

Please check the examination details below before entering your candidate information

Candidate surname

Other names

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

Centre Number

Candidate Number

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**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

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.
- Good luck with your examination.

Turn over ►

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Pearson

1. Adina is saving money to buy a new computer. She saves £5 in week 1, £5.25 in week 2, £5.50 in week 3 and so on until she has enough money, in total, to buy the computer.

She decides to model her savings using either an arithmetic series or a geometric series.

Using the information given,

- (a) (i) state with a reason whether an arithmetic series or a geometric series should be used,
  - (ii) write down an expression, in terms of  $n$ , for the amount, in pounds (£), saved in week  $n$ .
- (3)**

Given that the computer Adina wants to buy costs £350

- (b) find the number of weeks it will take for Adina to save enough money to buy the computer.
- (4)**

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**Question 1 continued**

Lined writing area for the answer to Question 1.

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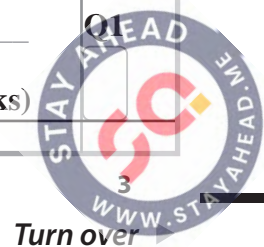
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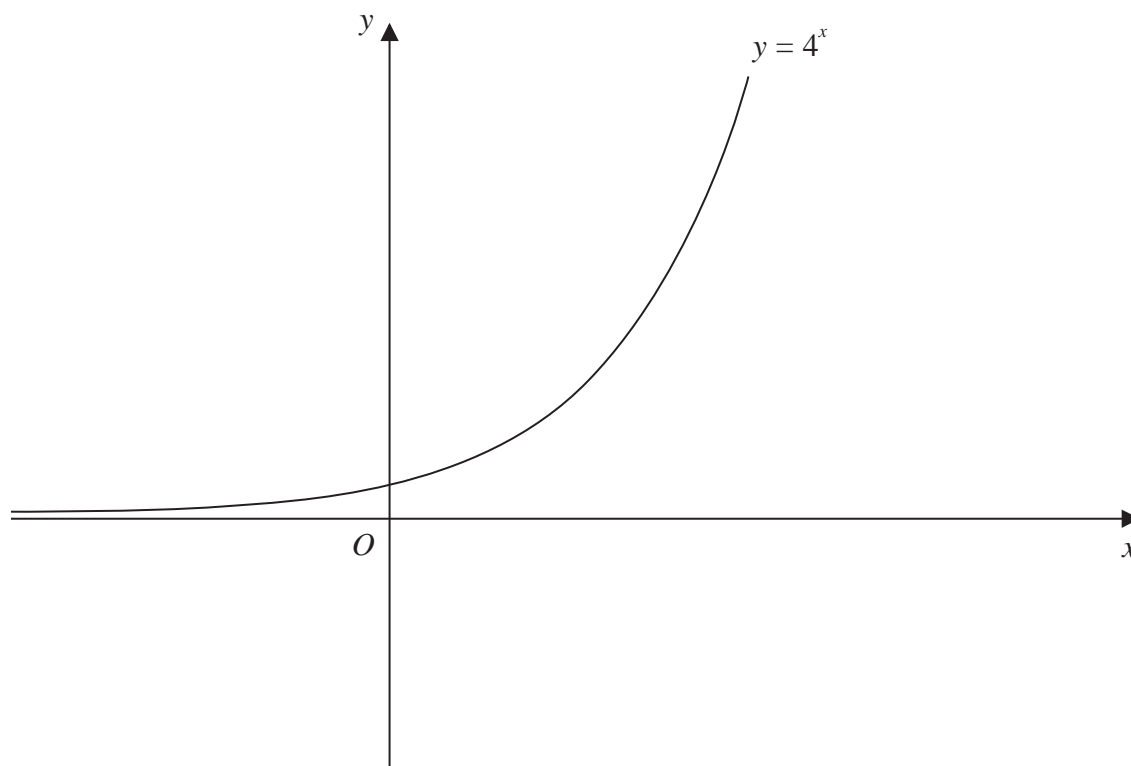


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2.



**Figure 1**

Figure 1 shows a sketch of the curve with equation  $y = 4^x$

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

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

(i)  $y = 2^x$

(ii)  $y = 4^x - 6$

Label clearly the coordinates of any points of intersection with the coordinate axes. **(4)**

The curve with equation  $y = 2^x$  meets the curve with equation  $y = 4^x - 6$  at the point  $P$ .

