

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				
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**Pearson Edexcel International Advanced Level**

**Monday 9 October 2023**

Afternoon (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. Given that

$$y = 5x^3 + \frac{3}{x^2} - 7x \quad x > 0$$

find, in simplest form,

(a)  $\frac{dy}{dx}$  (3)

(b)  $\frac{d^2y}{dx^2}$  (2)

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2. Given that

$$a = \frac{1}{64}x^2 \quad b = \frac{16}{\sqrt{x}}$$

express each of the following in the form  $kx^n$  where  $k$  and  $n$  are simplified constants.

(a)  $a^{\frac{1}{2}}$  (1)

(b)  $\frac{16}{b^3}$  (1)

(c)  $\left(\frac{ab}{2}\right)^{-\frac{4}{3}}$  (2)

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3.

**In this question you must show all stages of your working.****Solutions relying on calculator technology are not acceptable.**

(a) Write  $\frac{8 - \sqrt{15}}{2\sqrt{3} + \sqrt{5}}$  in the form  $a\sqrt{3} + b\sqrt{5}$  where  $a$  and  $b$  are integers to be found. (3)

(b) Hence, or otherwise, solve

$$(x + 5\sqrt{3})\sqrt{5} = 40 - 2x\sqrt{3}$$

giving your answer in simplest form. (3)

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4.

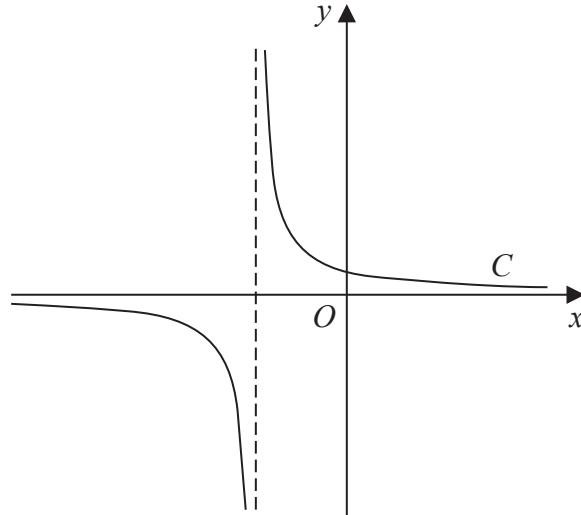


Figure 1

Figure 1 shows a sketch of part of the curve  $C$  with equation  $y = \frac{1}{x+2}$

(a) State the equation of the asymptote of  $C$  that is parallel to the  $y$ -axis.

(1)

(b) Factorise fully  $x^3 + 4x^2 + 4x$

(2)

A copy of Figure 1, labelled Diagram 1, is shown on the next page.

(c) On Diagram 1, add a sketch of the curve with equation

$$y = x^3 + 4x^2 + 4x$$

On your sketch, state clearly the coordinates of each point where this curve cuts or meets the coordinate axes.

(3)

(d) Hence state the number of real solutions of the equation

$$(x+2)(x^3 + 4x^2 + 4x) = 1$$

giving a reason for your answer.

(1)

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## Question 4 continued

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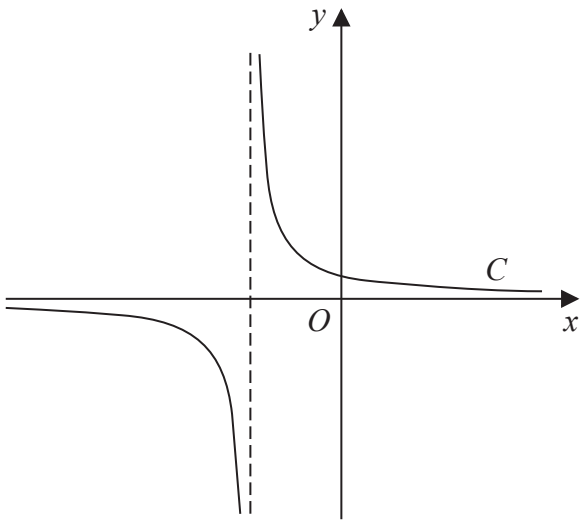
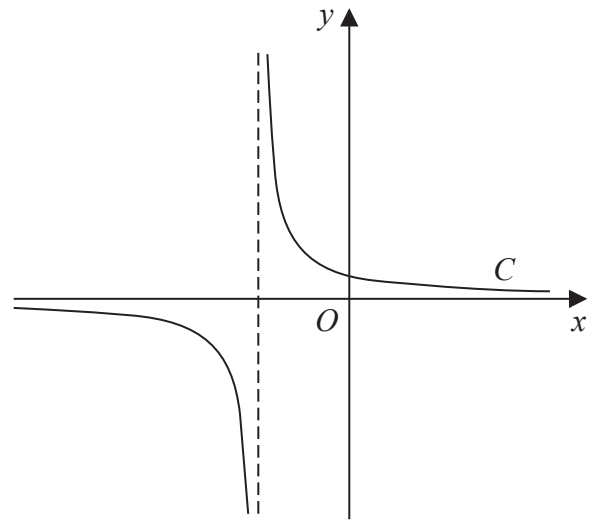


