ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4028/2

PAPER 2

JUNE 2011 SESSION 2 hours 30 minutes

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

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

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

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

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

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.

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

Copyright: Zimbabwe School Examinations Council, J2011.

Section A [64 marks]

Answer all the questions in this section.

1 **(a)** Simplify $\left(3\frac{1}{2}-1\frac{3}{5}\right)\div 1\frac{2}{3}$. [3]

(b) Find the exact value of

(i) $10{,}03 \times 0{,}17$;

(ii) $7{,}2 + 0{,}018$. [2]

(c) Three farmers share 120 hectares of land in the ratio 3 : 4 : 5.

Calculate the area of the largest piece of land. [2]

(d) Find the Highest Common Factor (H.C.F) of

$27x^2yz$,
$72xy^3z^2$ and
$108xyz^3$. [2]

---

2 **(a)** It is given that $r = 2q - 5$ and $q = 3p + 2$.

(i) Express r in terms of p.

(ii) Given also that $p = -3$, find the numerical value of r. [3]

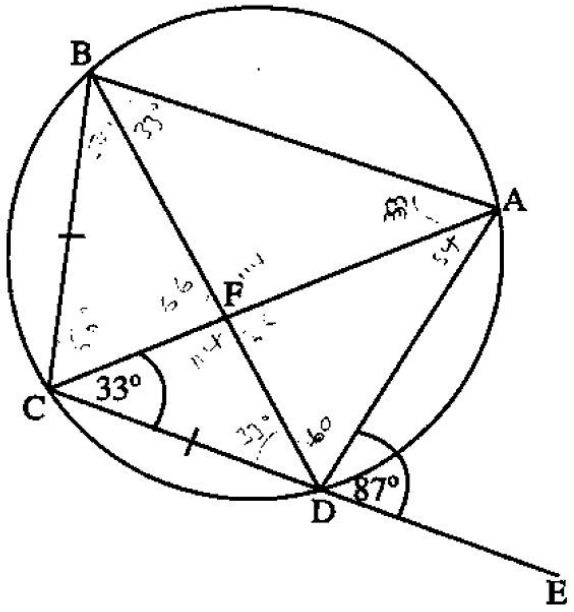
(b) **(i)** Express $\frac{x}{3}+\frac{x-4}{5}$ as a single fraction in its simplest form.

(ii) Hence or otherwise solve the equation $\frac{x}{3}+\frac{x-4}{5}=4$. [4]

(c) Express 150 g as a percentage of 3 kg. [2]

---

3 (a)



The diagram shows points A, B, C and D on the circumference of a circle such that BC = CD. AC and BD intersect at F and CD is produced to E. $A\hat{C}D = 33°$ and $A\hat{D}E = 87°$. Calculate

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

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

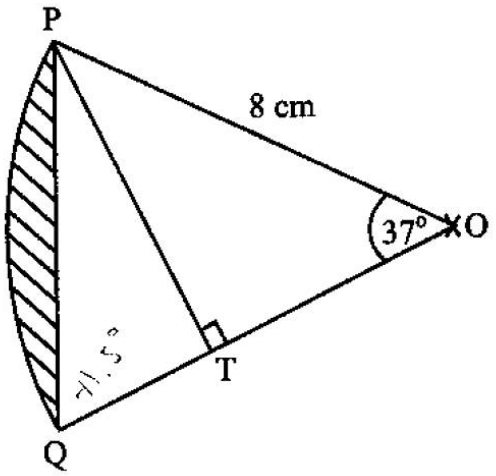
(iii) $B\hat{A}C$,

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

(v) $C\hat{F}D$.

[6]

(b)



Take π to be 3,142.

The diagram shows a sector of a circle centre O. $P\hat{O}Q = 37°$, PO = 8 cm and PT is perpendicular to QO. Calculate

(i) PT,

(ii) area of the sector,

(iii) area of triangle PQO,

(iv) the area of the shaded segment.

