

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Additional Mathematics Paper 2

4030/2

Wednesday

16 AUGUST 2017

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

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

3 TRIGONOMETRY

Identities

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

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

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

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

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

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

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

$$x + 2y + 2z = 4,$$

$$3x - y + 4z = 25,$$

$$3x + 2y - z = -4.$$

[6]

2 (a) Find the range of values of x for which $x(9 - x) \geq 18$. [3]

(b) Express $7 - 5x - 2x^2$ 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) $5^{x-1} = 9$, [3]

(b) $\log_4(x + 2) = \log_4(x^2 + 2) - 1$. [4]

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

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

5 (a) A committee consists of a patron, a matron and 8 prefects. Find the number of ways of arranging the committee members in a straight line if

(i) there are no restrictions, [2]

(ii) there is no prefect at the beginning and at the end of the line. [3]

(b) A delegation of 3 boys and 2 girls is to be chosen from 10 boys and 5 girls. In how many ways can this be done? [3]

6 (a) Solve the equation $\cos(\theta + 30^\circ) = \sin \theta$, for values of θ in the range $0^\circ \leq \theta \leq 360^\circ$. [4]

(b) Given that $\cos A = \frac{3}{5}$ and $\cos B = \frac{-5}{13}$, where angle A is acute and angle B is obtuse, find the value of $\sin(A + B)$. [4]

- 7 (a) The sum of the first four terms of an arithmetic progression is 62 and the second term is 17. Find
- (i) the first term and the common difference, [3]
 - (ii) the sum of the first 40 terms. [2]
- (b) A geometric progression is given by 81, 54, 36 ... Find
- (i) the 20th term, [2]
 - (ii) the sum to infinity. [2]

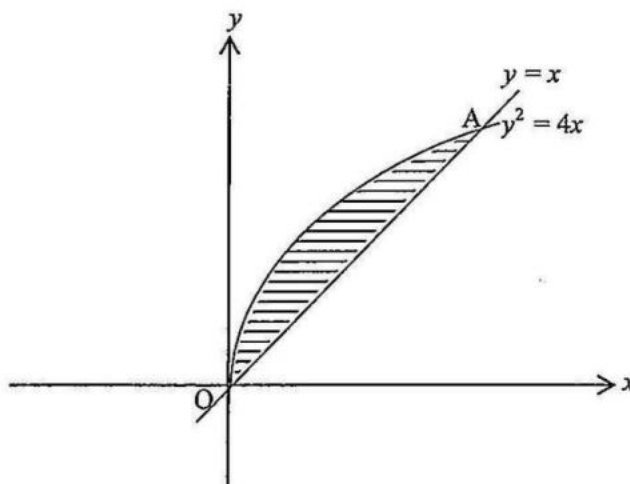
- 8 The table below shows the results in a Science test for 200 students.

Marks	1 – 20	21 – 40	41 – 60	61 – 80	81 – 100
Frequency	13	56	60	48	23

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

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- 9 The diagram below shows part of the curve $y^2 = 4x$ and the line $y = x$ meeting at the points O and A.



Find

- (a) the coordinates of A, [4]
- (b) the volume obtained by rotating the shaded region through 360° about the x-axis. [5]

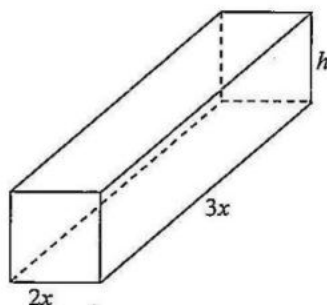
- 10 A particle moves in a straight line so that t seconds after passing a fixed point O, its acceleration, $a \text{ m/s}^2$ is given by $a = 4t - 12$. Given that the speed at O is 16 m/s , find
- (a) the values of t at which the particle is at instantaneous rest, [5]
- (b) the distance the particle travels in the fifth second. [5]

- 11 (a) A curve has the equation $y = 6x - \frac{x^2}{2} - \frac{x^3}{3}$.
- (i) Find the coordinates of the stationary points. [4]
- (ii) Determine the nature of the stationary points. [2]
- (b) Find the coordinates of the point where the curve $y = 3e^{2x-4}$ intersects the line $y = 3$, and the gradient of the curve at that point. [4]

- 12 Answer only one of the following alternatives:

Either

- (a) A curve has gradient function given by $\frac{dy}{dx} = 4x + \frac{1}{x^2}$ and passes through the point $(-1, 5)$. Find the equation of the curve. [3]
- (b) The diagram below shows a rectangular box without a lid which is made from a thin cardboard.



The base is $3x \text{ cm}$ long and $2x \text{ cm}$ wide and the height is $h \text{ cm}$. The total surface area of the box is 200 cm^2 .

- (i) Show that $h = \frac{20}{x} - \frac{3x}{5}$. [3]
- (ii) Hence, find the dimensions of the box which can give maximum volume. [4]

OR

- (a) An agent sponsoring students decides to give a sum of money to a school each year for 12 years. The agent decides to give K75 000.00 in the first year and to increase the sponsorship by K10 000.00 each year.
- (i) Find the amount the agent gives out in the twelfth year. [3]
- (ii) Find the amount received by the school from the agent altogether. [3]
- (b) The first term of a geometric progression is 1 and the sum of the first 3 terms is $\frac{7}{9}$. Find the two possible values of the common ratio of this series. [4]
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