

# 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  $\triangle ABC$

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

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

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

- 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]

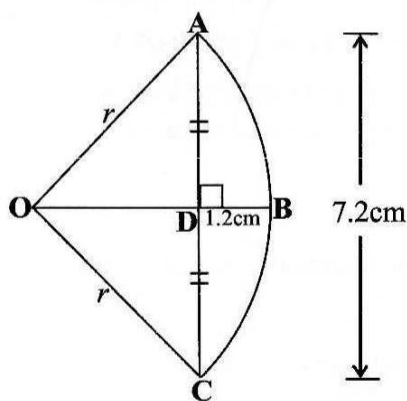
- 4 A function  $g$  is defined by  $g:x \longrightarrow \frac{2x-1}{3}$ .

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 5<sup>th</sup> 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]

---

9 Find all the angles between  $0^\circ$  and  $360^\circ$  which satisfy the equation

$|9 \cos x + 3| = 2$ . [5]

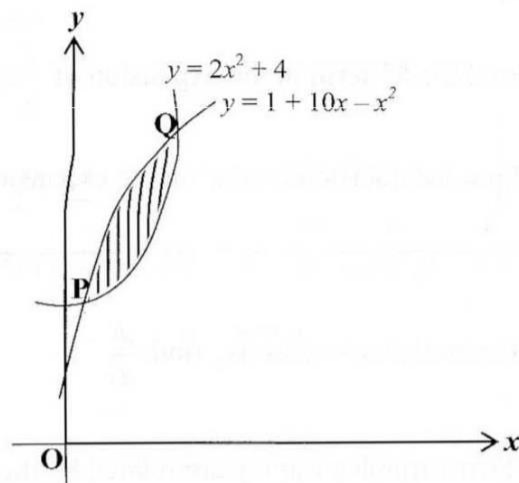
---

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.



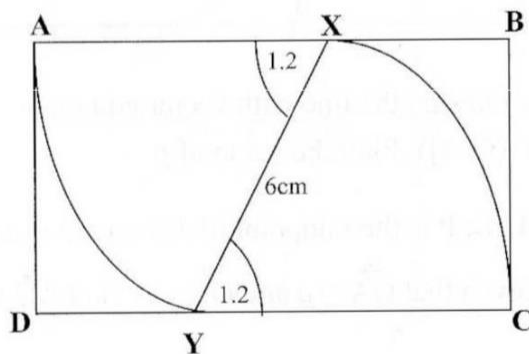
Find

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

Answer only one of the following alternatives.

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 XCY = 1.2 radians.



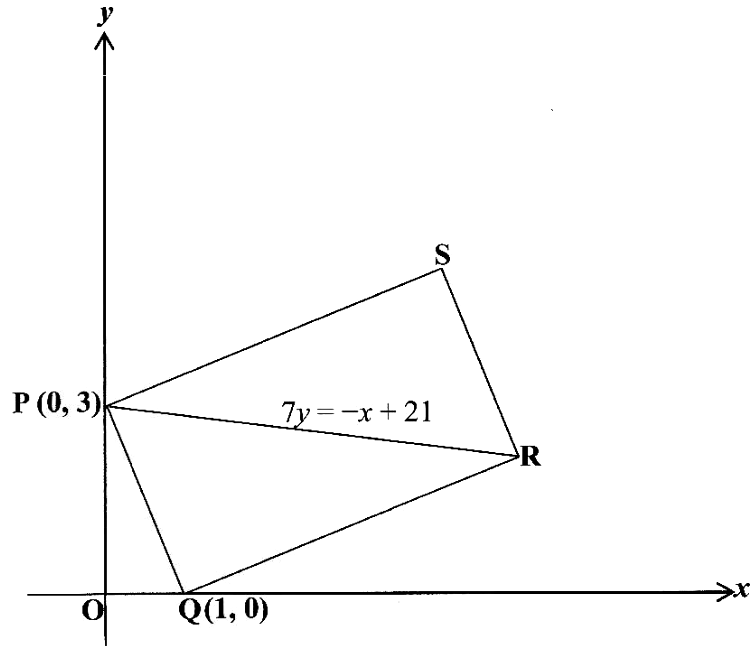
Find

- (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  $7y = -x + 21$ .



Find

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

---