

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

**Pearson Edexcel International Advanced Level**

**Thursday 9 May 2024**

Morning (Time: 1 hour 30 minutes) **Paper reference** **WMA11/01**

**Mathematics**

**International Advanced Subsidiary/Advanced Level**

**Pure Mathematics P1**

**You must have:**  
Mathematical Formulae and Statistical Tables (Yellow), calculator

Total Marks

**Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.**

### Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear.  
Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

### Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 11 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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1. Find

$$\int \left( 10x^4 - \frac{3}{2x^3} - 7 \right) dx$$

giving each term in simplest form.

(3)



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Question 1 continued

Lined area for writing the answer to Question 1.

(Total for Question 1 is 3 marks)



2. (i) Given that  $m = 2^n$ , express each of the following in simplest form in terms of  $m$ .

(a)  $2^{n+3}$  (1)

(b)  $16^{3n}$  (2)

(ii) **In this question you must show all stages of your working.**

**Solutions relying on calculator technology are not acceptable.**

Solve the equation

$$x\sqrt{3} - 3 = x + \sqrt{3}$$

giving your answer in the form  $p + q\sqrt{3}$  where  $p$  and  $q$  are integers. (3)



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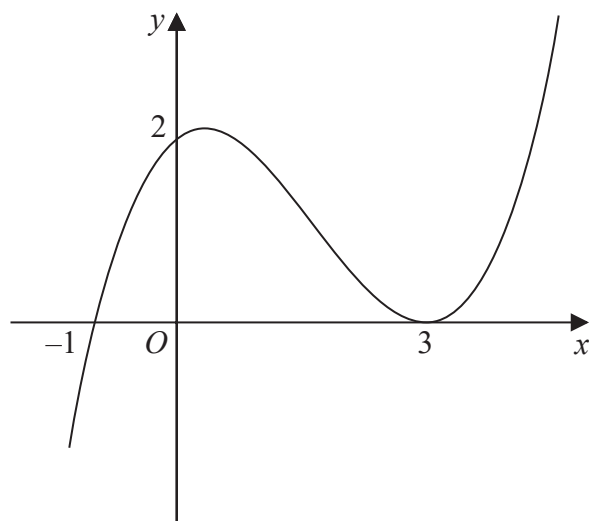
Question 2 continued

Lined area for writing the answer to Question 2.

(Total for Question 2 is 6 marks)



3.



**Figure 1**

Figure 1 shows a sketch of the curve with equation  $y = f(x)$ .

The curve passes through the points  $(-1, 0)$  and  $(0, 2)$  and touches the  $x$ -axis at the point  $(3, 0)$ .

On separate diagrams, sketch the curve with equation

(a)  $y = f(x + 3)$  (3)

(b)  $y = f(-3x)$  (3)

On each diagram, show clearly the coordinates of all the points where the curve cuts or touches the coordinate axes.

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Question 3 continued

(Total for Question 3 is 6 marks)



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4. The curve  $C_1$  has equation

$$y = x^2 + kx - 9$$

and the curve  $C_2$  has equation

$$y = -3x^2 - 5x + k$$

where  $k$  is a constant.

Given that  $C_1$  and  $C_2$  meet at a single point  $P$

(a) show that

$$k^2 + 26k + 169 = 0 \quad (3)$$

(b) Hence find the coordinates of  $P$  (3)

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Question 4 continued

Lined area for writing answers.

(Total for Question 4 is 6 marks)



5.

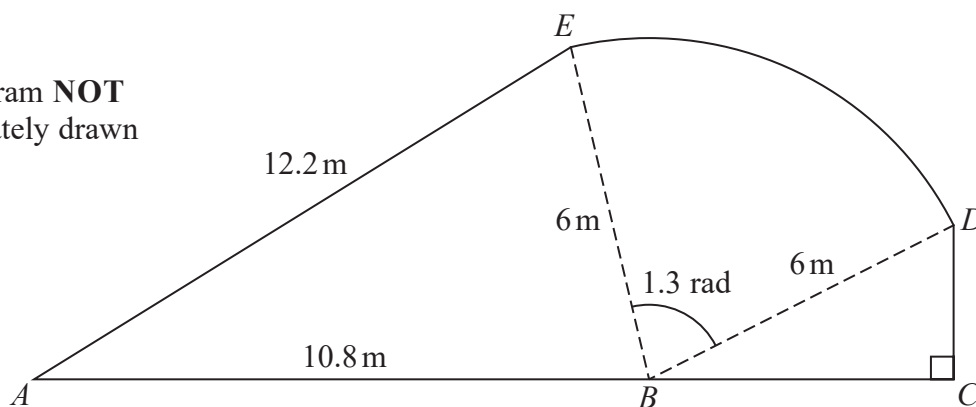
Diagram **NOT**  
accurately drawn

Figure 2

Figure 2 shows the plan view of a garden.

