A

AQA

Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

Level 2 Certificate

FURTHER MATHEMATICS

Paper 2 Calculator

8365/2

Wednesday 21 June 2023 **Afternoon**

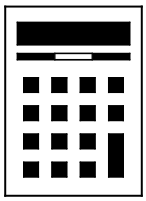
Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and forename(s), your centre number, your candidate number and add your signature.

[Turn over]

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.**
- **Answer ALL questions.**
- **You must answer the questions in the spaces provided. Do not write 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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

1 Solve $\frac{8d-3}{3d-7} = \frac{5}{2}$ [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 _____

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

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 = _____

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 _____

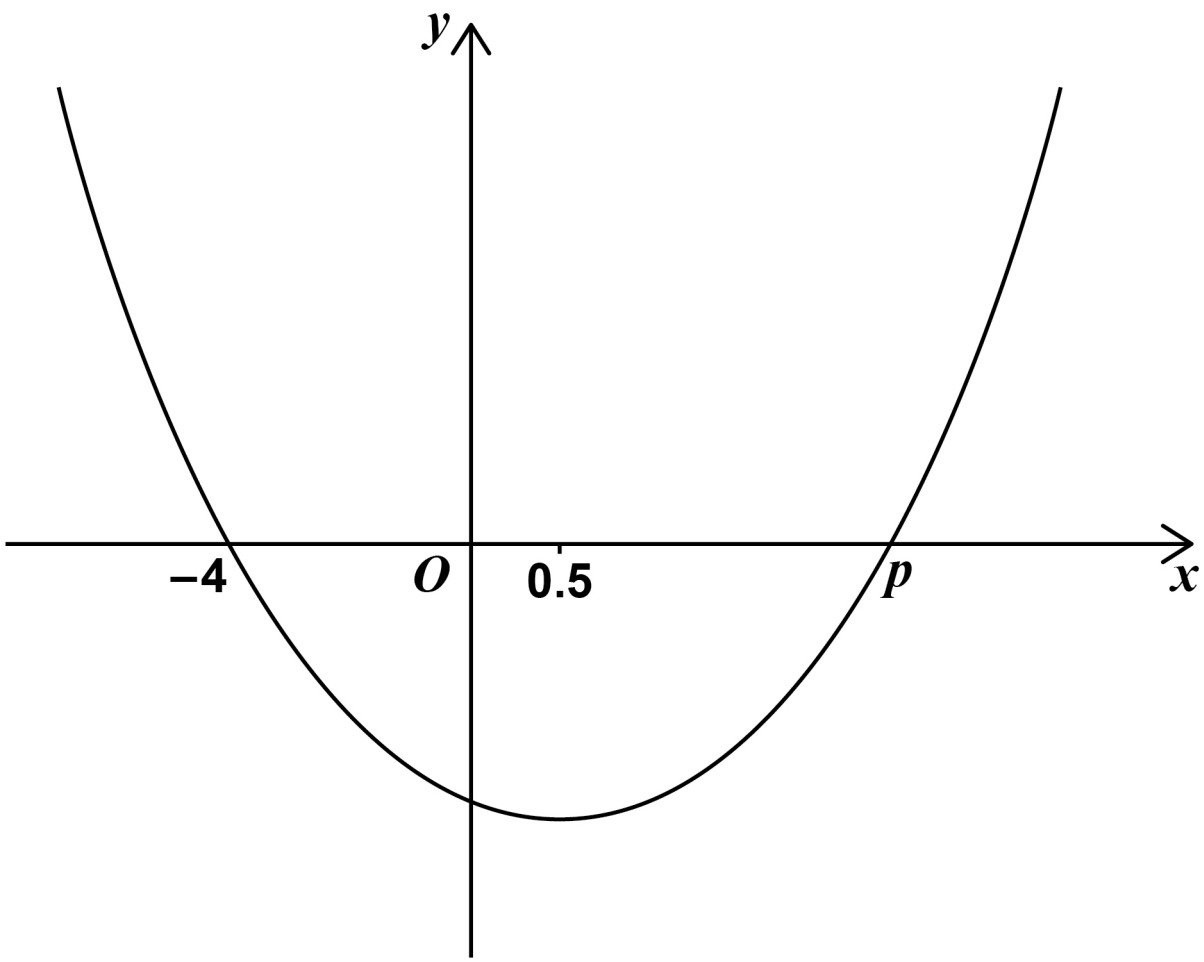
[Turn over]

