Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
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Centre Number | | | | | |

Candidate Number | | | | |

# 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*





Pearson

**1.** Given that

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

find, in simplest form,

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

**(3)**

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

**(2)**

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**Question 1 continued**

**(Total for Question 1 is 5 marks)**

**2.** Given that

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

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

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

**(1)**

(b) $\dfrac{16}{b^3}$

**(1)**

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

**(2)**

**Question 2 continued**

**(Total for Question 2 is 4 marks)**

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

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

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

**(3)**

(b) Hence, or otherwise, solve

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

giving your answer in simplest form.

**(3)**

Question 3 continued

(Total for Question 3 is 6 marks)

**4.**

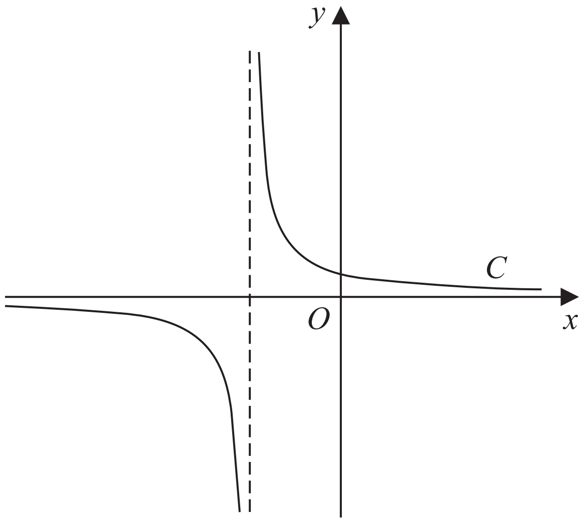



**Figure 1**

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

(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)**

**Question 4 continued**

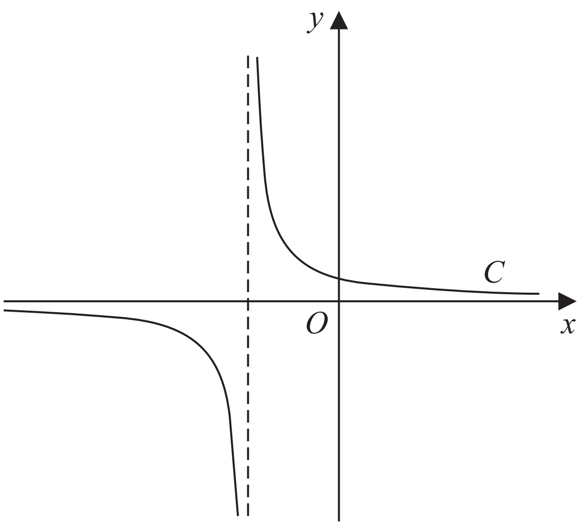
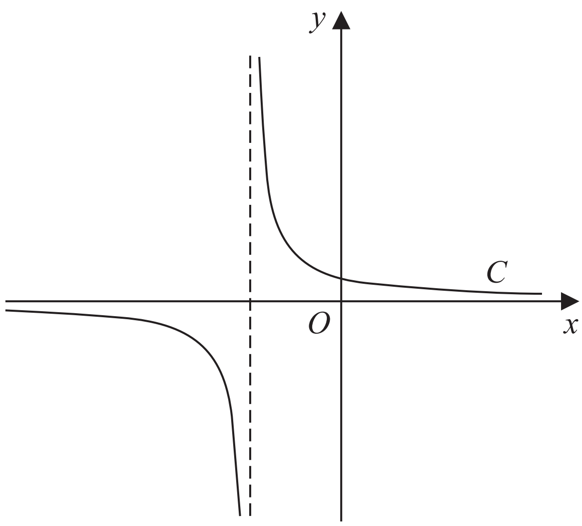



**Diagram 1**




**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)**

**5.**

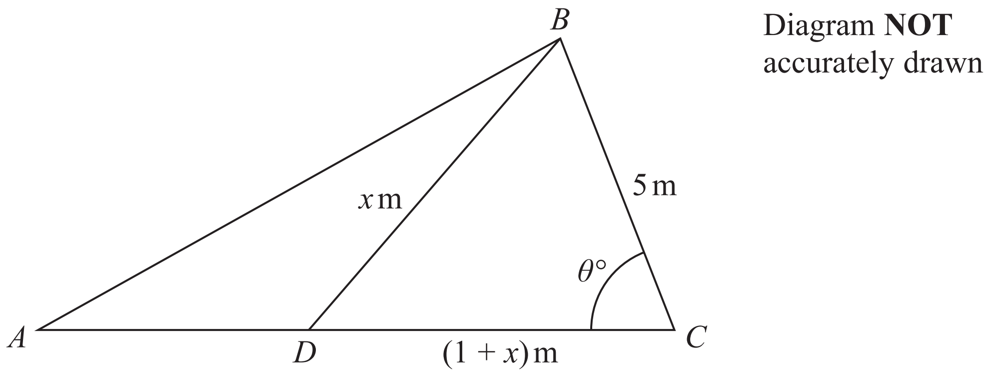



**Figure 2**

Figure 2 shows the plan view of a frame for a flat roof.

The shape of the frame consists of triangle $ABD$ joined to triangle $BCD$.

