

EXAMINATIONS COUNCIL OF ZAMBIA

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

ADDITIONAL MATHEMATICS 4030/2
PAPER 2

Tuesday

28 OCTOBER 2014

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

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

$$p - 3q + 2r = 2,$$

$$2p - q + r = 5,$$

$$2p + q + 4r = -3.$$

[6]

- 2 (a)** Find the range of values of x for which $4x^2 - 8x - 5 \geq 0$. [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 co-ordinates of the maximum turning point.

[4]

- 3 (a)** Find the value of p , given that the expression $2x^3 + px^2 - x - 2$ is divisible by $x + 3$. [3]

(b) Factorise the expression $2x^3 - 11x^2 + 17x - 6$.

[4]

- 4** Solve the equations

(a) $3^{2x+1} - 3^x = 4,$

[4]

(b) $\lg(3x + 2) + 6 \lg 2 = 2 + \lg(2x + 1).$

[3]

- 5 (a)** A family consists of a father, mother and six children. Find the number of ways of arranging them in a straight line if

(i) there are no restrictions,

[2]

(ii) the arrangements start and end with a parent.

[2]

(b) A chess team consisting of 8 boys and 5 girls is to be chosen from 10 boys and 7 girls.

In how many ways can this be done?

[3]

- 6** Find all the angles between 0° and 360° which satisfy the equations

(a) $\sin 2x = -0.645,$

[3]

(b) $5 \sin x - 3 \cos x = 0,$

[2]

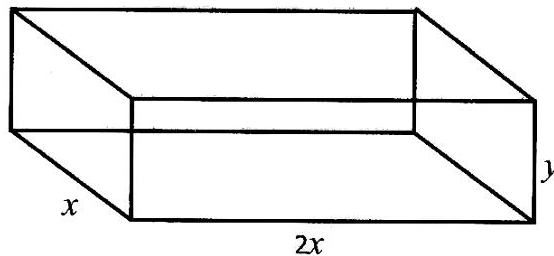
(c) $3 \tan^2 x + 5 = 7 \sec x.$

[4]

- 7 The table below shows a record of performance of pupils at school A and school B.

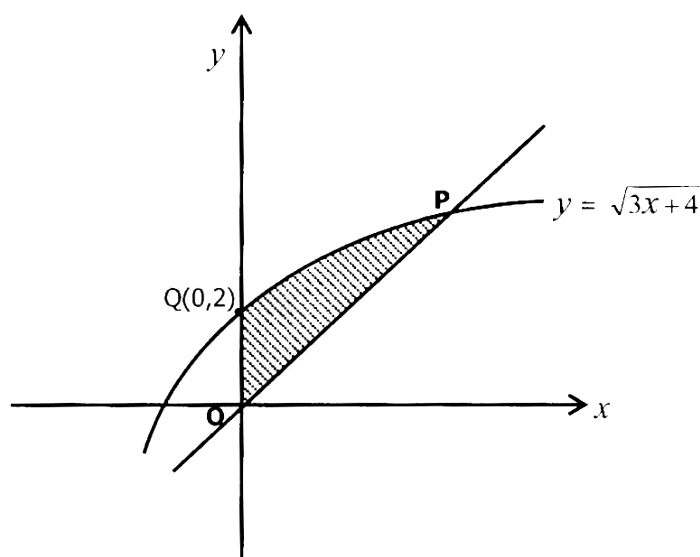
School A	1	1	2	3	3	3	4	6	6	6
School B	1	2	2	4	5	5	5	5	6	6

- (a) Find the mean performance of each school. [2]
- (b) Calculate the standard deviation for each school. [6]
- (c) Which of the two schools has better results? Give a reason for your answer. [1]
- 8 (a) Find $\int \left(x^3 + \frac{1}{x^3} \right) dx$. [2]
- (b) The diagram below shows a rectangular box made up of a thin sheet of metal with a lid. The length of the box is $2x$ cm, the breadth is x cm and the height is y cm.



- (i) Given that the volume of the box is 72cm^3 , show that the surface area, $A\text{cm}^2$, of the thin sheet of metal used is given by $A = 4x^2 + \frac{216}{x}$. [3]
- (ii) Given that x can vary, find the minimum area of the box. Show that this is a minimum value. [4]
- 9 (a) The eighth term of a geometric progression is 32 and the fourth term is 2. Find the first term and the positive value of the common ratio. [3]
- (b) Find the sum to infinity of a geometric progression whose first term is 5 and the second term is -4 . [2]
- (c) The n th term of an arithmetic progression is $3n + 7$. Find the sum of the first 40 terms. [4]

- 10** The velocity in m/s of a particle, travelling in a straight line at time t seconds after leaving a fixed point O, is given by $V = 10 + kt - 3t^2$, where $t \geq 0$ and k is a constant. When $t = 0$ the particle is at O and its acceleration is 1m/s^2 . Find the
- (a) value of k , [3]
- (b) value of t when the particle is instantaneously at rest, [3]
- (c) distance the particle has travelled when it is again at O. [4]
- 11** The diagram shows part of the curve $y = \sqrt{3x+4}$ and a straight line. The curve meets the straight line at P. The gradient of the straight line is 1.



- (a) Find
- (i) the equation of the straight line OP, [1]
- (ii) the co-ordinates of the point P. [3]
- (b) The shaded region is rotated through 360° about the x -axis to form a solid of revolution. Calculate the volume generated in terms of π . [6]

12 Answer only one of the following alternatives:

EITHER

- (a) A tangent touches the curve $y = 3x^2 + 2x + 1$ at the point where it is parallel to the line $4x + y = 5$. Find the co-ordinates of the point where the tangent touches the curve. [3]
- (b) (i) Draw the graph of $y = e^{2x} - 4$ for values of x at intervals of 0.5, for $-2 \leq x \leq 1\frac{1}{2}$. [4]
- (ii) By drawing a suitable straight line on your graph, obtain an approximate solution to the equation $x = \ln \sqrt{1-4x}$. [3]

OR

- (a) The sixth term of an arithmetic progression with 12 terms is 14 and the sum of the last six terms is 126. Calculate the sum of the first six terms. [5]
- (b) The fifth term of a geometric progression is $\frac{2}{81}$ and the sum of the third and fourth terms is $\frac{8}{27}$. Find the
- (i) positive value of the common ratio, r , [3]
- (ii) sum to infinity of the progression. [2]

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