

Please write clearly in block capitals.

Centre number

Candidate number

Surname \_\_\_\_\_

Forename(s) \_\_\_\_\_

Candidate signature \_\_\_\_\_

I declare this is my own work.

# Level 2 Certificate FURTHER MATHEMATICS

## Paper 1 Non-Calculator

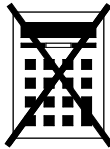
Time allowed: 1 hour 45 minutes

### Materials

For this paper you must have:

- mathematical instruments
- the Formulae Sheet (enclosed).

You must **not** use a calculator.



### Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more graph paper and tracing paper. These must be tagged securely to this answer book.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
<b>TOTAL</b>	



Answer **all** questions in the spaces provided.

- 1**  $(x + 1)$  is increased by 20%  
Its value is now the same as  $(x + 6)$

Work out the value of  $x$ .

**[3 marks]**

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Answer \_\_\_\_\_

- 2** The point  $(-6, -4)$  lies on a straight line with gradient  $\frac{3}{2}$

Work out the coordinates of the point where the line crosses the  $y$ -axis.

**[2 marks]**

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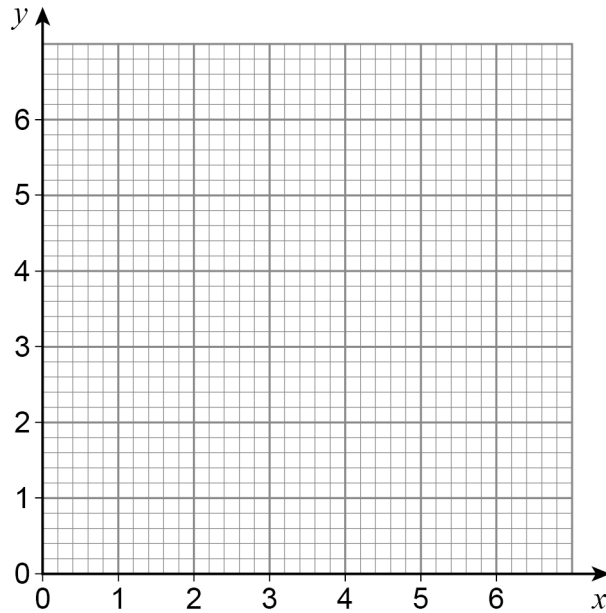
Answer ( \_\_\_\_\_ , \_\_\_\_\_ )



**3 (a)**  $f(x) = 4 - x \quad 0 \leq x < 1$   
 $= 4x - x^2 \quad 1 \leq x < 4$   
 $= 2x - 8 \quad 4 \leq x \leq 6$

On the grid, draw the graph of  $y = f(x)$

**[4 marks]**



**3 (b)**  $g(x) = 6 - 3x$

Work out  $g^{-1}(x)$ .

**[2 marks]**

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Answer \_\_\_\_\_



4 (a) Circle the value of  $\tan^2 30^\circ$

[1 mark]

$$\frac{1}{4}$$

$$\frac{1}{3}$$

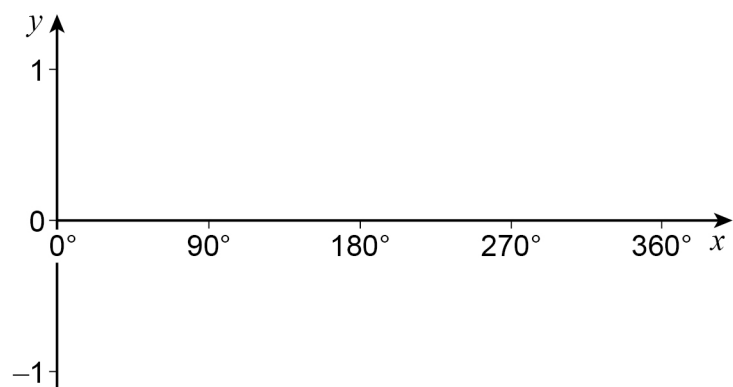
$$\frac{1}{2}$$

$$\frac{3}{4}$$

4 (b) On the axes, sketch

$$y = \cos x \quad \text{for} \quad 0^\circ \leq x \leq 360^\circ$$

[2 marks]



5  $(3x + a)(5x - 4) \equiv 15x^2 - 2x + b$

Work out the values of  $a$  and  $b$ .

[3 marks]

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$$a = \underline{\hspace{2cm}} \quad b = \underline{\hspace{2cm}}$$

6  $y = 2x^4 \left( x^3 + 2 - \frac{3}{x} \right)$

Work out  $\frac{dy}{dx}$

[3 marks]

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$$\frac{dy}{dx} = \underline{\hspace{4cm}}$$



7  $ABC$  is a right-angled triangle with vertices  $A(-1, 5)$ ,  $B(-2, 5)$  and  $C\left(-1, 5\frac{3}{4}\right)$

Work out the length of  $BC$ .

**[3 marks]**

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Answer \_\_\_\_\_ units



- 8** Use **matrix multiplication** to show that, in the  $x$ - $y$  plane,
- a rotation,  $90^\circ$  anticlockwise about the origin, followed by
  - a reflection in the line  $y = x$
- is equivalent to a reflection in the  $x$ -axis.

**[3 marks]**

Turn over for the next question

Turn over ►



9 (a) A quadratic sequence starts  $-2$   $-1$   $4$   $13$

Work out an expression for the  $n$ th term.

[3 marks]

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Answer \_\_\_\_\_

9 (b) A different quadratic sequence has  $n$ th term  $n^2 + 10n$

Use an algebraic method to work out how many terms in the sequence are less than 2000

Do **not** use trial and improvement.

You **must** show your working.

