=\frac{40+0,1}{0,1}$

OR $\frac{40,1}{0,1}$ M1

$=401$ A1

(ii) $yb=a+b$ M1

$b(y-1)=a$ M1

$b=\frac{a}{y-1}$ A1

(b) (i) $f(3)=2(3^2)+7x3$

$=39$ B1

(ii) $2x^2+7x=4$ M1

$(2x-1)(x+4)=0$ or $x=\frac{-7\pm\sqrt{81}}{4}$ M1

$x=\frac{1}{2}$ or -4 A1

[9]

2. (a) (i) $P+3Q=\begin{pmatrix}-4 & -7\\ 1 & 3\end{pmatrix}+3\begin{pmatrix}2 & -3\\ 4 & -1\end{pmatrix}$

$=\begin{pmatrix}2 & -16\\ 13 & 0\end{pmatrix}$ B2

(ii) $Q^2=\begin{pmatrix}2 & -3\\ 4 & -1\end{pmatrix}\begin{pmatrix}2 & -3\\ 4 & -1\end{pmatrix}$

$=\begin{pmatrix}-8 & -3\\ 4 & -11\end{pmatrix}$ B2

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(iii) det P=-12+7=-5 B1

$P=\frac{-1}{5}\begin{pmatrix} 3 & 7 \\ -1 & -4 \end{pmatrix}$ B3

(b) (i) A={11;13;17;19;23;29;31} B1
B={12;14;16;----------;18;30}

(ii) (a) C={15;20;25;30}
n(C)=4 B1

(b) $n(B \cup C)=12$ B1

(iii) $\{15;25\}=B' \cap C$ B2
OR $C \cap (B \cup A)'$ OR $A' \cap B' \cap C$

[13]

3. (a) (i) $8p^3 - 18p = 2p(4p^2 - 9)$ M1
$=2p(2p-3)(2p+3)$ A1

(ii) $as+2at-3s-6t=a(s+2t)-3(s+2t)$
OR $s(a-3)+2t(a-3)$ MA1

$(a-3)(s+2t)$ A1

(b) $y \propto x^3$
$y=kx^3$
$40=k\times 2^3$ M1
$5=k$
$\therefore y=5x^3$ A1

$y=5(3^3)$

$=135$ A1

[7]

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4.(a) (i) $\frac{Sin A\hat{C}B}{12} = \frac{Sin 58°}{15}$

Sin $A\hat{C}B = \frac{12 Sin 58°}{15}$ M2

$A\hat{C}B = 42° 43'$ or $42,7^0$ A1

(ii) $A\hat{B}C = 79,3°$ OR $79^0 17'$ B1

$\frac{h}{15}$ =Sin (180°-58°-42,7°)

Perpendicular =15 Sin (180°-58°-42,7°) M1

=14,74cm A1

(iii) $\frac{14,74}{AC} = Sin 58°$

$AC = \frac{14,74}{Sin 58°}$ M1

=17,38cm A1

(b) $BL^2 = 6^2 + 12^2 - 2x6x12$ Cos 58° M1

=103,69 A1

BL= $\sqrt{103,69}$ M1

=10,18cm A1

[12]

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5. (a) Monthly salary $= \frac{39000}{12}$

$=\$3250$ B1

(b) Total income = 39000+3½%x100 000 M1

= $42 500 A1

(c) 44145-39000
=5145 B1

Total sales $= \frac{100}{3.5}$x5145 M2

=$147 000 A1

(d)(i) % increase in salary $= \frac{46800-39000}{39000}x100$ M1

=20% A1

(ii) 50 000-46 800
=3200 B1

% bonus $= \frac{3200}{80000}x100$ M1

= 4% A1
[12]

6.

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(a) (i) $A\hat{B}C = 90^o \pm 2^o$ with correct construction arcs seen B1

$A\hat{C}D = 120^o \pm 2^o$ with correct construction arcs seen B1

Quadrilateral with sides $9 \pm 0{,}2$cm, $5 \pm 0{,}2$cm, $7 \pm 0{,}2$cm and ABC $= 90^o \pm 2^o$ and BCD$= 120^o \pm 2^o$ Q2

(ii) $B\hat{A}D = 77^o \pm 2^o$ stated or labelled B1

(b) (i) Bisector of $A\hat{B}C$ ruled, at least 3cm long with tolerances $\pm 2^o$ B1

Correct construction arcs seen B1

(iii) Perpendicular bisector of AB ruled at least 3cm long B1

Correct construction arcs seen B1

(c) (i) W clearly labelled at the intersection of the angle bisector and the perpendicular bisector W1

(ii) WD$= 81 \pm 2$m B1

[11]

7. (a) Time $= \frac{440}{x} hrs$ B1

(b) (i) Average speed $= (x-4)$km/hr B1

(ii) Time for mini-bus $= \frac{448}{x-4} hrs$ B1

(c) (i) $\frac{448}{x-4} - \frac{440}{x} = ½$ M1

$2x(448) - 2(440)(x-4) = x(x-4)$

$896x - 880x + 3520 = x^2 - 4x$

$16x + 3520 = x^2 - 4x$

$x^2 - 20x - 3520 = 0$ (*with no wrong* working) A2

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(ii) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{20 \pm \sqrt{(20)^2 - 4 \times 1 \times (3520)}}{2}$

$= \frac{20 \pm \sqrt{14480}}{2}$ B1B1

B1

=70,2 or- 50,2 B1B1

Alternatively by completing the square,

$(x-10)^2 = 3520 + 100$ B1

$(x-10) = \sqrt{3620}$ B1

$x = 10 \pm \sqrt{3620}$ B1

x=70,2 or 50,2 B1B1

Speed mini-bus = x-4

=66,2km/h B1 [12]

8. (a) (i) length of arc = $\frac{120}{360}$ x2π x 6,5 M1

=13,61cm A1

(ii) Perimeter of sector=13,61+6,5+6,5 M1

=26,61cm A1

(iii) Area of sector= $\frac{120}{360} \times \pi \times (6,5)^2$ M1

=44,24cm^2 A1

(b) (i) Volume of solid=44,24x12 M1

=530,9cm^3 A1

(ii) Density of solid= $\frac{4192}{530,9}$ M1

=7,895 g/cm^3 A1

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(iii) Total surface area
=2x6,5x12+2x44,24+13,61x12 M1

=407,76 cm^2 A1
[12]

9. (a) a=5,5 B1
b=9 B1

(b) Refer to graph. The 6 given points and (-1;5,5)
And (6;9) correctly plotted P3
Smooth curve, not grossly thick, passing through
all 8 correct points C1

(c) (i) Tangent drawn to the curve at x=3 M1
Gradient =1,00 A1

(ii) Area =6,67 ± 0,16 $(units)^2$
Or 26,7 ± 1,60 cm^2 (after converting using the s... B2

(d) Area = 12-6,67 M1
= 5,33 ± 0,41 $(units)^2$
or 21,39 ± 1,63 cm^2 A1
[12]

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10. (a) $p=44$ B1
$q=80$ B1

Refer to graph.

(b) The 5 given points and (80;44) and (100;80)
Correctly plotted P3
Smooth curve, not grossly thick passing through
The 7 correct points. C1

(c)(i) Dotted line (or marks) drawn at y=50,5 M1
Median=83 A1

(ii) Vertical lines (dotted) drawn at x=65 and x=120,
Or marks seen on graph M1

No. of pigs=96-18
=74 A1

(d) (i) $\frac{12}{60-40} \times x = 2,4$

$\therefore\ x = 4$

$For\ 60 < m \leq 80,\ height = \frac{32}{20} x4$

$= 6,4cm$ B1

$For\ 100 < m \leq 140, height = \frac{20}{40} x4$

$= 2cm$ B1

[12]

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11. Refer to graph

(a) Triangle A correctly drawn — T1
Triangle B correctly drawn — E1

(b) Enlargement — M1
Centre (0;1) — A1
Scale factor –2 — A1

(c) Triangle C correctly drawn with vertices at (3;-4), (6;-4) and (3;8) — S3

from $\begin{pmatrix} 3 & 0 \\ 0 & -2 \end{pmatrix}\begin{pmatrix} 1 & 2 & 1 \\ 2 & 2 & 4 \end{pmatrix}=\begin{pmatrix} 3 & 6 & 3 \\ -4 & -4 & -8 \end{pmatrix}$

(d) (i) $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 1 & 2 & 1 \\ 2 & 2 & 4 \end{pmatrix}=\begin{pmatrix} -2 & -2 & -4 \\ 1 & 2 & 1 \end{pmatrix}$

Coordinates are (-2;1), (-2;2) and (-4;1) — B1
Triangle D correctly drawn — T1

(ii) Rotation — M1
Centre origin or (0;0) and through 90 anti-clockwise
Or 270° clockwise — A1

[12]

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12 (a) (i) $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$= -a + b$ B1

(ii) $\overrightarrow{OD} = \frac{1}{2}a$ B1

(iii) $\overrightarrow{AC} = \frac{3}{4}\overrightarrow{AB} = \frac{3}{4}(-a+b)$ B1

(iv) $\overrightarrow{OC} = \overrightarrow{OB} + \frac{1}{4}\overrightarrow{BA}$

$= b - \frac{1}{4}(-a+b)$

$= \frac{1}{4}a + \frac{3}{4}b$ B1

(b) $\overrightarrow{BX} = k\overrightarrow{BD}$

$= k(\frac{1}{2}a - b)$ B1

$\overrightarrow{OX} = \overrightarrow{OB} + \overrightarrow{BX}$

$= b + k(\frac{1}{2}a - b)$ M1

$= \frac{1}{2}ka + (1-k)b$ A1

(c) $\overrightarrow{OX} = h(\frac{1}{4}a + \frac{3}{4}b)$ B1

(d) $\frac{1}{4}ha + \frac{3}{4}hb = \frac{1}{2}ka + (1-k)b$ M1

$\frac{1}{4}h = \frac{1}{2}k \therefore h = 2k$

$\frac{3}{4}h = 1 - k$

$\frac{3}{4} \times 2k = 1 - k$

$\frac{5}{2}k = 1$

$k = \frac{2}{5}$ A1

10

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$h=\frac{4}{5}$ A1

(e) $\overrightarrow{XD}=(1-k)\overrightarrow{BD}$

$=\frac{3}{5}(\frac{1}{2}\mathbf{a}-\mathbf{b})$

$\therefore$ BX:XD$=\frac{2}{5}(\frac{1}{2}\mathbf{a}-\mathbf{b}) : \frac{3}{5}(\frac{1}{2}\mathbf{a}-\mathbf{b})$

=2:3 B1

[12]

A:EG/4008-2-J00

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Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008/1, 4028/1

PAPER 1

Wednesday 8 NOVEMBER 2000 Morning 2 hours 30 minutes

Candidates answer on the question paper.
No additional materials are required.

159136

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.
Mathematical tables, slide rules and calculators may 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

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

1 (a) Evaluate, giving your answer in decimal form, 1,549 – 0,07267.

(b) Express as a fraction in its lowest terms,

(i) $\frac{3}{8} - \frac{2}{9}$,

(ii) $\frac{5}{16} + \frac{7}{12}$.

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

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

(ii)..... [1]

---

2 Given that p = 5, q = -2 and r = 1, find the value of

(a) pq^2r,

(b) $13 - 2(q - p)$.

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

(b) ..... [2]

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For Examiner's Use

3 In terms of time, Japan is 7 hours ahead of Zimbabwe when Britain is 2 hours behind Zimbabwe.

(a) Calculate the difference in time between Britain and Japan.

(b) It is 1135 in Zimbabwe. Giving your answer as time on the 24 hour clock, calculate the time in

(i) Britain,

(ii) Japan.

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

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

(ii) ..... [1]

---

4 (a) Calculate the highest common factor (H.C.F) of the three numbers 18, 30 and 42.

(b) Three uniform rods have lengths of 1,8m, 3,0m and 4,2m. Kuda cuts pieces of equal lengths from each of the rods. State the greatest possible length of each piece.

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

(b) ..... [1]

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5 (a) In the diagram, shade the set $(P \cap Q) \cup R$.

[1]

(b)

Use set notation to describe the shaded region in the diagram.

Answer ..... [2]

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6 (a) The number of pupils at a school to the nearest 10 is 450. State the greatest possible number of pupils at the school.

(b) A magic square is an array of numbers with a special property that the sum of all the numbers in a row, or column or along a diagonal is always the same. This sum is called the magic number of the square.

401	227	179
P	269	491
359	311	137

Using the magic square above, calculate

(i) the magic number of the square,

(ii) the value of P.

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

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

(ii) ..... [1]

7 (a) Simplify $\frac{a^3 b^4}{a^4 b^2 c}$.

(c) Solve the equation $m^2 + 7m - 18 = 0$.

