

Please write clearly in	n block capitals.	
Centre number	Candidate number	İ
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.

1	Solve	8d-3	_ 5
•	SOIVE	$\overline{3d-7}$	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 \_\_\_\_\_

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-		
	$k = \underline{\hspace{1cm}}$		



_		^	$.5x^2$
5	$\nu =$	U	.ox

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 \_\_\_\_\_

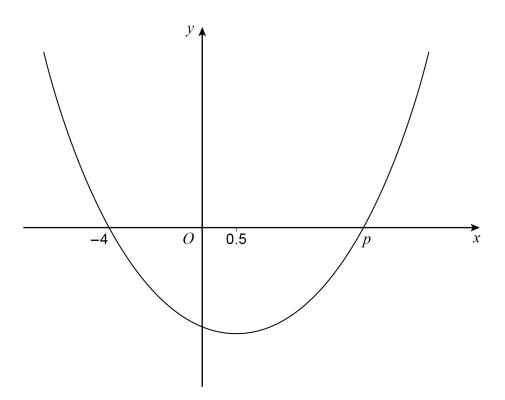
9



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.

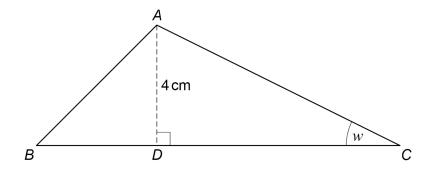
[1 mark]

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

[2 marks]

Answer

8 ABC is a triangle with perpendicular height AD.



Not drawn accurately

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

BD: DC = 2:3

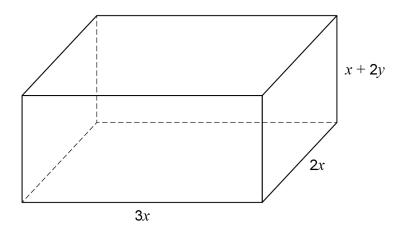
Work out the size of angle w.

[4 marks]

l-<u>-</u>



**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]

9 (b)	The volume of the cuboid is $V \mathrm{cm}^3$	
	Show that $V = 450x^2 - 30x^3$	[2 marks]
9 (c)	Use calculus to work out the maximum value of ${\it V}$ as ${\it x}$ varies.	[3 marks]
9 (c)	Use calculus to work out the maximum value of $V$ as $x$ varies.	[3 marks]
9 (c)	Use calculus to work out the maximum value of $V$ as $x$ varies.	[3 marks]
9 (c)	Use calculus to work out the maximum value of $V$ as $x$ varies.	[3 marks]
9 (c)	Use calculus to work out the maximum value of $V$ as $x$ varies.  Answer	[3 marks]



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]



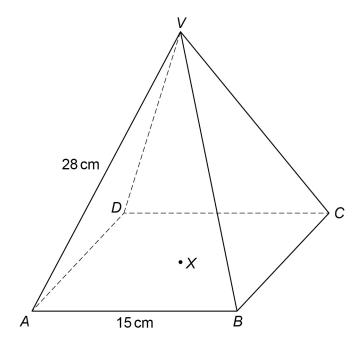
Expand and simplify	fully $(2x^3 - 9)(3x^2 + 4) + x(x - 4)$	4) <sup>2</sup> [4 marks]
Δnswer		
, wiewer _		
	Turn over for the next question	on



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.

 $VA = 28 \,\mathrm{cm}$ 



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

		[3 marks]
Answer		0
/ 113WCI		



**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



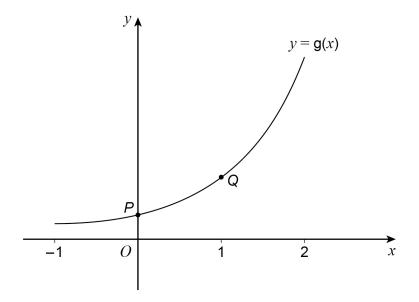
14	Simplify fully	$\frac{15a^2}{a^2 + 6a - 16} \times \frac{8 - 4a}{3a}$	
		a + 6a - 16	[4 marks]
		Answer	



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

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

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



Not drawn accurately

Work out the range of the function.

