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Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|
| | |

**Pearson Edexcel**
**International Advanced Level**

Centre Number | Candidate Number

Specimen Paper

(Time: 1 hour 30 minutes) | Paper Reference **WMA12/01**

# Mathematics

## International Advanced Subsidiary/Advanced Level
## Pure Mathematics P2

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

Total Marks

**Candidates may use any calculator permitted 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 10 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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**Answer ALL questions. Write your answers in the spaces provided.**

**1.** (a) Find the first four terms, in ascending powers of $x$, in the binomial expansion of

$$\left(1 - \frac{1}{8}x\right)^{10}$$

giving each term in its simplest form.

**(3)**

(b) Hence find the coefficient of $x^3$ in the expansion of

$$(3 + 10x)\left(1 - \frac{1}{8}x\right)^{10}$$

**(2)**

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**Question 1 continued**

**Q1**

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

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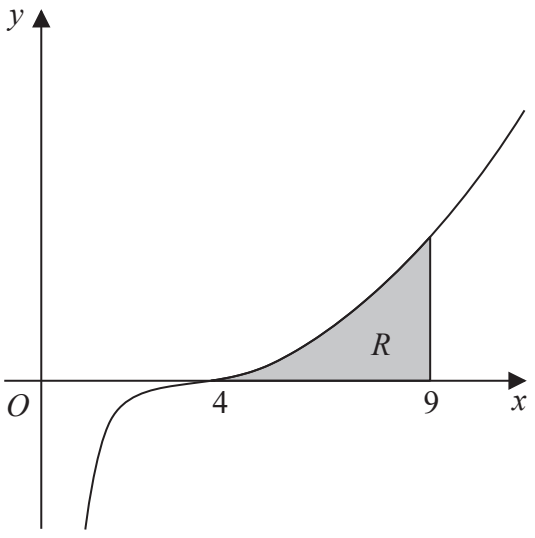



**Figure 1**

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

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

A curve has equation

$$y = 2x\sqrt{x} - \frac{16}{x^2} - 6x + 9 \qquad x > 0$$

The curve crosses the $x$-axis at the point (4, 0)

The finite region $R$, shown shaded in Figure 1, is bounded by the curve, the $x$-axis and the line with equation $x = 9$

Find the exact area of $R$.

**(6)**

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**Question 2 continued**

**Q2**

**(Total for Question 2 is 6 marks)**

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**3.** In an arithmetic series

- the sixth term is 11
- the sum of the first three terms is –15

For this series,

(a) show that the first term is –9 and calculate the common difference.

**(4)**

Given that $S_n > 888$

(b) find the least value of $n$.

**(3)**

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**Question 3 continued**

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**Q3**

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**4.**

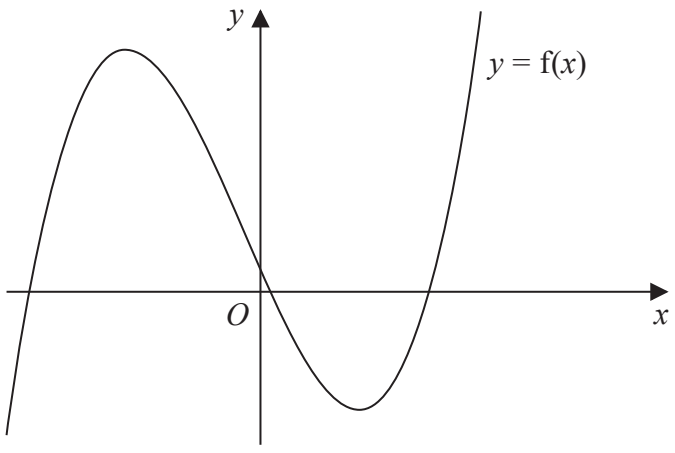



**Figure 2**

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

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

Figure 2 shows a sketch of the curve with equation $y = f(x)$ where

$$f(x) = 2x^3 + \frac{3}{2}x^2 - 18x + 3$$

(a) Find the set of values of $x$ for which $f(x)$ is decreasing.

**(4)**

Given that the equation $f(x) = k$, where $k$ is a constant, has one real root,

(b) find the set of values for $k$.

**(3)**

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**Question 4 continued**

**Q4**

**(Total for Question 4 is 7 marks)**

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**5.** $f(x) = x^3 - 8x + a$

When $f(x)$ is divided by $(x + 2)$ the remainder is $-24$

(a) Use the remainder theorem to show that $a = -32$

**(2)**

Given also that $(x - 4)$ is a factor of $f(x)$

(b) (i) write $f(x)$ as a product of two algebraic factors,

(ii) prove that the equation $f(x) = 0$ has only one real root.

**(4)**

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**Question 5 continued**

**Q5**

**(Total for Question 5 is 6 marks)**

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**6.** (a) Sketch the curve with equation

$$y = a^x, \quad a > 1$$

showing the coordinates of any points of intersection with the coordinate axes.