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

(b) m = .. or .... [2]

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For Examiner's Use

8 An orange syrup was diluted with water in the ratio 1:5 respectively. The volume of the orange syrup used was 350ml. Calculate

(a) the volume of the diluted drink,

(b) the number of people who can be served, if each is given exactly 80ml of the diluted drink.

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

(b) ..... [1]

---

9 A number in standard form is $6{,}714 \times 10^{23}$.

(a) State the number of zeros in the number when it is written in ordinary form.

(b) Express in standard form

(i) twice the number,

(ii) one-millionth of the number.

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

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

(ii) ..... [1]

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For Examiner's Use

10 (a) Convert 1001_2 to a number in base ten.

(b) Subtract 32_5 from 41_5, giving your answer in base five.

(c) Convert 27 to a number in base five.

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

(b) ..... [1]

(c) ..... [1]

---

11 (a) Evaluate $\begin{pmatrix} 4 & 2 \end{pmatrix}\begin{pmatrix} 5 \\ -17 \end{pmatrix}$.

(b) Express $3\begin{pmatrix} 2 & 6 \\ -1 & 4 \end{pmatrix} - \frac{1}{2}\begin{pmatrix} -6 & 2 \\ 0 & 8 \end{pmatrix}$ as a single matrix.

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

(b) ..... [2]

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For Examiner's Use

12

The graph shows straight lines l_1 and l_2 intersecting at A. O is the origin. Line l_1 cuts the x-axis at C, and line l_2 cuts the x-axis at B.

(a) Find the area of $\triangle ABC$.

(b) C is the image of A under a reflection in the line l_3. Draw the line l_3.

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

(b) on graph [1]

---

13 Evaluate **(a)** -8^0,

(b) $\log_4 32 + \log_4 2$.

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

(b) ..... [2]

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For Examiner's Use

14 Given that $-5 \leq x \leq 1$ and $6 \leq y \leq 17$, find

(a) the greatest value of $y - x$,

(b) the least value of $x^3 - y$.

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

(b) ..... [2]

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For Examiner's Use

15 A map is enlarged in the ratio 2:1. The original scale was 1: 250 000.

(a) Calculate the new scale in the form 1: n.

(b) A lake has an area of $56cm^2$ on the original map. Calculate the area of the lake on the enlarged map.

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

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

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For Examiner's Use

In the diagram, ABC is a triangle and AD is perpendicular to BC produced.
AC = 5cm, AD = 3cm, BC = 7cm and CD = 4cm.

(a) Find, as a common fraction

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

(ii) $\tan A\hat{C}B$.

(b) Write down the ratio of the area of △ ABC : the area of △ ACD in its simplest form.

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

(ii) $\tan A\hat{C}B$ = ... [1]

(b) area of △ABC: area of △ACD

= ..... [1]

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For Examiner's Use

17

In the diagram, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

The points C and D are also shown on the diagram.

(a) Mark and label clearly on the diagram the point X such that $\overrightarrow{OX} = 2\mathbf{a} + 3\mathbf{b}$.

(b) Write down $\overrightarrow{OC}$ in terms of **a** and **b**.

(c) Draw $\overrightarrow{DE}$ such that $\overrightarrow{DE} = \overrightarrow{OC}$.

Answer (a) on diagram [1]

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

(c) on diagram [1]

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For Examiner's Use

18

P, Q, R and S are points on a circle, centre O. TS is the tangent to the circle and TPQ is a straight line that cuts the circle at P and Q. ST is parallel to RP, $S\hat{T}P = 26^0$ and $S\hat{O}R = 134^0$.

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

(b) $O\hat{S}P$,

(c) $S\hat{P}T$.

Answer (a) $S\hat{P}R$ = ... [1]

(b) $O\hat{S}P$ = ...[1]

(c) $S\hat{P}T$ = ... [2]

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For Examiner's Use

19

The sign post shows the information displayed at a junction on the Bulawayo-Beitbridge road.

(a) Calculate the distance between Gwanda and Beitbridge, given that Gwanda is 126 km from Bulawayo.

(b) Calculate the time taken by a motorist who travelled between Bulawayo and Beitbridge at an average speed of 107 km/h.

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

(b) ..... h [2]

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For Examiner's Use

18

P, Q, R and S are points on a circle, centre O. TS is the tangent to the circle and TPQ is a straight line that cuts the circle at P and Q. ST is parallel to RP, $S\hat{T}P = 26^0$ and $S\hat{O}R = 134^0$.

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

(b) $O\hat{S}P$,

(c) $S\hat{P}T$.

Answer (a) $S\hat{P}R$ = ... [1]

(b) $O\hat{S}P$ = ...[1]

(c) $S\hat{P}T$ = ... [2]

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For Examiner's Use

19

The sign post shows the information displayed at a junction on the Bulawayo-Beitbridge road.

(a) Calculate the distance between Gwanda and Beitbridge, given that Gwanda is 126 km from Bulawayo.

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

(b) ..... h [2]

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For Examiner's Use

20 (a) Express 1,5g/cm^3 in kg/m^3.

(b) Given that $f(x) = kx^2 + 5x + 6$,

calculate the value of k given that f(3) = -60.

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

(b) k = ... [2]

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For Examiner's Use

21 **(a)** A plane is flying on a bearing of 293^0. It then changes direction through 83^0 anticlockwise. Calculate its new bearing.

(b)

In the diagram, AB and BC are adjacent sides of a square. AB and BX are adjacent sides of a regular n-sided polygon.

Given that $C\hat{B}X = 126^0$, calculate

(i) reflex $C\hat{B}X$,

(ii) the exterior angle of the n – sided polygon,

(iii) the value of n.

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

(b) *(i)* reflex $C\hat{B}X$=..... [1]

(ii) ..... [1]

(iii) n =..... [1]

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For Examiner's Use

22 (a) The shape shown is an isosceles trapezium. On the diagram draw the line of symmetry.

(b) The parallel sides of an isosceles trapezium are of lengths 8cm and 18cm, and its perpendicular height is 12 cm. Calculate the length of one of the non-parallel sides.

Answer *(a)* on the diagram [1]

(b) .....cm [3]

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For Examiner's Use

23 Study the pattern below.

Line 1	$2 + 3 = 5$
Line 2	$2 + 6 = 8$
Line 3	$2 + 9 = 11$
-	- -
-	- -
-	- -
Line n	$2 + b = x$
-	

Use the pattern to

(a) write down line 6,

(b) write down the value of b in terms of n,

(c) show that x cannot be 42.

Answer (a) line 6..... [1]

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

(c) .....

.....

.... [2]

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For Examiner's Use

24 **In this question take π to be $\frac{22}{7}$.**

Figure A

Figure B

Figure A and Figure B have the same volume. Figure A is a cone of base radius 9cm and height 28cm. Figure B is a prism whose length is 22cm, and whose cross-section is a right-angled isosceles triangle with the base and the height each equal to x cm.

Calculate (a) the volume of the cone,

(b) the value of x, leaving your answer in surd form.

[Volume of cone = $\frac{1}{3}\pi r^2 h$ where r = base radius and h = height.]

Answer (a) ..... cm^3 [2]

(b) x = ... [2]

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For Examiner's Use

25 A rectangular concrete slab is 4m long, $1\frac{1}{2}$ m wide and 20 cm thick.

(a) Calculate the **total surface area** of the slab, giving your answer in cm^2.

(b) The whole slab is to be painted at a cost of \$15,00 per square metre. Calculate the cost of painting the slab.

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

(b) \$..... [2]

---

26 **(a)** A discount of 15% is given on all goods that are sold for cash in a shop.

Calculate the cash price of an article that has a marked price of \$68,00.

(b) The price of a magazine was \$16,50 in 1999. Given that this was an increase of 10% from the 1998 price, calculate the price of the magazine in 1998.

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

(b) \$ ..... [2]

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For Examiner's Use

The diagram shows the speed-time graph of a train which retards in two stages until it comes to rest after a time of *t* seconds.

(a) Calculate

(i) the retardation of the train during the first 60 seconds,

(ii) the distance that the train covers in the first 60 seconds.

(b) Given that the train covers a total distance of 3000m during the period of retardation, calculate the value of *t*.

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

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

(b) t = ... [3]

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For Examiner's Use

28 The table shows the frequency distribution of the number of instruments that each of the members of a band could play.

Number of instruments	1	2	3	4	5
Frequency	x	10	5	y	1

(a) **(i)** Given that the total number of people in the band is 30, use this information to form an equation in terms of x and y.

(ii) Given further that the mean of the distribution is 2.1, form another equation in terms of x and y.

(b) Solve the two simultaneous equations.

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

(ii) ..... [2]

(b) $x =$ ....., $y =$ ..... [3]

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MATHS **NOVEMBER 2000**

4008/1

POSSIBLE ANSWERS

1. (a) 1,476 33 (b) (i) $\frac{11}{72}$ (ii) $\frac{15}{28}$

2. (a) 20 (b) 27

3. (a) 9 hours (b) (i) 09 35 (ii) 18 35

4. (a) 6 (b) 0,6m or 60cm

5. (a) (b) $B \cap C \cap A'$

6. (a) 454 (b) (i) 807 (ii) 47

7. (a) $\frac{b^2}{ac}$ (b) -9 or 2

8. (a) 2100 (b) 26

9. (a) 20 (b) (i) $1,3428 \times 10^{24}$ (ii) $6,714 \times 10^{17}$

10. (a) 9_{10} or 9_{ten} (b) 4_5 or 4_{five} (c) 102_5 or 102_{five}

11. (a) (-14) (b) $\begin{pmatrix} 9 & 17 \\ -3 & 8 \end{pmatrix}$

12. (a) 30 (b) straight line passing through (5;3) and (4;2) or (6;4)

13. (a) -1 (b) 3

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14. (a) 22 (b) -142

15. (a) 1:125 000 (b) 224

16. (a)(i) $\frac{3}{5}$ (ii) $-\frac{3}{4}$ (b) 7:4 or $\frac{7}{4}$

17. (a) X at 3 units along OB followed by 2 units parallel to OA (b) $-2\underline{a} - 3\underline{b}$ (c) Line DE drawn from D and ending at 4 units to the right of C horizontally

18. (a) 67° (b) 23° (c) 87°

19. (a) 195 (b) 3

20. (a) 1500 (b) -9

21. (a) 210° (b) (i) 234° (ii) 36 (iii) 10

22. (a) (b) 13

23. (a) 2+18=20 (b) 3n (c) $2+3n=42$
$3n=40$
$n=\frac{40}{3}$
$\therefore n$ is not a whole number or 40 is not a multiple of 3.

24. (a) 2 376 (b) $\sqrt{216}$ or $6\sqrt{6}$

25. (a) 142 000 (b) $213

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26. (a) \$57,80 (b) \$15

27. (a) (i) ½ or 0,5 (ii) 1 500 (b) 360

28. (a) (i) $x+10+5+y+1=30$ (ii) $\dfrac{x+20+15+4y+5}{30}$

(b) $x=11, y=3$ or $\dfrac{x+20+15+4y+5}{x+y+16}=2,1$

EG/4008-1-n00

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008/2

PAPER 2

Thursday 9 NOVEMBER 2000 Morning 2 hours 30 minutes

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

138850

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 12 printed pages.

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[Turn over

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Section A [64 marks]

Answer all the questions in this section.

1 (a) Simplify $4rt^2(3r - t^3)$. [2]

(b) Solve the equation $4(3x + 5) - 7(6 - x) = 16$. [2]

(c) Factorise completely

(i) $x^3 + 7x^2 + 12x$,

(ii) $ab - ad - bc + cd$. [

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

$$\frac{y}{4y-1} + \frac{3}{5}.$$ [3]

(e) The time taken to cook $w$kg of meat is given by the expression $(48w + 23)$ minutes. Calculate how long it would take to cook 3kg of meat, giving your answer in hours and minutes. [3]

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2 (a)

In the diagram, $B\hat{A}D = B\hat{C}D = 90^0$, AB = AD, BC = 7cm and CD = 1cm.
Calculate the length of line AB. [4]

(b) A rhombus has sides of length 8cm and one of its angles is 70^0. Calculate

(i) the length of the longer diagonal of the rhombus,

(ii) the area of the rhombus. [6]

---

3 (a) $U = \begin{pmatrix} 4 & -1 \\ 0 & 2 \end{pmatrix}$, $V = \begin{pmatrix} 2 & 3 \\ 0 & t \end{pmatrix}$.

(i) Find the inverse of U.

(ii) Given that UV = VU, calculate the value of t. [6]

(b) $\xi = \{ x : 1 \leq x < 10, x \text{ is an integer} \}$,

A = {x: x is a perfect square} and

B = {x: x is a multiple of 3}.

(i) List the elements of A.

(ii) Find $n(A \cap B)$.

(iii) Write down $(A \cup B)'$ by listing its elements. [5]

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4 (a)

In the diagram, KL is a diameter of the circle KLMN. NM is parallel to KL and $M\hat{K}L = 22^0$. Calculate

(i) $K\hat{N}M$,

(ii) $M\hat{K}N$. [4]

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(b)

In the diagram, BP = BQ, $P\hat{B}A = C\hat{B}Q$ and $B\hat{A}Q = B\hat{C}P$.

