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

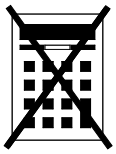
Paper 1 Non-Calculator

Tuesday 11 June 2024 Afternoon 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	
20–21	
22	
TOTAL	

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

Do not write outside the box

1 Work out the value of $\sqrt{\frac{t}{20}}$ where $t = 2.42 \times 10^3$

[2 marks]

Answer _____

2 Factorise $x^2 - y^2$

[1 mark]

Answer _____

Do not write outside the box

3 The nth term of a sequence is $\dfrac{3n + 4}{n}$

Circle the limiting value of $\dfrac{3n + 4}{n}$ as $n \to \infty$

[1 mark]

1 3 4 7

4 The equations of two straight lines are

$$y - 3x = 4 \quad \text{and} \quad 6y = 18x - 5$$

Show that the lines are parallel.

[2 marks]

Turn over for the next question

6

Do not write outside the box

5 $y = \dfrac{4x^3 + x^7}{x^4}$

Work out $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

[3 marks]

$\dfrac{\mathrm{d}y}{\mathrm{d}x} =$ _____

6 Points A (–12, 1) and B (12, –1) lie on a circle.

AB is a diameter of the circle.

Work out the equation of the circle.

[3 marks]

Answer _____

Do not write outside the box

7 A point P (x, y) is transformed using the transformation represented by $\begin{pmatrix} 4 & 0 \\ -2 & 3 \end{pmatrix}$

The image of P is $(-8, 7)$

Work out the values of x and y.

[3 marks]

$x =$ _____ $y =$ _____

9

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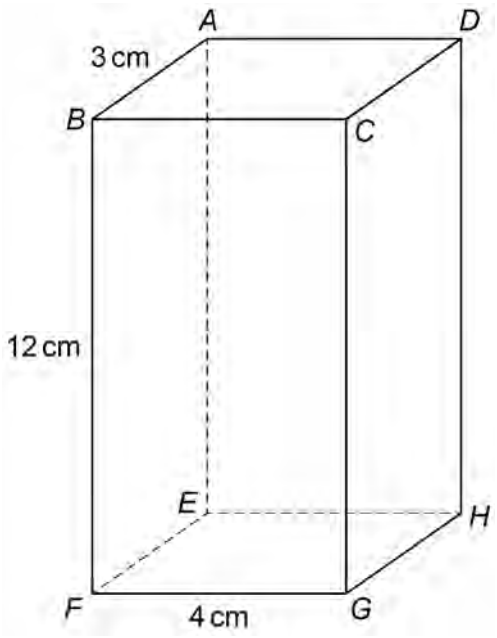
8 Solve by factorising $2x^3 - 9x^2 - 5x = 0$

[3 marks]

Answer _____

Do not write outside the box

9 *ABCDEFGH* is a cuboid.



Work out the length *AG*.

[3 marks]

AG = _____ cm

6

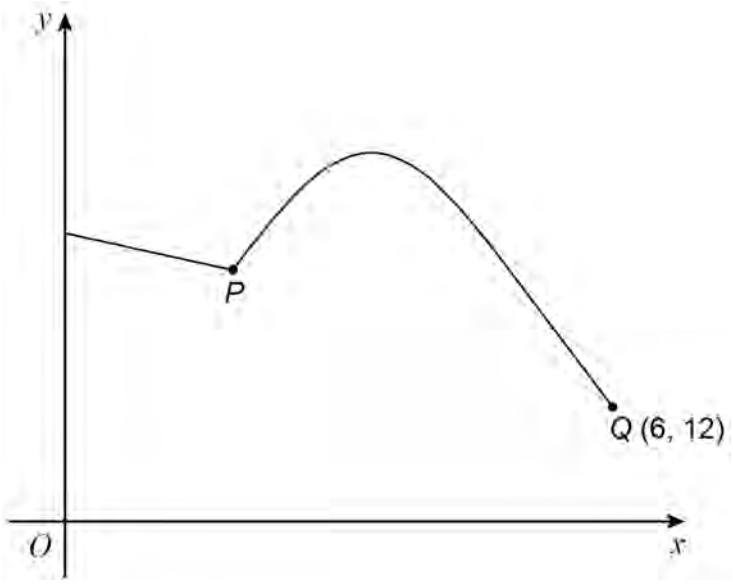
Do not write outside the box

10 A function f is given by

$$f(x) = -\frac{1}{2}x + 21 \qquad 0 \leqslant x \leqslant 2$$

$$= ax^2 + bx \qquad 2 < x \leqslant 6$$

A sketch of $y = f(x)$ is shown.



Work out the values of a and b.

[5 marks]

$a =$ _____ $b =$ _____

Do not write outside the box

11 (a) $(3x - 7)$ is a factor of $3x^3 - 4x^2 - 13x + 14$

Work out the other two linear factors.

[3 marks]

Answer _____ and _____

11 (b) $(x - 2)$ is a factor of $ax^4 - 3ax^3 + 5x - 22$

Work out the value of a.