Diagram 1



copy of Diagram 1

Only use the copy of Diagram 1 if you need to redraw your answer to part (c).

(Total for Question 4 is 7 marks)











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

Solutions relying on calculator technology are not acceptable.

The equation

$$4(p - 2x) = \frac{12 + 15p}{x + p} \quad x \neq -p$$

where  $p$  is a constant, has two distinct real roots.

(a) Show that

$$3p^2 - 10p - 8 > 0 \quad (3)$$

(b) Hence, using algebra, find the range of possible values of  $p$  (3)

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

Given that

$$\bullet \quad f'(x) = \frac{4x^2 + 10 - 7x^{\frac{1}{2}}}{4x^{\frac{1}{2}}}$$

• the point  $P(4, -1)$  lies on  $C$

(a) (i) find the value of the gradient of  $C$  at  $P$

(ii) Hence find the equation of the normal to  $C$  at  $P$ , giving your answer in the form  $ax + by + c = 0$  where  $a$ ,  $b$  and  $c$  are integers to be found.

(4)

(b) Find  $f(x)$ .

(6)

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

Solutions relying on calculator technology are not acceptable.

The curve  $C_1$  has equation

$$xy = \frac{15}{2} - 5x \quad x \neq 0$$

The curve  $C_2$  has equation

$$y = x^3 - \frac{7}{2}x - 5$$

(a) Show that  $C_1$  and  $C_2$  meet when

$$2x^4 - 7x^2 - 15 = 0 \quad (2)$$

Given that  $C_1$  and  $C_2$  meet at points  $P$  and  $Q$

(b) find, using algebra, the exact distance  $PQ$  (5)

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9.

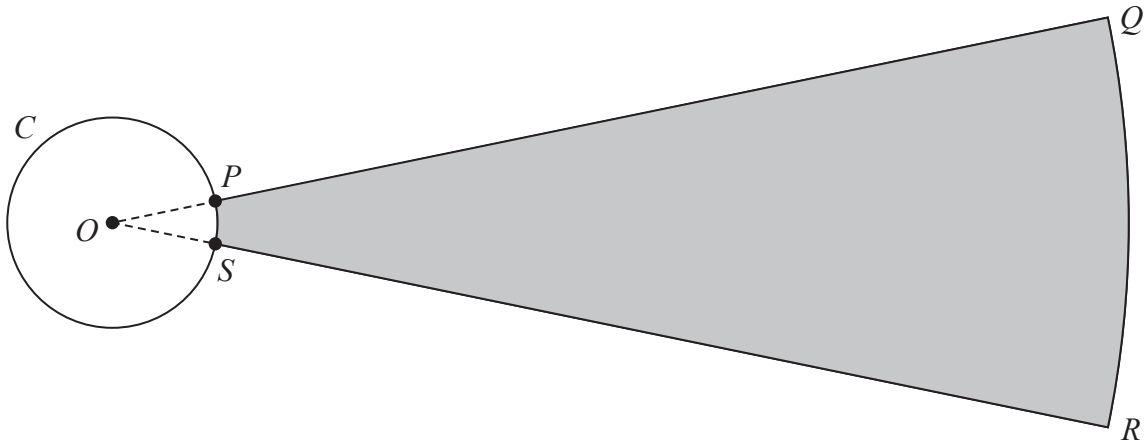
Diagram NOT  
accurately drawn

Figure 3

Figure 3 shows the plan view of the area being used for a ball-throwing competition.