The shape of the garden  $ABCDEA$  consists of a triangle  $ABE$  and a right-angled triangle  $BCD$  joined to a sector  $BDE$  of a circle with radius 6 m and centre  $B$ .

The points  $A$ ,  $B$  and  $C$  lie on a straight line with  $AB = 10.8$  m

Angle  $BCD = \frac{\pi}{2}$  radians, angle  $EBD = 1.3$  radians and  $AE = 12.2$  m

- (a) Find the area of the sector  $BDE$ , giving your answer in  $\text{m}^2$  (2)
- (b) Find the size of angle  $ABE$ , giving your answer in radians to 2 decimal places. (2)
- (c) Find the area of the garden, giving your answer in  $\text{m}^2$  to 3 significant figures. (3)

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Question 5 continued

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Question 5 continued

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Question 5 continued

Lined area for writing the answer to Question 5.

(Total for Question 5 is 7 marks)



6.

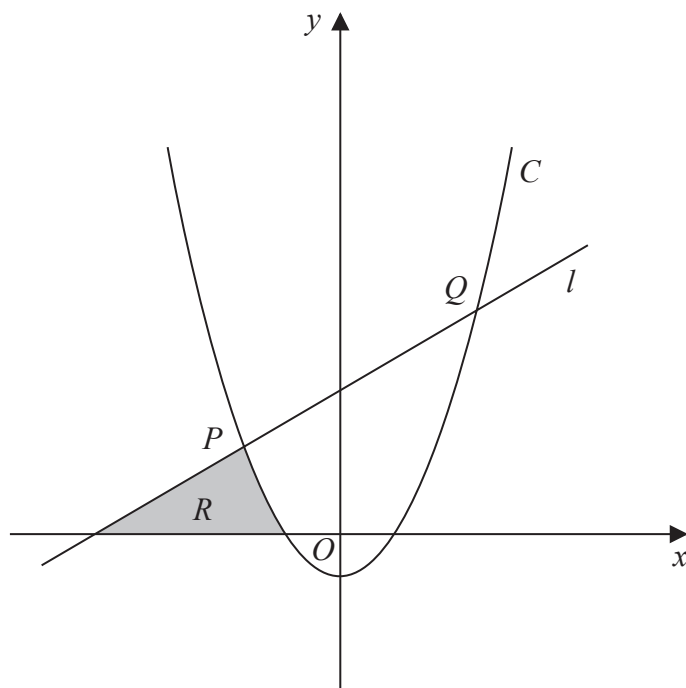


Figure 3

**In this question you must show all stages of your working.**

**Solutions relying on calculator technology are not acceptable.**

Figure 3 shows

- the line  $l$  with equation  $y - 5x = 75$
- the curve  $C$  with equation  $y = 2x^2 + x - 21$

The line  $l$  intersects the curve  $C$  at the points  $P$  and  $Q$ , as shown in Figure 3.

- (a) Find, using algebra, the coordinates of  $P$  and the coordinates of  $Q$ . (4)

The region  $R$ , shown shaded in Figure 3, is bounded by  $C$ ,  $l$  and the  $x$ -axis.

- (b) Use inequalities to define the region  $R$ . (3)

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Question 6 continued

Lined area for writing the answer to Question 6.



Question 6 continued

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Question 6 continued

Lined area for writing answers.

(Total for Question 6 is 7 marks)



7. The curve  $C$  has equation  $y = f(x)$  where

$$f(x) = 2x^3 - kx^2 + 14x + 24$$

and  $k$  is a constant.

- (a) Find, in simplest form,

- (i)  $f'(x)$

- (ii)  $f''(x)$

(3)

The curve with equation  $y = f'(x)$  intersects the curve with equation  $y = f''(x)$  at the points  $A$  and  $B$ .

Given that the  $x$  coordinate of  $A$  is 5

- (b) find the value of  $k$ .

(2)

- (c) Hence find the coordinates of  $B$ .

(3)

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Question 7 continued

Lined area for writing answers.