9

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 = _____

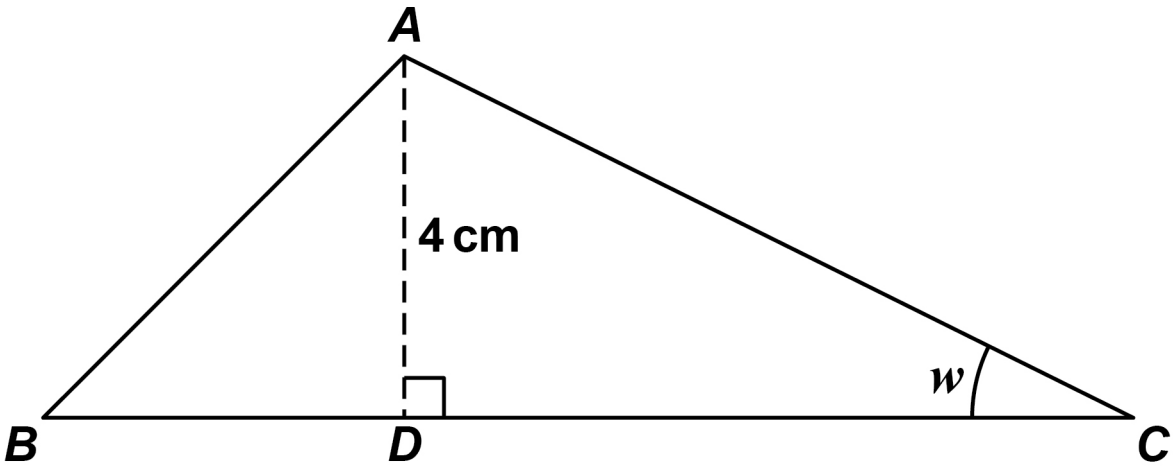
7 (b) **Solve $ax^2 + bx + c > 0$ [2 marks]**

Answer _____

[Turn over]

8 ABC is a triangle with perpendicular height AD.

The diagram is not drawn accurately.



Area of ABC = 25 cm^2

$BD : DC = 2 : 3$

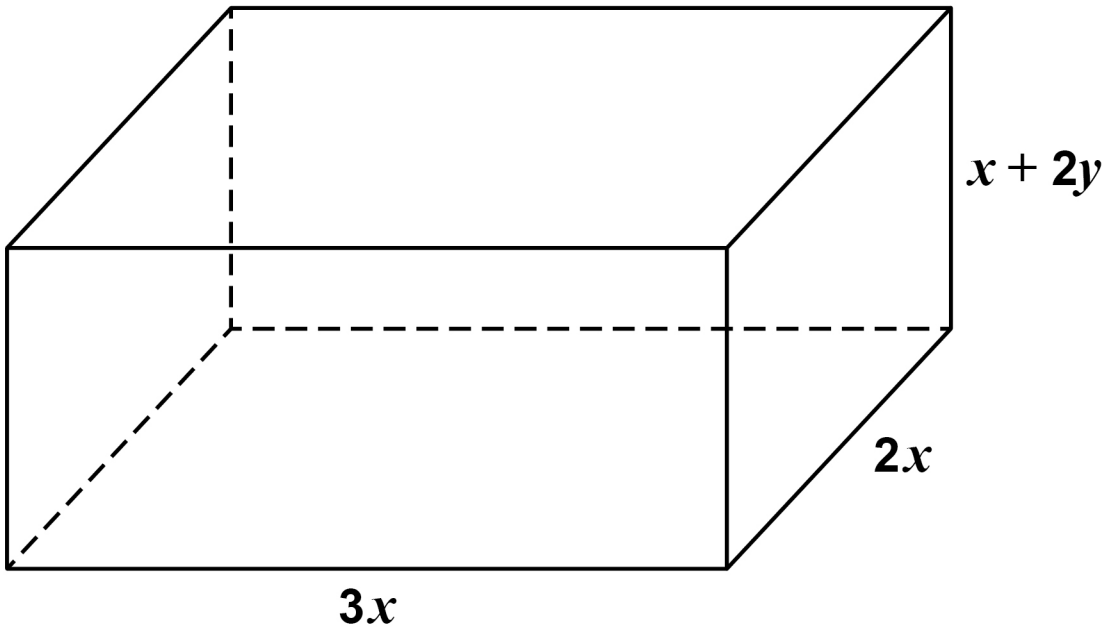
Work out the size of angle w. [4 marks]

$w =$ _____ °

[Turn over]

7

9 **The dimensions of the cuboid are given in centimetres.**



The total length of all 12 edges is 300 cm

9 (a) **Show that** $y = \frac{75 - 6x}{2}$ **[2 marks]**

[Turn over]

