

EXAMINATIONS COUNCIL OF ZAMBIA



Examination for General Certificate of Education Ordinary Level

Additional Mathematics

4030/2

Paper 2

2021

Additional Materials:

- Answer Booklet
- Silent electronic calculator (non programmable)

Time: 2 hours 30 Minutes

Marks: 100

Instructions to Candidates

1. Write the **centre number** and your **examination number** on **every page** of the separate **answer booklet** provided.
2. There are **twelve** questions in this paper. Answer **all** questions.
3. Write your answers in the separate Answer Booklet provided.
4. If you use more than one Answer Booklet, fasten the Answer Booklets together.
5. 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

1. The number of marks is shown in brackets [] at the end of each question or part question.
2. The use of a **non programmable electronic calculator** is expected, where appropriate.
3. You are reminded of the need for clear presentation in your answers.
4. Cell phones and other electronic devices are **not allowed** in the examination room.
5. 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 $S_n = \frac{a(1 - r^n)}{1 - r} \quad (r \neq 1)$

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

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

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

Grouped data

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

1 Solve the following systems of equations

$$2x + 3y + z = 17,$$

$$x - 3y + 2z = -8,$$

$$5x - 2y + 3z = 5.$$

[6]

2 (a) Find the range of values of u for which $3u^2 - 8u < 3$.

[3]

(b) Express $-3x^2 + 24x - 38$ in the form $a(x + b)^2 + c$, where a , b and c are constants. Hence, find the coordinates of the turning point.

[4]

3 Solve the equations

(a) $13^{3x-4} = \left(\frac{1}{4}\right)^{-3},$

[3]

(b) $\log_3(x + 25) = 2 + \log_3(2x - 1).$

[4]

4 (a) Find the value of q , given that the expression $x^3 + 3x^2 + qx - 24$ is divisible by $(x - 3)$.

[3]

(b) Solve the equation $x^3 - 7x + 6 = 0$.

[4]

www.eczpastpapers.com

5 (a) A group of 5 children consists of 2 girls whose names are Mary and Sarah, and 3 boys whose names are John, Joseph and James.

If these children sit in a straight line on 5 chairs, find the number of different possible seating arrangements if

(i) Joseph must sit in the middle,

[2]

(ii) Mary and John must sit together.

[3]

(b) A group of 6 designers is to be chosen from 8 men and 5 women. Find the number of ways of choosing at least 5 men.

[3]

6 (a) Solve the equation $3\sin(60^\circ - x) = \sin x$ for values of x in the range $0^\circ \leq x \leq 360^\circ$.

[4]

(b) (i) Express $4\cos x - \frac{5}{3}\sin x$ in the form $R\cos(x + \alpha)$, where

$$R > 0 \text{ and } 0^\circ < \alpha < 90^\circ.$$

[3]

(ii) Hence, find the maximum value of $12\cos x - 5\sin x$.

[1]

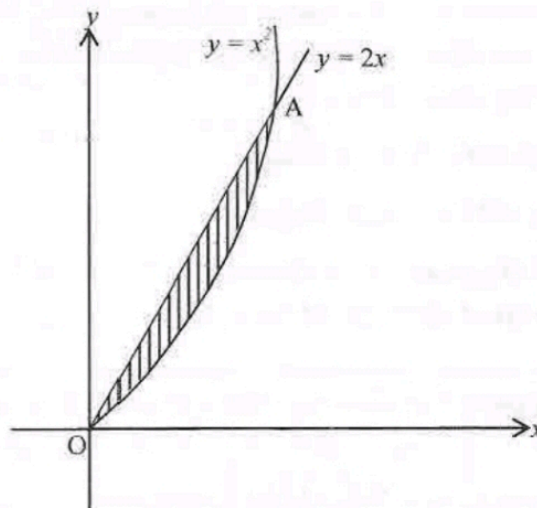
- 7 (a) In an arithmetic progression, the sum of the first 5 terms is 50 and the sum of the next 10 terms is 325. Find
- (i) the first term and the common difference, [3]
 - (ii) the sum of the first 13 terms of the progression. [1]
- (b) A doctor earns an annual salary of K4 000.00 during the first year of practice. In each succeeding year, the annual salary increases by 10%.
- (i) Find the sum of the doctor's annual salaries over the first 6 years. [2]
 - (ii) Find the number of years the doctor must work, if the sum of his annual salaries is to exceed a million kwacha. [3]

- 8 The table below shows the heights of 80 plants in a particular forest.

Height (cm)	164 - 168	169 - 173	174 - 178	179 - 183	184 - 188
Frequency	8	18	28	21	5

- (a) Find the median class. [1]
- (b) Calculate
 - (i) an estimate of the mean, [2]
 - (ii) the standard deviation. [6]

- 9 The following diagram shows part of the curve $y = x^2$ and the line $y = 2x$ meeting at A.

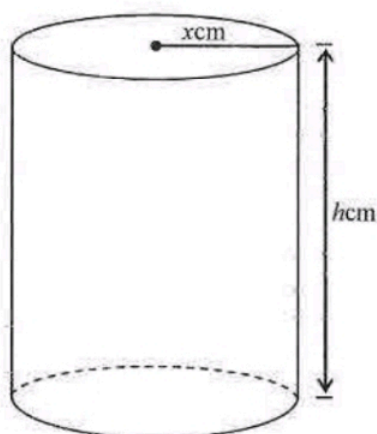


Find

- (a) the coordinates of A, [3]
- (b) the volume obtained by rotating the shaded region through 360° about the x-axis. [6]

- 10 The velocity, V m/s, of a particle moving in a straight line, at time t seconds is given by $V = 3t^2 - 2t + 2$. When $t = 0$, the particle is 3m from a fixed point O on the line.
- (a) Find the acceleration when $t = 1.5$. [2]
- (b) Find an expression in terms of t , for its distance from the fixed point. [4]
- (c) Find the distance between $t = 1$ and $t = 2$. [4]

- 11 The following diagram shows a cylindrical metal plate of radius x cm and height, h cm.



- (a) Given that its volume is 500cm^3 , express h in terms of x . [2]
- (b) Hence show that the total surface area (A) of the cylinder is given by
- $$A = 2\pi x^2 + \frac{1000}{x} \text{cm}^2. \quad [3]$$
- (c) Given that x varies, find the stationary value of A and show that this value is a minimum. [5]

- 12 The curve $y = e^{-2x} - 3$ meets the x -axis at P and the y -axis at Q .
- (a) Find the coordinates of P and of Q . [3]
- (b) Sketch the graph of $y = e^{-2x} - 3$ for the domain $-1 \leq x \leq 1$. [3]
- (c) Find the equation of the straight line which must be drawn on the graph of $y = e^{-2x} - 3$ to obtain a solution of the equation $x = \ln\left(\frac{1}{\sqrt{x+5}}\right)$. [4]