(Total for Question 7 is 8 marks)



8. The curve  $C_1$  has equation

$$y = x(4 - x^2)$$

- (a) Sketch the graph of  $C_1$  showing the coordinates of any points of intersection with the coordinate axes.

(3)

The curve  $C_2$  has equation  $y = \frac{A}{x}$  where  $A$  is a constant.

- (b) Show that the  $x$  coordinates of the points of intersection of  $C_1$  and  $C_2$  satisfy the equation

$$x^4 - 4x^2 + A = 0$$

(1)

- (c) Hence find the range of possible values of  $A$  for which  $C_1$  meets  $C_2$  at 4 distinct points.

(3)

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Question 8 continued

Lined area for writing the answer to Question 8.

(Total for Question 8 is 7 marks)



9. Given that

- the point  $A$  has coordinates  $(4, 2)$
- the point  $B$  has coordinates  $(15, 7)$
- the line  $l_1$  passes through  $A$  and  $B$

(a) find an equation for  $l_1$ , giving your answer in the form  $px + qy + r = 0$  where  $p$ ,  $q$  and  $r$  are integers to be found.

(3)

The line  $l_2$  passes through  $A$  and is parallel to the  $x$ -axis.

The point  $C$  lies on  $l_2$  so that the length of  $BC$  is  $5\sqrt{5}$

(b) Find both possible pairs of coordinates of the point  $C$ .

(4)

(c) Hence find the minimum possible area of triangle  $ABC$ .

(2)



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Question 9 continued

Lined area for writing the answer to Question 9.



Question 9 continued

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Question 9 continued

Lined area for writing the answer to Question 9.

(Total for Question 9 is 9 marks)



**10.** The curve  $C$  has equation  $y = f(x)$  where  $x > 0$

Given that

- $f'(x) = 6x - \frac{(2x-1)(3x+2)}{2\sqrt{x}}$

- the point  $P(4, 12)$  lies on  $C$

(a) find the equation of the normal to  $C$  at  $P$ , giving your answer in the form  $y = mx + c$  where  $m$  and  $c$  are integers to be found,

(4)

(b) find  $f(x)$ , giving each term in simplest form.

(6)



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Question 10 continued

Lined area for writing the answer to Question 10.



Question 10 continued

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Question 10 continued

Lined area for writing the answer to Question 10.

(Total for Question 10 is 10 marks)



11.

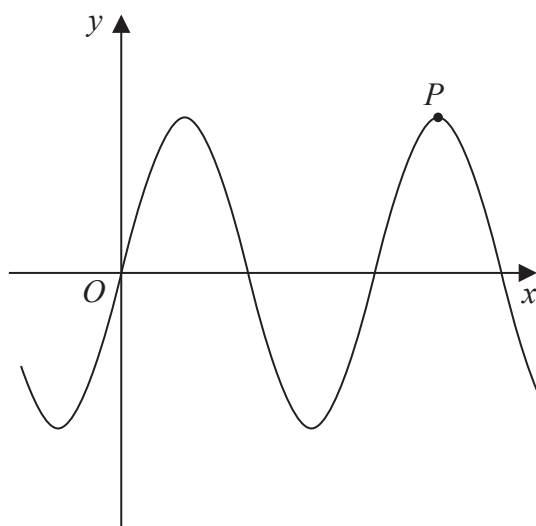


Figure 4

Figure 4 shows a sketch of part of the curve  $C_1$  with equation

$$y = 12 \sin x$$

where  $x$  is measured in radians.

The point  $P$  shown in Figure 4 is a maximum point on  $C_1$

(a) Find the coordinates of  $P$ .

(2)

The curve  $C_2$  has equation

$$y = 12 \sin x + k$$

where  $k$  is a constant.

Given that the **maximum** value of  $y$  on  $C_2$  is 3

(b) find the coordinates of the **minimum** point on  $C_2$  which has the **smallest** positive  $x$  coordinate.

(2)

The curve  $C_3$  has equation

$$y = 12 \sin(x + B)$$

where  $B$  is a positive constant.

Given that  $\left(\frac{\pi}{4}, A\right)$ , where  $A$  is a constant, is the **minimum** point on  $C_3$  which has the **smallest** positive  $x$  coordinate,

(c) find

(i) the value of  $A$ ,

(ii) the smallest possible value of  $B$ .

(2)



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Question 11 continued

Lined area for writing the answer to Question 11.



**Question 11 continued**

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(Total for Question 11 is 6 marks)

**TOTAL FOR PAPER IS 75 MARKS**

