



GCE AS/A level

0974/01

MATHEMATICS C2

Pure Mathematics

A.M. TUESDAY, 17 January 2012

1½ hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a 12 page answer book;
- a Formula Booklet;
- a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Answer **all** questions.

Sufficient working must be shown to demonstrate the **mathematical** method employed.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

1. Use the Trapezium Rule with five ordinates to find an approximate value for the integral

$$\int_1^3 \frac{x}{1+\sqrt{x}} dx.$$

Show your working and give your answer correct to three decimal places.

[4]

2. (a) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying

$$10\sin^2 \theta + 7\cos \theta = 5\cos^2 \theta + 8.$$

[6]

- (b) Find all values of x in the range $0^\circ \leq x \leq 360^\circ$ satisfying

$$\sin(x - 50^\circ) = -0.682.$$

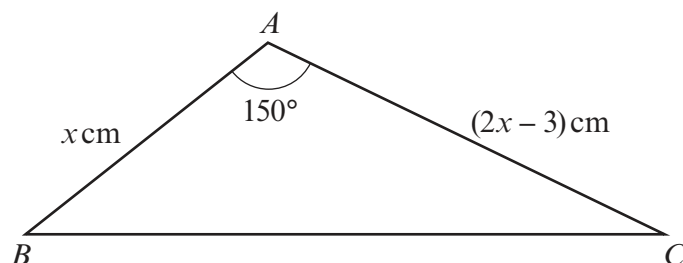
[3]

- (c) Without carrying out any calculations, explain why there are no values of ϕ which satisfy the equation

$$\sin \phi + \cos \phi = 3.$$

[1]

3. The diagram below shows a sketch of the triangle ABC with $AB = x$ cm, $AC = (2x - 3)$ cm and $\hat{BAC} = 150^\circ$. The area of triangle ABC is 6.75 cm^2 .



- (a) Show that x satisfies the equation $2x^2 - 3x - 27 = 0$. Hence evaluate x .

[4]

- (b) Find the length of BC . Give your answer correct to two decimal places.

[2]

The point D lies on BC and is such that AD is perpendicular to BC .

- (c) Find the length of AD . Give your answer correct to two decimal places.

[2]

4. The fifteenth term of an arithmetic series is seven times the fifth term.
The sum of the first eleven terms of the series is 88.

(a) Find the first term and common difference of the arithmetic series. [6]

(b) Given that the n th term of the series is 143, find the value of n . [2]

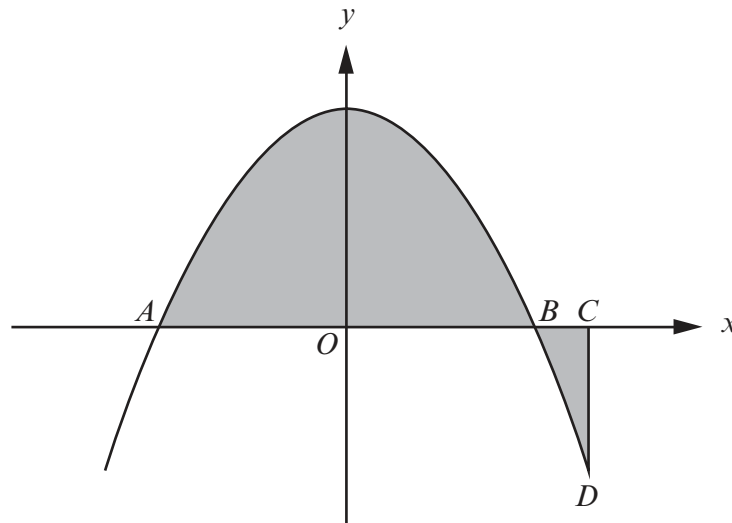
5. (a) A geometric series has first term a and common ratio r . Prove that the sum of the first n terms is given by

$$S_n = \frac{a(1-r^n)}{1-r}. \quad [3]$$

(b) The sum of the first two terms of a geometric series is 25.2. The sum to infinity of the series is 30. Given that the common ratio is positive, find the common ratio and first term of this geometric series. [6]

6. (a) Find $\int \left(\frac{4}{x^3} - 3x^{\frac{1}{4}} \right) dx$. [2]

(b)



The diagram shows a sketch of the curve $y = 4 - x^2$.
The curve intersects the x -axis at the points A and B . The point C has coordinates $(3, 0)$.
The point D lies on the curve and CD is parallel to the y -axis.

(i) Showing your working, find the x -coordinates of the points A and B . [2]

(ii) Find the **total** area of the shaded regions. [6]

TURN OVER

7. (a) Given that $x > 0, y > 0$, show that

$$\log_a xy = \log_a x + \log_a y. \quad [3]$$

- (b) Solve the equation

$$2^{3-5x} = 12.$$

Show your working and give your answer correct to three decimal places. [3]

- (c) (i) Express

$$\log_9(3x-1) + \log_9(x+4) - 2\log_9(x+1)$$

as a single logarithm.

- (ii) Hence solve the equation

$$\log_9(3x-1) + \log_9(x+4) - 2\log_9(x+1) = \frac{1}{2}. \quad [5]$$

8. The circle C has centre A and radius r . The points $P(3, -8)$ and $Q(5, 6)$ are at either end of a diameter of C .

- (a) (i) Write down the coordinates of A .

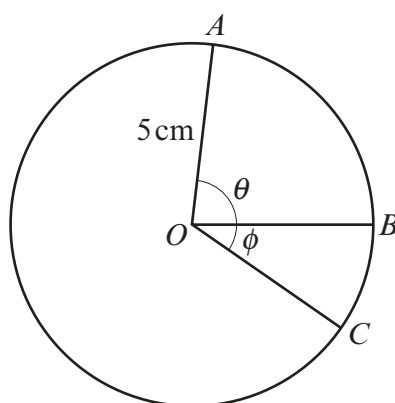
- (ii) Show that $r = \sqrt{50}$.

- (iii) Write down the equation of C . [4]

- (b) Verify that the point $R(9, -6)$ lies on C . [2]

- (c) Find $\widehat{PQR}$. [3]

9.



The diagram shows a circle with centre O and radius 5 cm. The points A , B and C lie on the circle and the angles θ and ϕ are measured in radians. The sum of the areas of the sectors AOB and BOC is 22.5 cm^2 .

- (a) Show that $\theta + \phi = 1.8$. [2]

- (b) Given that the arc AB is 3.5 cm longer than the arc BC , find the values of θ and ϕ . [4]