

EXAMINATIONS COUNCIL OF ZAMBIA

Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level

ADDITIONAL MATHEMATICS 4030/2
PAPER 2

Thursday

15 NOVEMBER 2012

Additional materials:

Answer Booklet

Mathematical tables/Electronic calculators

Graph 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 should not be brought in the examination room.

Check the formulae overleaf

Mathematical Formulae

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

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

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

$$2a + b - c = 5,$$

$$a + 4b + 2c = 16,$$

$$15a + 6b - 2c = 12.$$

[6]

2 (a) The surface area of a rectangular block of ice, $A \text{ cm}^2$, is given by

$$A = 6x^2 + \frac{216}{x}. \text{ Find an expression for } \frac{dA}{dx}.$$

[2]

(b) Given that the block of ice in (a) is melting in such a way that A is decreasing at a constant rate of $0.14 \text{ cm}^2/\text{s}$, calculate the rate of decrease of x at the instant when $x = 4$.

[4]

3 (a) Find the range of values of x for which $2x^2 - x - 1 > 2x + 1$.

[3]

(b) Express $2x^2 - 5x + 16$ in the form $a(x - b)^2 + c$, where a , b and c are constants. Hence find the minimum value of $2x^2 - 5x + 16$.

[4]

4 Solve the equations

(a) $5^{x-1} = 13,$

[3]

(b) $\lg(2x) - \lg(x - 3) = 1.$

[4]

5 The expression $f(x) = cx^3 + 8x^2 + dx + 6$ is exactly divisible by $x^2 - 2x - 3$.

(a) Find the value of c and d .

[4]

(b) Find the remaining factor of the expression.

[2]

(c) If $f(x)$ is not divisible by $x + 2$, find the remainder.

[2]

6 (a) In how many ways can 7 red marbles and 3 green marbles be put in a straight line, if

(i) there are no restrictions,

[2]

(ii) green marbles should not be next to each other?

[3]

(b) A group of 6 pupils is to be chosen from 10 boys and 8 girls. Find the number of ways of choosing at least 4 boys.

[3]

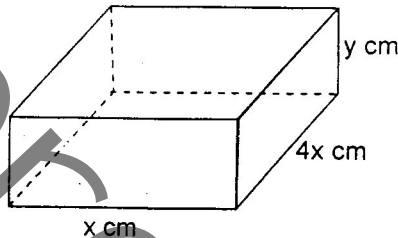
7 Find all the angles between 0° and 360° which satisfy the equation:

(a) $\tan \theta = -1.333$, [2]

(b) $\cos 3y = -0.5$, [3]

(c) $3\cos^2 z + 4\sin z = 4$. [4]

8 A pupil was given a 60 cm piece of wire to design a rectangular box for storing pens. The designer came up with the following diagram measuring $4x$ cm by x cm by y cm.



Given that the whole piece of wire was used,

(a) express the length of y in terms of x . [1]

(b) find an expression for the volume enclosed by the framework in terms of x . [2]

(c) calculate the value of x which makes the volume stationary. [3]

(d) show that this volume is maximum and find this volume. [3]

9 (a) The third term of a geometric progression of positive terms is 18 and the fifth term is 162.

(i) Find the common ratio and the first term. [2]

(ii) Write an expression for the n^{th} term of the progression. [1]

(iii) Find the sum of the first eight terms of the progression. [2]

(b) Find the geometric mean of $\frac{1}{64}$ and $\frac{1}{16}$. [1]

(c) Find the number of terms of the arithmetic progression 15, 19, 23, ... that must be taken for the sum to be equal to 444. [4]

10 The table below shows the frequency with which words of various lengths appear in the first paragraph of a particular book.

No. of letters	1 - 3	4 - 6	7 - 9	10 - 12	13 - 15
No. of words	35	33	34	13	5

Find the estimate of

(a) the mean, [2]

(b) the variance, [6]

(c) the standard deviation. [2]

- 11 A particle starts from rest at a point O and moves in a straight line with velocity v m/s given by $v = 6t - 3t^2$, where t is the time in seconds after the start.

Find

- (a) the acceleration of the particle when it is next at instantaneous rest, [3]
- (b) the maximum velocity, [3]
- (c) the distance travelled to that position when the particle was next at instantaneous rest. [4]
- 12 Answer only one of the following alternatives:

EITHER

The curve $y = e^{-2x} - 2$ meets the x -axis at A and the y -axis at B.

- (a) Find the coordinates of A and B. [3]
- (b) Sketch the graph of $y = e^{-2x} - 2$ 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 $y = e^{-2x} - 2$ to obtain a solution of the equation $x = \ln\left(\frac{1}{\sqrt{2x+3}}\right)$. [3]
- (d) State the range of $f: x \rightarrow e^{-2x} - 2$. [1]

OR

- (a) Grace would like to give a sum of money to a charity each year for 10 years. She decides to give \$120 in the first year, and to increase her contribution by \$10 each year.
- (i) How much does she give in the last year? [3]
- (ii) How much does the charity receive from her altogether? [3]
- (b) A geometric series has first term 27 and common ratio $\frac{4}{3}$. Find the least number of terms the series can have if its sum exceeds 729. [4]