(i) Name, in correct order, the triangle that is congruent to triangle ABQ. State the case of congruency.

(ii) Hence write down pairs of equal elements, not already given, in the congruent triangles. [5]

---

5 (a) Find the average of the three numbers $1\frac{3}{4}$, $-2\frac{1}{2}$, $3\frac{5}{8}$. [3]

(b) A householder used 960 units of electricity for which the charges were 35,2 cents per unit for the first 100 units, 30,5 cents per unit for the next 200 units and 26 cents per unit for the remainder. Calculate the total cost of the electricity used by the householder. [3]

(c) A greengrocer bought 30kg of bananas at \$18,75 per kg. He sold 40% of them at \$20,50 per kg and $66\frac{2}{3}$ % of the remainder at \$19,50 per kg. If the rest could not be sold, find the percentage loss he made, giving your answer correct to 2 significant figures. [5]

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

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

(a) Construct **on a single diagram**

(i) triangle ABC in which BC = 10cm, CA = 7 cm and AB = 8,5 cm,

(ii) the locus of a point P, such that BP = PC,

(iii) the locus of a point Q, such that AQ = 4cm. [6]

(b) Given that Q is on AC, measure and write down the length of BQ. [1]

(c) Shade the region inside the triangle ABC, in which a point R lies given that

$BR \geq RC$
and $AR \leq 4$ cm. [2]

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Section B [36 marks]

Answer three questions in this section.

7 (a) Solve the equation $3x^2 - 5x - 4 = 0$ giving the answers correct to 2 decimal places. [5]

(b) Given that $\frac{1}{g} = \frac{1}{e} + \frac{1}{f}$,

express e in terms of f and g. [4]

(c) It is given that y is inversely proportional to $(x - 3)$ and that $y = 4$ when $x = 2$, express y in terms of x. [3]

[Turn over

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8 **In this question do not redraw the diagram.**

In the diagram, line l intersects the curve $y = x^2 - 6x + 8$ at P and Q.

Use the diagram to answer the following questions.

(a) Estimate, correct to 1 decimal place, the solution of $x^2 - 6x + 2 = 0$. [2]

(b) Write down the coordinates of P and the coordinates of Q. [2]

(c) Find the gradient of the line l and hence or otherwise write down the equation of l. [3]

(d) Write down the equation in x which has the x-coordinates of P and Q as its solutions, giving the answer in the form $ax^2 + bx + c = 0$, where a, b and c are integers. [3]

(e) Estimate the area of the shaded region. [2]

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

The masses of pupils in Form 1 at a certain school are given in the following table.

Mass (m) in kg	$35 < m \leq 40$	$40 < m \leq 45$	$45 < m \leq 50$	$50 < m \leq 55$	$55 < m \leq 60$	$60 < m \leq 65$
Number of pupils	5	30	23	25	12	5

(a) Copy and complete the following cumulative frequency table.

Mass (m) in kg	35	40	45	50	55	60	65
Number of pupils with this mass or less	0	5		58			100

[2]

(b) **(i)** Using a horizontal scale of 2cm to represent 5kg and a vertical scale of 2cm to represent 10 pupils draw a smooth cumulative frequency curve for this distribution. [4]

(ii) Showing your method clearly, use your graph to estimate the median of this distribution. [2]

(c) One pupil is selected at random.

(i) Find as a fraction in its lowest terms the probability that the pupil's mass is more than 45kg but less than or equal to 55kg.

(ii) If the probability that the pupil's mass is more than m kg is $\frac{1}{10}$, use the graph to find the value of m. [4]

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10

In the diagram, E, F, G and H are four points on a sportsfield. E is due north of F, H is due east of F, $F\hat{E}H = 65^0$, FH = 15,2m, HG = 12,5m and $F\hat{G}H = 75^0\ 20'$.

(a) Calculate

(i) the distance EF, **[3]**

(ii) $G\hat{F}H$, **[4]**

(iii) the bearing of G from F. **[2]**

(b) A vertical pole, whose top is T, is erected at H.

Given that the height of the pole is 5,6m, calculate the angle of elevation of T from F. **[3]**

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

Triangle X has its vertices at (-4, 4), (-2, 2) and (0, 4). Using a scale of 1cm to represent 1 unit on each axis, draw axes for the values of x and y in the ranges $-4 \leq x \leq 14$ and $-6 \leq y \leq 12$ respectively.

(a) Draw and label triangle X. [1]

(b) A single transformation Z maps triangle X onto triangle Z (X) which has vertices at (6, -6), (3, -3) and (0, -6).

(i) Draw and label triangle Z(X).
(ii) Describe fully the transformation Z. [4]

(c) The transformation T is a translation which maps triangle X onto triangle T(X) with the vertex (-4, 4) of triangle X mapped to the point (8,2).

(i) Write down the translation vector T.

(ii) Draw and label triangle T(X). [4]

(d) The transformation R is a clockwise rotation of 90^0 about (4, 2). Draw and label triangle R(X). [3]

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12 (a) List the integer values of x that satisfy the inequality

$$14 - x \leq 5x < 27.$$ [3]

(b) Ratidzo has \$200 pocket money. She decides to buy c crayons and b books. Each crayon costs \$12,50 and each book costs \$25. She wishes to buy at least 5 crayons and at most 4 books.

Write down three inequalities, other than $c \geq 0$ and $b \geq 0$, which satisfy the above conditions. [3]

(c)

In the diagram OPA and OBR are straight lines. PR intersects AB at Q, $\overrightarrow{OA} = \boldsymbol{a}$, $\overrightarrow{OB} = \boldsymbol{b}$, $\overrightarrow{OP} = 4\overrightarrow{PA}$ and $\overrightarrow{OR} = 3\overrightarrow{OB}$.

(i) Express in terms of $\boldsymbol{a}$ and/or $\boldsymbol{b}$

(a) $\overrightarrow{AB}$,

(b) $\overrightarrow{PR}$.

(ii) Given that $\overrightarrow{PQ} = \mathrm{h}\overrightarrow{PR}$, express $\overrightarrow{PQ}$ in terms of h, $\boldsymbol{a}$ and $\boldsymbol{b}$ and hence show that

$$\overrightarrow{OQ} = \tfrac{4}{5}(1 - \mathrm{h})\boldsymbol{a} + 3\mathrm{h}\boldsymbol{b}.$$ [6]

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MATHS NOVEMBER 2000

4008-2

POSSIBLE ANSWERS

1. (a) $4rt^2 (3r - t^3) = 12\ r2t^2 - 4rt^5$ B2

(b) $12x + 20 - 42 + 7x = 16$
$12x + 7x = 16 + 42 - 20$ MA1
$x = 2$ A1

(c) (i) $x^3 + 7x^2 + 12x = x(x^2 + 7x + 12)$
$= x(x + 3)(x + 4)$ B2

(ii) $a(b - d) - c(b - d)$ M1
$(b - d)(a - c)$ A1

(d) $\frac{5y + 3(4y - 1)}{5(4y - 1)}$ M1

$\frac{17y - 3}{5(4y - 1)}$ A2

(e) Time $= 48 \times 3 + 23$ M1
$\frac{48 \times 3 + 23}{60}$ M1

2 hrs 47 minutes A1
(14)

2. (a) $BD = 7 + 1$ M1
$2AB^2 = BD^2$
$AB^2 = \frac{50}{2}$ M1

$AB = \sqrt{50/2}$ M1
$= 5cm$ A1

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(b)

(i) $x = 8 \text{ Cos } 35^0$ M1

Longer diagonal $= 2 \times 8 \text{ Cos } 35^0$ M1

$= 13{,}11$ cm A1

Alternatively

Longer diagonal $= \sqrt{8^2 + 8^2 - 2x8x8\cos 110^0}$ M2

13,11cm A1

(ii) Area of rhombus $= 8 \times 8 \text{ Sin } 70^0$ M2

$= 60{,}14 \text{ cm}^2$ A1

(10)

3. (a) (i) det U = 8 – 0 = 8

$$U^{-1} = \begin{pmatrix} \frac{1}{8} & 2 & 1 \\ & 0 & 4 \end{pmatrix}$$ B2

(ii) $$\begin{pmatrix} 4 & -1 \\ 0 & 2 \end{pmatrix}\begin{pmatrix} 2 & 3 \\ 0 & t \end{pmatrix} = \begin{pmatrix} 2 & 3 \\ 0 & t \end{pmatrix}\begin{pmatrix} 4 & -1 \\ 0 & 2 \end{pmatrix}$$ M1

$$\begin{pmatrix} 8 & 12-t \\ 0 & 2t \end{pmatrix} = \begin{pmatrix} 8 & 4 \\ 0 & 2t \end{pmatrix}$$ MA1

$12 - t = 4$ M1

$t = 8$ A1

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(b) E = 1; 2; 3; 4; 5; 6; 7; 8; 9; 10

(i) A = 1; 4; 9 B2

B = 3; 6; 9

(ii) $A \cap B$ = 9 B1

$n(A \cap B) = 1$

(iii) $(A \cup B)'$ = 2; 5; 7; 8 B2

(11)

4 a)

OR

$K\hat{N}M = 180^0 - (90^0 - 22^0)$ M1

$= 112^0$ A1

$M\hat{K}N = 180^0 - (112^0 + 22^0)$ M1

$= 46^0$ A1

(b) (i) Δ ABQ = CBP B1

Δ SAA or AAS or 2 angles and a corresponding side or Angle, angle side B1

(ii) AQ = CP, AB = CB, $A\hat{Q}B = C\hat{P}B$ B3

(9)

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5. (a) $1\frac{3}{4} - 2\frac{1}{2} + 3\frac{5}{8}$ M1

$7 - 5 + 3\frac{5}{8}$ M1

$\frac{1}{3}\left(\frac{14 - 20 + 29}{8}\right)$ M1

$\frac{23}{24}$ or 0,9 583 A1

(b) Total Cost = 100 x 3,5,2 + 200 x 30,5 + (960 – 300) x 26 M2
= $267,80

(c) Cost Price = 30 x 18,75 M1

$\frac{40}{100} \times 30 \times 20,5 + (30 - \frac{40}{100} \times 30) \times \frac{66\frac{2}{3}}{100} \times 19,5$ M1

= $480

% Loss made = $\frac{30 \times 18,75 - 480}{30 \times 18,75} \times 100$ M1

= 15% A1
(11)

6. Refer to diagram drawn.
(a) (i) Correct triangle with sides 10 ± 0,2cm, 7 ± 0,2 cm and 8,5 ± 0,2 cm. Δ1
Correct construction arcs T1

(ii) Ruled bisector of BC at least 3cm long B1
Correct construction arcs B1

(iii) Circle centre A with radius 4 ± 0,2 cm drawn C2

(b) BQ = 8,7 cm B1
(c) Correct region bounded by solid lines inside the triangle, shaded. R2
(9)

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7. (a) $3x^2 - 5x - 4 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{5 \pm \sqrt{(-5)^2 - 4(3)(-4)}}{2x3}$$

$$= \frac{5 \pm \sqrt{73}}{6}$$ B1 B1

$= 2{,}26$ Or $-0{,}59$ B1 B1

Or by completing the square,

$$x^2 - \frac{5}{3}x = \frac{4}{3}$$

$$\left(x - \frac{5}{6}\right)^2$$ B1

$$\sqrt{\frac{73}{36}}$$ B1

$$x = \frac{5}{6} \pm \sqrt{\frac{73}{36}}$$ B1

$= 2{,}26$ or $-0{,}59$ B1 B1

(b) $\frac{1}{g} = \frac{1}{e} + \frac{1}{f}$

$\frac{1}{e} = \frac{1}{g} - \frac{1}{f}$ or $ef = gf + eg$ M1

$\frac{1}{e} = \frac{f - g}{fg}$ or $ef - eg = gf$ M1

$e = \frac{fg}{f - g}$ A2

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(c) $y \alpha \frac{1}{x-3}$ M1

$y = \frac{k}{x-3}$

$k = y(x-3)$
$= 4(2-3)$
$= -4$ A1

$y = \frac{-4}{x-3}$ A1
(12)

8. Refer to graph on question paper

(a) The values of x are read at the points where the line $y = 6$ cuts the curve

x = 0;3 or 5;6 B1 B1

(b) P(1;3) Q(6;8) B1 B1

(c) Grad of line l = 1 B1
The line passes through the point (1;3)
Equation of line is

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

Or $y - 3 = 1(x-1)$ M1
$y = x + 2$ A1

(Or using $y = mx + c$, $y = 1(x) + 2$) M1
$y = x + 2$ A2

(d) The x coordinates of P and Q are 1 and 6 respectively

Required equation is
$(x-1)(2-6) = 0$ M1
$x^2 - 7x + 6 = 0$ A2

(e) By counting squares
Area = 15,2 (units)^2 B2

(12)

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9. (a)

≤45	≤55	≤ 60
35	83	95

B2

(b) Refer to graph

(i) The 4 given points together with (45; 35), (55;83) and (60;95) correctly plotted — P3

Correct curve, smooth and not grossly thick. — C1

(ii) Line y = h where 50 ≤ h ≤ 51 shown on graph. — M1

Median = 48,4 kg — A1

(c) (i) $p(45 \leq \text{mass} \leq 55) = \frac{23 + 25}{100}$ — M1

$= \frac{12}{25}$ — A1

(ii) Line y = k where 90 ≤ kπ 91 shown on graph. — M1

m = 57,5kg — A1

(12)

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10.

