AQA

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

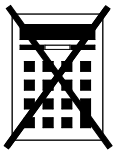
Paper 1 Non-Calculator

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.

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

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.

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

Do not write outside the box

1 $(x + 1)$ is increased by 20%

Its value is now the same as $(x + 6)$

Work out the value of x.

[3 marks]

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]

Answer (_____ , _____)

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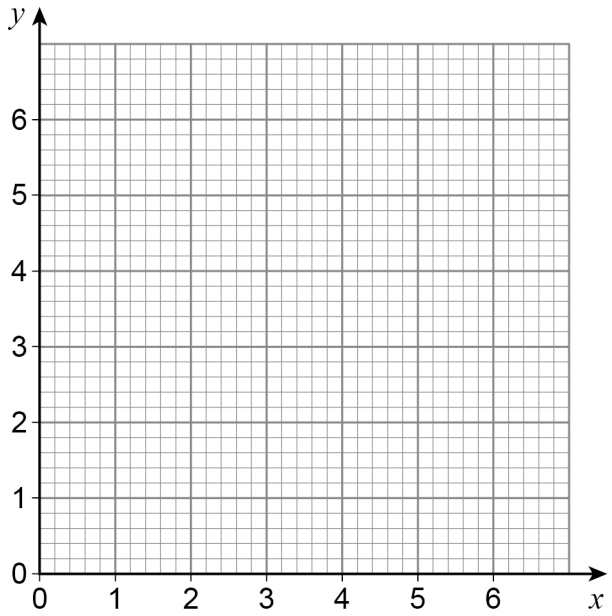
3 (a) $f(x) = 4 - x \quad 0 \leqslant x < 1$

$= 4x - x^2 \quad 1 \leqslant x < 4$

$= 2x - 8 \quad 4 \leqslant x \leqslant 6$

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]

Answer _____

11

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

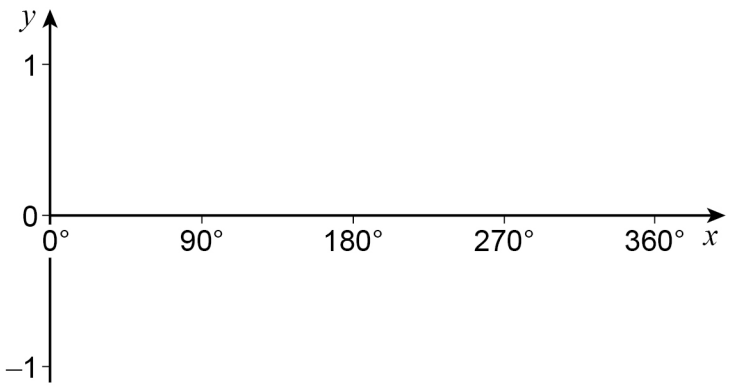
[1 mark]

$\frac{1}{4}$ $\frac{1}{3}$ $\frac{1}{2}$ $\frac{3}{4}$

4 (b) On the axes, sketch

$y = \cos x$ for $0° \leqslant x \leqslant 360°$

[2 marks]



Do not write outside the box

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

Work out the values of a and b.

[3 marks]

$a =$ _____ $b =$ _____

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

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

[3 marks]

$\frac{dy}{dx} =$ _____

9

Do not write outside the box

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]

Answer _____ units

Do not write outside the box

8 Use **matrix multiplication** to show that, in the x-y plane,

- a rotation, 90° 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

6

Do not write outside the box

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

Work out an expression for the nth term.

[3 marks]

Answer _____

9 (b) A different quadratic sequence has nth 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]

Answer _____

Do not write outside the box

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

[3 marks]

Answer _____

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

[4 marks]

Answer _____

13

Do not write outside the box

12 The nth term of a sequence is $\dfrac{3n^2}{n^2+2}$

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

Work out the value of n.

