



47082402



EXAMINATIONS COUNCIL OF ZAMBIA



Examination for School Certificate Ordinary Level

Additional Mathematics

4030/1

Paper 1

Tuesday

21 NOVEMBER 2023

Additional Materials:

Answer Booklet
Silent electronic calculator (Non programmable)
Graph Paper (1 sheet)

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.

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 $\triangle ABC$

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

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

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

www.eczpastpapers.com

- 1 The points A and B are $(-6, 4)$ and $(-2, 7)$ respectively. Find the equation of the perpendicular line to the line AB through the point B. [4]

- 2 Solve the simultaneous equations

$$x + 2y = 1,$$

$$x^2 + y^2 = 2.$$

[5]

- 3 Find the values of k for which the line $x + y = k$ is a tangent to the curve $x^2 + xy = y^2 + 5$. [4]

- 4 The functions f and h are defined by $f: x \rightarrow \frac{ax+6}{x}$, $x \neq 0$ and $h: x \rightarrow \frac{x+1}{x-3}$, $x \neq 3$.

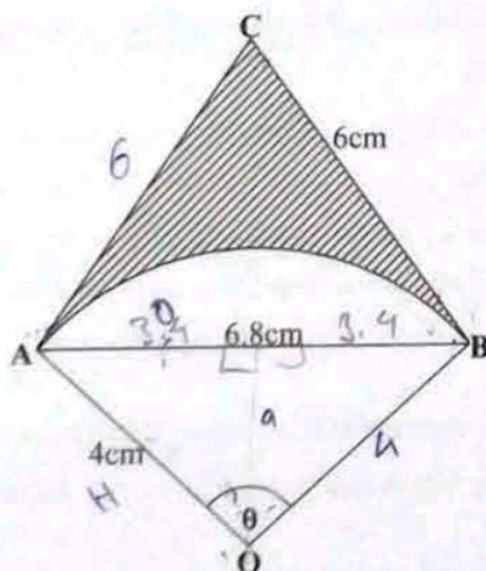
Find

(a) $h^2(x)$, [3]

(b) the value of a for which $fh(3) = 6$. [3]

- 5 In the following diagram, ACBO is a kite with $AC = BC = 6\text{cm}$ and $AO = OB = 4\text{cm}$. The diagonal $AB = 6.8\text{cm}$. AOB is a sector of a circle with centre O, radius 4cm and angle $AOB = \theta$.

www.eczpastpapers.com



Find the

- (a) angle θ in radians, [2]
 (b) perimeter of the shaded region. [3]

- 6 Prove the identity

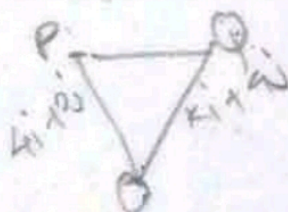
$$\frac{2}{\cos^4 \theta - \sin^4 \theta + 1} \equiv \sec^2 \theta. \quad [4]$$

- 7 (a) The term independent of x in the expansion of $\left(\frac{k}{x^2} + x\right)^9$ is 61 236, where k is a constant. Find the value of k . [4]
- (b) Find the third term in the expansion of $(1 - 2x)(2 + 3x)^6$. [5]

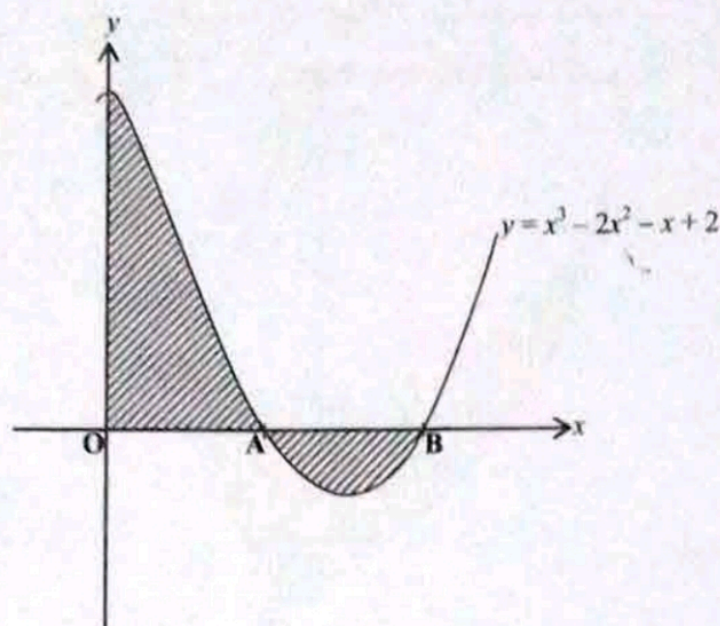
- 8 (a) Find an expression for $\frac{dy}{dx}$ of the equation $y = \frac{5}{2 - 3x}$. [3]
- (b) The variables x and y are related by the equation $y = (2x + 1)^4$. Obtain an expression for $\frac{dy}{dx}$ and find the approximate change in y as x increases from 1 to 1.02. [6]