(a) (i) $\frac{EF}{15,2} = \tan 25^0$ or $\frac{15,2}{EF} = \tan 65^0$

$EF = 15,2 \tan 25^0$ or $\frac{15,2}{\tan 65^0}$ M2

$= 7,088m$ A1

(ii) $\frac{\sin G\hat{F}H}{12,5} = \frac{\sin 75^0 20'}{15,2}$

$\sin G\hat{F}H = \frac{12,5 \sin 75^0 20'}{15,2}$ M2

$G\hat{F}H = 52,7^0$ OR $52^0 43'$ A2

(iii) Bearing of G from F $= 90^0 + 52,7$ M2
$= 142,7^0$ A1

OR S $142,7^0$ E

(b) $\tan \hat{F} = \frac{5,6}{15,2}$ M2

$\hat{F} = 20,2^0$ OR $20^0 13'$ A1

(12)

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11. Refer to graph drawn.

(a) ΔX Correctly drawn — $\Delta 1$

(b) (i) $\Delta Z(X)$ correctly drawn. — M1

(ii) Enlargement. — M1

Center origin or (0,0) — A1

Scale factor $-1\frac{1}{2}$ or $-1,5$ — A1

(c) (i) Translation vector $= \begin{pmatrix} 8 \\ 2 \end{pmatrix} - \begin{pmatrix} -4 \\ 4 \end{pmatrix}$

$= \begin{pmatrix} 12 \\ -2 \end{pmatrix}$ — B2

(ii) $\Delta T(X)$ correctly drawn with vertices at (8;2), (10;0) and (12;2) — T2

(ii) $\Delta R(X)$ correctly drawn with vertices at (4;8), (6;10) and (6;6) — R3

(12)

12. (a) $14 - x \leq 5x$ and $5x < 27$

$14 \leq 6x$ and $x < 5\frac{2}{5}$

$2\frac{1}{3} \leq x$ and $x\ 5\frac{2}{5}$

values are 3; 4; 5 — B3

(b) $12,5c + 25b \leq 200$

$125c + 250b \leq 2\ 000$

$5c + 10b \leq 80$ — B1

$c \geq 5$ — B1

$b \leq 4$ — B1

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(c) (i) (a) $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB}$

$= a + b$ B1

(b) $\overrightarrow{PR} = \overrightarrow{PO} + \overrightarrow{OR}$

$-\frac{4}{5}a + 3b$ B2

(ii) $\overrightarrow{PQ} = h(-\frac{4}{5}a + 3b)$ B2

$\overrightarrow{OQ} = \overrightarrow{OP} + \overrightarrow{PQ}$

$= -\frac{4}{5}a + h(-\frac{4}{5}a + 3b)$ B2

$= \frac{4}{5}a - \frac{4}{5}ha + 3b$ B1

$= \frac{4}{5}(1-h)a + 3b$ A1

(12)

/lg

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Candidate Name	Centre Number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008/1, 4028/1

PAPER 1

Monday 4 JUNE 2001 Morning 2 hours 30 minutes

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

17379

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.
Mathematical tables, slide rules and calculators may 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.

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

For Examiner's Use

1 (a) Giving your answer as a common fraction in its lowest terms, find the value of

(i) $7\frac{2}{5} - 6\frac{2}{3}$,

(ii) 0,45 of $\frac{5}{9}$.

(b) Express $\frac{15}{16}$ as a terminating decimal.

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

(ii) ..... [1]

(b) ..... [1]

2 (a) Express 158,697

(i) correct to the nearest hundredth,

(ii) correct to two significant figures.

(b) Express 720 as a product of its prime factors.

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

(ii) ..... [1]

(b) ..... [1]

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3 (a) Find the sum of 2 days 15 hours and 3 days 21 hours, giving your answer in days and hours.

(b) Express 34_5 as a number in base two.

Answer (a) ---------- days ----------hours [1]

(b) ---------- [2]

4 Simplify $\dfrac{a^2-b^2}{ab+a^2} \div \dfrac{ab-a^2}{2a^3}$.

Answer ---------- [3]

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5 **(a)** Two similar cylinders have their volumes in the ratio 1:8.
Write down the ratio of the areas of their circular surfaces.

(b)

A, B and C are three points on level ground.
The bearing of C from B is 138° and $A\hat{B}C = 92°$.

Calculate the bearing of B from A.

Answer (a) ---------- [1]

(b) ---------- [2]

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8 Evaluate

(a) $\left(\frac{1}{5}\right)^{-2}$,

(b) $-27^{\frac{2}{3}}$.

Answer (a) ---------- [1]

(b) ---------- [2]

9

In the diagram, ABE and DCF are parallel straight lines, ABCD is a parallelogram, DC = 7cm, EC = 8cm and $E\hat{C}F = 65^{\circ}$.
Using the information given below where necessary, find

(a) the area of ΔDEC,
(b) the area of parallelogram ABCD.

[$\sin 65^{\circ} = 0{,}91$; $\cos 65^{\circ} = 0{,}42$; $\tan 65^{\circ} = 2{,}14$.]

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

(b) ----------cm^2 [1]

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10

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In the diagram, line l_1 and line l_2 are parallel.

(a) Find the gradient of line l_1.

(b) Find the equation of line l_2, giving your answer in the form $ax + by = c$ where a, b and c are integers.

Answer (a) ---------- [1]

(b) ---------- [2]

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Write down the three inequalities which define the unshaded region in the diagram above.

Answer ---------- [1]

---------- [1]

---------- [1]

4008/1 4028/1 J2001

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12

In the diagram, AB = 11cm, BC = 7cm and AC = 6cm.
Calculate the value of $\cos A\hat{C}B$, giving your answer as a common fraction in its lowest terms.

Answer $\cos A\hat{C}B$ = ---------- [3]

13 Solve the simultaneous equations

$$2x - 3y = 13,$$
$$3x + 2y = 0.$$

Answer x = ----------

y = ---------- [3]

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For Examiner's Use

14 (a) Estimate, to the nearest whole number, the value of

$$\frac{7{,}9 \times \sqrt{80{,}6}}{1{,}8 \times 3{,}1}.$$

(b) The length of a square is given as 10cm correct to one significant figure. Find the smallest possible area of the square.

Answer (a) ---------- [2]

(b) ----------cm^2 [2]

15 Given that $m = 4{,}8 \times 10^3$ and $n = 1{,}2 \times 10^{-5}$,

find, giving your answer in standard form,

(a) $5m$

(b) n^2,

(c) $\frac{n}{m}$.

Answer (a) ---------- [1]

(b) ---------- [1]

(c) ---------- [2]

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For Examiner's Use

16 (a) Expand and simplify $(x + 2)(5 + 2x - x^2)$.

(b) Factorise completely

$$3x^2 - 6x - ax + 2a.$$

Answer (a) ---------- [2]

(b) ---------- [2]

17

In the diagram, PA and PB are tangents to the circle centre O. Given that Q is a point on the minor arc AB and that $A\hat{O}B = 140°$, find

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

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

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

Answer (a) ---------- [1]

(b) ---------- [1]

(c) ---------- [2]

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18 $\mathbf{A} = \begin{pmatrix} 7 & -2 \\ 4 & -1 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} -1 & 2 \\ -4 & 7 \end{pmatrix}$ and $\mathbf{M} = \begin{pmatrix} -3 & -5 \\ 2 & 6 \end{pmatrix}$. Find

(a) **AB**,

(b) the inverse of **M**.

Answer (a) ---------- [2]

(b) ---------- [2]

19 It is given that $\mathbf{a} = \begin{pmatrix} 11 \\ -7 \end{pmatrix}$, $\sqrt{17} = 4{,}123$ and $\sqrt{1{,}7} = 1{,}304$.

Find

(a) $\sqrt{0{,}17}$,

(b) the magnitude of **a** correct to two significant figures.

Answer (a) ---------- [2]

(b) ---------- [2]

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For Examiner's Use

20 In a regular polygon of n sides, the size of each interior angle x°, is given by the formula

$$x = 180 - \frac{360}{n}.$$

(a) Make n the subject of the formula.

(b) Calculate the number of sides of a regular polygon whose interior angle is 150°.

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

(b) ---------- [2]

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For Examiner's Use

21

The diagram shows ΔABC and ΔDEF.

(a) On the diagram, draw and label ΔPQR, the image of ΔABC under a translation of vector $\begin{pmatrix} 7 \\ 4 \end{pmatrix}$.

(b) Describe fully the single transformation that maps ΔABC onto ΔDEF.

Answer (a) On the diagram. [1]

(b) .....

.....

..... [3]

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For Examiner's Use

22 The scale of a map is given as 1:50 000.

(a) Calculate the length of a line on the map that represents a road 6,4km long.

(b) Calculate the area, in hectares, of a piece of land represented on the map by an area of $3cm^2$.

[1 hectare = $10\ 000m^2$.]

Answer (a) ----------cm [2]

(b) ----------ha [3]

---

23 m is directly proportional to n^2 and $m = 28$ when $n = 2$.

(a) Write down an expression for m in terms of n and a constant k.

(b) Calculate

(i) the value of k,

(ii) the values of n when $m = 63$.

Answer (a) ---------- [1]

(b) (i) k = ---------- [2]

(ii) n = ----- or ------ [2]

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For Examiner's Use

24 Given that log216 = 2,334 and log3 = 0,477, find

(a) log2,16,
(b) log6,
(c) log72.

Answer (a) ---------- [1]

(b) ---------- [2]

(c) ---------- [2]

---

25 (a) The graph of $x + 2y + p = 0$ and the graph of $3x + qy = 9$ intersect at the point (–2, 3). Find the value of p and the value of q.

(b) Factorise $4x^2 - 12x + 9$.

Hence or otherwise solve the equation $4x^2 - 12x + 9 = 16$.

Answer (a) p = ---------- [1]

q = ---------- [1]

(b) ---------- [2]

x = ---------- or ---------- [2]

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26

For Examiner's Use

The diagram shows the velocity-time graph of a car during a period of 20 minutes. Find

(a) the retardation during the first 5 minutes,
(b) the distance, in kilometres, travelled at constant velocity,
(c) the total distance travelled, in kilometres,
(d) the average velocity, in km/h, during the 20 minutes.

Answer *(a)* ---------- km/h/min [1]

(b) ----------km [2]

(c) ----------km [2]

(d) ----------km/h [3]

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MATHS

JUNE 2001

4008/1

POSSIBLE ANSWERS

1. (a) (i) $\frac{11}{15}$ (ii) ¼ (b) 0,9375

2. (a) (i) 158,70 (ii) 160 (b) $2^4 x 3^2 x 5$

3. (a) 6 days 12 hours (b) 10011_2 or 10011_{two}

4. (a) -2a

5. (a) 1:4 (b) 050° or
50° E of N or
N 50° E

6. (a) 1 (b) $\frac{3}{\sqrt{13}}$ or $\frac{3\sqrt{13}}{13}$

7. (a) $\frac{55}{89}$ (b) $\frac{x+y}{x+2y}$

8. (a) 25 (b) -9

9. (a) 25,48 or $25\frac{48}{100}$ (b) 50,96 or $50\frac{96}{100}$ or $50\frac{24}{25}$

or $25\frac{12}{25}$

10. (a) $\frac{-4}{3}$ or $-1\frac{1}{3}$ (b) $4x+3y=32$ or

$-4x-3y=-32$

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11. $y>-4$ or $-4<y$
$2y \leq 7x+14$ or $7x+14 \geq 2y$
$y+x \leq 7$ or $7 \geq y+x$

12. $\frac{-3}{7}$

13. $x=2$ $y=-3$

14. (a) 12 (b) 90,25 or $90\frac{25}{100}$ or 90¼

15. (a) $2{,}4\times10^{4}$ (b) $1{,}44\times10^{-10}$ (c) $2{,}5\times10^{-9}$

16. (a) $10+9x-x^3$ or equivalent expression (b) $(x-2)(3x-a)$ or $(3x-a)(x-2)$

17. (a) 90° (b) 40° (c) 110°

18. (a) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ (b) $-\frac{1}{8}\begin{pmatrix} 6 & 5 \\ -2 & -3 \end{pmatrix}$

19. (a) 0,4123 (b) 13

20. (a) $\frac{360}{180-x}$ or $\frac{-360}{x-180}$ (b) 12

21. (a) Δ PQR with P (4;3) Q (6;30) and R (6;1) (b) Shear,factor -3 x –axis or line y=o being invariant

22. (a) 12,8 or $12\frac{8}{10}$ or $12\frac{4}{5}$ (b) 75

23. (a) $m=kn^2$ or $\frac{n^2}{k}$ (b) $k=7$ or $\frac{1}{7}$ with respect to (a) (c) 3 or –3

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24. (a) 0,334 (b) 0,778 (c) 1,857

25. (a) $p=-4$ $q=5$ (b) $(2x-3)(2x-3)$ or $(2x-3)^2$
$x=-½$ or $3½$ or
$x=-0,5$ or $3,5$
($\frac{7}{2}$ is accepted in place of 3½ or3,5)

26. (a) 12 (b) 5 (c) 15 (d) 45

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4028/2

PAPER 2

Thursday **7 JUNE 2001** Morning 2 hours 30 minutes

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

02879

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.
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 or electronic calculators may be used to evaluate explicit numerical expressions.

