

EXAMINATIONS COUNCIL OF ZAMBIA

Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level

ADDITIONAL MATHEMATICS 4030/1

PAPER 1

Monday

27 OCTOBER 2014

Additional materials:

Answer Booklet

Graph paper (1 Sheet)

Mathematical tables/Electronic calculators



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 should not be brought 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 $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

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 $\triangle ABC$

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

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

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

Solve the following simultaneous equations;

$$3x^2 + xy - 2y^2 = 27,$$

$$y = -x + 2.$$

[5]

The line $2y = -x + 8$ is the perpendicular bisector of the line AB with $A(2, -2)$.

Find the coordinates of the midpoint of AB.

[4]

The functions f and g are defined by $f(x) = x^2 - 2x - 24$ and $g(x) = \frac{8x}{3} + 5$.

(a) Find the range of f .

[3]

(b) Sketch the functions g and g^{-1} on the same axes.

[3]

Given that the line $y = 3 - kx$ is a tangent to the curve $x^2 + xy - 3 = 0$, find the value of k . [4]

(a) Find the middle term in the expansion of $\left(x - \frac{1}{x}\right)^{10}$.

[4]

(b) Expand $(1 + a - a^2)^5$ in ascending powers of a up to the term containing a^2 .

[5]

Prove the identity

$$\frac{1}{\sec\theta + \tan\theta} + \frac{1 + \sin\theta}{\cos\theta} = 2\sec\theta.$$

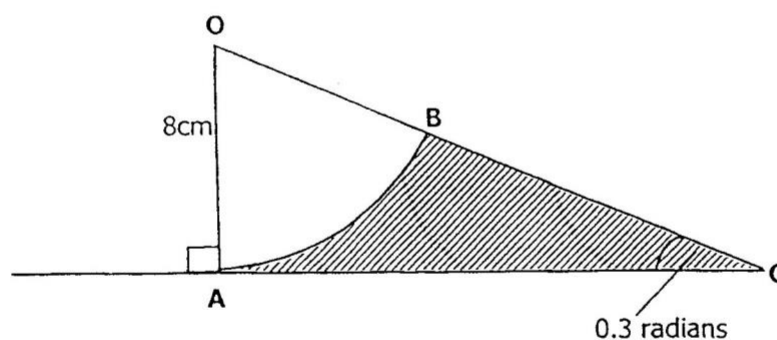
[4]

Draw the graph of $y = |3\sin x|$ for the domain $0 \leq x \leq 2\pi$ and hence find the approximate

solutions to the equation $|3\sin x| = 1.5$.

[5]

In the diagram below, OAB is a sector of a circle with centre O and radius 8cm. The line AC is perpendicular to the radius OA and the line OC cuts the circle at B. Angle OCA is 0.3 radians.



Calculate

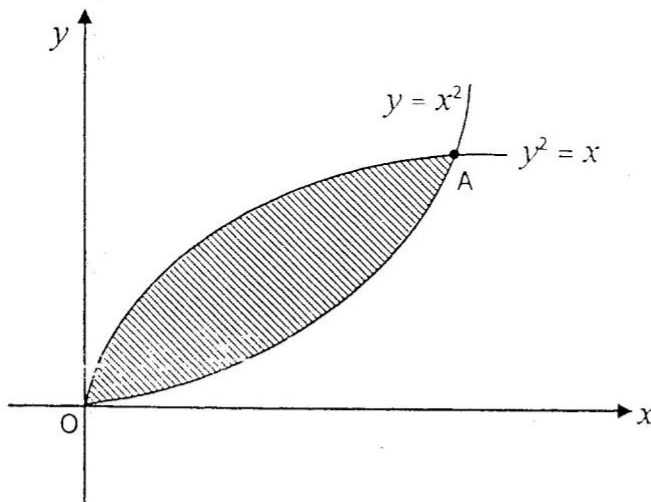
(a) the area of the shaded region,

[2]

(b) the perimeter of the shaded region.

