AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

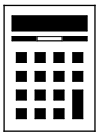
Level 2 Certificate
FURTHER MATHEMATICS

Paper 2 Calculator

Wednesday 21 June 2023 Afternoon Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:



- a calculator
- mathematical instruments
- the Formulae Sheet (enclosed).

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.
- The use of a calculator is expected but calculators with a facility for symbolic algebra must **not** be used.

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 Solve $\dfrac{8d-3}{3d-7}=\dfrac{5}{2}$

[3 marks]

$d =$ _____

2 (a) The first four terms of a linear sequence are

15 18.5 22 25.5

Work out an expression for the nth term.

[2 marks]

Answer _____

Do not write outside the box

2 (b) A different linear sequence has nth term $318 - 9n$

Work out the value of the first **negative** term in the sequence.

[2 marks]

Answer _____

3 $\begin{pmatrix} 3 & 5 \\ u & 2 \end{pmatrix} \begin{pmatrix} 1 \\ 4 \end{pmatrix} = \begin{pmatrix} t \\ 6 \end{pmatrix}$

Work out the values of t and u.

[2 marks]

$t =$ _____ $u =$ _____

9

Do not write outside the box

4 A line passes through P (1, k) and Q (r, 6) where k and r are constants.

The midpoint of PQ has x-coordinate 5

The gradient of the line is 2

Work out the value of k.

[4 marks]

$k =$ _____

Do not write outside the box

5 $y = 0.5x^4$

Work out the value of x for which the rate of change of y with respect to x is 6.75

[3 marks]

$x =$ _____

6 The equation of a circle is $(x + 7)^2 + (y - 4)^2 = 36$

Complete these statements.

[2 marks]

The coordinates of the centre of the circle are (_____ , _____)

The radius of the circle is _____

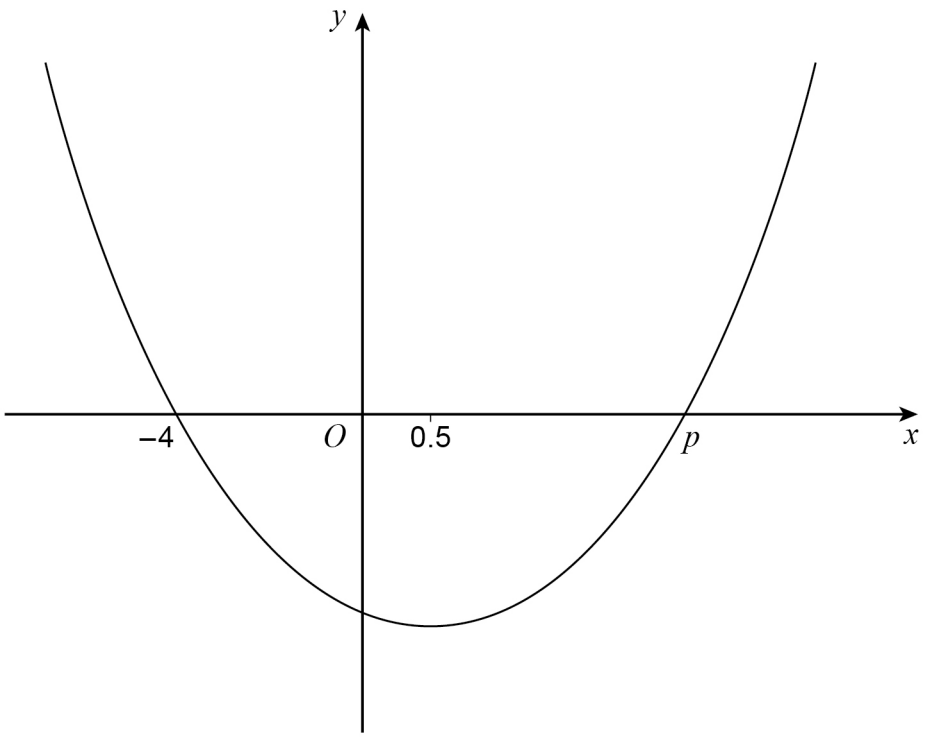
9

Do not write outside the box

7 Here is a sketch of the curve $y = ax^2 + bx + c$ where a, b and c are constants.

The curve intersects the x-axis at $(-4, 0)$ and $(p, 0)$

The turning point has x-coordinate 0.5



7 (a) Work out the value of p.