[3 marks]

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Answer \_\_\_\_\_





10 Rationalise and simplify fully  $\frac{\sqrt{3}}{3 + \sqrt{3}}$

[3 marks]

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Answer \_\_\_\_\_

11 Expand and simplify fully  $(3 + 2x)^5$

[4 marks]

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Answer \_\_\_\_\_



**12** The  $n$ th term of a sequence is  $\frac{3n^2}{n^2 + 2}$

**12 (a)** One term in the sequence is  $\frac{32}{11}$

Work out the value of  $n$ .

**[2 marks]**

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Answer \_\_\_\_\_

**12 (b)** Write down the limiting value of the sequence as  $n \rightarrow \infty$

**[1 mark]**

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Answer \_\_\_\_\_



13 Simplify fully  $(6x^3y^{-2} + 9x^5y) \div 3x^2y^{-3}$

[3 marks]

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Answer \_\_\_\_\_

14 Rearrange  $ef = \frac{5e + 4}{3}$  to make  $e$  the subject.

[3 marks]

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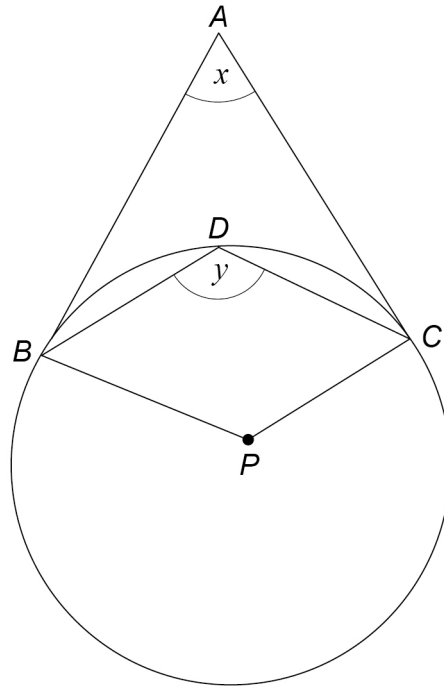
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Answer \_\_\_\_\_



- 15  $B$ ,  $C$  and  $D$  are points on a circle, centre  $P$ .  
 $AB$  and  $AC$  are tangents to the circle.



Not drawn  
accurately

Prove that  $y = 90 + \frac{x}{2}$

[5 marks]

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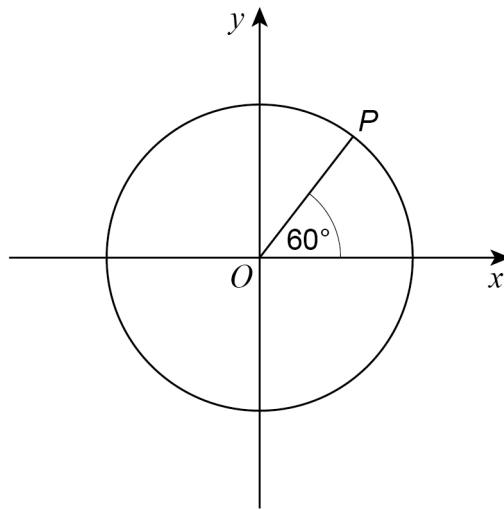
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- 17 The point  $P$  lies on the circle  $x^2 + y^2 = 16$   
The line  $OP$  is at an angle of  $60^\circ$  to the positive  $x$ -axis.



Not drawn  
accurately

- 17 (a) Show that the coordinates of point  $P$  are  $(2, 2\sqrt{3})$

[2 marks]

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- 17 (b)** Work out the equation of the tangent to the circle at  $P$ .  
Write your answer in the form  $x + ay = b$  where  $a$  and  $b$  are constants.

**[4 marks]**

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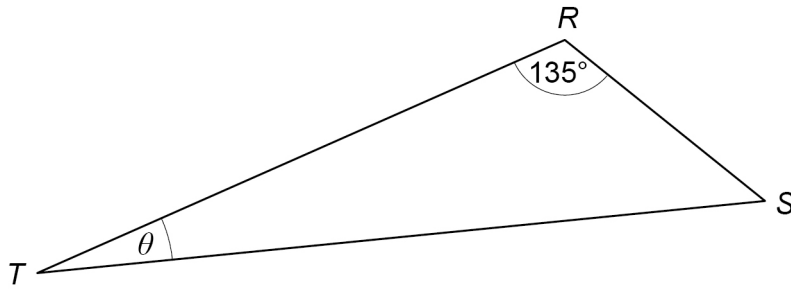
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Answer \_\_\_\_\_

**Turn over for the next question****Turn over ►**

18 In triangle  $RST$   $RS : ST = 1 : 4$



Not drawn  
accurately

Work out the exact value of  $\sin \theta$ .

[3 marks]

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Answer \_\_\_\_\_





**19** Write  $6x^2 - 24x + 17$  in the form  $a(x + b)^2 + c$  where  $a$ ,  $b$  and  $c$  are integers.

**[3 marks]**

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Answer \_\_\_\_\_

**Turn over for the next question**



20

The curve  $y = x^4 - 18x^2$  has three stationary points.

Work out the coordinates of the three stationary points and determine their nature.

You **must** show your working.

**[6 marks]**


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Stationary point ( \_\_\_\_\_ , \_\_\_\_\_ ) Nature \_\_\_\_\_

Stationary point ( \_\_\_\_\_ , \_\_\_\_\_ ) Nature \_\_\_\_\_

Stationary point ( \_\_\_\_\_ , \_\_\_\_\_ ) Nature \_\_\_\_\_



21

Show that

$$\frac{4 \cos^2 x + 3 \sin^2 x - 4}{\cos^2 x} \equiv -\tan^2 x$$

**[3 marks]**

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**END OF QUESTIONS**

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