

EXAMINATIONS COUNCIL OF ZAMBIA



Examination for General Certificate of Education Ordinary Level

Additional Mathematics

4030/1

Paper 1

2021

Additional Materials:

Answer Booklet

Silent electronic calculator (Non programmable)

Time: 2 hours

Marks: 80

Instructions to Candidates

- 1 Write the **centre number** and your **examination number** on **every page** of the separate **Answer Booklet** provided.
- 2 There are **twelve** questions in this paper. Answer **all** questions.
- 3 Write your answers in the separate Answer Booklet provided.
- 4 If you use more than one Answer Booklet, fasten the Answer Booklets together.
- 5 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

- 1 The number of marks is shown in brackets [] at the end of each question or part question.
- 2 The use of a **non programmable electronic calculator** is expected, where **appropriate**.
- 3 You are reminded of the need for clear presentation in your answers.
- 4 Cell phones and other electronic devices are **not allowed** in the examination room.
- 5 Check the formulae overleaf.

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MATHEMATICS FORMULAE

1 ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \dots + \binom{n}{r} a^{n-r} b^r + \dots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

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2 TRIGONOMETRY

Identities

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

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

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

Formulae for $\triangle ABC$

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

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

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

- 1 Given that the coordinates of the midpoint of the points $(1 - p, 1 + t)$ and $(2p, 4t + 3)$ are $(3, 7)$, find the value of p and of t . [4]

- 2 Solve the simultaneous equations
 $2y = x + 5,$
 $x^2 + xy = -1.$ [5]

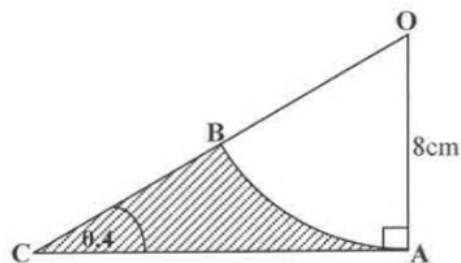
- 3 Find the values of k for which $x + 2y = k$ is a tangent to the curve $y^2 + 4x - 20 = 0$. [4]

- 4 The functions f and g are defined by $f:x \mapsto \frac{x+5}{2x}, x \neq 0$ and $g:x \mapsto 2x + 4,$
 where x is a real number.

Find

- (a) $(fg)^{-1}(x),$ [4]
 (b) the value of x for which $(fg)^{-1}(x) = -3.$ [2]

- 5 In the diagram below, triangle OCA is right angled at A , angle ACO is 0.4 radians and OBA is a sector of a circle centre O and radius 8 cm. www.eczpastpapers.com



Calculate

- (a) the length of $AC,$ [2]
 (b) the area of the shaded region. [3]

- 6 Prove the identity

$$\frac{1}{(\sec \theta - \tan \theta)^2} \equiv \frac{1 + \sin \theta}{1 - \sin \theta}.$$
 [4]

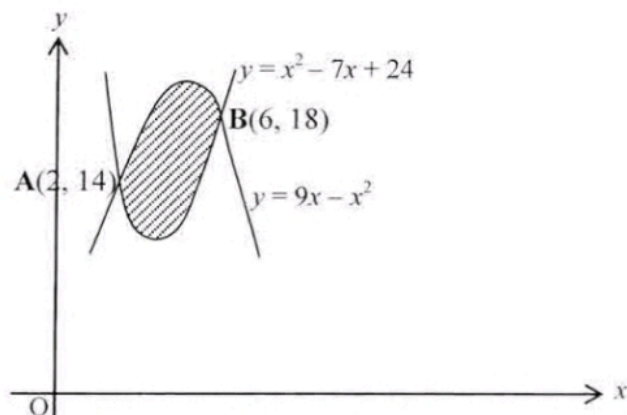
- 7 (a) Find the coefficient of x in the expansion of $\left(x^2 - \frac{4}{x}\right)^5.$ [4]
 (b) Obtain the first four terms in the expansion of $(1 + p)^8$ in ascending powers of $p.$
 Hence find the coefficient of x in the expansion of $(1 + x + 2x^2)^8.$ [5]

- 8 (a) Find the gradient function of $y = \frac{2x^2}{3x^2 + 6}$. [3]
- (b) Find the equation of the normal to the curve $y = \frac{3}{2x-5}$, $x \neq \frac{5}{2}$, at a point where $x = 2$. [6]

- 9 On the same diagram, sketch the graphs of $y = \left| \cos\left(\frac{x}{2}\right) - 1 \right|$ and $y = 1$ for the domain $0 \leq x \leq 2\pi$. Hence state the number of solutions for which $\left| \cos\left(\frac{x}{2}\right) - 1 \right| = 1$. [5]

- 10 (a) Find the vector equation of the perpendicular bisector of the line joining the points $(-3, -9)$ and $(11, 5)$. [4]
- (b) The position vectors of P, Q and R are $3i - 2j$, $ni + j$ and $2i - 8j$ respectively. Find the value of n for which P, Q and R are collinear. [5]

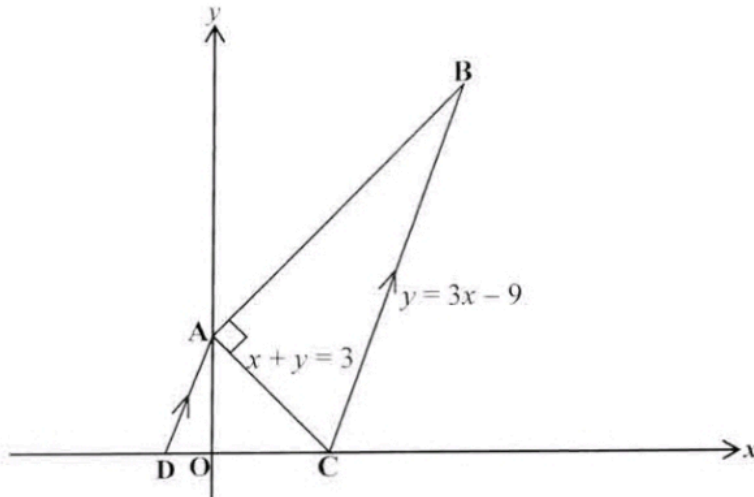
- 11 (a) Find $\int \left(x^3 - \frac{6}{x^2} \right) dx$. [2]
- (b) The diagram below shows part of the curves $y = x^2 - 7x + 24$ and $y = 9x - x^2$ intersecting at A(2, 14) and B(6, 18).



Find

- (i) the tangent to the curve $y = x^2 - 7x + 24$ at the point B, [4]
- (ii) the area of the shaded region. [4]

- 12 In the diagram below, ABCD is a trapezium in which $\angle BAC = 90^\circ$ and AD is parallel to CB. The points C and D lie on the x-axis and A lies on the y-axis. The equations of lines CB and AC are $y = 3x - 9$ and $x + y = 3$ respectively.



Find

- | | | |
|-----|--|-----|
| (a) | the equation of line AB, | [3] |
| (b) | the coordinates of the points D and B, | [4] |
| (c) | the area of the trapezium ABCD. | [3] |