ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

PURE MATHEMATICS 4027/2

PAPER 2

SPECIMEN PAPER 2 hours 30 minutes

Additional materials: Answer paper
Mathematical Data booklet MF 7
Non-programmable electronic calculator
Mathematical instruments
Mathematical tables

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

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

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

Write your answers on the separate answer paper provided.

If you use more than one sheet of paper, fasten the sheets together.

All working must be clearly shown on the same sheet as the rest of the answer.

Omission of essential working will result in loss of marks.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise. Decimal 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.
Non-programmable Electronic calculators or Mathematical tables may be used to evaluate explicit numerical expressions.

This Specimen paper consists of 5 printed pages.

Section A [52 marks]

*Answer **all** questions in this Section.*

1 Simplify

(a) $\left(2\frac{1}{4}\right)^{-\frac{1}{2}}$, [3]

(b) $\frac{3+\sqrt{2}}{2+\sqrt{3}} + \sqrt{6} - 2\sqrt{2}$. [3]

(c) $\text{Log}15 + 2\log 2 - \log 6$. [3]

2 **(a)** **(i)** Show that $x^3 + 4x^2 + x - 6$ is divisible by $x + 3$. [2]

(ii) Hence factorise completely $x^3 + 4x^2 + x - 6$. [3]

(b) Express $\frac{x-3}{(x+1)(x+2)}$ in partial fractions. [5]

3 **(a)** **(i)** Express $3x^2 - 6x + 1$ in the form $a(x + b)^2 + c$ where a, b and c are intergers. [3]

(ii) Hence or otherwise state the minimum value of $3x^2 - 6x + 1$. [1]

(b) Solve the equations:

$a + 3b = 1$
$ab = -2$ [3]

(c) Find the value of k: $k \neq 0$ so that the equation $kx^2 + 2kx + 1 = 0$ has equal roots. [4]

4 **(a)** Use the substitution $y = 3^x$ to solve the equation $3^x + 3^{-x} = 2$. [4]

(b) Solve the inequality $x(x + 1)(x - 1) < 0$. [4]

(c) Expand and simplify $(1 + x)^4$ [3]

5 **(a)** Solve the equation $3sin2\theta - 2 = 0$, for $0° \leq \theta \leq 360°$. [7]

(b) Solve the equation $2^{x+1} = 3$ giving the answer to two decimal places. [4]

Section B [48 marks]

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

Each question in this section carries 12 marks

6 The position vectors of points **A**, **B** and **C** are $2\boldsymbol{i} + 3\boldsymbol{j} + 5\boldsymbol{k}$, $\boldsymbol{i} + 7\boldsymbol{j} - 3\boldsymbol{k}$ and $-2\boldsymbol{i} + 3\boldsymbol{j}$ respectively.

Find

(a) $|\mathbf{BC}|$, [3]

(b) the unit vector in the direction of **AC**, [3]

(c) the angle between **AB** and **BC**, [4]

(d) the area of triangle **ABC**. [2]

7 **(a)** Show that the equation $x^3 + 3x^2 - 5x = 0$ has a root between 1 and 2. [3]

(b) **(i)** Differentiate $x^3 + 3x^2 - 5x$, with respect to x. [2]

(ii) Use the Newton-Raphson method, once to estimate the root of the equation $x^3 + 3x^2 - 5x = 0$ starting with $x_0 = 1{,}25$. Give the answer correct to four significant figures. [2]

(c) Use the trapezium rule with 4 ordinates to estimate the area of the region bounded by the curve $y = 3 + 2x - x^2$, the x-axis and the lines $x = 0$ and $x = 3$. [5]

8 Points A, B and C have coordinates (1;3), $(2; -1)$ and $(-2; -2)$ respectively.

Find the

(a) gradient of line segment AB, [2]

(b) equation of line AB, [2]

(c) distance from C to the mid-point of AB, leaving the answer in surd form. [4]

(d) area of triangle ABC. [4]

9 **(a)** In an arithmetic progression, the second term is $3\frac{1}{2}$ and the fourth term is $4\frac{1}{2}$.

Find the

(i) first term and the common difference, [3]

(ii) ninth term. [2]

(iii) sum of the first 17 terms. [2]

(b) In a geometric progression the first term is $\frac{1}{4}$ and the common ratio is 2.

Find the

(i) eighth term, [2]

(ii) value of n, given that the sum of the first n terms is 255,75. [3]

10 Given that $f(x) = x^3 + 2x^2 + x + 2$

Find the

(a) gradient of $f(x)$ at $x = 1$, [2]

(b) equation of the tangent to the curve $f(x)$ at $x = 1$. [3]

(c) equation of the normal to the curve at $x = 1$. [3]

(d) coordinates of the stationary points of $f(x)$. [4]

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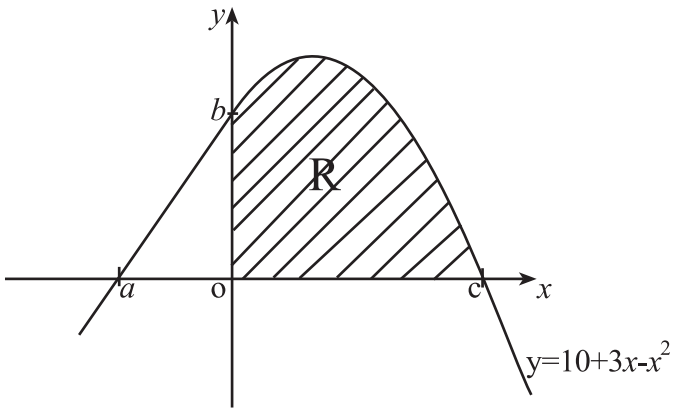

The diagram shows the graph of $y = 10 + 3x - x^2$. The region bounded by the curve between $x = 0$ and $x = c$ is denoted by **R**.

(a) Find the values of

(i) a, [1]

(ii) b, [1]

(iii) c. [1]

(b) Find the area of the region **R**. [4]

(c) Find the volume generated by rotating the region **R** through 360º about the x-axis. [5]

12 The functions f and g are such that $f: x \to \frac{3}{x} - 4$ and $g: x \to (x-1)^2 + 2$

(a) State the domain and range of g. [2]

(b) Give a reason why function f is one to one. [1]

(c) Find the inverse of f. [3]

(d) Find gof. [2]

(e) Sketch the graph of g. [3]

(f) Give a reason why g has no inverse. [1]