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Section A [64 marks]

Answer all the questions in this section.

1 (a) If 18 200m^2 of land is shared in the ratio 2:3:8, calculate the area of the smallest share. [2]

(b) Given that $x \geq 29\frac{1}{5}$, state the least possible value of x if

(i) x is a perfect cube,
(ii) x is a rational number. [2]

(c) Calculate the time that \$2 000 would take to amount to \$3 645 if invested at $23\frac{1}{2}$% per annum simple interest. [3]

(d) A girl bought 72g of chocolates for \$10,80. Calculate the amount she would have paid for 0,5kg of the same type of chocolates. [2]

---

2 (a) Given that a = 3, b = – 2 and c = 10, calculate

(i) ac^2,
(ii) a^b. [3]

(b) Express $\frac{4}{p} - \frac{3}{1-5p}$ as a single fraction in its simplest form. [3]

(c) Given that $f(x) = 2x - 3$, calculate the value of k when f (k) = – 21. [2]

(d)

In the diagram, MNP is parallel to CD. Angle PND= 59^0, angle NMC = u^0, angle MCD = v^0 and angle CDQ = r^0.

(i) Calculate the value of r.
(ii) Express v in terms of u. [3]

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3 (a) A man earns \$30 per hour for the first 35 hours and \$40 for each additional hour that he works each week. If he earned \$1 290 in a week, calculate the total number of hours he worked. [4]

(b)

The figure shows a uniform triangular prism, 27cm long. The right-angled triangle PQR is a cross-section of the prism and PQ = RQ = 6cm and angle PQR = 90^0.
Calculate

(i) PR,
(ii) the volume of the prism,
(iii) the total surface area of the prism. [7]

---

4 **Answer the whole of this question on a sheet of plain paper.**

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

(a) Construct on a **single** diagram

(i) a parallelogram ABCD with AB = 9cm, AD = 7cm and the angle BAD = 60^0,
(ii) the locus of points equidistant from AB and AD,
(iii) the perpendicular bisector of BC. [7]

(b) (i) Mark the point P that lies on DC and is equidistant from AB and AD.
(ii) Measure and write down the length of BP. [2]

(c) Describe the locus that the perpendicular bisector of BC represents. [2]

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5 Each of 37 pupils when ordering an ice cream had at least one of the following flavours:

a vanilla,
a chocolate,
a peppermint.

In the Venn diagram, the expressions represent the number of pupils in each subset.

(a) Write down the total number of pupils who chose a peppermint. [1]

(b) Express y in terms of x in its simplest form. [2]

(c) The number of pupils who chose a peppermint only was three more than the number who chose chocolate only.

(i) Write down an equation in x.
(ii) Solve this equation.
(iii) Determine the number of pupils who had a chocolate only. [4]

(d) Find the probability that a pupil who had a vanilla also had a chocolate. [2]

(e) Two pupils were chosen at random from all the pupils.
Calculate the probability that both pupils had peppermint,
giving your answer as a fraction in its lowest terms. [3]

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

The charges made by a firm of carriers named Phiri Packages, for delivering parcels of various masses are based on a fixed minimum charge for parcels of 5 kg or less. For parcels over 5 kg the total charge is made up of the fixed minimum charge together with an additional charge which is proportional to the amount by which the mass exceeds 5 kg. For parcels over 5 kg the table shows some examples of the charges.

Mass of parcel (kg)	15	23	29
Charge ($)	28,50	40,50	49,50

(a) Taking 2 cm to represent 5 kg on the horizontal axis and 2 cm to represent $5 on the vertical axis, draw a straight line graph to show the total charges for parcels up to 30 kg. [4]

(b) Use your graph to estimate

(i) the fixed minimum charge,
(ii) the rate per kilogram for the amount by which a parcel exceeds 5 kg,
(iii) the mass of the parcel that would cost $38,50 to dispatch. [4]

(c) Calculate the charge for a parcel of mass 75 kg. [2]

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Section B [36 marks]

Answer three questions in this section.

7

In this question take π to be 3,142.

In the diagram, ABCD is a rectangle and PQRS is a sector of a circle centre P. Given that P is also the mid-point of AB, PQ = PS = 8 cm and the length of the arc QRS = 14cm, calculate

(a) the perimeter of the sector PQRS, [1]

(b) the angle SPQ, [3]

(c) the area of the sector PQRS, [2]

(d) the area of the rectangle, [4]

(e) the area of the shaded region. [2]

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In the diagram, ABC is a triangle in which BC = 9cm, angle ABC = 68° and angle BAC = 42°.

(a) Calculate the length of AC. [3]

(b) The point H is on AC such that AH = 4,1cm and the point G is on ABsuch that AG = 4,7cm. Calculate

(i) the length of HG, [4]

(ii) the area of the triangle AHG. [3]

(c) Calculate the perpendicular distance from B to AC. [2]

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9

The diagram shows a circle with diameter CB. ED and CB produced meet at A. TC is the tangent to the circle at C, and the angle TCE = 35°.

(a) Calculate

(i) angle CBE,
(ii) angle BCE,
(iii) angle BDA. [3]

(b) Name, in the correct order, the triangle that is similar to triangle ADB. [1]

(c) It is given that AB = $(x + 3)$ cm, CE = x cm, AE = 8 cm and BD = 1cm.

(i) Show that $x^2 + 3x - 8 = 0$.
(ii) Solve this equation, giving the answers correct to 2 significant figures.
(iii) Hence write down the length of EC. [8]

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

Using a scale of 2cm to represent 1 unit on each axis, draw axes for values of x and y in the ranges $-3 \leq x \leq 5$ and $-6 \leq y \leq 4$ respectively.

(a) Triangle ABC has vertices at (1,1), (3,1) and (2,3) respectively. Draw and label triangle ABC. [1]

(b) Triangle $A_1B_1C_1$ is the image of triangle ABC under a reflection in the y – axis. Draw and label triangle $A_1B_1C_1$. [2]

(c) Triangle $A_2B_2C_2$ is the image of triangle ABC under an enlargement scale factor –2 and centre (2, 0). Draw and label triangle $A_2B_2C_2$. [3]

(d) Triangle $A_3B_3C_3$ has vertices at (–1, –3), (–1, –1) and (–3, –2) respectively.

(i) Draw and label triangle $A_3B_3C_3$.

(ii) Triangle $A_3B_3C_3$ is the image of triangle ABC under a certain **single** transformation. Describe **fully** this transformation. [4]

(e) Find the matrix that transforms triangle ABC onto triangle $A_4B_4C_4$ which has the coordinates (1, –2), (3, –2) and (2, –6) respectively. [2]

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12 **(a)**

In the diagram, the point P is such that $AP = 2PB$ and the point Q is such that $AB = BQ$.
Given that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$, express as simply as possible, in terms of **a** and **b**

(i) $\overrightarrow{AB}$,

(ii) $\overrightarrow{AP}$,

(iii) $\overrightarrow{OP}$,

(iv) $\overrightarrow{AQ}$. [5]

(b) **M** is a 2 x 2 matrix such that $\mathbf{M} - 2\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix} = 3\begin{pmatrix} 1 & 1 \\ -1 & 0 \end{pmatrix}$. Find **M**. [3]

(c) **N** is a 2 x 2 matrix such that $\mathbf{N}\begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$ and $\mathbf{N}\begin{pmatrix} 0 \\ 1 \end{pmatrix} = \begin{pmatrix} x \\ 2 \end{pmatrix}$.

(i) Find the matrix **N**.

(ii) Find the value of x if **N** has no inverse. [4]

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POSSIBLE ANSWERS

1. (a) Smallest share = $\frac{2}{13} \times 18\,200$ M1

= 2 800 m² A1

(b) (I) Perfect cubes are 1, 8, 27, 64, ...

Therefore $x = 64$ B1

(ii) 29½ itself is a rational number
Therefore $x = 29\frac{1}{2}$ B1

(c) Simple interest = 3 645 - 2 000 M1

= $1 645

$T = \frac{100I}{PR}$

$= \frac{100 \times 1645}{2\,000 \times 23\frac{1}{2}}$

$= \frac{100 \times 1\,645}{2\,000} \times \frac{2}{47}$ M1

=3½ years A1

(d) 72 g : $10,80
Therefore 0,5 kg : more

Cost = $\frac{500g}{72\,g} \times \$10,80$ M1

= $75 A1

[9]

2 (a) (I) $ac^2 = 3 \times 10^2$
=300 B1

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$r = 180° - 59°$

$= 121°$ B1

(ii) $u + v = 180°$ (allied angles on // lines) M1

$v = 180 - u$ A1

[11]

3 (a) Amount for first 35 hrs = 30 x 35 M1

Remaining amount = 1 290 - 30 x 35

No. of hours at \$40 = $\frac{1\,290 - 30 \times 35}{40}$ M1

= 6 A1

Total No. of hours = 35 + 6

= 41 A1

(b) (i) $PR = \sqrt{6^2 + 6^2}$ M1

= 8,485 cm A1

(ii) Volume of prism = base area x height

$= (\frac{1}{2} x 6 x 6) \times 27$ M1

= 486 cm³ A1

(iii) Total surface Area

=2 x (½x6x6) +2 x (27x6)+ 27 x 8,485 M2

589,1 cm² A2

[11]

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4. Diagram

(a)	(i)	Angle A = 60°±2° with correct construction arcs.	C1
		Parallelogram with sides 9,0 ±0,2 cm, and 7,0 ±0,2 cm and angles 60°±2° and 120°±2°.	P1
		Construction arcs for // gram	A1
	(ii)	Ruled bisector of angle at least 3 cm long.	L1
		Correct construction arcs	C1
	(iii)	Ruled perpendicular bisector of BC at least 3 cm long.	L1
		Correct construction arcs	C1
(b)	(i)	P marked on the intersection of DC and the angle bisector	P1
	(ii)	BP = 6,2 ±0,2 cm	B1
(c)		**Points** that are equidistant from B and C	B2
			[11]

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5. (a) $n(P) = x + 21 - x$
$= 21$ — B1

(b) $y+2+2x+x+21-x = 37$ — M1
$y + 2x = 14$
$y = 14 - x$ — A1

(c) (I) $21 - x - 3 = 2x$ — B1

(ii) $3x = 18$ — M1
$x = 6$ — A1

(iv) n(chocolate only) = $2x$
$= 12$ — B1

(d) $p(V \cap C) = \frac{2}{37}$ — B2

(e) p(both had peppermint)= $\frac{21}{37} \times \frac{20}{36}$ — M2

$= \frac{35}{111}$ — A1

[12]

6. (a) Refer to graph.
The 3 given points correctly plotted — P3
Straight line not grossly thick passing through The correct 3 points — L1

(b) (i) \$13,50 — B1

(ii) $\frac{40,5-28,5}{23-15}$ or figures coming from the graph — M1

\$1,50 — A1

(iii) 21,5 kg — B1

(c) 13,5+ (75,-5) x 1,5 — M1
\$118,50 — A1

Note
With no graph the score is zero.

