

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]

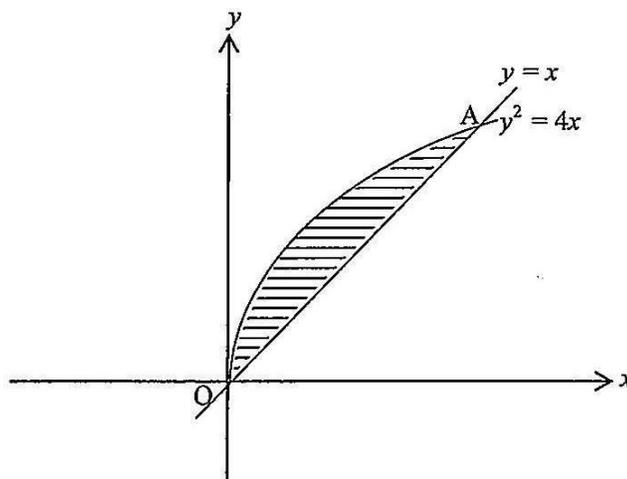
- 7 (a) The sum of the first four terms of an arithmetic progression is 62 and the second term is 17. Find
- (i) the first term and the common difference, [3]
 - (ii) the sum of the first 40 terms. [2]
- (b) A geometric progression is given by 81, 54, 36 ... Find
- (i) the 20th term, [2]
 - (ii) the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

- 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]

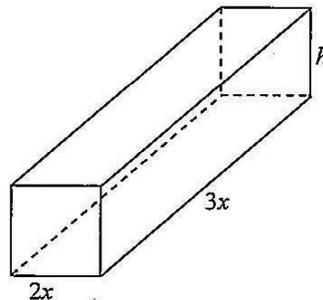
- 10 A particle moves in a straight line so that t seconds after passing a fixed point O, its acceleration, $a \text{ m/s}^2$ is given by $a = 4t - 12$. Given that the speed at O is 16 m/s , find
- (a) the values of t at which the particle is at instantaneous rest, [5]
- (b) the distance the particle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