[1 mark]

$p =$ _____

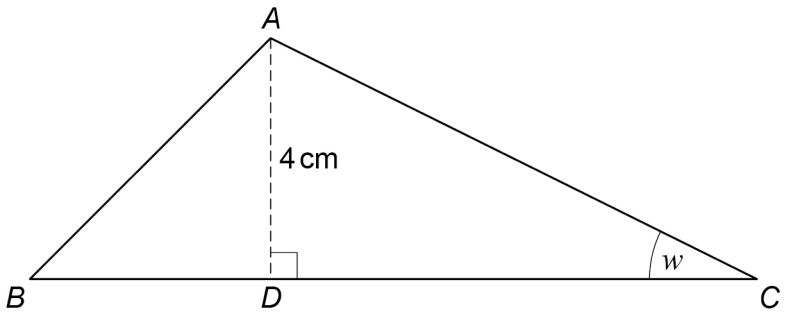
7 (b) Solve $ax^2 + bx + c > 0$

[2 marks]

Answer _____

Do not write outside the box

8 *ABC* is a triangle with perpendicular height *AD*.



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Area of $ABC = 25\,\text{cm}^2$

$BD : DC = 2 : 3$

Work out the size of angle w.

[4 marks]

$w =$ _____ °

7

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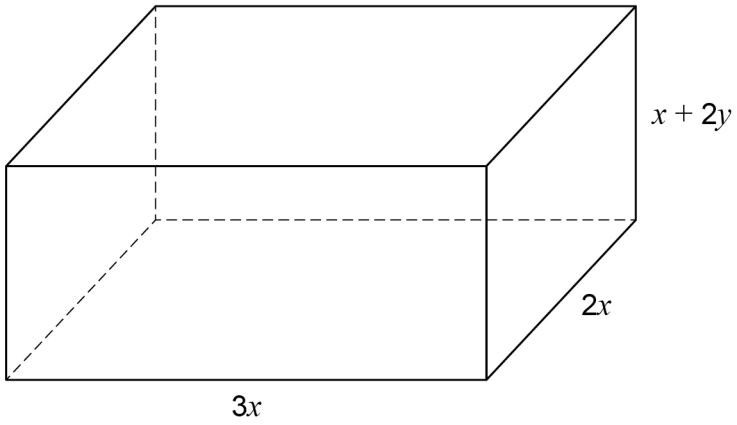
9 The dimensions of the cuboid are given in centimetres.



The total length of all 12 edges is 300 cm

9 (a) Show that $y = \dfrac{75 - 6x}{2}$

[2 marks]

Do not write outside the box

9 (b) The volume of the cuboid is V cm^3

Show that $V = 450x^2 - 30x^3$

[2 marks]

9 (c) Use calculus to work out the maximum value of V as x varies.

[3 marks]

Answer _____

7

Turn over ►

Do not write outside the box

10 Line K has equation $4x - 5y = 17$

Line L passes through the points (3, 6) and (–5, 16)

Tick (✓) the correct statement about lines K and L.

The lines are parallel. ☐

The lines are perpendicular. ☐

The lines are neither parallel nor perpendicular. ☐

Show working to support your answer.

[3 marks]

Do not write outside the box

11 Expand and simplify fully $(2x^3 - 9)(3x^2 + 4) + x(x - 4)^2$

[4 marks]