[7]

---

4 **(a)** Factorise completely

(i) $3np - 6nq + ap - 2aq$,

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

(b) In a survey of 72 girls, it was found that every girl watched at least one of the following TV programmes, Teen Scene or Fashion Show. Fifty girls watched Teen Scene and 62 girls watched Fashion Show. Find the number of girls who watched

(i) both programmes,

(ii) Fashion Show only. [4]

---

5 (a) (i) Convert 112_3 to a number in base 5.

(ii) Evaluate $1101_2 + 1011_2$, giving your answer in base 2. [3]

(b) (i) Show that $2\log_5(3x+2) - \log_5 2 = 1$ reduces to $3x^2 + 4x - 2 = 0$.

(ii) Solve the equation $3x^2 + 4x - 2 = 0$, giving your answers correct to two decimal places. [9]

---

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

Use ruler and compasses only and show clearly all construction lines and arcs. All constructions should be in a **single** diagram.

A secondary school, Boterekwa, is to be built to service three primary schools Tugwi, Shinga and Hlangu. Shinga is 16 km from Tugwi on a bearing of 150°. Hlangu is 15 km North-East of Shinga.

(a) Using a scale of 1 cm to represent 2 km, construct a diagram to show the positions of the three primary schools. [7]

(b) Boterekwa is 8 km from Shinga and equidistant from Tugwi and Hlangu.

(i) Construct the locus of points 8 km from Shinga and the locus of points equidistant from Tugwi and Hlangu

(ii) Mark and label B_1 and B_2 the possible positions of Boterekwa. [4]

(c) Use your diagram to find the shorter distance between Boterekwa and Tugwi. [2]

Section B [36 marks]

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

Each question carries 12 marks.

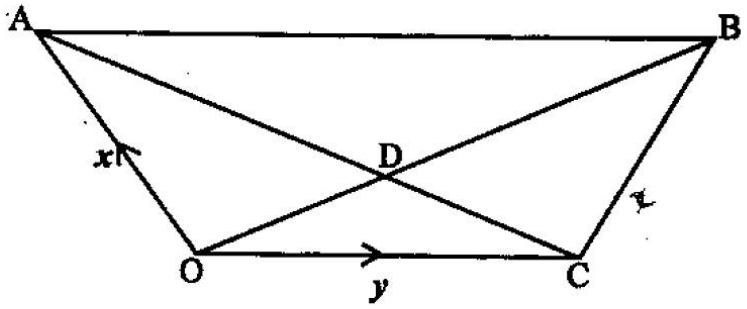
7 **(a)** Given that $\mathbf{A} = \begin{pmatrix} 3 & -4 \\ 1 & -2 \end{pmatrix}$,

(i) find the inverse of matrix **A**,

(ii) hence or otherwise solve the equations

$3x - 4y = -3$,
$x - 2y = -2$. [5]

(b)



The diagram shows a trapezium OABC where OC is parallel to AB, with $\overrightarrow{OA} = x$ and $\overrightarrow{OC} = y$. Diagonals OB and AC intersect at D such that AD : DC = 3 : 2.

Express, in terms of x and/or y,

(i) **(a)** $\overrightarrow{AC}$,

(b) $\overrightarrow{AD}$.

(ii) Given that $\overrightarrow{AB} = k\overrightarrow{OC}$, express $\overrightarrow{OB}$ in terms of k, x and y.

(iii) Given also that $\overrightarrow{OB} = h\overrightarrow{OD}$, express $\overrightarrow{OB}$ in terms of h, x and y.

(iv) Using results from **(ii)** and **(iii)** above, find the numerical value of h and the numerical value of k.

[7]

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

Triangle ABC has vertices A(2; 1), B(4; 1) and C(4; 4). Using a scale of 1 cm to represent 1 unit on both axes, draw the x and y-axes for $-4 \leq x \leq 14$ and $-10 \leq y \leq 12$.

(a) Draw and label clearly triangle ABC. [1]

(b) Triangle $A_1B_1C_1$ is a reflection of triangle ABC in the line $y = -2$. Draw and label clearly triangle $A_1B_1C_1$. [3]

(c) Triangle $A_2B_2C_2$ has vertices $A_2(6; 4)$ $B_2(10; 4)$ and $C_2(10; 10)$.