[3 marks]

$a =$ _____

11

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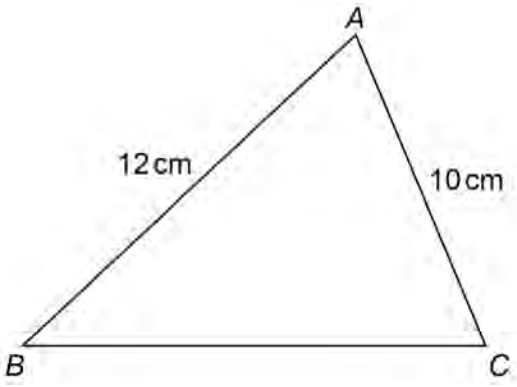
12 In triangle ABC, $\cos A = \frac{3}{4}$



Not drawn accurately

Work out the length BC.

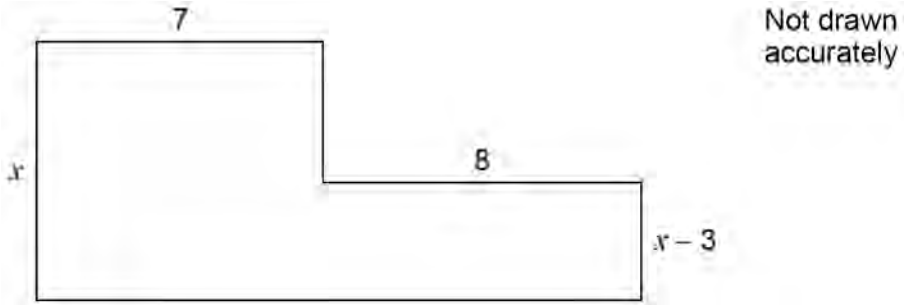
[3 marks]

Answer _____ cm

Do not write outside the box

13 A garden patio is made from two rectangles.

All lengths are in metres.



The area of the patio is **less than** 51 m^2

Work out the range of possible values of x.

Give your answer in the form $a < x < b$ where a and b are both integers.

You **must** show your working.

[4 marks]

Answer _____ $< x <$ _____

7

Do not write outside the box

14 (a) Write $2x^2 - 16x + 7$ in the form $k(x + m)^2 + n$ where k, m and n are integers.

[3 marks]

Answer _____

14 (b) Solve $(x - 1)^2 - 5 = 0$

[1 mark]

Answer _____

Do not write outside the box

15 (a) Matrix **M** represents a reflection in the line $y = -x$

Write down matrix **M**

[1 mark]

$$\mathbf{M} = \begin{pmatrix} \_\_\_ & \_\_\_ \\ \_\_\_ & \_\_\_ \end{pmatrix}$$

15 (b) $\mathbf{N} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

Describe geometrically the single transformation represented by $\mathbf{N}^2$

[2 marks]

Turn over for the next question

7

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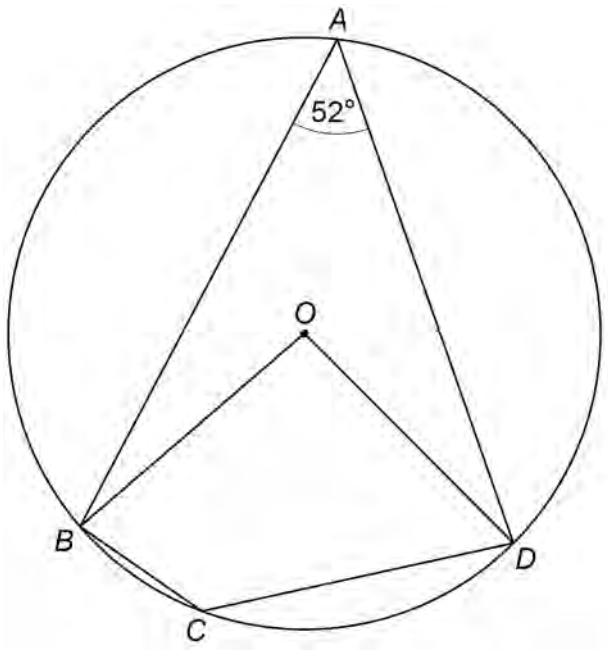
16 *A*, *B*, *C* and *D* are points on a circle, centre *O*.

angle *OBC* : angle *ODC* = 5 : 3



Not drawn accurately

Work out the size of angle *OBC*.

You **must** show your working.

[4 marks]

Answer _____ °

Do not write outside the box

17 Show that $\frac{21x}{3x^2-2x-8}-\frac{7}{x-2}$ simplifies to $\frac{k}{3x^2-2x-8}$ where k is an integer.

[3 marks]

Turn over for the next question

7

Do not write outside the box

18 Rationalise the denominator and simplify fully

$$\frac{3\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$$

[4 marks]

Answer _____

Do not write outside the box

19 The equation of a curve is $y = x^3 - 3x^2 + 5$

Work out the stationary points of the curve and determine their nature.

You **must** show your working.