(b) Using algebra, find the exact coordinates of  $P$ . **(4)**

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Question 2 continued

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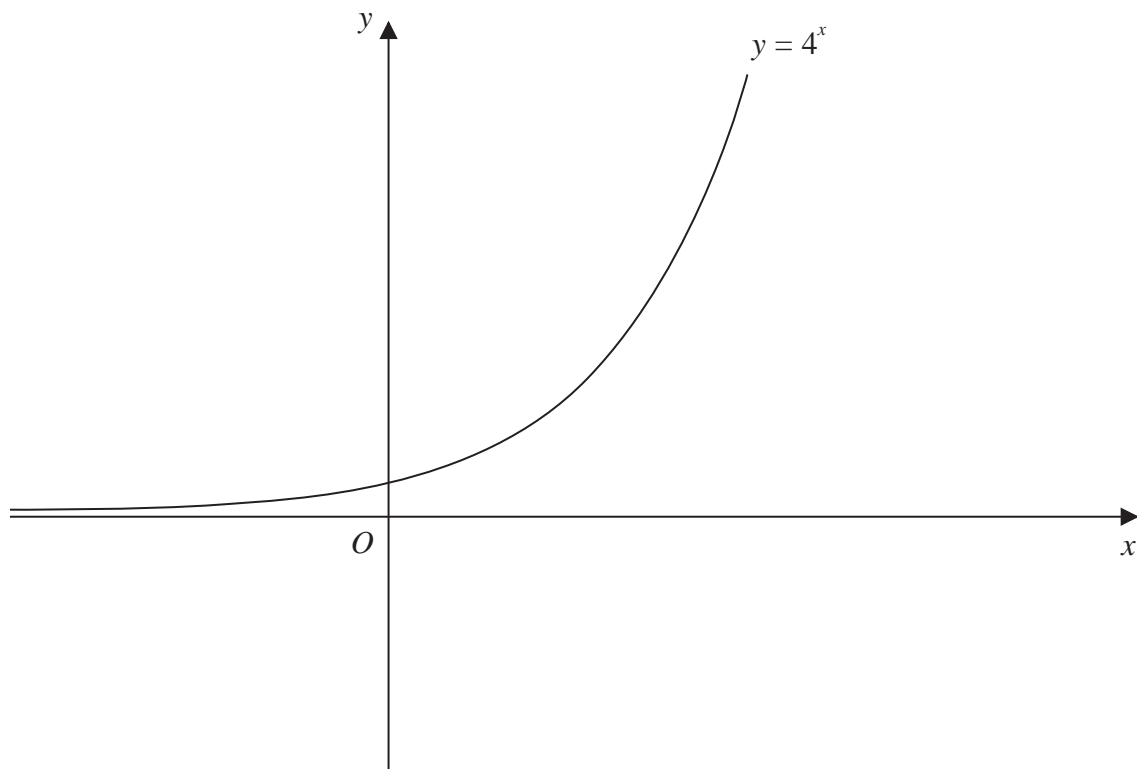


Diagram 1

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(Total 8 marks)



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- 4. (a) Find, in ascending powers of  $x$ , up to and including the term in  $x^3$ , the binomial expansion of

$$\left(2 + \frac{x}{8}\right)^{13}$$

fully simplifying each coefficient.

(4)

- (b) Use the answer to part (a) to find an approximation for  $2.0125^{13}$

Give your answer to 3 decimal places.

(3)

Without calculating  $2.0125^{13}$

- (c) state, with a reason, whether the answer to part (b) is an overestimate or an underestimate.

(1)

Horizontal lines for student answers.

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**Question 4 continued**

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A series of 28 horizontal lines for writing, providing space for the student's response to Question 4.

**(Total 8 marks)**



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5.

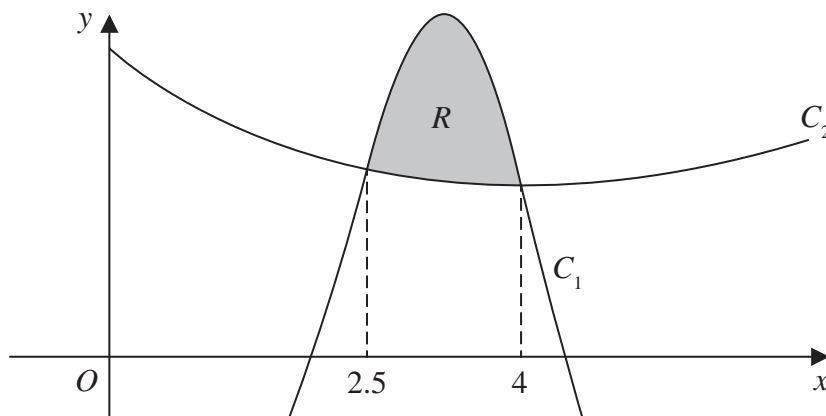


Figure 2

Figure 2 shows a sketch of part of the graph of the curves  $C_1$  and  $C_2$

The curves intersect when  $x = 2.5$  and when  $x = 4$

A table of values for some points on the curve  $C_1$  is shown below, with  $y$  values given to 3 decimal places as appropriate.