**(2)**

| $x$ | 2 | 2.4 | 2.8 | 3.2 | 3.6 | 4 |
|---|---|---|---|---|---|---|
| $y$ | 11 | 16.37 | 24.47 | 36.83 | 55.80 | 85 |

The table above shows corresponding values of $x$ and $y$ for $y = 3^x + x$. The values of $y$ are given to two decimal places as appropriate.

Using the trapezium rule with all the values of $y$ in the given table,

(b) obtain an estimate for $\int_2^4 (3^x + x)\,\mathrm{d}x$, giving your answer to one decimal place.

**(3)**

Using your answer to part (b) and making your method clear, estimate

(c) $\int_2^4 (3^{x+1} + x)\,\mathrm{d}x$

**(3)**

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**Question 6 continued**

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**Q6**

**(Total for Question 6 is 8 marks)**

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**7.** (i) Find, in terms of $\log_2 3$, an exact solution of the equation

$$3 \times 2^{x-2} = 8^x$$

**(4)**

(ii) Solve, using algebra, the equation

$$2\log_5(2y + 1) - \log_5(2 - y) = 1$$

explaining clearly why there is only one solution.

**(4)**

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**Question 7 continued**

**Q7**

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**8.** The depth of water, $D$ metres, in a harbour on a particular day is modelled by the equation

$$D = 3 - 1.2\sin\left(\frac{\pi t}{6}\right), \qquad 0 \leqslant t < 19$$

where $t$ is the number of hours after 05:00, and $\frac{\pi t}{6}$ is measured in radians.

(a) Show that the depth of the water at 06:00 is 2.4 metres.

**(1)**

(b) State the greatest value of $D$.

**(1)**

(c) Find the first two times of the day, after 05:00, when the depth of the water in the harbour is 3.5 metres. Show all steps in your working and give your answers to the nearest minute.

**(6)**

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**Question 8 continued**

**Q8**

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**9.** The first three terms of a geometric series are

$$\sin\theta,\ \cos\theta \text{ and } 0.5 \qquad \text{where } \theta \text{ is a constant}$$

(a) Show that

$$2\sin^2\theta + \sin\theta - 2 = 0$$

**(3)**

Given that $\theta$ lies in the interval $90° < \theta < 180°$

(b) find the value of $\theta$ giving your answer to one decimal place.

**(4)**

(c) Hence prove that this series is convergent.

**(3)**

(d) Find, to two significant figures, $S_\infty$

**(2)**

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**Question 9 continued**

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**Question 9 continued**

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**Question 9 continued**

**(Total for Question 9 is 12 marks)**

**Q9**

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**10.**

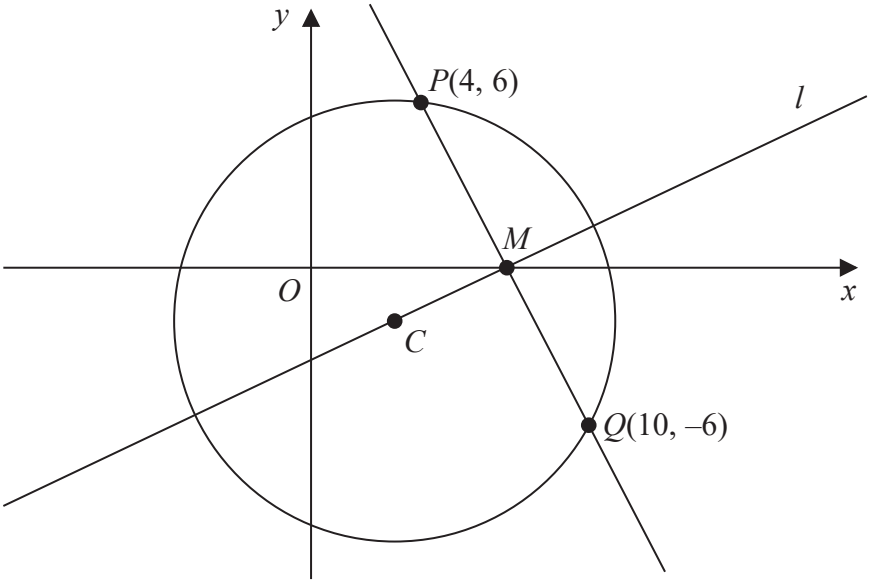



**Figure 3**

Figure 3 shows a circle with centre $C$.

The point $P(4, 6)$ and the point $Q(10, -6)$ both lie on the circumference of the circle.

The point $M$ is the midpoint of $PQ$.

The line $l$ passes through $C$ and $M$.

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

**(4)**

Given that the $y$ coordinate of $C$ is $-2$

(b) find an equation for the circle.

**(4)**

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**Question 10 continued**

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**Question 10 continued**

**Q10**

**(Total for Question 10 is 8 marks)**

**TOTAL FOR PAPER IS 75 MARKS**