[10]

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7 7. (a) Perimeter = 8+8+14
= 30 cm B1

(b) $\frac{S\hat{P}Q}{360^{\circ}} \times 2\pi \times 8 = 14$ M1

$S\hat{P}Q = \frac{14 \times 360^{\circ}}{2\pi \times 8}$ M1

$= 100{,}2^{\circ}$ or $100^{\circ}\ 15'$

(c) Area of sector $= \frac{100{,}2}{360} \times 8 \times 8$ π

$= 56{,}01\ cm^2$ A1

(d)

AD = r = 8 cm

x = 8 Sin 50,1° or 8 Cos 39,9° M1

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Therefore QS = 2 x 8 Sin 50,1° or 2 x 8 Cos 39,9° M1
Area = 8 x 2 x 8 Sin 50,1° M1
= 98,23 cm² A1

(e) Shaded area = 98,23 -56,01 M1
= 42,22 cm² A1

[12]

8 (a) $\frac{AC}{Sin68^0} = \frac{9}{Sin42^0}$

$AC = \frac{9sin68^0}{sin42^0}$ M2

= 12,47 cm A1

(b) (i) HG² = 4,1²+4,7²- 2 x (4,1)x(4,7)xCos 42° M1

= 10,26 A1

HG = $\sqrt{10,26}$ M1

= 3, 203 cm A1

(ii) Area of ΔAHG =½(4,1)(4,7) Sin 42° M2

= 6, 447 cm² A1

(c)

$\frac{h}{9}$ = Sin (180°- 68°- 42°) M1

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$h = 9Sin\,(180° - 68° - 42°)$ M1

$= 8.457$ cm A1

[12]

9 (a) (i) $C\hat{B}E = 35$ (angle in alternate segment) B1

(ii) $B\hat{C}E = 90° - 35°$

$= 55°$ B1

(iii) $B\hat{D}A = B\hat{C}E$

(ext. L of cyclic quad equal to int. opp. L)

$= 55°$ B1

(b)

Equal angles are marked the same.
ΔACE is similar to ΔADB B1

(c) (i) From the similar Δs,

$$\frac{AB}{AE} = \frac{BD}{EC}$$

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$\frac{x+3}{8} = \frac{1}{x}$ M1

$x^2 + 3x - 8 = 0$ A1

(ii) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{-3 \pm \sqrt{3^2 - 4(1)(-8)}}{2 \times 1}$

$= \frac{-3 \pm \sqrt{41}}{2}$ B1B1 B1

$x = 1{,}7$ B1

or $-4{,}7$ B1

Alternatively, using completion of the square,

$\left(x + \frac{3}{2}\right)^2 = 8 + \left(\frac{3}{2}\right)^2$

$\left(x + \frac{3}{2}\right)^2 = \frac{41}{4}$ B1B1

$x = \frac{-3}{2} + \sqrt{\frac{41}{4}}$ B1

$= 1{,}7$ B1

or $-4{,}7$ B1

(iii) EC = x

$= 1{,}7$ cm B1

[12]

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10.	(a)	m =6	B1
		n = 1,5	B1
		Refer to graph	
	(b)	The 5 given points and (1;6) and (4;1,5) correctly plotted	P3
		Smooth curve, not grossly thick passing through the correct 7 points.	C1
	(c)	$1,7 < x < 5,7$	B2
	(d)	Table of values for x +y = 5 or intercepts with graph Marked or calculated.	M1
		Line $x + y = 5$ correctly drawn	A1
	(e)	Line parallel to x + y =5 touching the curve at one point	M1
		$x = 2,2$	A1
			[12]

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(a) ΔABC correctly drawn — $\Delta 1$

(b) $\Delta A_1B_1C_1$ correctly drawn with vertices at (-1;1),(-3;1) and(-2;3) — S2

(c) $\Delta A_2B_2C_2$ correctly drawn with vertices at (-1;1), -3;1) and(-2;3) — E3

(d) $\Delta A_3B_3C_3$ correctly drawn — T1

(ii) Rotation — M1

90° anticlockwise or 270° clockwise — A1
Centre of rotation (2; -2) — A1

(f) Let matrix be $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} 1 & 3 & 2 \\ 1 & 1 & 3 \end{pmatrix} = \begin{pmatrix} 1 & 3 & 2 \\ -2 & -2 & -6 \end{pmatrix}$$

$a + b = 1$
$3a + b = 3 \therefore 2a = 2$ and $a = 1$
$\therefore b = 0$

$c + d = -2$
$3c + d + -2 \therefore 2c = 0$ and $c = 0$
$\therefore d = -2$

matrix is $\begin{pmatrix} 1 & 0 \\ 0 & -2 \end{pmatrix}$ — B2

[12]

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12. (a) (i) $\overrightarrow{AB}=\overrightarrow{AO}+\overrightarrow{OB}$

$= -a + b$ B1

(ii) $\overrightarrow{AP}=\frac{2}{3}\overrightarrow{AB}$

$= \frac{2}{3}(-a+b)$ B1

(iii) $\overrightarrow{OP}=\overrightarrow{OA}+\overrightarrow{AP}$

$=a+\frac{2}{3}(-a+b)$ M1

$=\frac{1}{3}a+\frac{2}{3}b$ A1

(iv) $\overrightarrow{AQ}=2(\overrightarrow{AB})$

$= 2(-a+b)$ B1

(b) $M = 3\begin{pmatrix}1 & 1\\ -1 & 0\end{pmatrix} + 2\begin{pmatrix}1 & -1\\ 0 & 1\end{pmatrix}$

$= \begin{pmatrix}5 & 1\\ -3 & 2\end{pmatrix}$ *B3*

(c) (i) Let $N = \begin{pmatrix}a & b\\ c & d\end{pmatrix}$

$= \begin{pmatrix}a & b\\ c & d\end{pmatrix}\begin{pmatrix}1\\ 0\end{pmatrix} = \begin{pmatrix}-3\\ 1\end{pmatrix}$

$= \begin{pmatrix}a\\ c\end{pmatrix} = \begin{pmatrix}-3\\ 1\end{pmatrix}$

$= \begin{pmatrix}a & b\\ c & d\end{pmatrix}\begin{pmatrix}0\\ 1\end{pmatrix} = \begin{pmatrix}x\\ 2\end{pmatrix}$

Therefore

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$$\begin{pmatrix} b \\ d \end{pmatrix} = \begin{pmatrix} x \\ 2 \end{pmatrix}$$

	$N = \begin{pmatrix} -3 & x \\ 1 & 2 \end{pmatrix}$	B2
(ii) det N	$= -3(2)+1(x) = 0$	M1
	$x = 6$	A1
		[12]

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Candidate Name	Centre number	Candidate Number

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008/1,4028/1

PAPER 1

Monday **3 DECEMBER 2001** Morning 2 hours 30 minutes

Candidates answer on question paper.
Additional materials
Geometrical Instruments

167338

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 answer 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

Mathematical tables, slide rules and calculators should not be brought to 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

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[Turn over

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

For Examiner's Use

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

(a) $\frac{3}{4} + \frac{1}{5}$,

(b) $\frac{5}{8} \times \frac{22}{45}$,

(c) $\frac{1}{3} \div \frac{11}{24}$.

Answer (a)……[1]

(b)……[1]

(c)……[1]

2 (a) Find 15% of \$270.

(b) Express 93m as a decimal fraction of 3 km.

Answer (a)……[1]

(b)……[2]

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For Examiner's Use

3 Calculate, in decimal form, the exact value of

(a) 0,02 x 0,6 ,

(b) $\sqrt{0,000004}$,

(c) 5,6 – 7,3.

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

(b) .....[1]

(c) .....[1]

4 (a) Evaluate (i) $32^{\frac{3}{5}}$,

(ii) $3^4 \times 3^0$.

(b) Given that $5^x = 125$, find the value of x.

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

(ii) .....[1]

(b) x = ...[1]

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For Examiner's Use

5 (a) If $x = m + n$ and $y = m - n$, express $3x + 2y$ in terms of m and n.

(b) Factorise completely $5r^2 - 5rt + qr - qt$

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

(b) ..... [2]

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For Examiner's Use

A, B, C, D and E are points on a circle. Given that AB = BC = CD, $D\hat{A}E = 24°$ and $A\hat{E}B = 17°$, find

(a) $E\hat{C}D$,

(b) $B\hat{E}D$,

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

Answer (a) $E\hat{C}D$ = ... ° [1]

(b) $B\hat{E}D$ = ... ° [1]

(c) $B\hat{A}E$ = ... ° [1]

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For Examiner's Use

7 (a) Express 0,0148 correct to one significant figure.

(b) The sides of a rectangle are 15 cm and 7 cm measured correct to the nearest centimetre. Find the smallest possible area of the rectangle.

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

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

8 (a) Solve the inequality $4 + 3x < 25$.

(b) Expand $x^2 y (x^4 - xy^3)$.

(c) Express 37 100 in standard form.

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

(b) .....[1]

(c) .....[1]

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For Examiner's Use

9 (a) Evaluate $341_5 - 23_5$, giving your answer in base 5.

(b) Jabulani completed a track event in 16,45 minutes.

(i) Express this time in minutes and seconds.

(ii) If Farai took 1 minute 56 seconds longer than Jabulani, calculate the time he took to complete the event.

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

(b)(i).....*minutes*.....*seconds* [1]

(ii).....*minutes*.....*seconds* [1]

10 A bus has 80 passengers consisting of adults and school children.

(a) Given that the ratio of the adults to school children is 2 : 3, calculate the number of adults on the bus.

(b) Adult passengers pay \$15 while school children pay half the fare. Calculate the total amount paid by the passengers.

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

(b)\$.....[2]

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For Examiner's Use

11 There are 25 children in a class. Of these, 9 are in the debating club and 13 are in the history club.

It is given that ξ = {children in the class},
D = {children in the debating club},
H = {children in the history club}

and $n(D \cap H) = 5$.

(a) Find (i) the number of children in the debating club only,

(ii) $n(D \cup H)$.

(b) Express in set notation children who are in neither the debating club nor the history club.

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

(ii) $n(D \cup H)$=.....[1]

(b).....[1]

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For Examiner's Use

12 It is given that $C = a + KN^2$.
Find the two possible values of N given that C = 102, a = 27 and K = 3.

Answer N = ……or……[3]

13 An incomplete water bill for a household is shown below.

Description	Previous reading	Present reading	Consumption (Units)	Rate cents/unit	$
	14 May	27 June			
Water	5992,4	6034,6	x	350	y
Fixed Charge					50,00
Amount					z

Find the value of (a) x,

(b) y,

(c) z.

Answer (a) x = …… [1]

(b) y = …… [1]

(c) z = ……[1]

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Examiner's Use

In a survey, the adults in a literacy class were each asked their shoe size. The bar chart illustrates the results of the survey.

(a) State the mode of the distribution.
(b) Find the number of adults in the literacy class.
(c) State the median shoe size.

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

(b)..... [1]

(c)..... [1]

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For Examiner's Use

15

In the diagram, AB and BC are adjacent sides of a regular n–sided polygon, and AB and BD are adjacent sides of a square. The side AB is produced to E. Given that $A\hat{B}C = 15x^{\circ}$ and $C\hat{B}E = 3x^{\circ}$, calculate the value of

(a) the exterior angle of the n–sided polygon,

(b) n,

(c) reflex $C\hat{B}D$.

Answer (a) ..... ° [1]

(b) $n =$ ..... [1]

(c) *reflex* $C\hat{B}D =$ ..... ° [1]

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For Examiner's Use

16 (a) Given that $f(x) = x(x - 6)$ and $f(1) = k$, find the value of k.

(b) If $\log 3 = m$ and $\log 8 = n$, express

(i) $\log 9$ in terms of m,

(ii) $\log 2\frac{2}{3}$ in terms of m and n.

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

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

(ii) .....[1]

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For Examiner's Use

17

The diagram shows a rod consisting of two parts x metres and y centimetres long, where x and y are whole numbers.

(a) Write down, in terms of x and y, an expression for the length of the rod in centimetres.

(b) If the length of the rod is 244 cm, state the value of

(i) x,

(ii) y.

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

(b)(i) x =..... [1]

(ii) y =.....[1]

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18

For Examiner's Use

The diagram shows triangle ABC with AB = $4x$ cm, BC = 6 cm and $A\hat{B}C = 30°$. Given that the area of the triangle is 15 cm^2, find the value of x.

[sin 30° = 0,5; cos 30° = 0,87; tan 30° = 0,58]

Answer $x =$ ..... [3]

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For Examiner's Use

19

The unshaded region A in the diagram is defined by four inequalities, three of which are

$$y \geq 1,$$
$$x + 3y \leq 12,$$
and $y \leq x$.

(a) Write down the fourth inequality.

(b) Find the least value of $3x + 4y$, given that x and y satisfy the inequalities.

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

(b) ..... [2]

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For Examiner's Use

20 The table below gives the changes in the number of jobs in three industries for the period January 1991 to January 1992 in a certain town.

Industry	Change in the number of jobs
Food	– 91
Retail	– 152
Electronics	+ 186

(a) Calculate the mean change in the number of jobs for the three industries.

(b) Given that there were 150 jobs as at January 1991 in the food industry, calculate the number of jobs as at January 1992.

(c) Given that there were 286 jobs as at January 1992 in the retail industry, calculate the number of jobs as at January 1991.

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

(b).....[1]

(c).....[1]

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For Examiner's Use

21 ABCD is a rhombus whose diagonals meet at O.

(a) State the size of $A\hat{O}B$ in degrees.

(b) Given that BD = 10 cm and AC = 24 cm, calculate AD.

