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

$S_\infty = \frac{a}{1-r}$ 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 Δ ABC

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

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

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

4 STATISTICS

Mean and standard deviation

Ungrouped data

$$\text{Mean } (\bar{x}) = \frac{\sum x}{n}, \quad \text{SD} = \sqrt{\left\{\frac{\sum (x-\bar{x})^2}{n}\right\}} = \sqrt{\left\{\frac{\sum x^2}{n} - (\bar{x})^2\right\}}$$

Grouped data

$$\text{Mean } (\bar{x}) = \frac{\sum fx}{\sum f}, \quad \text{SD} = \sqrt{\left\{\frac{\sum f(x-\bar{x})^2}{\sum f}\right\}} = \sqrt{\left\{\frac{\sum fx^2}{\sum f} - (\bar{x})^2\right\}}$$

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

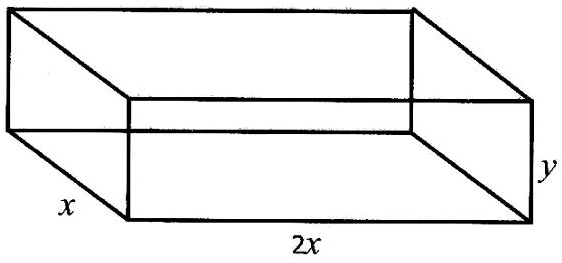
(a) Find the mean performance of each school. [2]

(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 $\int\left(x^3+\frac{1}{x^3}\right)\mathrm{d}x$. [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, Acm^3, 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 nth term of an arithmetic progression is $3n + 7$. Find the sum of the first 40 terms. [4]

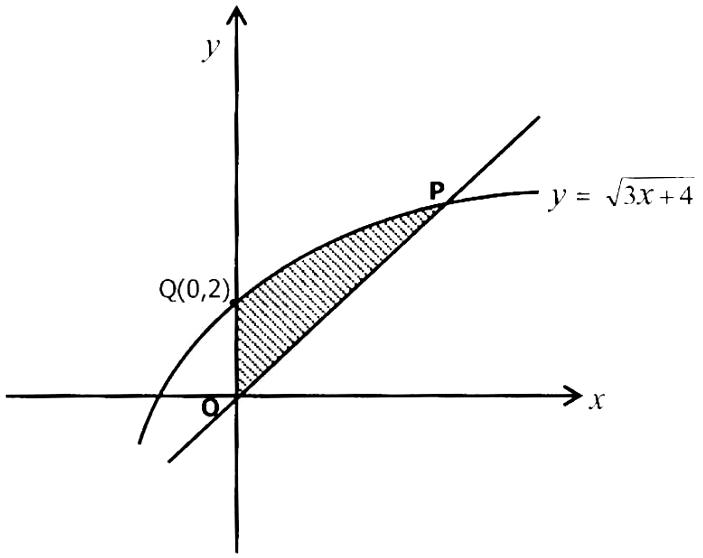
10 The velocity in m/s of a particle, travelling in a straight line at time t seconds after leaving a fixed point O, is given by $V = 10 + kt - 3t^2$, where $t > 0$ and k is a constant. When $t = 0$ the particle is at O and its acceleration is $1 m/s^2$. Find the

(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]