(i) Draw and label clearly triangle $A_2B_2C_2$.

(ii) Describe fully the **single** transformation that maps triangle ABC onto triangle $A_2B_2C_2$.

[4]

(d) Triangle ABC is rotated through 90° anticlockwise about (0; 0) onto triangle $A_3B_3C_3$.

(i) Draw and label clearly triangle $A_3B_3C_3$.

(ii) Write down the matrix that represents this transformation. [4]

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

The table below shows the grades obtained by candidates in a Mathematics examination.

Grade	A	B	C	D	E	U
Frequency	10	25	40	24	21	30

(a) Calculate the number of candidates who wrote the examination. [2]

(b) State the modal grade. [1]

(c) Using a scale of 2 cm to represent 5 candidates, draw a bar graph to show the information. [4]

(d) Given that the passing grades are A, B and C, find the probability that two candidates chosen at random passed the examination. [3]

(e) If a pie-chart is drawn for this information, calculate the angle of the sector that represents grade C. [2]

10 **(a)** The length, l, of a rectangle of constant area varies inversely as b, the width of the rectangle.

(i) State the relationship between l, b and a constant k.

(ii) Given that $l = 8{,}5$ cm when $b = 6$ cm, find b when $l = 10{,}2$ cm. [4]

(b) **Answer this part of the question on a sheet of graph paper.**

Using a scale of 1 cm to represent 1 unit on the $x-$axis and 2 cm to represent 1 unit on the y-axis draw the x and y axes for $0 \leq x \leq 14$ and $-3 \leq y \leq 5$.

(i) Show by shading the **unwanted** regions, the region which is

defined by $x \geq 3$,

$y \geq -2$,

and $x + 2y \leq 8$.

(ii) From the region defined, find the coordinates of a point that gives a maximum value of $3x - 2y$.

(iii) State the maximum value of $3x - 2y$.

[8]

11 (a) The pattern below refers to the number of elements in a set and the number of subsets of that set. Study the pattern and answer the questions that follow.

Number of elements in a set	Number of subsets
1	2
2	4
3	8
4	16
5	p
.	.
.	.
.	.
q	128
.	.
.	.
.	.
n	r

(i) Find the value of p and the value of q.

(ii) Express r in terms of n. [4]

(b) Mbudzi Investments borrowed \$6 000 from a bank to start a project. The bank charged them interest and expected the company to pay \$120 per month to service the loan. The following is an incomplete Loan Account Statement for Mbudzi Investments.

Date	**Details**	**Debit** **\$**	**Credit** **\$**	**Balance** **\$**
1-09-06				6 000
30-09-06	Interest	80		6 080
30-09-06	Repayment		120	5 960
30-10-06	Interest	79,47		6 039,47
30-10-06	Repayment		120	5 919,47
30-11-06	Interest	78,93		5 998,40
30-11-06	Repayment		120	5 878,40
30-12-06	Interest	w		x
30-12-06	Repayment		y	z

(i) Find the rate of simple interest per annum.

(ii) Calculate the values of

(a) w,

(b) x,

(c) y,

(d) z.

[8]

---

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

The velocity of a particle moving along a straight line is given by $v = 15 + 7t - 2t^2$.

The table below shows corresponding values of v and t.

Time (t) s	0	1	2	3	4	5	6
Velocity (v)m/s	15	p	21	18	q	0	−15

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

(b) Using a scale of 2 cm to represent 5 m/s on the v-axis and 2 cm to represent 1 second on the t-axis, draw a graph of $v = 15 + 7t - 2t^2$ from $t = 0$ to $t = 6$. [4]

(c) Use your graph to estimate

(i) the maximum value of v,

(ii) the acceleration of the particle when t = 3 seconds,

(iii) the distance travelled by the particle from $t = 0$ to $t = 5$. [6]

BLANK PAGE