GradeMax

Please check the examination details below before entering your candidate information

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

Centre Number | Candidate Number

# Wednesday 20 May 2020

Morning (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 9 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.** (a) Find the first 4 terms, in ascending powers of $x$, of the binomial expansion of

$$\left(2 - \frac{x}{4}\right)^{10}$$

giving each term in its simplest form.

**(4)**

(b) Hence find the constant term in the series expansion of

$$\left(3 - \frac{1}{x}\right)^2 \left(2 - \frac{x}{4}\right)^{10}$$

**(3)**

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**Question 1 continued**

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**Question 1 continued**

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**Question 1 continued**

**Q1**

**(Total 7 marks)**

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**2.**

$$y = \frac{2^x}{\sqrt{(5x^2 + 3)}}$$

(a) Complete the table below, giving the values of $y$ to 3 decimal places.

| $x$ | −0.25 | 0 | 0.25 | 0.5 | 0.75 |
|---|---|---|---|---|---|
| $y$ | 0.462 | | 0.653 | | 0.698 |

**(1)**

(b) Use the trapezium rule, with all the values of $y$ from the completed table, to find an approximate value for

$$\int_{-0.25}^{0.75} \frac{2^x}{\sqrt{(5x^2 + 3)}} \, \mathrm{d}x$$

**(3)**

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**Question 2 continued**

**(Total 4 marks)**

**Q2**

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**3.** $f(x) = ax^3 - x^2 + bx + 4$

where $a$ and $b$ are constants.

When $f(x)$ is divided by $(x + 4)$, the remainder is $-108$

(a) Use the remainder theorem to show that

$$16a + b = 24$$

**(2)**

Given also that $(2x - 1)$ is a factor of $f(x)$,

(b) find the value of $a$ and the value of $b$.

**(3)**

(c) Find $f'(x)$.

**(1)**

(d) Hence find the exact coordinates of the stationary points of the curve with equation $y = f(x)$.

**(4)**

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**Question 3 continued**

**(Total 10 marks)**

**Q3**

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**4.** The points $P$ and $Q$ have coordinates $(-11, 6)$ and $(-3, 12)$ respectively.

Given that $PQ$ is a diameter of the circle $C$,

(a) (i) find the coordinates of the centre of $C$,

(ii) find the radius of $C$.

**(4)**

(b) Hence find an equation of $C$.

**(2)**

(c) Find an equation of the tangent to $C$ at the point $Q$ giving your answer in the form $ax + by + c = 0$ where $a$, $b$ and $c$ are integers to be found.

**(3)**

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**Question 4 continued**

**Q4**

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**5.** Ben is saving for the deposit for a house over a period of 60 months.

Ben saves £100 in the first month and in each subsequent month, he saves £5 more than the previous month, so that he saves £105 in the second month, £110 in the third month, and so on, forming an arithmetic sequence.

(a) Find the amount Ben saves in the 40th month.

**(2)**

(b) Find the total amount Ben saves over the 60-month period.

**(3)**

Lina is also saving for a deposit for a house.

Lina saves £600 in the first month and in each subsequent month, she saves £10 less than the previous month, so that she saves £590 in the second month, £580 in the third month, and so on, forming an arithmetic sequence.

Given that, after $n$ months, Lina will have saved exactly £18 200 for her deposit,

(c) form an equation in $n$ and show that it can be written as

$$n^2 - 121n + 3640 = 0$$

**(3)**

(d) Solve the equation in part (c).

**(2)**

(e) State, with a reason, which of the solutions to the equation in part (c) is **not** a sensible value for $n$.