$x$	2.5	2.75	3	3.25	3.5	3.75	4
$y$	5.453	7.764	9.375	9.964	9.367	7.626	5

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

- (a) find, to 2 decimal places, an estimate for the area bounded by the curve  $C_1$ , the line with equation  $x = 2.5$ , the  $x$ -axis and the line with equation  $x = 4$

(4)

The curve  $C_2$  has equation

$$y = x^{\frac{3}{2}} - 3x + 9 \quad x > 0$$

- (b) Find  $\int \left( x^{\frac{3}{2}} - 3x + 9 \right) dx$

(3)

The region  $R$ , shown shaded in Figure 2, is bounded by the curves  $C_1$  and  $C_2$

- (c) Use the answers to part (a) and part (b) to find, to one decimal place, an estimate for the area of the region  $R$ .

(3)

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### Question 5 continued

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**Question 5 continued**

Lined writing area for question response.

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6. A circle has equation

$$x^2 - 6x + y^2 + 8y + k = 0$$

where  $k$  is a positive constant.

Given that the  $x$ -axis is a tangent to this circle,

(a) find the value of  $k$ .

(3)

The circle meets the coordinate axes at the points  $R$ ,  $S$  and  $T$ .

(b) Find the exact area of the triangle  $RST$ .

(4)

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Question 6 continued

Lined writing area for the answer to Question 6.

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Question 6 continued

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Lined writing area for the answer.



Question 6 continued

Lined writing area for the answer.

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(Total 7 marks)



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7. (a) Given that

$$3 \log_3(2x - 1) = 2 + \log_3(14x - 25)$$

show that

$$2x^3 - 3x^2 - 30x + 56 = 0 \tag{4}$$

(b) Show that  $-4$  is a root of this cubic equation. (2)

(c) Hence, using algebra and showing each step of your working, solve

$$3 \log_3(2x - 1) = 2 + \log_3(14x - 25) \tag{4}$$

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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.

(i) Solve, for  $0 < \theta < 360^\circ$ , the equation

$$3 \sin(\theta + 30^\circ) = 7 \cos(\theta + 30^\circ)$$

giving your answers to one decimal place.

(4)

(ii) (a) Show that the equation

$$3 \sin^3 x = 5 \sin x - 7 \sin x \cos x$$

can be written in the form

$$\sin x(a \cos^2 x + b \cos x + c) = 0$$

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

(b) Hence solve for  $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$  the equation

$$3 \sin^3 x = 5 \sin x - 7 \sin x \cos x$$

(6)

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Question 8 continued

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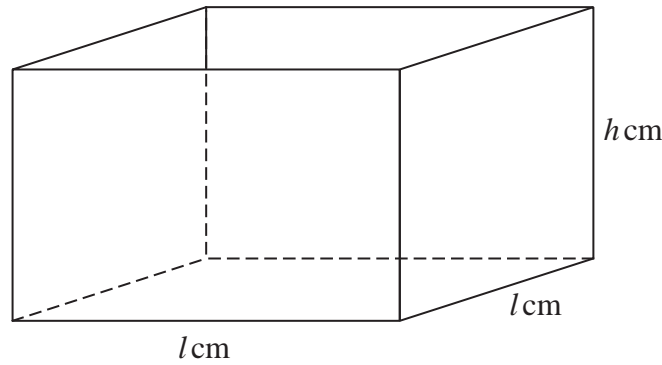
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9.



**Figure 3**

Figure 3 shows a sketch of a square based, open top box.

The height of the box is  $h$  cm, and the base edges each have length  $l$  cm.

Given that the volume of the box is  $250\,000\text{ cm}^3$

(a) show that the external surface area,  $S\text{ cm}^2$ , of the box is given by

$$S = \frac{250\,000}{h} + 2000\sqrt{h} \quad (3)$$

(b) Use algebraic differentiation to show that  $S$  has a stationary point when  $h = 250^k$  where  $k$  is a rational constant to be found. (5)

(c) Justify by further differentiation that this value of  $h$  gives the minimum external surface area of the box. (2)

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