

<b>Name</b> _____ _____	<b>Class</b> _____  <b>Date</b> _____
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**Materials**

For this paper you must have:

- The booklet of formulae and statistical tables
- You may use a graphics calculator.

**Instructions**

- Use black ink or black ball-point pen.  
Pencil should be used for drawing.
- Answer **all** questions.
- You must answer each question in the space provided for that question. If you require extra space, use a supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

**Information**

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.

**Advice**

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily have to use all the space provided.

Question	Mark
1	
2	
3	
4	
5	
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11	
12	
13	
14	
15	
16	
<b>Total</b>	

**Answer ALL questions. Write your answer in the spaces provided.**

**1 a** Show that  $(x-2)$  is a factor of  $f(x) = x^3 - 9x^2 + 26x - 24$  **[2 marks]**

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**b** Hence factorise  $f(x)$  completely. **[3 marks]**

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**Turn over for the next question**

**2 a** Work out the value of  $a$  and the value of  $b$  given that

**a i**  $\log_{10} 100 = a$

**[1 mark]**

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**a ii**  $\log_2 b = 4$

**[1 mark]**

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**b** Find the exact value of the solution to the equation  $\log_3(2x) = \log_3 6 + \log_3\left(\frac{1}{x}\right)$  **[3 marks]**

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**Turn over for the next question**

**3**

A curve has equation  $y = 2x^3 + 3x^2 - 4x - 1$

Find the equation of the normal to the curve at  $x = 1$

**[6 marks]**

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**Turn over for the next question**

**4**     $f(x) = x^3 - 2x^2 + 3x - 1$

Prove that the graph of  $y = f(x)$  has no turning points.

**[4 marks]**

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**5 a**    Expand  $(1 - x^2)^7$  in ascending powers of  $x$  up to the term in  $x^4$

**[2 marks]**

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**b**    Find the coefficient of the term in  $x^{10}$ , giving your answer in the simplest form.

**[2 marks]**

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7      $f(x) = 3x^2$

Prove that  $f'(x) = 6x$

**[5 marks]**

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**Turn over for the next question**

**8** Given that  $\mathbf{p} = 4\mathbf{i} - 3\mathbf{j}$ , work out

**a** A vector parallel to  $\mathbf{p}$  with magnitude 20

**[3 marks]**

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**b** The unit vector  $\hat{\mathbf{p}}$  in the direction of  $\mathbf{p}$

**[2 marks]**

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**Turn over for the next question**





**10 a**  $f(x) = x^2 - 4x + k$ , where  $1 < k < 3$

Sketch the curve  $y = f(x)$  showing clearly, in terms of  $k$ , the coordinates of the points where the curve cuts the  $y$ -axis, and the coordinates of the turning point.

**[4 marks]**

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**b** The equation  $f(x) = -2$  has two distinct solutions. Find the range of values for  $k$  **[3 marks]**

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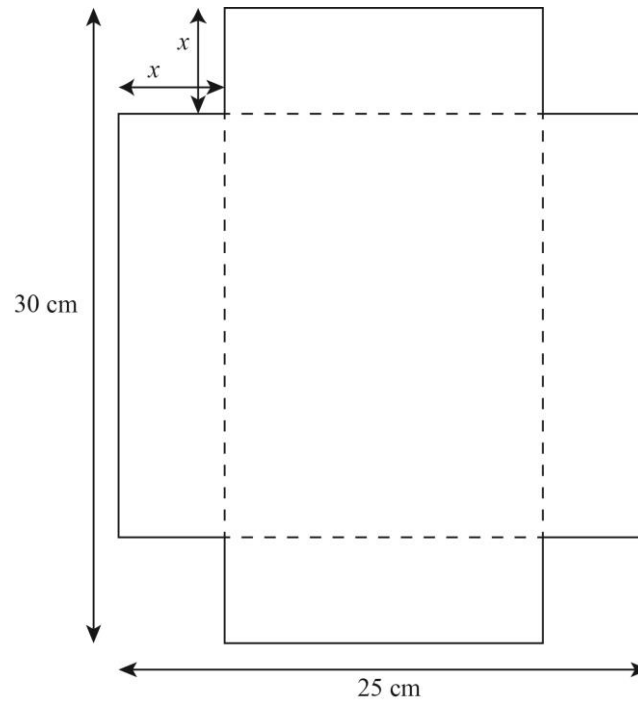
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- 11** An open-top box is made by cutting a small square with side length  $x$  cm from each of the four corners of a rectangular tin sheet, as shown in the diagram.



- a** Show that the volume of the box,  $V$ , can be written as  $V = 4x^3 - 110x^2 + 750x$  [2 marks]

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- b** Find the maximum volume of the box. [8 marks]

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**Turn over for the next question**

**16** Prove that if  $n$  is an integer,  $n^3 + 6n^2 + 11n + 6$  is always a multiple of three.

**[5 marks]**

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**End of questions**