EXAMINATIONS COUNCIL OF ZAMBIA

Examination for General Certificate of Education Ordinary Level

Additional Mathematics 4030/1

Paper 1

Tuesday **15 AUGUST 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

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

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

2 TRIGONOMETRY

Identities

$\text{Sin}^2 A + \cos^2 A = 1$

$\text{Sec}^2 A = 1 + \tan^2 A$

$\text{Cosec}^2 A = 1 + \cot^2 A$

Formulae for ΔABC

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

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

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

1 Find the equation of a line parallel to the line $3x - 4y = 12$ passing through the point $(-2, 5)$. [4]

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2 Solve the simultaneous equations

$x - 2y = 1$,

$y^2 - 3xy + 8 = 0$. [5]

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3 Given that the line $y - 2x = m$ is a tangent to the curve $x^2 + xy = -12$, find the possible values of m. [4]

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4 Functions f and g are defined by $f: x \longrightarrow \frac{3}{2x+1}, x \neq -\frac{1}{2}$

and $g: x \longrightarrow 2x + 3$.

Find

(a) the value of t, given that $fg(t) = \frac{2}{5}$, [3]

(b) the values of x for which $g(x) = f(x)$. [3]

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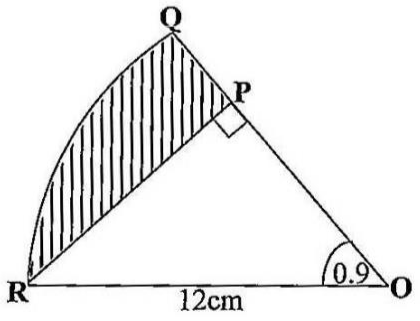
5 In the diagram below, ORQ is a sector of a circle with centre O and radius 12cm. RP is perpendicular to OQ at P and angle POR = 0.9 radians.



Find

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

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

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6 Prove the identity $\frac{1-\cos^2\theta}{\sec^2\theta-1} \equiv 1-\sin^2\theta$. [4]

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7 **(a)** Given that $540x^6$ is the middle term in the expansion of $(a+x^n)^6$ where a is a real number, find the value of a and of n. [4]

(b) Find the term in x^3 in the expansion of $(1+x+x^2)(1-x)^8$. [5]

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8 **(a)** A curve has the equation $y = \frac{-8}{2x-1}$. Find the value of x, for which $\frac{dy}{dx} = 1, x > 0$. [4]

(b) Find the equation of the normal to the curve $y = \frac{2x+4}{x-2}$ at the point where $x = 4$. [5]

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9 Find all the angles between 0° and 360° which satisfy the equation $|\sin x - 0.6| = 0.3$. [5]

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10 **(a)** The coordinates of the points A and B are (−1, 4) and (2, 3) respectively. Find

(i) the magnitude of $\overrightarrow{AB}$, [3]

(ii) a vector equation of the line AB. [1]

(b) Find the angle between the vectors $3\mathbf{i} + 4\mathbf{j}$ and $5\mathbf{i} + 12\mathbf{j}$. [5]

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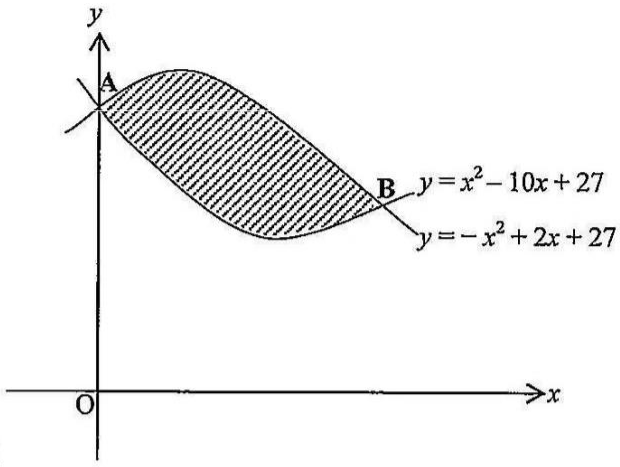
11 **(a)** Find the value of n if $\int_0^3 (x^2 + nx)\,dx = 27$. [3]

(b) The diagram below shows part of the curve $y = x^2 - 10x + 27$ intersecting the curve $y = -x^2 + 2x + 27$ at A and B.



Find

(i) the x-coordinate of point B, [3]

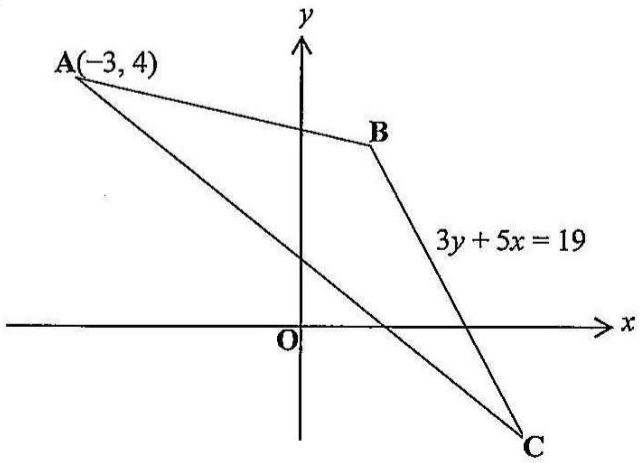
(ii) the area of the shaded region. [4]

Answer only one of the following alternatives.

12 **EITHER**

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

In the diagram below, ABC is a triangle. The coordinates of A are (−3, 4) and the equation of BC is $3y + 5x = 19$. The gradients of AB and AC are $-\frac{1}{5}$ and $-\frac{3}{4}$ respectively.



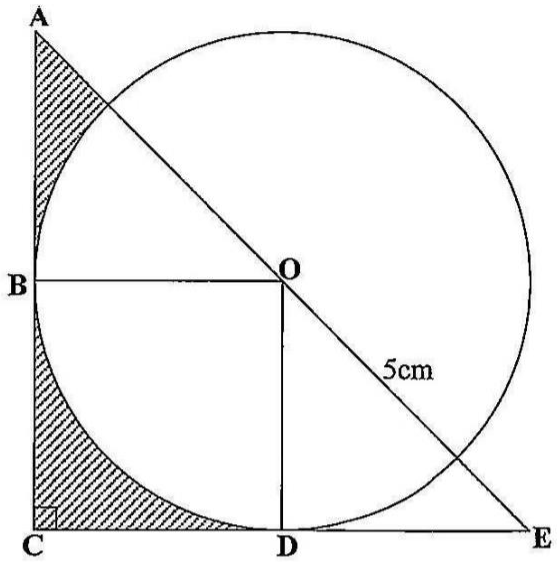
Find

(a) the coordinates of B, [4]

(b) the magnitude of AC. [6]

OR

The diagram shows a circle, centre O, of radius 5cm. ACE is an isosceles triangle such that the adjacent sides AC and CE are tangents to the circle at B and D respectively. Angle ACE is $\frac{\pi}{2}$ radians.



Find

(a) the perimeter of the shaded region, [5]

(b) the area of the shaded region. [5]