

EXAMINATIONS COUNCIL OF ZAMBIA

Examination for School Certificate Ordinary Level

Additional Mathematics

4030/1

Paper 1

Friday

17 NOVEMBER 2017

Additional Materials:

Answer Booklet
Silent electronic calculator (non programmable)

Time: 2 hours

Instructions to Candidates

Write your **name**, **centre number** and **candidate number** in the spaces on the Answer Booklet provided.

There are **12 questions** in this paper. Answer **all** questions.

Write your answers in 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 80.

The use of a non programmable electronic calculator is expected, where appropriate.

Cell phones are not allowed in the examination room.

You are reminded of the need for clear presentation in your answers.

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 $\triangle ABC$

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

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

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

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- 1 Find the equation of the line through the point $O(0, 0)$ which is perpendicular to the line through $A(2, -4)$ and $B(1, 3)$. [4]

- 2 Solve the simultaneous equations

$$3x = y + 7,$$

$$x^2 + xy = y^2 + 1. \quad [5]$$

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

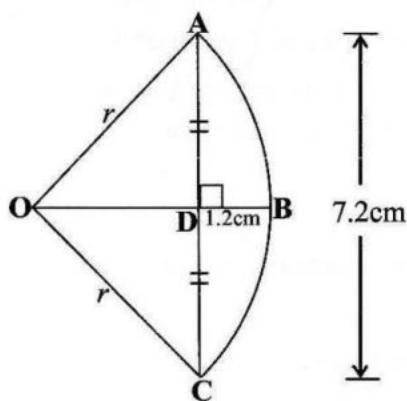
- 4 A function g is defined by $g:x \longrightarrow \frac{2x-1}{3}$.

Find

- (a) an expression for $g^2(x)$, [3]

- (b) the value of x such that $g^2(x) = g(x)$. [3]

- 5 In the diagram below, $OABC$ is a sector of a circle centre O , radius r and $AC = 7.2\text{cm}$. OB bisects AC at D and $BD = 1.2\text{cm}$.



Find

- (a) the value of r , [3]

- (b) the perimeter of the sector. [2]

6 Prove the identity $\frac{\sin \theta}{1 + \cos \theta} + \frac{1 + \cos \theta}{\sin \theta} \equiv 2 \operatorname{cosec} \theta$. [4]

7 (a) Find the 5th term in the expansion of $\left(x^2 - \frac{1}{2x}\right)^{10}$. [4]

(b) Find the coefficient of x^2 in the expansion of $(1 + x)^4 (2 - x)^7$. [5]

8 (a) Given that $y = \sqrt{4 + 3x}$, find $\frac{dy}{dx}$. [3]

(b) Two variables x and y are related by the equation $y = \frac{4x}{x + 1}$.

Obtain an expression for $\frac{dy}{dx}$ and find the approximate change in y as x increases from 2 to 2.03. [6]

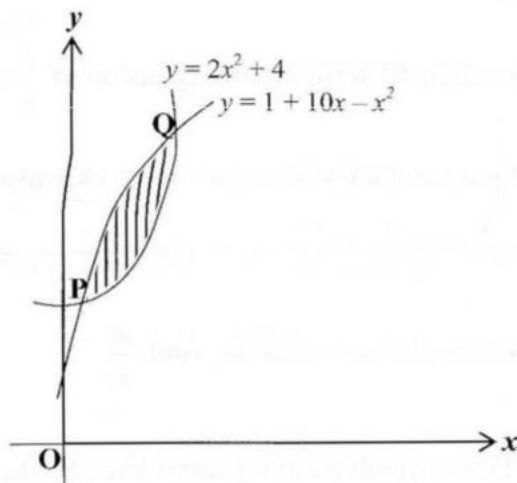
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9 Find all the angles between 0° and 360° which satisfy the equation $|9 \cos x + 3| = 2$. [5]

