Pleasechecktheexaminationdetailsbelowbeforeenteringyourcandidateinformation

| Candidatesurname | Othernames |
|---|---|
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Centre Number | Candidate Number

# Pearson Edexcel International Advanced Level

**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 (Yellow), calculator

TotalMarks

**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.

*Turn over* ▶

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Q:1/1/1/1/

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

$$\left(2+\frac{3}{8}x\right)^{10}$$

Give each coefficient as an integer.

**(4)**

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**Question 1 continued**

**Q1**

**(Total 4 marks)**

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**2.**

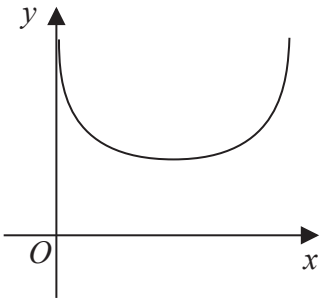



**Figure 1**

Figure 1 shows the graph of

$$y = 1 - \log_{10}(\sin x) \qquad 0 < x < \pi$$

where $x$ is in radians.

The table below shows some values of $x$ and $y$ for this graph, with values of $y$ given to 3 decimal places.

| $x$ | 0.5 | 1 | 1.5 | 2 | 2.5 | 3 |
|---|---|---|---|---|---|---|
| $y$ | 1.319 | | 1.001 | | 1.223 | 1.850 |

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

**(2)**

(b) Use the trapezium rule with all the $y$ values in the completed table to find, to 2 decimal places, an estimate for

$$\int_{0.5}^{3} \left(1 - \log_{10}(\sin x)\right) \mathrm{d}x$$

**(3)**

(c) Use your answer to part (b) to find an estimate for

$$\int_{0.5}^{3} \left(3 + \log_{10}(\sin x)\right) \mathrm{d}x$$

**(3)**

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**Question 2 continued**

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**Question 2 continued**

**Q2**

**(Total 8 marks)**

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**3.** (i) Show that the following statement is **false**:

"$(n + 1)^3 - n^3$ is prime for all $n \in \mathbb{N}$"

**(2)**

(ii) Given that the points $A(1, 0)$, $B(3, -10)$ and $C(7, -6)$ lie on a circle, prove that $AB$ is a diameter of this circle.

**(5)**

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**Question 3 continued**

**Q3**

**(Total 7 marks)**





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

**Give your answers in fully simplified surd form.**

Given that $a$ and $b$ are positive constants, solve the simultaneous equations

$$a - b = 8$$
$$\log_4 a + \log_4 b = 3$$

**(6)**

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**Question 4 continued**

**Q4**

**(Total 6 marks)**





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

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

Solve, for $-180° < \theta \leqslant 180°$, the equation

$$3\tan(\theta + 43°) = 2\cos(\theta + 43°)$$

**(6)**

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**Question 5 continued**

**Q5**

**(Total 6 marks)**

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**6.** In a geometric sequence $u_1, u_2, u_3, \ldots$

- the common ratio is $r$
- $u_2 + u_3 = 6$
- $u_4 = 8$

(a) Show that $r$ satisfies

$$3r^2 - 4r - 4 = 0$$

**(3)**

Given that the geometric sequence has a sum to infinity,

(b) find $u_1$

**(3)**

(c) find $S_\infty$

**(2)**

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**Question 6 continued**

**Q6**

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**7.** $f(x) = Ax^3 + 6x^2 - 4x + B$

where $A$ and $B$ are constants.

Given that

- $(x + 2)$ is a factor of $f(x)$
- $\int_3^5 f(x)\,dx = 176$

find the value of $A$ and the value of $B$.

**(7)**

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**Question 7 continued**

**Q7**

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

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

A curve has equation

$$y = 256x^4 - 304x - 35 + \frac{27}{x^2} \qquad x \neq 0$$

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

**(3)**

(b) Hence find the coordinates of the stationary points of the curve.

**(5)**

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**Question 8 continued**

**Q8**

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**9.** A scientist is using carbon-14 dating to determine the age of some wooden items.

The equation for carbon-14 dating an item is given by

$$N = k\lambda^t$$

where

- $N$ grams is the amount of carbon-14 **currently** present in the item
- $k$ grams was the **initial** amount of carbon-14 present in the item
- $t$ is the number of years since the item was made
- $\lambda$ is a constant, with $0 < \lambda < 1$

(a) Sketch the graph of $N$ against $t$ for $k = 1$

**(2)**

Given that it takes 5700 years for the amount of carbon-14 to reduce to half its initial value,

(b) show that the value of the constant $\lambda$ is 0.999878 to 6 decimal places.

**(2)**

Given that Item $A$

- is known to have had 15 grams of carbon-14 present initially
- is thought to be 3250 years old

(c) calculate, to 3 significant figures, how much carbon-14 the equation predicts is currently in Item $A$.

**(2)**

Item $B$ is known to have initially had 25 grams of carbon-14 present, but only 18 grams now remain.

(d) Use algebra to calculate the age of Item $B$ to the nearest 100 years.

**(3)**

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**Question 9 continued**

**Q9**

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**10.** The circle $C$ has centre $X(3, 5)$ and radius $r$

The line $l$ has equation $y = 2x + k$, where $k$ is a constant.

(a) Show that $l$ and $C$ intersect when

$$5x^2 + (4k - 26)x + k^2 - 10k + 34 - r^2 = 0$$

**(3)**

Given that $l$ is a tangent to $C$,

(b) show that $5r^2 = (k + p)^2$, where $p$ is a constant to be found.

**(3)**

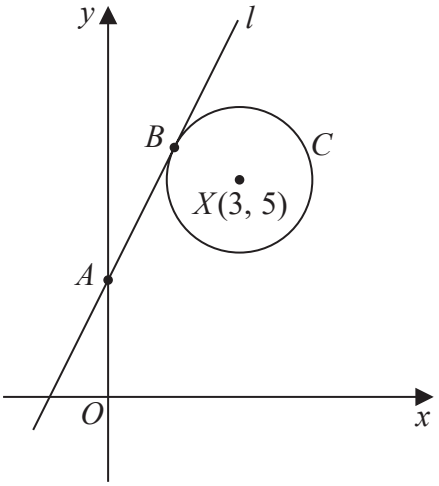



**Figure 2**

The line $l$

- cuts the $y$-axis at the point $A$
- touches the circle $C$ at the point $B$

as shown in Figure 2.

Given that $AB = 2r$

(c) find the value of $k$

**(6)**

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**Q10**

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**TOTAL FOR PAPER IS 75 MARKS**

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