



GCE AS/A Level – **LEGACY**

0974/01



**MATHEMATICS – C2**  
**Pure Mathematics**

WEDNESDAY, 23 MAY 2018 – 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. (a) Use the Trapezium Rule with five ordinates to find an approximate value for the integral

$$\int_1^4 \log_{10}(6x-1) dx.$$

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

- (b) Use your answer to part (a) to deduce an approximate value for the integral

$$\int_1^4 \log_{10} \sqrt{(6x-1)} dx. \quad [1]$$

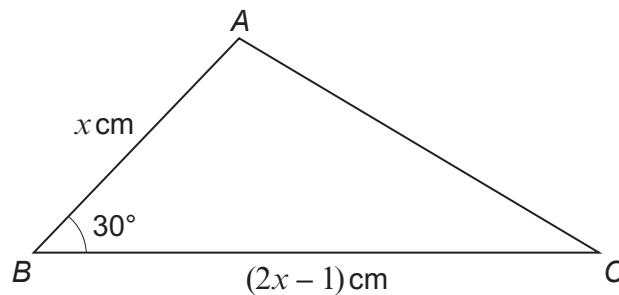
2. (a) Find all values of  $\theta$  in the range  $0^\circ \leq \theta \leq 360^\circ$  satisfying

$$10 \sin^2 \theta + 3 \sin \theta = 4 \cos^2 \theta - 2. \quad [6]$$

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

$$\frac{3}{\cos \phi} - \frac{5}{\sin \phi} = 0. \quad [3]$$

3. (a) The diagram below shows a sketch of the triangle  $ABC$  with  $AB = x$  cm,  $BC = (2x - 1)$  cm and  $\hat{ABC} = 30^\circ$ . The area of triangle  $ABC$  is  $11.25$  cm<sup>2</sup>.



- (i) Write down and simplify a quadratic equation satisfied by  $x$ .  
Hence show that  $x = 5$ .
- (ii) Find the length of  $AC$ . Give your answer correct to one decimal place. [6]
- (b) The triangle  $XYZ$  is such that  $XY = 29$  cm,  $XZ = 16$  cm and  $\hat{XYZ} = 17^\circ$ .  
Find the possible values of  $\hat{YXZ}$ . Give your answers correct to the nearest degree. [4]

4. Dafydd enters into an agreement with a finance company to provide him with a loan to buy a car. Under the terms of the agreement, he is to repay a total of £3900 over a period of two years by making 24 monthly repayments. The first repayment is £ $P$ , and in each subsequent month, the value of the repayment for that month is £ $x$  **less** than the repayment for the previous month. Given that Dafydd's eighth repayment is £185, find the value of  $P$  and the value of  $x$ . [5]

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

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

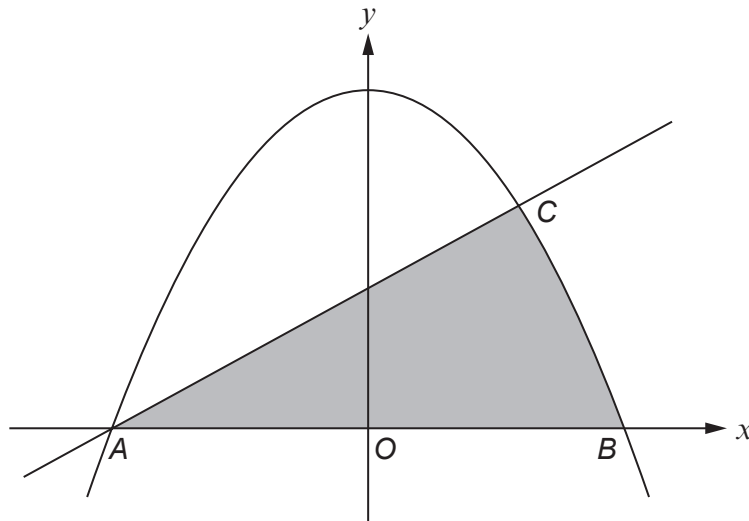
- (b) The sum of the first and third terms of a geometric series is 340. The sum of the fourth and sixth terms of the series is 73.44.

(i) Prove that  $r = 0.6$ , where  $r$  denotes the common ratio of the series.

(ii) Find the sum to infinity of the series. [8]

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

(b)



The diagram shows a sketch of the curve  $y = 25 - x^2$  and the line  $y = 2x + 10$ . The curve and the line intersect at the points  $A$  and  $C$ . The curve intersects the  $x$ -axis at the points  $A$  and  $B$ . The coordinates of  $A$ ,  $B$  and  $C$  are  $(-5, 0)$ ,  $(5, 0)$  and  $(3, 16)$  respectively. Find the area of the shaded region. [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) Find all values of  $x$  satisfying the equation

$$\log_a(11x^2 + 16x + 5) - \log_a(4x^2 + 1) = 3 \log_a 2. \quad [5]$$

8. The circle  $C_1$  has centre  $A(2, -1)$  and passes through the point  $P(6, 1)$ .

- (a) (i) Show that the equation of  $C_1$  is given by

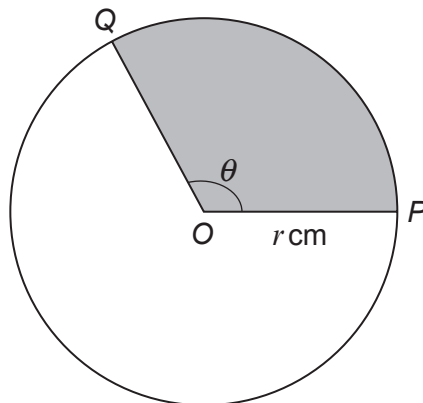
$$x^2 + y^2 - 4x + 2y - 15 = 0.$$

- (ii) Given that the point  $Q$  is such that  $PQ$  is a diameter of  $C_1$ , find the coordinates of  $Q$ .

- (iii) Find the equation of the tangent to  $C_1$  at  $P$ . [9]

- (b) The circle  $C_2$  has centre  $B(-4, 7)$  and radius  $\sqrt{8}$ . Find the shortest distance between  $C_1$  and  $C_2$ . Give your answer correct to one decimal place. [3]

9.



The diagram shows two points  $P$  and  $Q$  on a circle with centre  $O$ . The radius of the circle is  $r$  cm and  $\widehat{POQ} = \theta$  radians. The **perimeter** of the shaded sector  $POQ$  is 27 cm and its **area** is  $45 \text{ cm}^2$ .

- (a) Write down two equations involving  $r$  and  $\theta$ . [2]

- (b) Show that  $2r^2 - 27r + 90 = 0$ . [2]

- (c) Find the two possible values of  $r$  and the corresponding values of  $\theta$ . [3]

**END OF PAPER**