Competitors must stand within the circle  $C$  and throw a ball as far as possible into the target area,  $PQRS$ , shown shaded in Figure 3.

Given that

- circle  $C$  has centre  $O$
- $P$  and  $S$  are points on  $C$
- $OPQRSO$  is a sector of a circle with centre  $O$
- the length of arc  $PS$  is  $0.72$  m
- the size of angle  $POS$  is  $0.6$  radians

(a) show that  $OP = 1.2$  m

(1)

Given also that

- the target area,  $PQRS$ , is  $90$  m<sup>2</sup>
- length  $PQ = x$  metres

(b) show that

$$5x^2 + 12x - 1500 = 0$$

(3)

(c) Hence calculate the total perimeter of the target area,  $PQRS$ , giving your answer to the nearest metre.

(3)

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10.

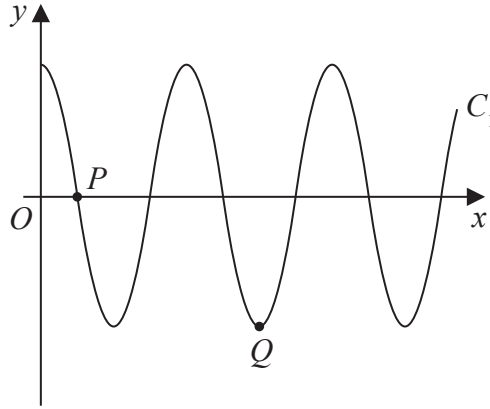


Figure 4

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

$$y = 3 \cos\left(\frac{x}{n}\right)^\circ \quad x \geq 0$$

where  $n$  is a constant.

The curve  $C_1$  cuts the positive  $x$ -axis for the first time at point  $P(270, 0)$ , as shown in Figure 4.

(a) (i) State the value of  $n$

(ii) State the period of  $C_1$

(2)

The point  $Q$ , shown in Figure 4, is a minimum point of  $C_1$

(b) State the coordinates of  $Q$ .

(2)

The curve  $C_2$  has equation  $y = 2 \sin x^\circ + k$ , where  $k$  is a constant.

The point  $R\left(a, \frac{12}{5}\right)$  and the point  $S\left(-a, -\frac{3}{5}\right)$ , both lie on  $C_2$

Given that  $a$  is a constant less than  $90$

(c) find the value of  $k$ .

(2)

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11.

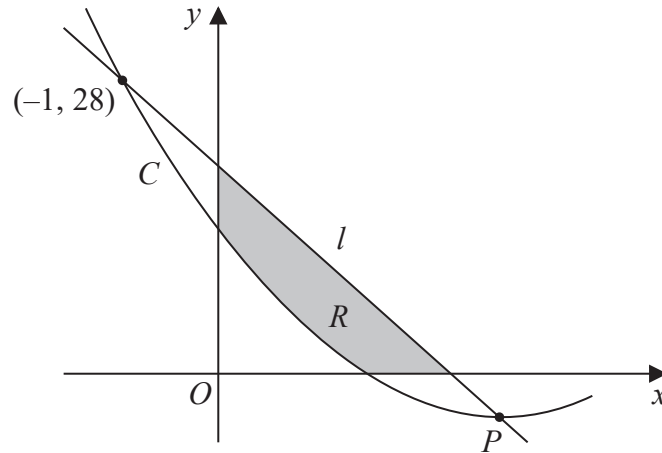


Figure 5

Figure 5 shows part of the curve  $C$  with equation  $y = f(x)$  where

$$f(x) = 2x^2 - 12x + 14$$

(a) Write  $2x^2 - 12x + 14$  in the form

$$a(x + b)^2 + c$$

where  $a$ ,  $b$  and  $c$  are constants to be found.

(3)

Given that  $C$  has a minimum at the point  $P$

(b) state the coordinates of  $P$

(1)

The line  $l$  intersects  $C$  at  $(-1, 28)$  and at  $P$  as shown in Figure 5.

(c) Find the equation of  $l$  giving your answer in the form  $y = mx + c$  where  $m$  and  $c$  are constants to be found.

(3)

The finite region  $R$ , shown shaded in Figure 5, is bounded by the  $x$ -axis,  $l$ , the  $y$ -axis, and  $C$ .

(d) Use inequalities to define the region  $R$ .

(3)

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