[2 marks]

Answer _____

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

[1 mark]

Answer _____

Do not write outside the box

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

[3 marks]

Answer _____

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

[3 marks]

Answer _____

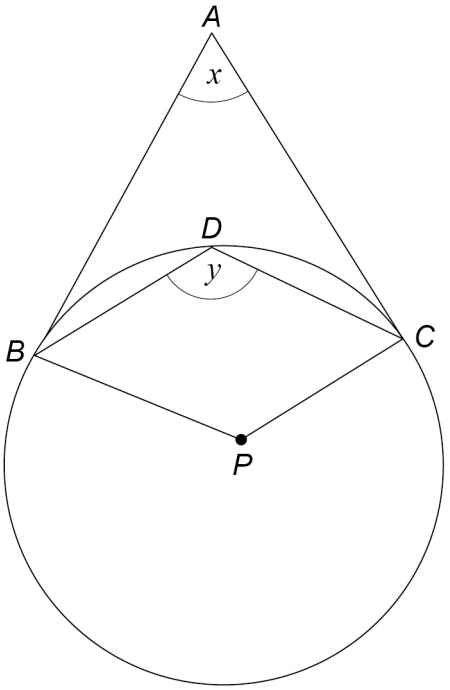
9

Turn over ►

Do not write outside the box

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]

Do not write outside the box

16 Solve the simultaneous equations

$$x - y = \frac{19}{4}$$

$$xy = -3$$

Do **not** use trial and improvement.

You **must** show your working.

[6 marks]

Answer _____

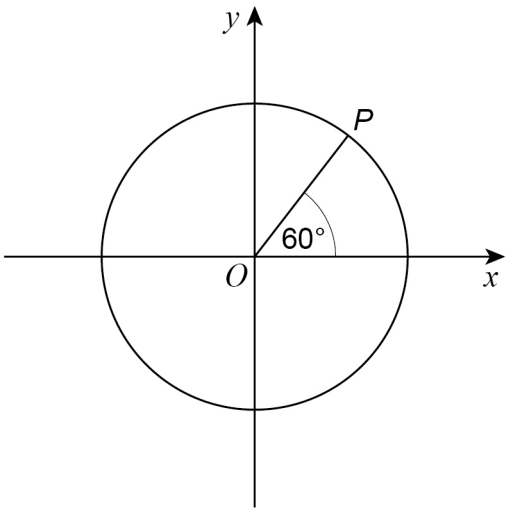
11

Turn over ►

Do not write outside the box

17 The point P lies on the circle $x^2 + y^2 = 16$

The line OP is at an angle of 60° to the positive x-axis.



Not drawn accurately

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

[2 marks]

Do not write outside the box

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]

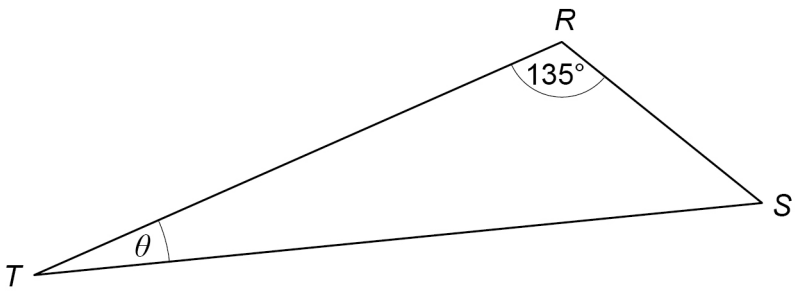
Answer _____

Turn over for the next question

6

Do not write outside the box

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



Not drawn accurately

Work out the exact value of sin θ.

[3 marks]

Answer _____

Do not write outside the box

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

[3 marks]

Answer _____

Turn over for the next question

6

Do not write outside the box

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]

Stationary point (_____ , _____) Nature _____

Stationary point (_____ , _____) Nature _____

Stationary point (_____ , _____) Nature _____

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21 Show that $\dfrac{4\cos^2 x + 3\sin^2 x - 4}{\cos^2 x} \equiv -\tan^2 x$

[3 marks]

END OF QUESTIONS

9

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