10 (a) The point $(1, p)$ lies on the line with vector equation $\mathbf{r} = (3\mathbf{i} - 3\mathbf{j}) + t(\mathbf{i} - 4\mathbf{j})$. Find the value of p . [4]

(b) In a triangle OAB, P is the midpoint of AB and Q is a point on OP such that $\vec{OQ} = \frac{3}{4} \vec{OP}$. Given that $\vec{OA} = \underline{a}$ and $\vec{OB} = \underline{b}$, find $\vec{AQ}$ in terms of $\underline{a}$ and $\underline{b}$. [5]

- 11 (a) The gradient function of a curve passing through $(0, 3)$ is given by $3x^2 + 2x - 5$. Find the equation of the curve. [3]
- (b) The diagram below shows part of the curve $y = 2x^2 + 4$ intersecting the curve $y = 1 + 10x - x^2$ at P and Q.



Find

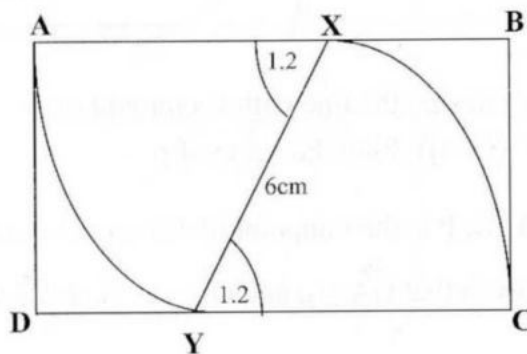
- (i) the coordinates of P and of Q, [3]
- (ii) the area of the shaded region. [4]

Answer only one of the following alternatives.

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12 Either

The diagram below shows a rectangle ABCD. Equal arcs AY and CX are drawn with radius 6cm and centres X and Y respectively. Angle AXY = angle XYZ = 1.2 radians.



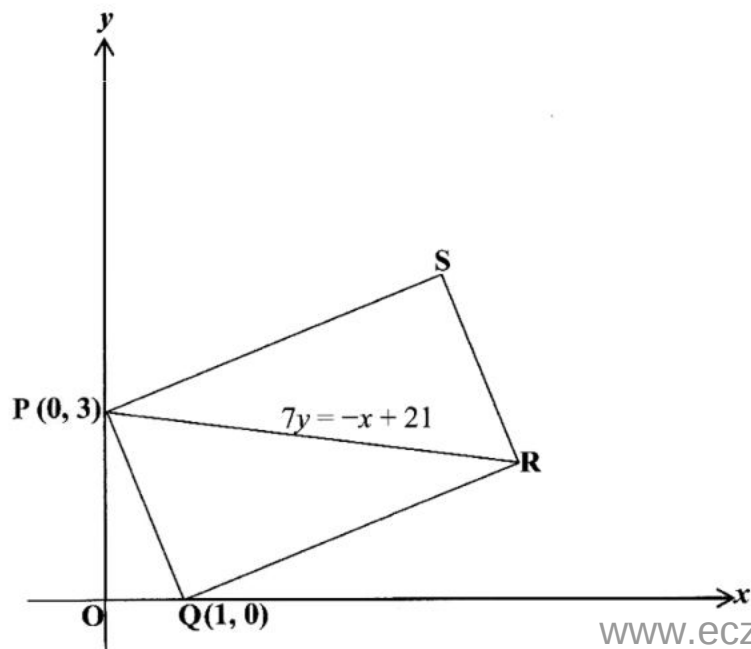
Find

- (a) the perimeter of sector XAY, [2]
- (b) the area of sector XAY, [2]
- (c) the length of AB and of AD. [6]

Or

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

In the diagram below, PQRS is a rectangle with $P(0, 3)$ and $Q(1, 0)$. PR is a diagonal with equation $7y = -x + 21$.



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Find

- (a) the coordinates of R and of S, [6]
- (b) the area of rectangle PQRS. [4]

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