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

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]

[Turn over]

11 **Expand and simplify fully**

$(2x^3 - 9)(3x^2 + 4) + x(x - 4)^2$ **[4 marks]**

Answer _____

[Turn over]

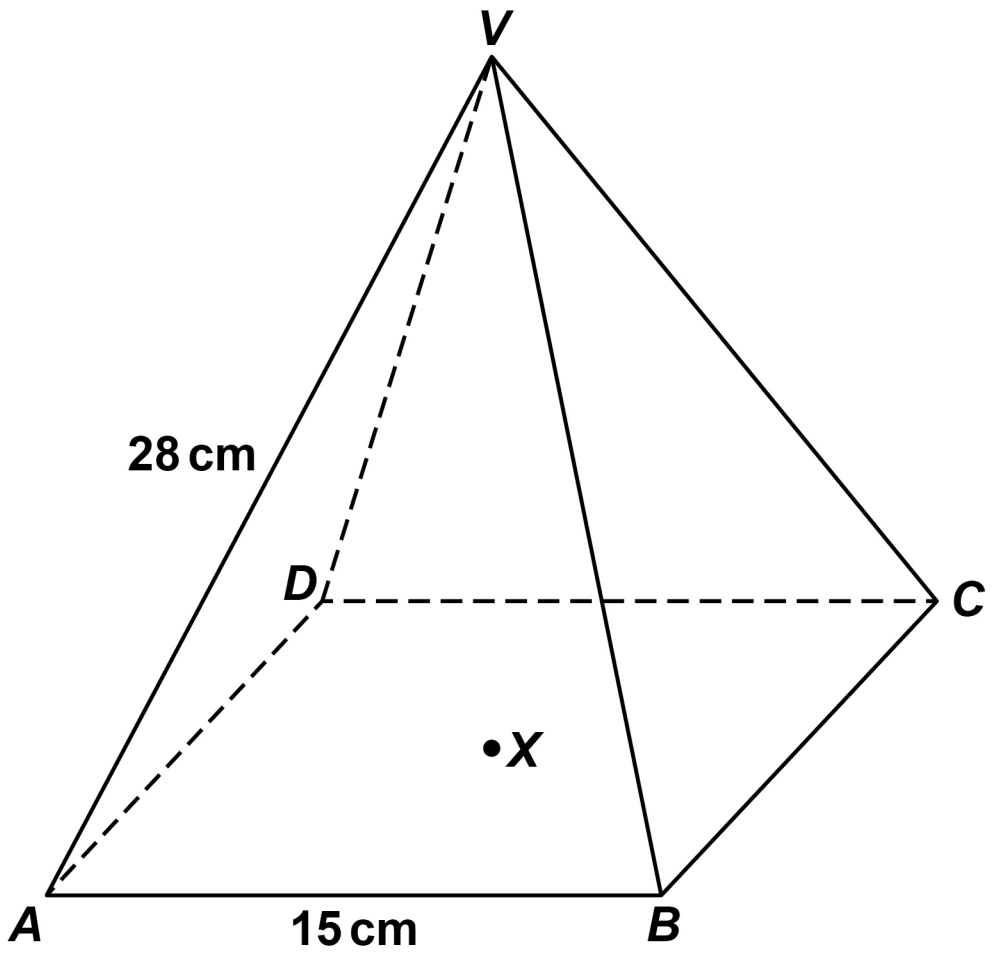
7

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 _____ °

[Turn over]

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]

$c =$ _____ $d =$ _____

[Turn over]

