EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

Additional Mathematics 4030/2

Paper 2

Specimen

Additional Materials:

Answer Booklet;
Silent electronic calculator (non programmable)

Time: 2 hours 30 Minutes

Instructions to Candidates

Write your **name, centre number** and **candidate number** in the spaces on the separate Answer Booklet provided.

There are **twelve (12)** questions in this paper. Answer **all** questions.

Write your answers on the **Answer Booklet** provided.

If you use more than one Answer Booklet, **fasten** the Answer Booklets together.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

Information for candidates

The number of marks is shown in brackets [ ] at the end of each question or part question. The total number of marks for this paper is 100.

The use of a non programmable electronic calculator is expected where appropriate.

Cell phones are not allowed in the examination room.

Check the formulae overleaf

Mathematical Formulae

1 ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

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

2 SERIES

Arithmetic $S_n = \frac{1}{2} n [2a + (n-1)d]$

Geometric $S_n = \frac{a(1-r^n)}{1-r}$ $(r \neq 1)$

$$S\infty = \frac{a}{1-r} \text{ for } |r| < 1$$

3 TRIGONOMETRY

Identities

$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$.

$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$.

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$\sin 2A = 2 \sin A \cos B$

$\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

4 STATISTICS

Mean and standard deviation

Ungrouped data

$$\text{Mean } (\bar{x}) = \frac{\Sigma x}{n}, \quad \text{SD} = \sqrt{\left\{\frac{\Sigma(x-\bar{x})^2}{n}\right\}} = \sqrt{\left\{\frac{\Sigma x^2}{n} - (\bar{x})^2\right\}}$$

Grouped data

$$\text{Mean } (\bar{x}) = \frac{\Sigma fx}{\Sigma f}, \quad \text{SD} = \sqrt{\left\{\frac{\Sigma f(x-\bar{x})^2}{\Sigma f}\right\}} = \sqrt{\left\{\frac{\Sigma fx^2}{\Sigma f} - (\bar{x})^2\right\}}$$

1 Solve the following systems of equations

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

$x - 2y - 4z = 8$,

$3x + 5y + 2z = -7$. [6]

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2 (a) Find the range of values of x for which $3x^2 - 10x - 8 < 0$. [3]

(b) Express $12x^2 - 6x + 5$ in the form $a(x + b)^2 + c$, where a, b and c are constants. Hence, find the minimum value of $12x^2 - 6x + 5$. [4]

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3 Solve the equations

(a) $4^{3x-2} = 19$, [3]

(b) $\log_2(2x^2 + 3x + 5) = 3 + \log_2(x + 1)$. [4]

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4 (a) Find the value of k, given that the expression $3x^3 - 14x^2 - 7kx + 10$ is exactly divisible by $(x + 1)$. [3]

(b) Solve the equation $2x^3 - 3x^2 - 30x + 56 = 0$. [4]

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5 (a) In how many ways can the letters of the word 'UNGROUPED' be arranged? [2]

(b) A team of 5 people is to be selected from 7 women and 6 men. Find the number of different teams that could be selected if there must be more women than men in the team. [5]

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6 (a) Solve the equation $\cos(x + 60°) = 2\sin x$ for values of x in the range $0° \leq x \leq 360°$. [4]

(b) (i) Express $5\sin x + 12\cos x$ in the form $R\sin(x + \alpha)$, where $R > 0$ and $0° < \alpha < 90°$. [3]

(ii) Hence, find the maximum value of $R\sin(x + \alpha)$. [1]

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7 (a) The sum of the first 6 terms of an arithmetic progression is 555 and the sum of the next 6 terms is 1 455. Find the first term and the common difference. [4]

(b) In a geometric progression, the third term is 45 and the fifth term is 405. Find the

(i) first term and the common ratio ($r > 0$), [3]

(ii) sum of the first 8 terms. [2]

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8 The table below shows the points scored by 95 students in an examination.

Points scored	1 – 3	4 – 6	7 – 9	10 – 12	13 – 15	16 – 18	19 – 21	22 – 24
Frequency	12	9	8	11	7	20	13	15

(a) Find the median class. [1]

(b) Calculate

(i) an estimate of the mean, [2]

(ii) the standard deviation. [6]

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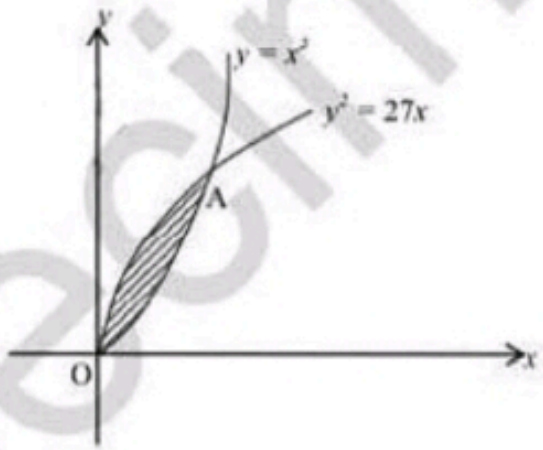
9 **(a)** A curve has equation $y = \frac{x+a}{x+2}$. Given that $\frac{dy}{dx} = -\frac{1}{25}$ when $x = 3$, find the value of a. [3]

(b) The diagram below shows part of the curves $y^2 = 27x$ and $y = x^2$ intersecting at O and A.



Find

(i) the coordinates of A, [3]

(ii) the volume obtained by rotating the shaded region through 360° about the x-axis. [4]

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10 The velocity, $V ms^{-1}$ of a particle moving in a straight line, t seconds after passing through a fixed point O, is given by $V = 36t - 3t^2$.

Find the

(a) value of t when the velocity is constant, [3]

(b) value of t when the velocity is at instantaneous rest, [3]

(c) distance of the particle from O when the particle is at instantaneous rest. [4]

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11 (a) The curves $y = e^{3x}$ and $y = e^{2-x}$ intersect at the point B.

Find the

(i) coordinates of B. [3]

(ii) gradient of each curve in terms of e, at B. [3]

(b) When $\log_{10} y$ is plotted against x, a straight line is obtained passing through the points (0.6, 0.3) and (1.1, 0.2). Find $\log_{10} y$ in terms of x. [4]

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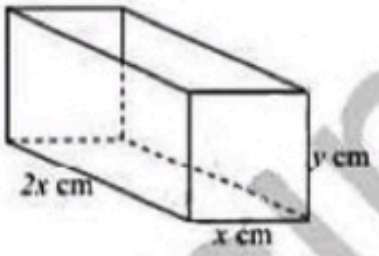
12 (a) A curve has equation $y = 2x - 3\sin x$. find the smallest positive value of x for which the curve has gradient $\frac{1}{2}$. [3]

(b) The diagram shows a cuboid with a rectangular base of sides x cm and $2x$ cm. The height of the cuboid is y cm and its total surface area is 120cm^2.



(i) Show that the volume $V\text{cm}^3$, of the cuboid is given by $V = 40x - \frac{4x^3}{3}$. [3]

(ii) Given that x can vary, find the dimensions of the cuboid when V is a minimum. [4]