Given that

- $BD = x$ m
- $CD = (1 + x)$ m
- $BC = 5$ m
- angle $BCD = \theta°$

(a) show that $\cos\theta° = \dfrac{13 + x}{5 + 5x}$

**(2)**

Given also that

- $x = 2\sqrt{3}$
- angle $BAC = 30°$
- $ADC$ is a straight line

(b) find the area of triangle $ABC$, giving your answer, in $m^2$, to one decimal place.

**(5)**

**Question 5 continued**

**Question 5 continued**





P 7 4 3 1 6 A 0 1 2 3 2

**Question 5 continued**

**(Total for Question 5 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

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

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

(a) Show that

$$3p^2 - 10p - 8 > 0$$

**(3)**

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

**(3)**

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**Question 6 continued**

**(Total for Question 6 is 6 marks)**

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

Given that

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

- 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)**

**Question 7 continued**

**Question 7 continued**

**Question 7 continued**

**(Total for Question 7 is 10 marks)**

**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

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

The curve $C_2$ has equation

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

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

$$2x^4 - 7x^2 - 15 = 0$$

**(2)**

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

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

**(5)**

Question 8 continued

**Question 8 continued**





P 7 4 3 1 6 A 0 2 2 3 2

**Question 8 continued**

**(Total for Question 8 is 7 marks)**

**9.**

Diagram **NOT** accurately drawn

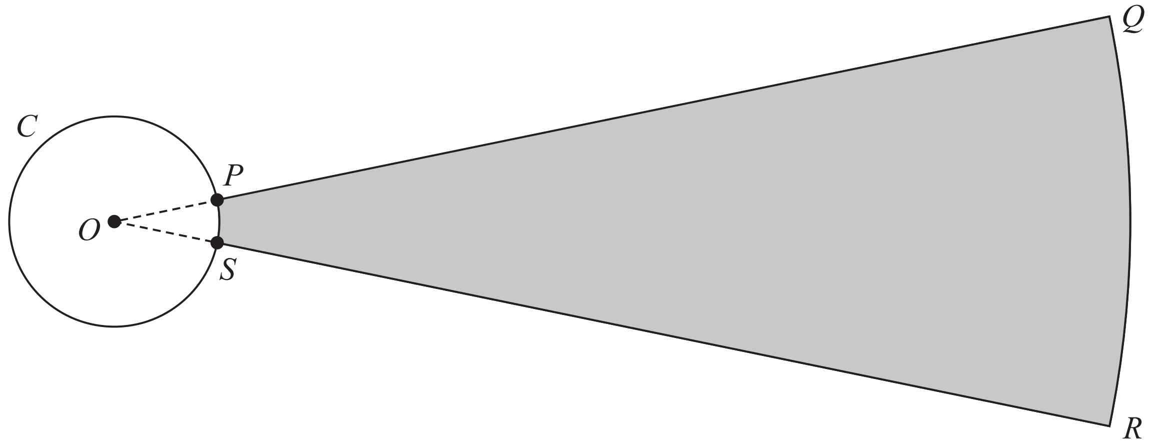


**Figure 3**

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 $90\text{ m}^2$
- 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)**

Question 9 continued

**Question 9 continued**

**Question 9 continued**

**(Total for Question 9 is 7 marks)**

**10.**

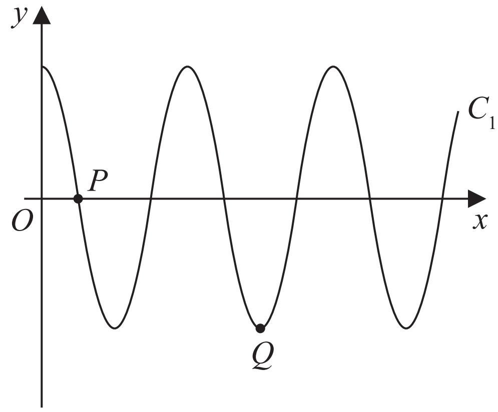


**Figure 4**

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

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

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)**





P 7 4 3 1 6 A 0 2 8 3 2

**Question 10 continued**

**(Total for Question 10 is 6 marks)**

**11.**

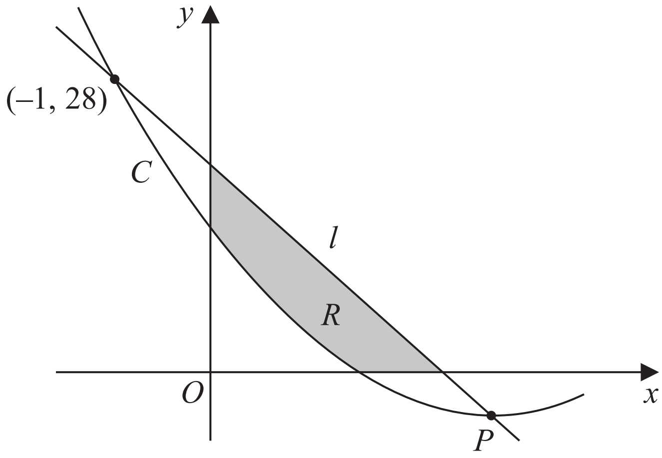


**Figure 5**

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

$$\mathrm{f}(x) = 2x^2 - 12x + 14$$

(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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Question 11 continued

**Question 11 continued**

**(Total for Question 11 is 10 marks)**

**TOTAL FOR PAPER IS 75 MARKS**