9

14 Simplify fully $\frac{15a^2}{a^2 + 6a - 16} \times \frac{8 - 4a}{3a}$ [4 marks]

Answer _____

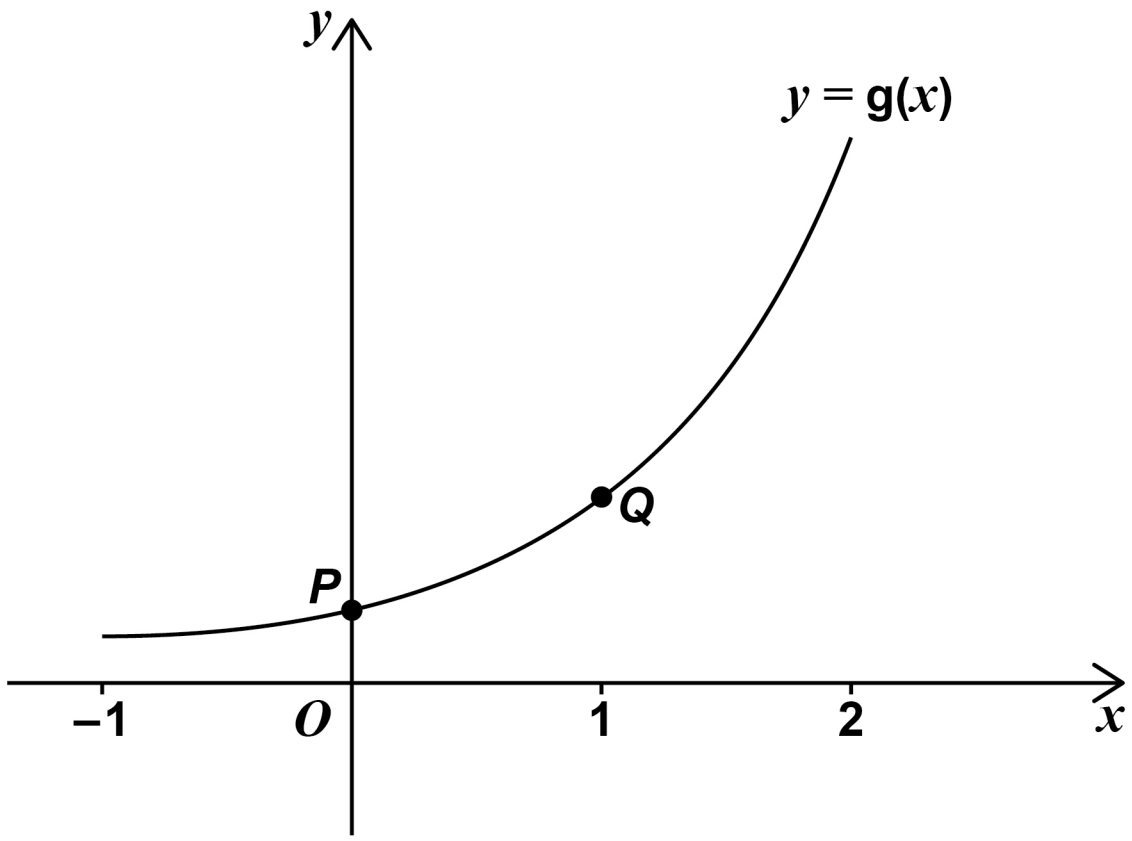
[Turn over]

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 $y = g(x)$

The diagram is not drawn accurately.



Work out the range of the function. [4 marks]

Answer _____

[Turn over]

8

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 _____

[Turn over]

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 _____

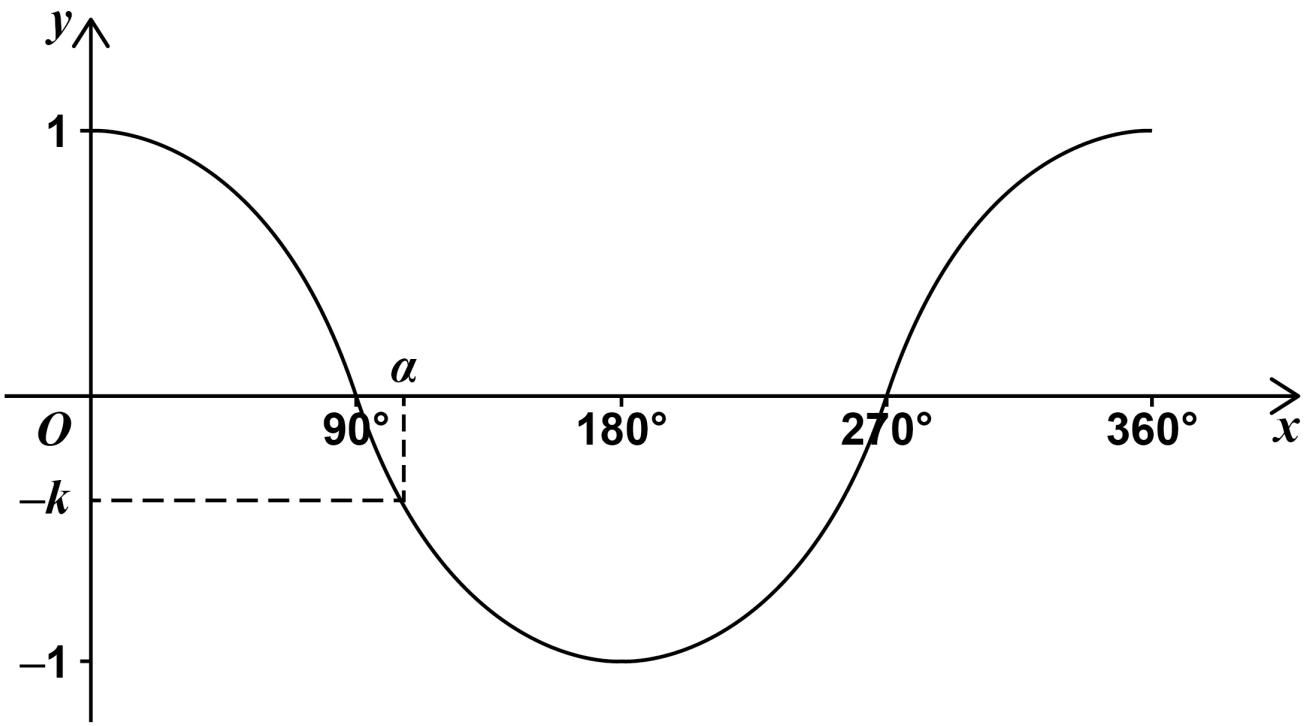
[Turn over]