Answer _____

Turn over for the next question

7

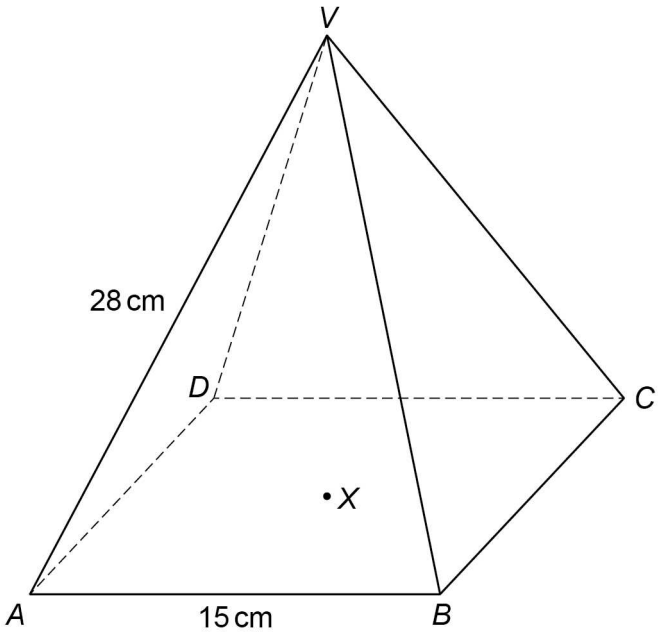
Do not write outside the box

12 *VABCD* is a pyramid.

The square horizontal base, *ABCD*, has side length 15 cm

V is directly above the centre, *X*, of the base.

VA = 28 cm



Work out the size of the angle that *VA* makes with *ABCD*.

[3 marks]

Answer _____ °

Do not write outside the box

13 (a) Circle the expression equivalent to $3x^{-7}$

[1 mark]

$-\frac{3}{x^7}$ $-\frac{1}{3x^7}$ $\frac{1}{3x^7}$ $\frac{3}{x^7}$

13 (b) Simplify fully $\frac{12w^8}{\left(4w^3\right)^2}$

[2 marks]

Answer _____

13 (c) $\sqrt{y} \times \sqrt[3]{y} = \sqrt[c]{y^d}$ where c and d are positive integers.

Work out the **least** possible values of c and d.

[3 marks]

$c =$ _____ $d =$ _____

9

Do not write outside the box

14 Simplify fully $\dfrac{15a^2}{a^2+6a-16} \times \dfrac{8-4a}{3a}$

[4 marks]

Answer _____

Do not write outside the box

15 The function g is given by $g(x) = a \times b^x$ where a and b are constants.

The domain of the function is $-1 \leqslant x \leqslant 2$

$P\left(0, \frac{1}{2}\right)$ and $Q\left(1, \frac{3}{2}\right)$ are points on the graph $y = g(x)$

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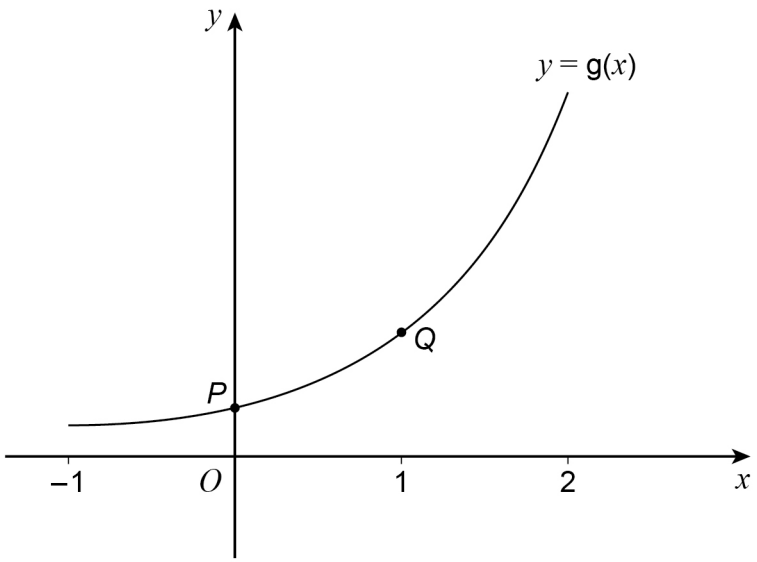

Work out the range of the function.

[4 marks]

Answer _____

8

Turn over ►

Do not write outside the box

16 $(2x - 3)$ is a factor of $6x^3 - 25x^2 + 28x - 6$

Solve $6x^3 - 25x^2 + 28x - 6 = 0$

Give all solutions as **exact** values.

[4 marks]

Answer _____

Do not write outside the box

17 The function h is given by $h(x) = ax(3x^2 - 2) + 5x$ where a is a **positive** constant.

h is an **increasing** function for all values of x.

Work out the possible values of a.

Give your answer as an inequality.

