



**GCE AS/A level**

0973/01



S15-0973-01

**MATHEMATICS – C1**  
**Pure Mathematics**

A.M. WEDNESDAY, 13 May 2015

1 hour 30 minutes

#### **ADDITIONAL MATERIALS**

In addition to this examination paper, you will need:

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

#### **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.

Calculators are **not** allowed for this paper.

#### **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. The points  $A$ ,  $B$ ,  $C$  have coordinates  $(-7, 3)$ ,  $(2, 0)$ ,  $(-3, 5)$ , respectively. The line  $L$  passes through  $C$  and is perpendicular to  $AB$ .

(a) (i) Find the gradient of  $AB$ .

(ii) Show that the equation of  $AB$  is

$$x + 3y - 2 = 0.$$

(iii) Find the equation of  $L$ .

[7]

(b) The line  $L$  intersects  $AB$  at the point  $D$ . Show that the coordinates of  $D$  are  $(-4, 2)$ .

[2]

(c) Show that  $L$  is not the perpendicular bisector of  $AB$ .

[2]

(d) Find the value of  $\tan \hat{ABC}$ . Give your answer in its simplest form.

[5]

2. Simplify

(a)  $\frac{4\sqrt{2} - \sqrt{11}}{3\sqrt{2} + \sqrt{11}},$

[4]

(b)  $\frac{7}{2\sqrt{14}} + \left(\frac{\sqrt{14}}{2}\right)^3.$

[3]

3. The curve  $C$  has equation  $y = x^3 - x^2 - 13x + 18$ .

(a) The point  $P$ , whose  $x$ -coordinate is 2, lies on  $C$ . Find the equation of the **normal** to  $C$  at  $P$ .

[6]

(b) The point  $Q$ , whose  $x$ -coordinate is  $a$ , lies on  $C$  and is such that the **tangent** to  $C$  at  $Q$  is parallel to the line with equation  $y = -8x + 7$ .

Find the possible values of  $a$ .

[3]

4. (a) Express  $4x^2 - 24x - 189$  in the form  $a(x + b)^2 + c$ , where the values of the constants  $a$ ,  $b$  and  $c$  are to be found.

[3]

(b) **Using your answer to part (a)**, solve the equation

$$4x^2 - 24x - 189 = 0.$$

[3]

5. (a) Find the range of values of  $k$  for which the quadratic equation

$$kx^2 + (2k - 5)x + (k - 6) = 0$$

has **no real roots**.

[4]

- (b) Without carrying out any further calculation, write down the value of  $k$  for which the quadratic equation

$$kx^2 + (2k - 5)x + (k - 6) = 0$$

has **two equal roots**.

[1]

6. (a) Using the binomial theorem, write down and simplify the first four terms in the expansion of  $\left(1 - \frac{x}{2}\right)^8$  in ascending powers of  $x$ .

[4]

- (b) The first two terms in the expansion of  $(2 + ax)^n$  in ascending powers of  $x$  are 32 and  $-240x$  respectively. Find the value of  $n$  and the value of  $a$ .

[4]

7. (a) Given that  $y = 9x^2 - 8x - 3$ , find  $\frac{dy}{dx}$  from first principles.

[5]

- (b) Differentiate  $\frac{3}{x^6} - 4x^{\frac{5}{3}}$  with respect to  $x$ .

[2]

8. (a) Given that  $x - 3$  is a factor of  $px^3 - 13x^2 - 19x + 12$ , write down an equation satisfied by  $p$ . Hence show that  $p = 6$ .

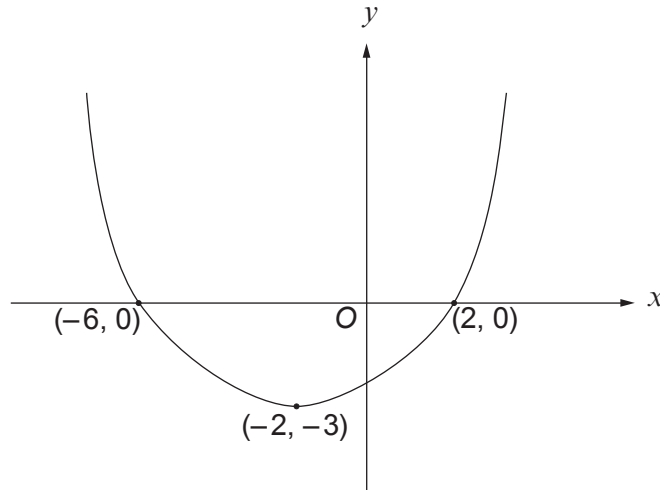
[2]

- (b) Solve the equation  $6x^3 - 13x^2 - 19x + 12 = 0$ .

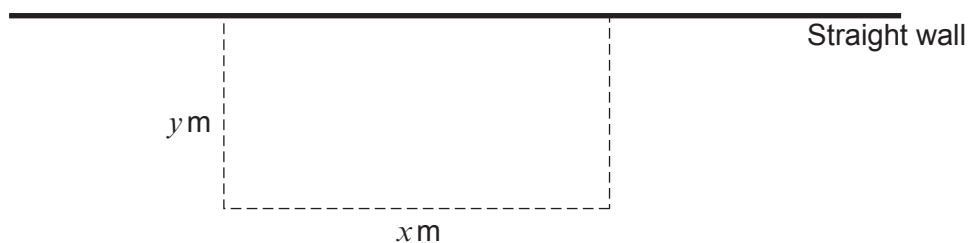
[4]

# TURN OVER

9. The diagram shows a sketch of the graph of  $y = f(x)$ . The graph passes through the points  $(-6, 0)$  and  $(2, 0)$  and has a minimum point at  $(-2, -3)$ .



- (a) Sketch the graph of  $y = f\left(\frac{1}{2}x\right)$ , indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the  $x$ -axis. [3]
- (b) Angharad is asked by her teacher to draw the graph of  $y = af(x)$  for various non-zero values of the constant  $a$ . One of Angharad's graphs passes through the origin  $O$ . Explain why this cannot possibly be correct. [1]
10. A sheep farmer wishes to construct a rectangular enclosure for his animals. He decides to use a straight wall as one side of the enclosure and fencing for the other three sides. The area of the enclosure is to be  $800\text{m}^2$ . The lengths of the sides of the rectangular enclosure are  $x\text{m}$  and  $y\text{m}$ , as shown in the diagram, and the total length of the **fencing** is  $L\text{m}$ .



- (a) Show that  $L = x + \frac{1600}{x}$ . [2]
- (b) Find the minimum value of  $L$ , showing that the value you have found is a minimum value. [5]

**END OF PAPER**