



GCE AS/A Level – **LEGACY**

0974/01



MATHEMATICS – C2
Pure Mathematics

WEDNESDAY, 22 MAY 2019 – MORNING

1 hour 30 minutes

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- a WJEC pink 16-page answer booklet;
- 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

$$\int_4^5 \frac{1}{\sqrt{6x - x^2 - 4}} dx.$$

Show your working and give your answer correct to four decimal places. [4]

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

$$6 \cos^2 \theta + 2 = 4 \sin^2 \theta - \cos \theta. \quad [6]$$

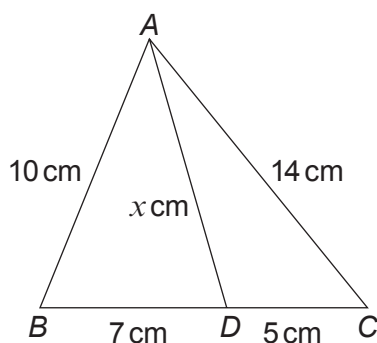
- (b) Find all values of x in the range $0^\circ \leq x \leq 180^\circ$ satisfying

$$\tan(2x - 51^\circ) = -0.7. \quad [3]$$

- (c) Find all values of ϕ in the range $0^\circ \leq \phi \leq 180^\circ$ satisfying

$$9 \tan \phi + 14 \sin \phi = 0. \quad [4]$$

3. The diagram below shows a sketch of the triangle ABC with $AB = 10$ cm and $AC = 14$ cm. The point D is on BC such that $BD = 7$ cm, $DC = 5$ cm and $AD = x$ cm.



- (a) (i) By applying the cosine rule in each of the triangles ADB and ADC , show that

$$\cos \hat{ADB} = \frac{x^2 - 51}{14x} \text{ and find a similar expression for } \cos \hat{ADC}.$$

- (ii) Noting that \hat{ADB} and \hat{ADC} are angles on a straight line, use the expressions derived in (a) (i) to write down an equation satisfied by x . Hence, show that $x = 11$. [6]

- (b) Find the exact value of the area of triangle ADB . Give your answer in its simplest form. [4]

4. (a) The first term of an arithmetic series is 6 and the common difference is -4 .

- (i) Show that the n th term of the arithmetic series is $10 - 4n$.
 (ii) The sum of the first n terms of this series is given by

$$S_n = 6 + 2 + \dots + (14 - 4n) + (10 - 4n).$$

Without using the formula for the sum of the first n terms of an arithmetic series, find an expression for S_n in the form

$$S_n = 2n(a + bn),$$

where a, b are integers whose values are to be found. [4]

- (b) The sum of the first eight terms of another arithmetic series is 44. The sum of the **next** ten terms of the series is 325. Find the first term and the common difference of the arithmetic series. [5]

5. (a) The p th term of a geometric series is $\frac{64}{9}$. The $(p + 3)$ th term of this series is -24 .

Find the $(p + 7)$ th term of the series. [4]

- (b) Water is leaking through a faulty valve at the bottom of a tank. The volume of water which leaks through the valve during the first minute after the tank has been filled is 70 ml. In each subsequent minute, the volume of water which leaks through the valve may be assumed to be 96% of the volume which leaked through the valve during the previous minute.

- (i) Find the volume of water which leaks through the valve during the 8th minute after the tank has been filled. Give your answer in ml, correct to one decimal place.
 (ii) At the end of the n th minute after the tank has been filled, the **total** volume of water which has leaked through the valve during these n minutes is 1192 ml, correct to the nearest ml. Showing all your working, find the value of n . [7]

6. (a) Find $\int \left(\frac{4}{\sqrt[3]{x}} - 7x^{\frac{5}{4}} \right) dx$. [2]

- (b) The region R is bounded by the curve $y = 5x^2 + \frac{1}{2}x^4 + 1$, the x -axis and the lines $x = -1$, $x = 2$. Find the area of R . [5]

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

$$\log_a \left(\frac{x}{y} \right) = \log_a x - \log_a y. \quad [3]$$

- (b) Given that $\int_2^5 \log_{10} x \, dx = 1.59$, correct to two decimal places, find an approximate value for $\int_2^5 \log_{10} (100x) \, dx$. [3]

8. The circle C has centre A and radius r . The points $P(5, -10)$ and $Q(7, 4)$ are at opposite ends of a diameter of C .

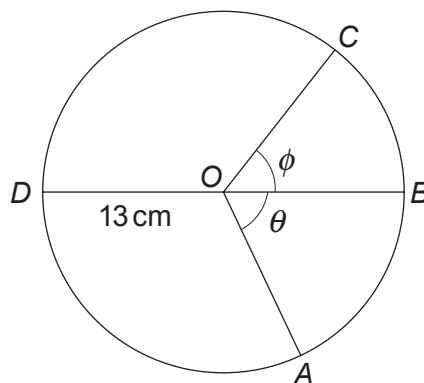
- (a) (i) Write down the coordinates of A .

(ii) Show that $r = \sqrt{50}$. [3]

- (b) The point $R(11, 2)$ lies on the circle C . Show that $\tan \widehat{QPR}$ may be expressed in the form $\frac{a}{b}$, where a, b are integers whose values are to be found. [3]

- (c) The point S lies on the circle C . The tangent to the circle at S passes through the point $T(21, -12)$. Find the length of ST . [3]

9.



The diagram shows a sketch of a circle with centre O and radius 13 cm . Four points A, B, C and D lie on the circle. The line BD is a diameter of the circle, $\widehat{AOB} = \theta$ radians and $\widehat{BOC} = \phi$ radians.

- (a) The area of sector AOB is 104.78 cm^2 . Find the value of θ . [2]
- (b) The length of the arc BC is 19 cm less than the length of the arc CD . Find the value of ϕ , giving your answer correct to two decimal places. [4]

END OF PAPER