[4 marks]

Answer _____

Turn over for the next question

8

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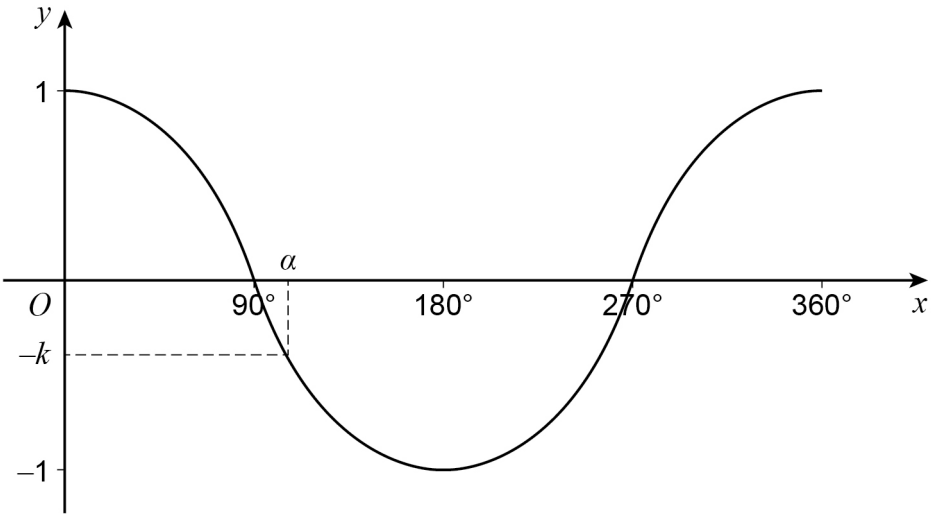
18 Here is a sketch of $y = \cos x$ for values of x from 0° to 360°

α is an obtuse angle measured in degrees.

$\cos \alpha = -k$ where k is a positive constant.



18 (a) Tick (✓) **two** boxes that show expressions for x where $\cos x = -k$

[2 marks]

☐ $180° - \alpha$ ☐ $180° + \alpha$

☐ $270° - \alpha$ ☐ $270° + \alpha$

☐ $360° - \alpha$ ☐ $360° + \alpha$

18 (b) Circle the expression for x where $\sin x = -k$

[1 mark]

α $90° + \alpha$ $180° - \alpha$ $180° + \alpha$

Do not write outside the box

19 In these simultaneous equations, k is a positive constant.

$$3x + 4y = k$$

$$y = 2kx$$

Solve the simultaneous equations.

Give the answers in their simplest form in terms of k.

[3 marks]

$x =$ _____ $y =$ _____

6

Turn over ►

Do not write outside the box

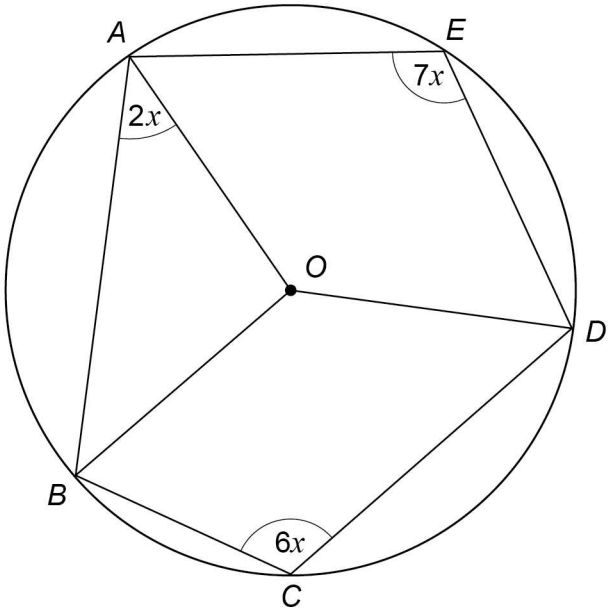
20 Show that

$2\sin^3 x + 2\sin x \cos^2 x + 5\tan x \cos x$ simplifies to $p \sin x$ where p is a constant.

[3 marks]

Do not write outside the box

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



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Work out the value of x.

[4 marks]

$x =$ _____

7

Turn over ►

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22 Five-digit integers are made using

1 2 7 8 9

For each integer, all the digits are used exactly once.

The integers are

greater than 40 000 **and** odd.

How many different integers can be made?

You **must** show your working.

[3 marks]

Answer _____

END OF QUESTIONS

3

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