(c) State the radius of the circle that passes through A, O and D.

Answer (a) $A\hat{O}B$ =.....° [1]

(b) AD = ...cm [2]

(c) .....cm [1]

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For Examiner's Use

In the diagram, rectangle PQRS is transformed onto rectangle TUVW by an enlargement, centre O and scale factor $1\frac{1}{2}$. PQ = 6 cm and the area of rectangle TUVW is 117 cm^2.

(a) Calculate

(i) the length of TU,
(ii) the area of rectangle PQRS.

(b) Write down the matrix representing the enlargement.

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

(ii).....cm^2 [2]

(b) ( ) [1]

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For Examiner's Use

23 It is given that $\overrightarrow{OP} = 9\boldsymbol{a} + 5\boldsymbol{b}$.

(a) Express $5\overrightarrow{OP}$ in terms of $\boldsymbol{a}$ and $\boldsymbol{b}$.

(b) Given that $\frac{3h}{4}\boldsymbol{a} + (h-k)\boldsymbol{b} = \overrightarrow{OP}$, find the value of h and the value of k.

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

(b)h =.....

k=.....[3]

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For Examiner's Use

24 Given the line XY (see answer spaces),

(a) construct the locus of points that are

(i) 3 cm from X,
(ii) 2 cm from XY.

(b) mark and label the two possible positions of a point P, above XY, which are 3 cm from X and 2 cm from XY.

Answer (a)

(a)(i) On the diagram. [1]

(ii) On the diagram. [2]

(b) The two positions labelled. [1]

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For Examiner's Use

The diagram shows the graph of the quadratic curve $y = -x^2 + 6x - 5$.

(a) State

(i) the maximum value of y,

(ii) the equation of the line of symmetry of the curve.

(b) The curve cuts the y – axis at P(0; –5), find the coordinates of P_1 the image of P on the graph, under a reflection in the line of symmetry.

(c) Write down the equation whose roots are at the intersection of the graphs $y = -x + 5$ and $y = -x^2 + 6x - 5$.

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

(ii)..... [1]

(b) P_1(.....,.....)..... [1]

(c)..... [2]

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For Examiner's Use

26

In the diagram, AB is parallel to DC, AD = 3,3 cm, DC = 6 cm and BC = 10 cm. $A\hat{B}C = 16°$ and $D\hat{A}C = 90°$.

(a) Find sin $A\hat{C}D$ leaving the answer as a proper fraction.

(b) Name an angle which is equal to $A\hat{C}D$.

(c) Calculate AC.

[sin16° = 0,28; cos16° = 0,96; tan16° = 0,29]

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

(b).....[1]

(c) .....*cm* [3]

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For Examiner's Use

27 **In this question take π to be $\frac{22}{7}$.**

(a) A solid sphere of radius $10\frac{1}{2}$ cm is made of a metal alloy.
Given that 1cm^3 of the alloy has a mass of 5g, find the mass of the sphere in kilograms.

[Volume of sphere = $\frac{4}{3}\pi r^3$]

(b) The sphere is melted and used, without waste, to make a length of the wire. Given that the wire is a circular cylinder of radius 0,07 cm, find its length in metres.

Answer *(a)*.....*kg* [3]

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

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MATHEMATICS **NOVEMBER 2001**

4008/1-4028/1

POSSIBLE ANSWERS

1(a)	$\frac{19}{20}$	(b)	$\frac{11}{36}$	(c)	$\frac{8}{11}$	
2(a)	\$40,50 or 4050c	(b)	0,031			
3(a)	0,012	(b)	0,002	(c)	-1.7	
4(a)	(i) 8	(ii)	81	(b)	3	
5(a)	$5m+n$ or $n+5m$	(b)	$(r-t)(5r+q)$ or $(5r+q)(r-t)$			
6(a)	24	(b)	34	(c)	58	
7(a)	0,01	(b)	94,25 or $94\frac{25}{100}$ or 94 ¼			
8.(a)	$x<7$ or $x>7$	(b)	$x^6y - x^3y^4$	(c)	$3{,}71\times10^4$	
9.(a)	313_5 or 313_{five}	(b)(i)	16min 27s	(ii)	18min 23s	
10.(a)	32	(b)	840			
11	4	(ii)	17	(b)	$(D\cup H)'$ or $D'\cap H'$	
12	5 or -5					
13	42,2	(b)	147,70	(c)	197,70	
14	6	(b)	21	(c)	6	
15	30	(b)	12	(c)	240	
16	-5	(b) (i)	$2m$	(ii)	$n-m$	
17	$100x+y$ or $y+100x$	(b) (i)	2	(ii)	44	
18	2,5 or 2 ½ or $\frac{5}{2}$					

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19. (a) $x + y \leq 8$ (b) 7

20. (a) -19 (b) 59 (c) 438

21 (a) 90 (b) 13 (c) 6 ½ or 6,5

22 (a) (i) 9 (ii) 52 (b) $\begin{pmatrix} 1\frac{1}{2} & 0 \\ 0 & 1\frac{1}{2} \end{pmatrix}$ or $\begin{pmatrix} \frac{3}{2} & 0 \\ 0 & \frac{3}{2} \end{pmatrix}$

23. (a) $45a + 25b$ or $25b + 45a$ (b) $h = 12$, $k = 7$

24. (a) (i) Circle centre X radius 3±0,2cm (ii) Two lines parallel to XY, one on either side, at a distance of 2 cm from XY.

(b) Points of intersection of (a) (i) and (a) (ii) above line XY.

25. (a) (i) 4 (ii) x=3 or 3=x (b) (6; -5)

(c) $x^2 - 7x + 10 = 0$ or $(x - 2)(x - 5) = 0$

26. (a) $\frac{11}{20}$ (b) BÂC (a) 5,09 *or* $5\frac{1}{11}$ *or* 5,09

27. (a) 24,255 (b) 3 150

28. (a) 64,8 (b) (i) $\frac{3}{5}$ *or* 0,6 (ii) 20 (iii) 210

AM40081-28N01

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4008 /2

PAPER 2

Tuesday **4 DECEMBER 2001** Morning 2 hours 30 minutes

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

152730

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 answer 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 together 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 12 printed pages.

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[Turn over

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Section A [64 marks]

Answer all the questions in this section.

1 (a) Linda spent $\frac{3}{5}$ of her pocket money and had \$20 left. Find the amount of money she had at first. [3]

(b)

The diagram above represents a rectangular garden 9 m long and 7 m wide with a path 50 cm wide. Calculate the area of the path giving the answer in square metres. [4]

(c) Express 54 minutes as a percentage of 2 hours. [2]

(d) A shop sells a packet of biscuits for \$23,46 making a profit of 15% on the cost price. Calculate the cost price. [3]

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2 (a) Write down

(i) the factors of $x^2 - 4$,

(ii) the factors of $x^2 + 4x + 4$,

(iii) the L.C.M. of $x^2 - 4$ and $x^2 + 4x + 4$. [3]

(b) Solve the equation $\frac{9}{a} + 18 = 0$. [2]

(c) Express $\frac{1}{s} + \frac{1}{t} + \frac{1}{st}$ as a single fraction. [2]

(d) A formula that can be used for changing degrees Fahrenheit (F) to degrees centigrade (C) is

$$C = \frac{5F - 160}{9}.$$

(i) Calculate the value of C when F = 95.

(ii) Make F the subject of this formula. [4]

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3

In the diagram, PS = 4,8 cm, SQ = 12 cm, $S\hat{Q}R = 36{,}7°$ and $Q\hat{R}S = 90°$.

Calculate

(a) the length of QR, [2]

(b) the length of PR, [3]

(c) the size of the angle marked $y°$, [2]

(d) the area of the triangle PSQ. [2]

---

4 A municipal swimming pool is 12 m long, 5 m wide and 1,5 m deep.

(a) Calculate the total internal surface area of the pool. [2]

(b) The municipality employs Harry to paint the pool. One litre of paint covers 3 m^2. The paint is sold in 5 litre tins at \$850 per tin.

Calculate

(i) the number of tins required,

(ii) the cost of the paint. [5]

(c) Harry is paid \$432 for painting the pool. Calculate his rate of pay per hour, if he takes 3 days, working 8 hours a day. [2]

(d) The pool is then filled with water to a depth of 1,25 m. Calculate the volume, in litres, of water in the pool. [3]

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5 (a) P is the point (6; 3) and Q is the point (2; 6).

Calculate

(i) $\overrightarrow{PQ}$,

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

(b) Given that $\mathbf{A} = \begin{pmatrix} 3 & 1 \\ 1 & -3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 0 & -2 \\ 2 & -6 \end{pmatrix}$,

calculate

(i) $\mathbf{A} + \mathbf{B}$, [2]

(ii) $\mathbf{AB}$, [2]

(iii) the inverse of $\mathbf{B}$, [2]

(iv) the value of K, given that

$A^2 = \begin{pmatrix} 10 & 0 \\ 0 & 10 \end{pmatrix}$ and $A^6 = K\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. [2]

---

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

Use ruler and compass only for all constructions and show clearly all the construction lines and arcs.

William is walking straight across a field towards a vertical flagpole. He observes that when he is at point A, the angle of elevation of T, the top of the flagpole, is 30° and when he is at point B, on the same side of the flagpole as A, the angle of elevation of T is 45°. The distance between A and B is 20 metres.

(a) Using a scale of 1 cm to represent 4m, construct a single diagram to show the relative positions of A, B and T. [5]

(b) Using a suitable construction **on the same diagram,** find the height of the flagpole. [4]

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Section B [36 marks]

*Answer **three** questions in this section.*

7 **(a)** Given the two equations

$3x + 2y = 9$ and

$2x + 3y = 16$, find

(i) the value of $x + y$ by adding the two equations,

(ii) the value of $x - y$ by subtracting the two equations.

Hence, or otherwise, solve the equations for x and y. [4]

(b)

In the diagram, ABCD is a trapezium in which AB is parallel to DC and $A\hat{B}C = 90°$.

(i) Given that AB = $(x + 4)$ cm, DC = $(3x - 2)$ cm and BC = $(x - 3)$ cm, find in terms of x, an expression for the area of the trapezium.

(ii) Given that the area of the trapezium is 16 cm^2, form an equation in x and show that it reduces to $2x^2 - 5x - 19 = 0$.

(iii) Solve this equation and hence find the length of BC correct to 1 decimal place. [8]

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8 (a) In a group of five boys, three play soccer and two play hockey.

(i) One boy is chosen at random, write down the probability that he is a soccer player

(ii) Two boys are chosen at random, calculate the probability that one plays soccer and the other plays hockey. [4]

(b) **Answer the whole of this question on a sheet of graph paper.**

Two variables P and Q are connected by a law of the form P = kQ, where k is a constant. The table below shows corresponding values of P and Q

P	0	3	6
Q	0	5	10

(i) Using a scale of 2 cm to represent 1 unit on both axes, with P along the horizontal axis and Q along the vertical axis, draw a graph to show the relationship between P and Q. [2]

(ii) Use the graph to find the value of

(a) k, [2]

(b) Q when P = 4. [2]

(iii) Calculate the value of P when Q = 30 [2]

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9 (a)

In the diagram, AB is a diameter of the circle, centre O. TA is the tangent at A and $T\hat{A}C = 2x°$. Find, in terms of x,

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

(ii) $C\hat{O}A$,

(iii) $A\hat{C}O$,

(iv) $C\hat{O}B$. [4]

(b)

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In the diagram, A is 5,5 km due north of B, AC = 3,0 km and $B\hat{A}C = 118°$.

Calculate

(i) the bearing of C from A,

(ii) the distance that A is east of C,

(iii) the distance BC. [8]

---

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

The following is an incomplete table of values for the function $y = 12 + 5x - 2x^2$.

x	-2	$-1\frac{1}{2}$	-1	0	1	2	3	4	5
y	-6	0	p	12	15	q	9	0	-13

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

(b) Using a scale of 2 cm to represent 1 unit on the x – axis, draw the graph of $y = 12 + 5x - 2x^2$ for $-2 \leq x \leq 5$. 4]

(c) Use the graph to

(i) solve the equation $4 + 5x - 2x^2 = 0$,

(ii) find the gradient of the curve when $x = 3$,

(iii) find the area bounded by the curve $y = 12 + 5x - 2x^2$, the x – axis, the y – axis and the line $x = 3$. [6]

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11

The triangles ABC, $A_1B_1C_1$, $A_2B_2C_2$ and the line ℓ are shown in the diagram.

(a) $\Delta A_1B_1C_1$ is the image of ΔABC under a translation. Write down the column vector of this translation. [1]

(b) Describe completely the transformation that maps ΔABC onto $\Delta A_2B_2C_2$. [3]

(c) $\Delta A_3B_3C_3$ (not shown in the diagram) is the image of ΔABC under a reflection in the line ℓ. Write down

(i) the equation of the line ℓ,

(ii) the matrix of this reflection,

(iii) the coordinates of the points A_3 and C_3. [5]

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In the diagram, A is 5,5 km due north of B, AC = 3,0 km and $B\hat{A}C = 118°$.