[5]

- 9 (a) Given that \vec{OA} has magnitude 15 and has the same direction as $\begin{pmatrix} 24 \\ 18 \end{pmatrix}$, express \vec{OA} as a column vector. [3]
- (b) The position vector of B relative to the origin O is $5\mathbf{i} - 3\mathbf{j}$. Given that $\vec{AB} = 3\mathbf{i} - 5\mathbf{j}$, find angle AOB. [4]
- 10 (a) Given that $y = \frac{3}{\sqrt{2x^2 + 5}}$, find an expression for $\frac{dy}{dx}$. [3]
- (b) Given that $y = \frac{x-2}{2x+3}$ where $x \neq -1.5$, find the approximate increase in y as x increases from 2 to 2.35. [6]
- 11 (a) The gradient function of a curve is $2x + \frac{3}{\sqrt{x}}$. Given that the curve passes through the point (4, 19), find the equation of the curve. [5]
- (b) The diagram below shows the curves $y = x^2$ and $y^2 = x$ intersecting at O and A.



Find

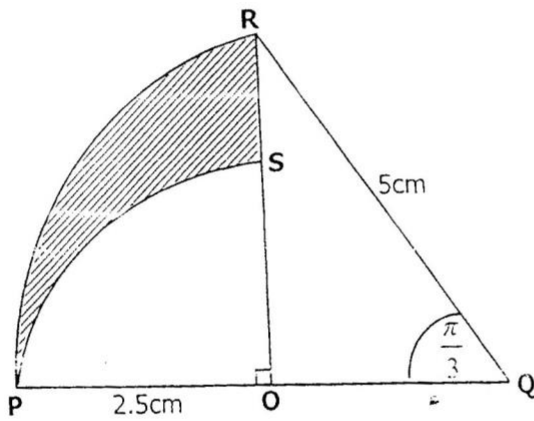
- (i) the coordinates of A, [3]
- (ii) the area of the shaded region. [2]

12 Answer only one of the following alternatives:

Either

In the diagram below, PR is an arc of a circle with centre Q and radius 5cm. PS is an arc of another circle with centre O and radius 2.5cm. OSR and POQ are straight lines. Angle

$$\angle OQR = \frac{\pi}{3} \text{ radians.}$$

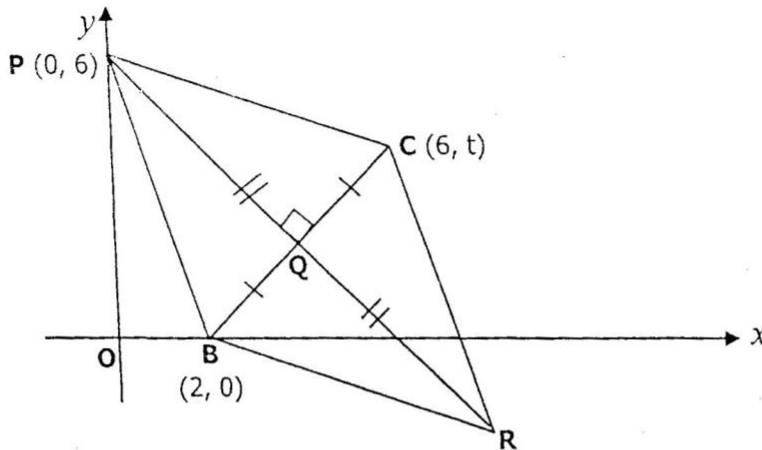


Find

- (a) the area of the shaded region, [6]
- (b) the perimeter of the shaded region. [4]

Or

In the diagram below, BPCR is a rhombus. P is (0, 6), C is (6, t) and B is (2, 0). The lines PR and BC bisect at Q, PR = 2BC and PR = $8\sqrt{2}$.



Find

- (a) the value of t and the coordinates of R, [5]
- (b) the equation of PR, [3]
- (c) the area of the rhombus. [2]