8

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) On the opposite page, 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 $90° + \alpha$ $180° - \alpha$ $180° + \alpha$

[Turn over]

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 = _____

[Turn over]

6

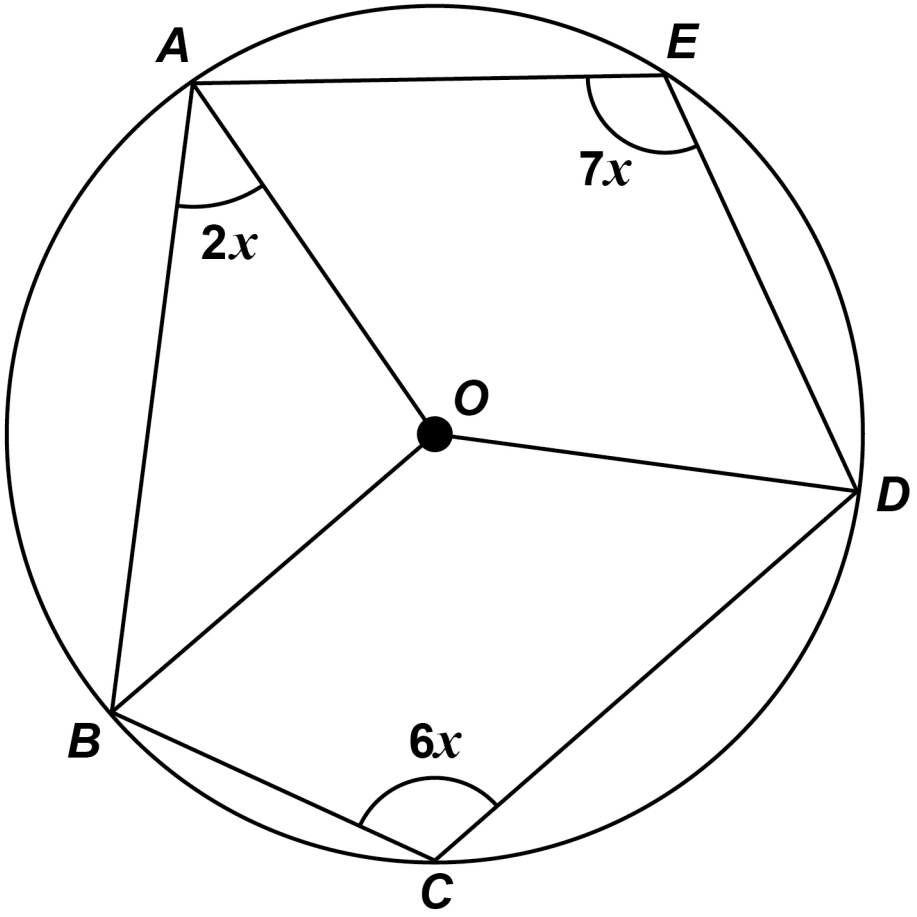
20 **Show that**

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

[Turn over]

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

The diagram is not drawn accurately.



Work out the value of x. [4 marks]

x = _____

[Turn over]

7

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

Additional page, if required.

Write the question numbers in the left-hand margin.

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Write the question numbers in the left-hand margin.

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For Examiner's Use	
Pages	Mark
4–7	
8–11	
12–15	
16–19	
20–23	
24–27	
28–31	
32–35	
36–39	
40–43	
44–45	
TOTAL