

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

Additional Mathematics

4030/2

PAPER 2

Monday

26 OCTOBER 2015

Additional materials

Answer Booklet

Mathematical tables/Electronic calculators

Scrapping paper (1 sheet)

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

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

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

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

Formula for ΔABC

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

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

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

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
- $$4x - y + z = 10,$$
- $$x + 2y - 3z = -3,$$
- $$2x + y + 2z = 5. \quad [6]$$
- 2 (a) Solve the inequality $2x^2 + x < 3 - 4x$. [3]
- (b) Given that $h(x) = -2x^2 + 16x - 24$, express $h(x)$ in the form $a(x - b)^2 + k$ where a , b and k are constants. Hence state the maximum value of $h(x)$. [4]
- 3 Solve the equations
- (a) $7^{x-1} = 0.432$, [3]
- (b) $\lg(x + 6) - \lg(x - 3) = 1$. [4]
- 4 (a) Given that the expression $2x^3 + px^2 - 8x + q$ is exactly divisible by $2x^2 - 7x + 6$, find the values of p and q . [4]
- (b) Given that $3x^3 - 13x^2 + 18x - 10 = (Ax + B)(x - 1)(x - 2) + C$ for all values of x . Find the values of A , B and C . [4]
- 5 (a) In how many ways can seven Additional Mathematics books and two English books be arranged on a shelf if
- (i) there are no restrictions, [2]
- (ii) one English book is put at one end and the other English book at the other end. [3]
- (b) In how many ways can a president, a vice president, a secretary, a treasurer and 2 committee members be appointed from a group of 10 candidates? [3]
- 6 Find all the angles between 0° and 360° which satisfy the equations
- (a) $\cos x = -0.4713$, [2]
- (b) $5 \sin \theta - 13 \cos \theta = 0$, [2]
- (c) $4 \tan^2 y + 4 \sec y + 1 = 0$. [4]

- 7 The first term of an arithmetic progression is 8 and the common difference is d , where $d \neq 0$. The first term, the fifth term and the eighth term of this arithmetic progression are the first term, the second term and the third term respectively, of a geometric progression whose common ratio is r .

- (a) (i) Write two equations connecting d and r . [1]
 (ii) Hence find the value of r and the value of d . [3]
 (b) Find the sum to infinity of the geometric progression. [2]
 (c) Find the sum of the first 8 terms of the arithmetic progression. [3]

- 8 The masses of 40 packets of tea of a certain brand, measured correct to the nearest gram, are shown in the table below.

Mass (grams)	140 – 144	145 – 149	150 – 154	155 – 159	160 – 164
No of packets	5	10	9	8	8

- (a) State the median class. [1]
 (b) Find
 (i) an estimate of the mean, [3]
 (ii) the standard deviation. [5]

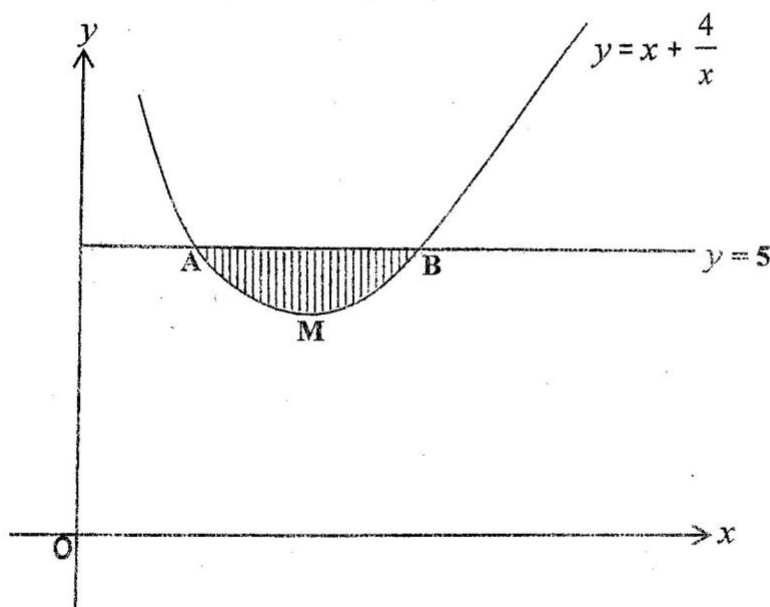
- 9 A particle moves in a straight line so that its velocity $V \text{ ms}^{-1}$ at time t seconds from the start is given by $V = 4t - \frac{t^2}{2}$.

- (a) Find
 (i) an expression for acceleration, a , in terms of t , [1]
 (ii) the acceleration when $t = 2$. [1]
 (iii) the maximum velocity. [3]
 (b) If the particle started from a fixed point O on the line, how far is it from O after 8 seconds? [4]

- 10 (a) The equation of a curve is $y = \frac{6}{5-2x}$. Calculate the gradient of the curve at the point where $x = \frac{1}{2}$. [3]

- (b) A curve has the equation $p = 2t^3 - 3t^2 - 12t + 18$.
 (i) Find the stationary points. [3]
 (ii) Determine the nature of the stationary points. [3]

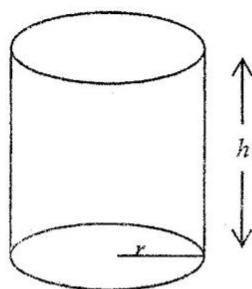
- 11 The diagram below shows part of the curve $y = x + \frac{4}{x}$ which has a minimum point at M. The line $y = 5$ intersects the curve at the points A and B.



- (a) Find the coordinates of A, B and M. [4]
- (b) Find the volume obtained when the shaded region is rotated through 360° about the x -axis. [6]
- 12 Answer only one of the following alternatives:

EITHER

A closed cylinder shown below is made from thin sheet metal. Its radius is r cm and height h cm. The volume of the cylinder is 600cm^3 and its external surface area is $A\text{cm}^2$.



- (a) Show that $A = 2\pi r^2 + \frac{1200}{r}$. [3]
- (b) Find the value, to two significant figures, of r and h for which A has a stationary value. [3]
- (c) Calculate the stationary value of A and determine whether it is a maximum or a minimum. [4]

OR

- (a) The third and sixth terms of a geometric progression are $2\frac{2}{3}$ and $\frac{8}{81}$ respectively. Find the sum to infinity. [4]
- (b) An arithmetic progression has third term 90 and fifth term 80.
- (i) Find the first term and the common difference. [3]
- (ii) Find the value of p , given that the sum of the first p terms is equal to the sum of the first $(p + 1)$ terms. [3]

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