- 9 On the same diagram, sketch the graph of $y = |4 \cos x|$ and $y = 2.5$ for the domain $0 \leq x \leq 2\pi$. Hence, state the number of solutions of the equation $|4 \cos x| = 2.5$ for $0 \leq x \leq 2\pi$. [5]

- 10 (a) The position vectors of points P and Q relative to the origin O are $4\mathbf{i} + 2\mathbf{j}$ and $k\mathbf{i} + 4\mathbf{j}$ respectively. Given that $\vec{QP}$ is perpendicular to $\vec{OP}$, find the value of k . [4]
- (b) Two lines r_1 and r_2 intersect at R. r_1 passes through the points with position vectors $5\mathbf{i} + 3\mathbf{j}$ and $-2\mathbf{i} - 4\mathbf{j}$. Given that $\mathbf{r}_2 = \mathbf{i} - 3\mathbf{j} + \lambda(\mathbf{i} + 2\mathbf{j})$, find the coordinates of R. [5]



- 11 (a) Given that $\int_{-1}^2 (ax^2 + x) dx = 10\frac{1}{2}$, find the value of a . [2]
- (b) The diagram shows part of the curve $y = x^3 - 2x^2 - x + 2$ intersecting the x -axis at A and B.



Find the

- (i) x coordinates of A and of B,
- (ii) area of the shaded region.

www.eczpastpapers.com

[6]

$\frac{4ac}{4(3)}$

$$\cos \theta + \sin \theta = 1 - \sin^2 \theta$$

$$\sin \theta + \tan \theta = \sec \theta$$

$$\cot \theta + 1 = \operatorname{cosec} \theta$$

$$\frac{1}{\cos} = \sec$$

$$\cos^4 \theta + \sin^4 \theta = 1$$

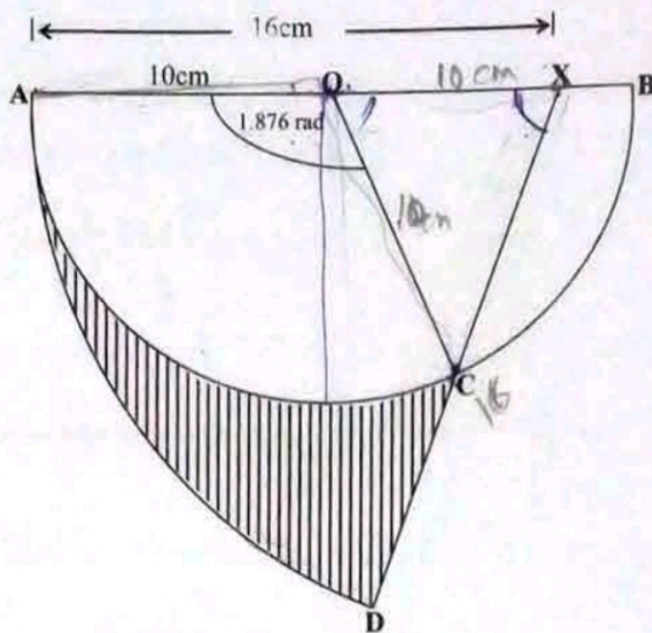
$$\cos \theta = 1 - \sin \theta$$

$$\frac{1 \pm \sqrt{16+12}}{6}$$

$$x+1, x \pm 2$$

$$\frac{1}{\cos \theta}$$

- 12 In the following diagram, ABC is a semi-circle with centre O, radius 10cm and angle $\text{AOC} = 1.876$ radians. AXD is a sector of a circle with centre X and has radius of 16cm.



Find

- the area of the sector AOC, [2]
- angle AXC, [4]
- the area of the shaded region. [4]

www.eczpastpapers.com

193.8

570796329