Calculate

(i) the bearing of C from A,

(ii) the distance that A is east of C,

(iii) the distance BC. [8]

---

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

The following is an incomplete table of values for the function $y = 12 + 5x - 2x^2$.

x	-2	$-1\frac{1}{2}$	-1	0	1	2	3	4	5
y	-6	0	p	12	15	q	9	0	-13

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

(b) Using a scale of 2 cm to represent 1 unit on the x – axis, draw the graph of $y = 12 + 5x - 2x^2$ for $-2 \leq x \leq 5$. 4]

(c) Use the graph to

(i) solve the equation $4 + 5x - 2x^2 = 0$,

(ii) find the gradient of the curve when $x = 3$,

(iii) find the area bounded by the curve $y = 12 + 5x - 2x^2$, the x – axis, the y – axis and the line $x = 3$. [6]

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(d) $\Delta A_4B_4C_4$ (not shown in the diagram) is the image of ΔABC under a shear with invariant line $y = 0$. Given that A_4 is the point (4; 1), write down

(i) the shear factor,

(ii) the matrix that represents this transformation. [3]

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12

In this question take π to be $\frac{22}{7}$.

A large solid cone is cut into two parts by a plane parallel to its horizontal circular base, the upper part being a small solid cone.

The figure above represents the solid, with V the vertex, AB the base diameter and VO the perpendicular height of the large cone. DC is the base diameter and VP the perpendicular height of the smaller cone.

Given that AO = OB = 14 cm, VO = 10,5 cm and VP = 3 cm,

calculate

(a) DP, [3]

(b) DA, [3]

(c) the ratio of the volume of the smaller cone to the volume of the larger cone, giving the answer as a fraction in its lowest terms. [3]

(d) the curved surface area of the smaller cone. [3]

[Volume of a cone = $\frac{1}{3}\pi r^2 h$. Curved surface area of a cone = $\pi r \ell$.]

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MATHEMATICS **NOV 2001**

4008/4028/02

POSSIBLE ANSWERS

1. (a) (i) Fraction left $1 - \frac{3}{5}$ M1

$= \frac{2}{5}$

Therefore amount left $= \frac{5}{2} \times 20$ M1

$= \$50$ A1

(b) Area of big rectangle =9x7 M1
Area of small rectangle = 8x6 M1
Therefore area of path =9x7 - 8x6 M1
= 15m² A1

(c) 54 minutes as a % of 2 hrs $= \frac{54}{120} \times 100$ M1

=45% A1

(d) \$23,46 : 115%

Therefore 100% $= \frac{100}{115} \times \frac{23,46}{1}$ M2

=\$20,40 A1

[12]

2. (a) (i) Factors of $x^2 - 4$ are $x + 2$ and $x - 2$ B1

(ii) Factors of x^2+4x+4 are $x+2$ and $x+2$ B1

(iii) LCM = $(x + 2)(x + 2)(x - 2)$ B1

(b) $\frac{9}{a} + 18 = 0$

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$9 + 18a = 0$

$18a = -9$ M1

$a = -\frac{1}{2}$ A1

(c) $\frac{1}{s} + \frac{1}{t} + \frac{1}{st}$

$= \frac{t+s+1}{st}$ B2

(d) (i) C $= \frac{5 \times 95 - 160}{9}$ M1

$= 35°$ A1

(ii) $9C = 5F - 160$

$5F = 9C + 160$ M1

$F = \frac{9c + 160}{5}$ A1

[11]

3. (a) $\frac{QR}{12} = \text{Cos } 36{,}7°$

$QR = 12 \text{ Cos } 36{,}7°$ M1

$= 9{,}621$ cm A1

(b) $\frac{SR}{12} = \text{Sin } 36{,}7°$

$SR = 12 \text{ Sin} 36{,}7°$ M1

$\therefore PR = 4{,}8 + 12 \text{ Sin } 36{,}7°$ M1

$= 11.97$ cm A1

(c) $\tan y = \frac{9{,}621}{11{,}97}$ M1

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$\therefore y = 38{,}8°$ or $38°47'$ A1

(d) $P\hat{S}Q = 90° + 36{,}7°$

$= 126{,}7°$

Area of $\Delta PSQ = \frac{1}{2} \times 12 \times 4{,}8 \sin 126{,}7°$ M1

$= 23{,}09$ cm. A1

[9]

4. (a) Internal surface area
$= 2 \times 5 \times 1{,}5 + 2 \times 12 \times 1{,}5 + 12 \times 5$ M1

$= 111 m^2$ A1

(b) (i) No. of 1 l tins $= \frac{111}{3}$ M1

No. of 5l tins $= \frac{111}{3 \times 5}$ M1

$= 8$ tins A1

(ii) Cost of paint $= 8 \times 850$ M1

$= \$6\ 800$ A1

(c) Total No. of hours $= 3 \times 8$
Rate of pay $= \frac{432}{3 \times 8}$ M1

$= \$18$ A1

(d) Volume of water $= 12 \times 5 \times 1{,}25\ m^3$ M1

$= 12 \times 5 \times 1{,}25 \times 1000l$ M1

$= 75\ 000l$ A1

[12]

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5. (a) (i) $\overrightarrow{PQ} = \begin{pmatrix} 2 \\ 6 \end{pmatrix} - \begin{pmatrix} 6 \\ 3 \end{pmatrix}$

$= \begin{pmatrix} -4 \\ 3 \end{pmatrix}$ B1

(ii) $\overrightarrow{PQ} = \sqrt{(-4)^2 + 3^2}$ M1

= 5 A1

(b) (i) $A + B = \begin{pmatrix} 3+0 & 1-2 \\ 1+2 & -3-6 \end{pmatrix}$

$= \begin{pmatrix} 3 & -1 \\ 3 & -9 \end{pmatrix}$ B2

(ii) $AB = \begin{pmatrix} 3\times 0 + 1\times 2 & (3\times -2) + (1\times -6) \\ 1\times 0 + (-3\times 2) & (1\times -2) + (-3\times -6) \end{pmatrix}$

$\begin{pmatrix} 2 & -12 \\ -6 & 16 \end{pmatrix}$ B2

(iii) det B =(0 x –6) – (–2 x 2)

= 4

$B^{-1} = \frac{1}{4}\begin{pmatrix} -6 & 2 \\ -2 & 0 \end{pmatrix}$ B2

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(iv) $A^2 = 10\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

$\therefore A^6 = (A^2)^3 = 1000\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ M1

$\therefore$ k = 1 000 A1

[11]

6.

First draw a horizontal line and mark the points A and B, 5cm apart.

Construct an angle of 30° at A M1

Correct construction arcs A1

Construct an angle of 45° at B M1

Correct construction arcs A1

Accurate ΔABT with AB= 5 cm±0,2cm Δ1

Construct a perpendicular from T to AB produced. L1

Correct construction arcs C1

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Length of perpendicular from T in the range 6,6 -7,0 cm. A1

Height of flag pole = 6,8 x 5

= 27,2 ±0,8 m A1

[9]

7. (a) (i) $3x + 2y = 9$
$+(2x + 3y = 16)$
$5x + 5y = 25$

$\therefore x + y = 5$ B1

(ii) $x - y = -7$ B1

$x + y = 5$
$+(x - y = -7)$
$2x = -2$
$x = -1$ B1

$\therefore y = 6$ B1

(b) (i) Area of trapezium $= \frac{1}{2}(3x-2+x+4)(x-3)$ M1

(ii) $\frac{1}{2}(3x-2+x-4)(x-3) = 16$ M1
$\frac{1}{2}(4x+2)(x-3) = 16$
$2x^2 - 5x - 19 = 0$ A1

(iv) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{-5 \pm \sqrt{(-5)^2 - 4(2)(-19)}}{2 \times 2}$

$= \frac{5 \pm \sqrt{177}}{4}$ B1B1 B1

= 4,6 and -2,1

OR 4,576 and -2,076 B1

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BC = 4,576 –3

=1,6 B1

Alternatively by completing the square,

$\left(x-\frac{5}{4}\right)^2$ B1

$\sqrt{\frac{177}{16}}$ B1

$x=\frac{5}{4}\pm\sqrt{\frac{177}{16}}$ B1

= 4,6 and -2,1 B1

[12]

8. (a) (i) P(Soccer player) = $\frac{3}{5}$ B1

(ii) $P(1st\ soccer\ 2nd\ hockey)=\frac{3}{5}\times\frac{2}{4}$

$P(1st\ hockey\ 2nd\ soccer)=\frac{2}{5}\times\frac{3}{4}$

$\therefore P(1soccerand1hockey) = \frac{3}{5}\times\frac{2}{4}+\frac{2}{5}\times\frac{3}{4}$ M2

$= \frac{3}{5}$ A1

(b) Refer to graph below

(i) (0,0), (3,5) and (6,10) correctly plotted P1
Correct straight line drawn L1

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(ii) (a) $k = \frac{1}{gradient}$

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

$= \frac{3}{5}$ B2

(b) Vertical line at P =4 to graph and across to Q Axis. M1

Q=6,6 A1

(iii) When Q = 30,

$P = \frac{3}{5} \times 30$ M1

$= 18$ A1

[12]

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9 (a)

(i) $C\hat{B}O = 2x^0$ (*angle in alternative segment*) B1

(ii) $C\hat{O}A = 4x°$ (exterior angle of ΔOCB) B1
(iii) $A\hat{C}O = 90° - 2x°$ B1
(iv) $C\hat{O}B = 180° - 4x°$ B1

(b) (i) Bearing = 180°+118°

=298° B1

(ii) Distance = 3 Sin (180°-118°) M1
= 2,649 km A1

(iii) $BC^2 = 3^2 + 5,5^2 - 2 \times 3 \times 5,5 \cos 118$ M1
$= 3^2 + 5,5^2 + 2 \times 3 \times 5,5 \cos (180-118)$ M1
= 54,74 A1

$BC = \sqrt{54,74}$ M1

$= 7,399km$ A1

[12]

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10.	(a)		$p=5$	B1
			$q=14$	B1
	(b)		Refer to graph The 7 given points and (1½;5) and (2;14) correctly Plotted. Correct curve, smooth, not grossly Thick, passing through all 9 points	P3 C1
	(c)	(i)	Line $y = -8$ drawn $x = -2{,}1$ and $4{,}6$	M1 A1
		(ii)	tangent drawn at $x = 3$ gradient $= -7$	M1 A1
		(iii)	Area = 40,5 (units)^2	B2 [12]

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(a) p = 5
q = 14

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11. (a) $\begin{pmatrix}6\\12\end{pmatrix}-\begin{pmatrix}0\\4\end{pmatrix} OR \begin{pmatrix}10\\12\end{pmatrix}-\begin{pmatrix}4\\4\end{pmatrix} OR \begin{pmatrix}8\\a\end{pmatrix}-\begin{pmatrix}2\\1\end{pmatrix}$

$\begin{pmatrix}6\\8\end{pmatrix}$ *T*1

(b) Rotation M1

90° anticlockwise or 270°clockwise A1

Centre (–3;4) A1

(c) (I) line L has gradient –1 and intercepts the y axis at 0

Therefore equation of line is $y = -x + 0$ or $y = -x$ E1

(ii) *Matrix of reflection* $\begin{pmatrix}0 & -1\\-1 & 0\end{pmatrix}$ *R*2

(iii) $\begin{pmatrix}0 & -1\\-1 & 0\end{pmatrix}\begin{pmatrix}2 & 0\\1 & 4\end{pmatrix}=\begin{pmatrix}-1 & -4\\-2 & 0\end{pmatrix}$

Coordinates are A_3 (–1;–2) *B*1

C_3 (–4; 0) *B*1

(d) (i) The x coordinate has been increased by a factor 2

Therefore scale factor = 2 B1

(ii) *Matrix for the shear is* $\begin{pmatrix}1 & 2\\0 & 1\end{pmatrix}$ *B*2

[12]

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12. (a)

Δs AOV and DPV are similar

Therefore $\frac{DP}{3} = \frac{14}{10.5}$ M1

DP = $\frac{3 \times 14}{10.5}$ M1

=4 cm A1

(b) $DA^2 = (14-DP)^2 + 7,5^2$

$DA = \sqrt{10^2 + 7,5^2}$ M2

$= 12,5cm$ A1

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(c) $Ratio\ of\ volumes = \left(\frac{3}{10,5}\right)^3$ M1

$Ratio\ of\ height = \frac{3}{10,5}$

$= \left(\frac{3}{1} \times \frac{2}{21}\right)^3$ M1

$= \frac{8}{343}$ A1

(d) $Curved\ surface\ area = \frac{22}{7} \times 4 \times 5$ M1

= 62,857 A2

[12]