



09552087



EXAMINATIONS COUNCIL OF ZAMBIA



Examination for School Certificate Ordinary Level

Additional Mathematics

4030/1

Paper 1

Tuesday

22 NOVEMBER 2022

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 **12 questions** in this paper. Answer **all** questions.
- 3 Write your answers in the 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 are **not allowed** in the examination room.
- 5 **Check the formulae overleaf.**

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 $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

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 ΔABC

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

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

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

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- 1 The points A(5, 3) and B(1, -2) lie on a straight line. Find the equation of the line passing through the origin and the midpoint of the line AB. [4]

- 2 Solve the simultaneous equations

$$2y = x + 10,$$

$$2x^2 + xy - y^2 = -16. \quad [5]$$

- 3 Find the range of values of k for which the line $y = 3x + k$ does not meet the curve $y = x^2 + 4x - 4$. [4]

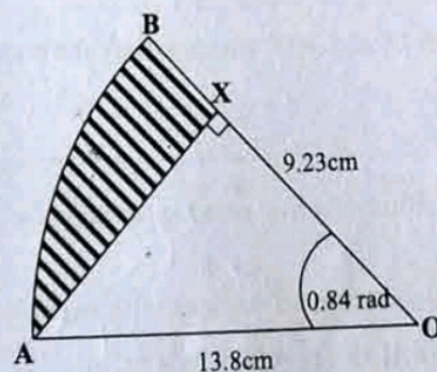
- 4 The functions f and g are defined by $f: x \rightarrow \frac{1}{2-x}$, $x \neq 2$ and $g: x \rightarrow 4 - \frac{2}{3}x$.

Find

(a) $fg(x)$, [2]

(b) the value of x for which $fg(x) = g(x)$. [4]

- 5 In the following diagram, OAB is a sector of a circle with centre O and radius 13.8cm. AX is perpendicular to OB at X. Angle AOB is 0.84 radians and OX = 9.23cm.



Find the

(a) perimeter of the shaded region, [3]

(b) area of the shaded region. [2]

6 Prove the identity

$$\frac{\cos \theta}{1 + \sin \theta} + \tan \theta \equiv \sec \theta.$$

[4]

7 (a) The term independent of x in the expansion of $\left(x^2 + \frac{k}{x^4}\right)^6$ is 60. Find the value of the constant k .

[4]

(b) Find the coefficient of x in the expansion of $(2 + 3x)^5 (1 - 2x)^3$.

[5]

8 (a) Find $\frac{dy}{dx}$ for the equation $y = \frac{x-1}{3x+2}$.

[4]

(b) Two variables x and y are related by the equation $2y = 4x^2 - 5x - 3$. Obtain an expression for $\frac{dy}{dx}$ and find the approximate change in y as x increases from 2 to 2.06.

[5]

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9 Find all the angles between 0° and 360° which satisfy the equation $|3 \tan x - 2| = 5$.

[5]

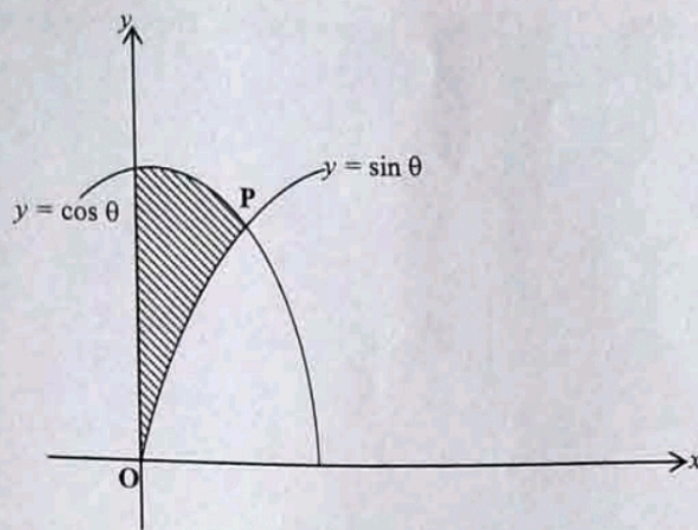
10 (a) Find the vector equation of a line passing through the points (2, 3) and (3, 1).

[3]

(b) Find the point of intersection of the lines with vector equations $\mathbf{r}_1 = (1 + m)\mathbf{i} + (2 + m)\mathbf{j}$ and $\mathbf{r}_2 = (1 + 3n)\mathbf{i} + 5n\mathbf{j}$.

[6]

- 11 (a) Evaluate $\int_{-1}^2 (3 - 4x)^3 dx$. [3]
- (b) The diagram shows part of the curve $y = \cos \theta$ intersecting the curve $y = \sin \theta$ at P.



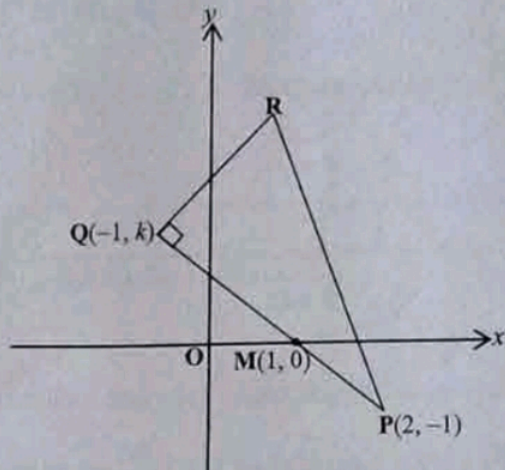
Find the

- (i) coordinates of P, [3]
- (ii) area of the shaded region. [4]

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12 Solutions to this question by scale drawing will not be accepted.

In the following diagram, PQR is a triangle and $\angle PQR = 90^\circ$. The points $P(2, -1)$, $Q(-1, k)$ and $M(1, 0)$ are on the same straight line. The ratio of the gradient of PQ to that of PR is 1 : 5.



Find the

- | | | |
|-----|-------------------------|-----|
| (a) | value of k , | [2] |
| (b) | equation of line QR, | [2] |
| (c) | coordinates of point R, | [3] |
| (d) | area of triangle PQR. | [3] |

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