

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Additional Mathematics 4030/2
Paper 2

Wednesday

27 JULY 2016

Additional materials:

Answer Booklet

Mathematical tables/Electronic calculators (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 in 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.

MATHEMATICS FORMULAE

1 ALGEBRA

Quadratic Equation

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

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

2 SERIES

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

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

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

3 TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1.$$

$$\sec^2 A = 1 + \tan^2 A.$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A.$$

Formula for Δ ABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A.$$

$$\Delta = \frac{1}{2} bc \sin A$$

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 simultaneous equations
- $$\begin{aligned}x + 4y + 3z &= 10, \\2x + y - z &= -1, \\3x - y + z &= 11.\end{aligned}$$
- [6]
- 2 (a) Solve the inequality $3x^2 < 10x - 3$. [3]
- (b) Given that $y = 7 - 5x - 3x^2$, express y in the form $a - b(x + c)^2$, where a , b and c are constants. Hence or otherwise, write the coordinates of the turning point of y . [4]
- 3 Solve the equations
- (a) $8^{x-1} = 3$, [3]
- (b) $\log_3(2x + 1) = 2 + \log_3(3x - 1)$. [4]
- 4 The expression $x^3 + ax^2 + bx + 12$ is divisible by $(x - 1)$ and $(x + 3)$.
- (a) Find the values of a and b . [4]
- (b) Find the remaining factor of the expression. [1]
- (c) Hence or otherwise, solve the equation $x^3 + ax^2 + bx + 12 = 0$. [3]
- 5 (a) Calculate the number of arrangements of the letters in the word LOGARITHMS. [2]
- (b) 12 different books are to be arranged on a shelf. If the shelf has a space for 8 books, how many ways are there of arranging 8 of the books on the shelf? [3]
- (c) A committee of 6 members is to be chosen from 5 students and 4 teachers. Find the number of ways of choosing 4 students and 2 teachers. [3]
- 6 (a) The volume $V\text{cm}^3$ of a liquid in a container when the depth of the liquid is x cm is given by $V = 2x^3 - 4x^2 + 5$.
Given that the depth is increasing at the rate of 1.5cm/s , find the rate of increase in the volume of the liquid when $x = 4$. [2]
- (b) The velocity, $V\text{m/s}$, of a particle moving in a straight line is given by $V = 4 + 3t - t^2$. Find
- (i) the value of t when the particle is at instantaneous rest, [2]
- (ii) the maximum velocity, [1]
- (iii) the displacement of the particle from O when $t = 4$. [3]

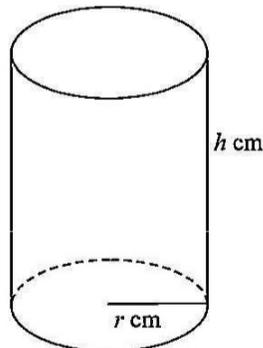
- 7 (a) The 9th term of an arithmetic progression is 22 and the sum of the first 4 terms is 49. Find the first term and the common difference. [4]
- (b) The 4th term and the 10th term of a geometric progression are 256 and 4 respectively. Find
- (i) the first term and the common ratio, [2]
- (ii) the sum to infinity of the progression. [2]

- 8 Find all the angles between 0° and 360° which satisfy the equations
- (a) $\sin \theta = -0.5921$, [2]
- (b) $6 \sin x \cos x = \sin x$, [3]
- (c) $2 \sec^2 y = 3 - \tan^2 y$. [4]

- 9 The table below shows the marks obtained by 35 candidates in an examination.

Marks	35	45	55	65	75	85	95
Frequency	3	4	10	5	7	4	2

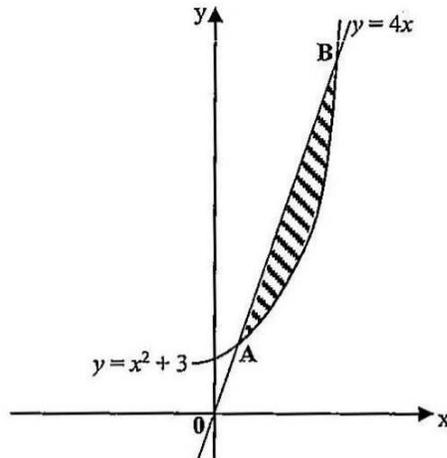
- (a) State the median mark. [1]
- (b) Find the mean mark. [4]
- (c) Calculate the standard deviation. [4]
- 10 A closed cylinder has radius r cm and height h cm. The volume of the cylinder is 1500cm^3 .



- (a) Find an expression of h in terms of r . [2]
- (b) Show that the total surface area, A cm², of the cylinder is given by
- $$A = 2\pi r^2 + \frac{3000}{r}. \quad [2]$$
- (c) Given that r varies, find correct to 2 decimal places, the value of r when A has a stationary value. [4]
- (d) Find the stationary value of A and determine its nature. [2]

11 (a) Evaluate $\int_1^2 \frac{x+1}{x^3} dx$. [3]

- (b) The diagram below shows part of the curve $y = x^2 + 3$ and the line $y = 4x$ intersecting at A and B.



- (i) Find the coordinates of A and B. [3]
- (ii) Calculate the volume generated when the shaded region is rotated through 360° about the x-axis. [4]

- 12 Answer only one of the following alternatives:

EITHER

A curve $y = x + \frac{4}{x}$ passes through a point P, where $x = 4$.

- (a) Find the equation of the tangent to the curve at the point P. [3]
- (b) Find the equation of the normal at the point P. [3]
- (c) Find the co-ordinates of the point Q, where the normal meets the curve again. [4]

OR

- (a) The first term of an arithmetic progression is 6. Given that the sum of the first 8 terms is 160 and the sum of all the terms is 240, calculate
- (i) the common difference, [2]
 - (ii) the number of terms. [3]
- (b) The numbers $x + 3$, $5x + 3$ and $11x + 3$ ($x \neq 0$) are three consecutive terms of a geometric progression. Find
- (i) the value of x , [3]
 - (ii) the sum to infinity of the progression. [2]

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