**(1)**

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**Question 5 continued**

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**Q5**

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**6.**

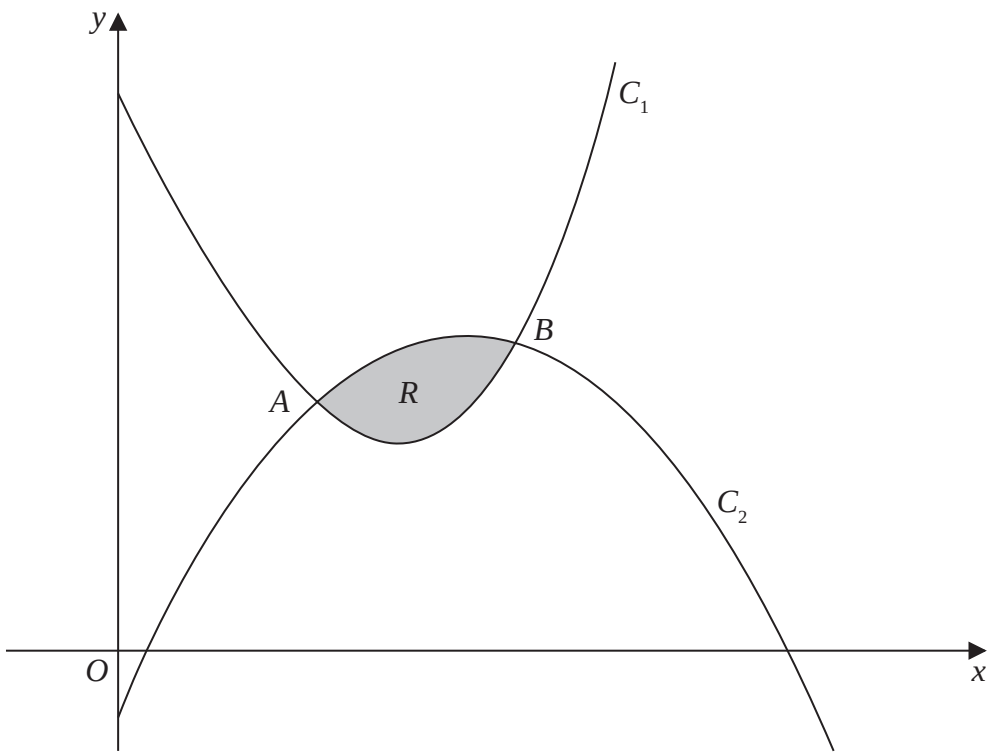



**Figure 1**

Figure 1 shows a sketch of part of the curves $C_1$ and $C_2$ with equations

$$C_1 : y = x^3 - 6x + 9 \qquad x \geqslant 0$$
$$C_2 : y = -2x^2 + 7x - 1 \qquad x \geqslant 0$$

The curves $C_1$ and $C_2$ intersect at the points $A$ and $B$ as shown in Figure 1.

The point $A$ has coordinates (1, 4).

Using algebra and showing all steps of your working,

(a) find the coordinates of the point $B$.

**(4)**

The finite region $R$, shown shaded in Figure 1, is bounded by $C_1$ and $C_2$

(b) Use algebraic integration to find the exact area of $R$.

**(5)**

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**Q6**

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**7.** (i) Show that

$$\tan\theta + \frac{1}{\tan\theta} \equiv \frac{1}{\sin\theta\cos\theta} \qquad \theta \neq \frac{n\pi}{2} \quad n \in \mathbb{Z}$$

**(3)**

(ii) Solve, for $0 \leqslant x < 90°$, the equation

$$3\cos^2(2x + 10°) = 1$$

giving your answers in degrees to one decimal place.

(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

**(4)**

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**Question 7 continued**

**Q7**

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**8.** A geometric series has first term $a$ and common ratio $r$.

(a) Prove that the sum of the first $n$ terms of this series is given by

$$S_n = \frac{a(1 - r^n)}{1 - r}$$

**(3)**

The second term of a geometric series is –320 and the fifth term is $\frac{512}{25}$

(b) Find the value of the common ratio.

**(2)**

(c) Hence find the sum of the first 13 terms of the series, giving your answer to 2 decimal places.

**(3)**

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**Question 8 continued**

**Q8**

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**9.** (i) Find the exact value of $x$ for which

$$\log_3(x + 5) - 4 = \log_3(2x - 1)$$

**(4)**

(ii) Given that

$$3^{y+3} \times 2^{1-2y} = 108$$

(a) show that

$$0.75^{y} = 2$$

**(4)**

(b) Hence find the value of $y$, giving your answer to 3 decimal places.

**(2)**

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**Question 9 continued**

**Q9**

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**TOTAL FOR PAPER IS 75 MARKS**

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