[5 marks]

Stationary point (_____ , _____) Nature _____

Stationary point (_____ , _____) Nature _____

9

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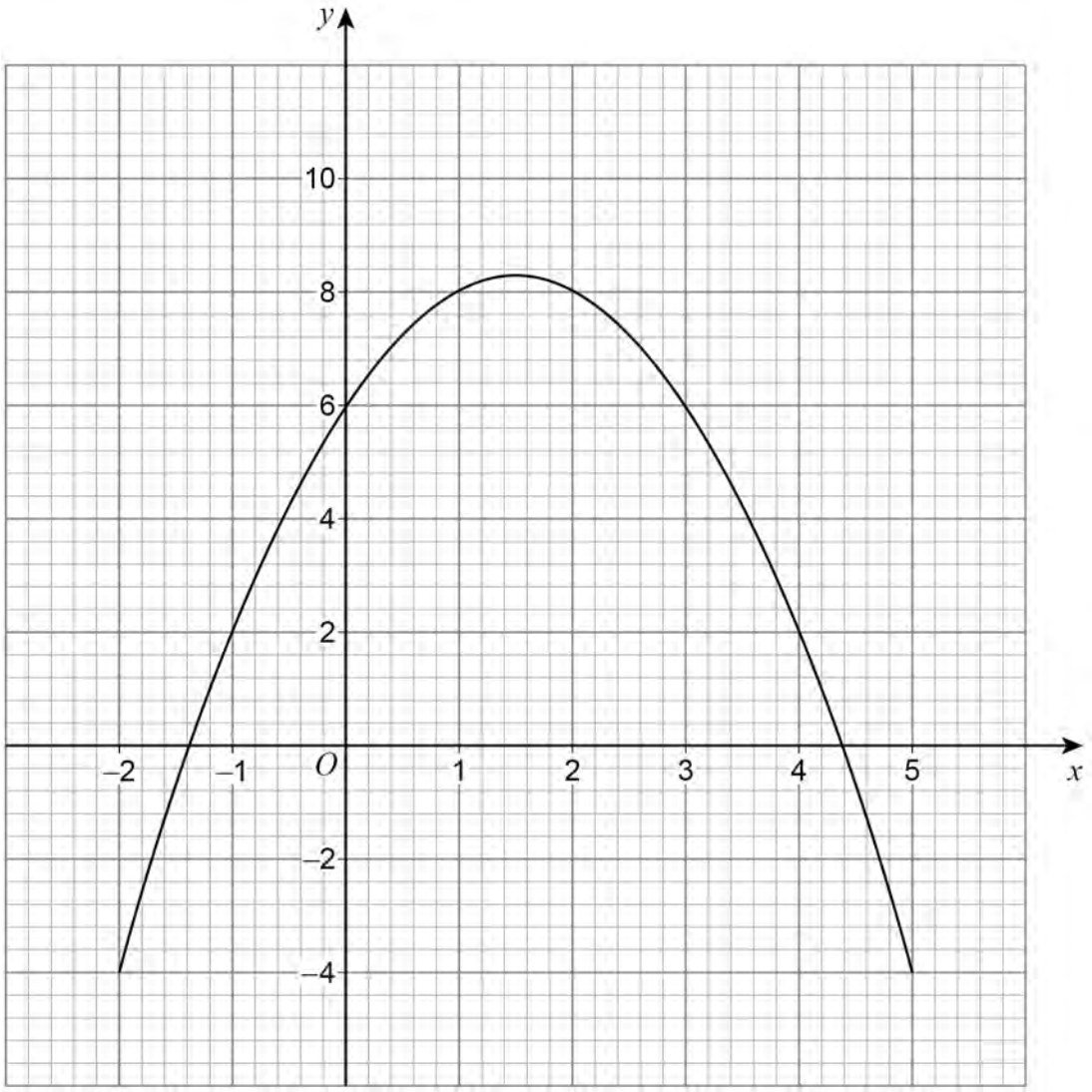
20 Here is the graph of $y = -x^2 + 3x + 6$ for $-2 \leqslant x \leqslant 5$



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By drawing a suitable **straight line**, work out approximate solutions to

$$x^2 - \frac{7}{2}x - 3 = 0$$

[4 marks]

Answer _____

4

Do not write outside the box

21 $\left(2^{x+3}\right)^{4x+1} = 8^{x-1}$

Work out the possible values of x.

[5 marks]

Answer _____

Do not write outside the box

22 $f(x) = \dfrac{3\sin x \cos x + \sin^2 x}{12\cos^2 x + 4\sin x \cos x}$

Simplify $f(x)$ and hence solve $f(x) = -\dfrac{\sqrt{3}}{4}$ for $90° < x < 180°$

You **must** show your working.

[4 marks]

$x =$ _____

Turn over for the next question

9

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23 The nth term of a quadratic sequence is $an^2 - 5n + c$ where a and c are integers.

The first four terms of the sequence are

2 x 16 y

Work out the values of x and y.

[5 marks]

$x =$ _____ $y =$ _____

END OF QUESTIONS

5

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