[4 marks]

Answer \_\_\_\_



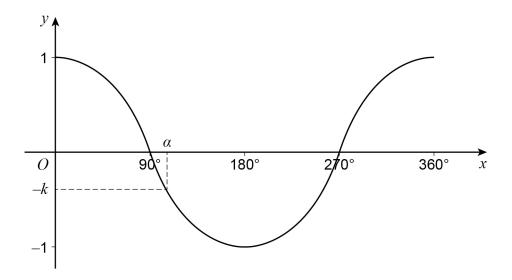


$(2x-3)$ is a factor of $6x^3 - 25x^2 + 28x - 6$	
Solve $6x^3 - 25x^2 + 28x - 6 = 0$	
Give all solutions as <b>exact</b> values.	<b>F4</b>
	[4 mark
Answer	



The function h is given by $h(x) = ax(3x^2 - 2) + 5x$ where a is a <b>positive</b> con h is an <b>increasing</b> function for all values of x.	onstant.
Work out the possible values of $a$ .	
Give your answer as an inequality.	[4 marks
Answer	
Town soon for the most word in	
Turn over for the next question	

Here is a sketch of  $y = \cos x$  for values of x from 0° to 360°  $\alpha$  is an obtuse angle measured in degrees.  $\cos \alpha = -k$  where k is a positive constant.



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

[2 marks]

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

[1 mark]

$$\alpha$$

$$90^{\circ} + \alpha$$

$$180^{\circ} - \alpha$$

180° + 
$$\alpha$$

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]

$$x = v = v = v$$

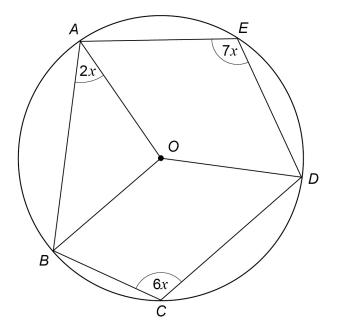
6



Show that			
$2\sin^3 x + 2\sin x \cos^2 x + 5\tan x \cos x$	simplifies to	$p \sin x$	
			[3 marks



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



Not drawn accurately

Work out the value of x.

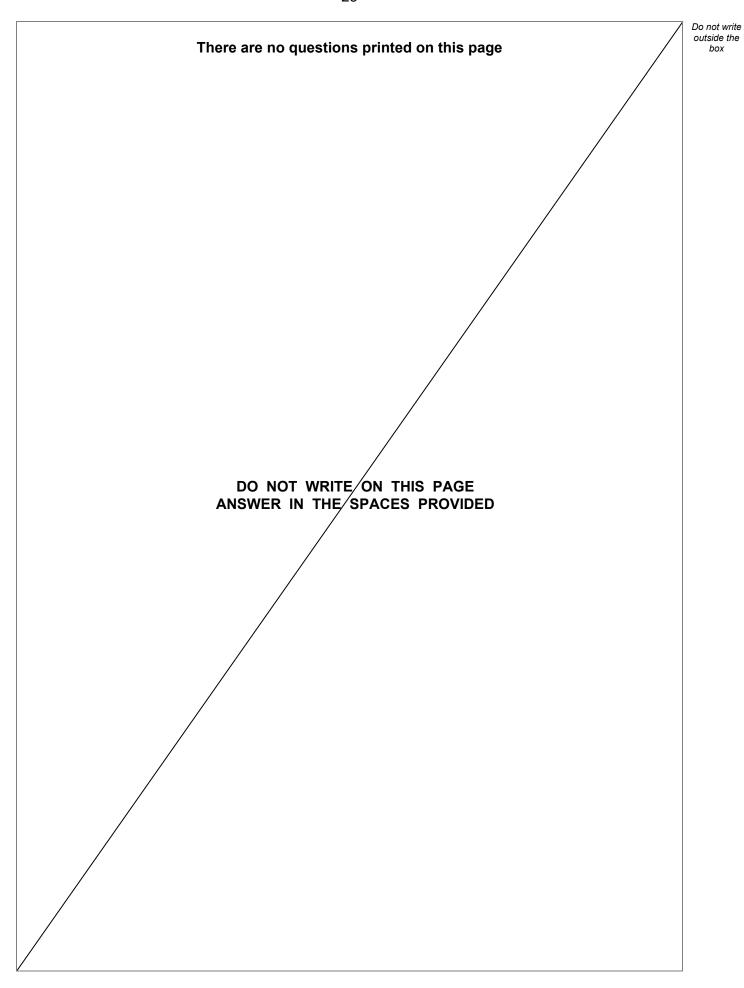
[4 marks]



Fi	ve-digit inte	gers are m	ade using				
		1	2	7	8	9	
Fo	or each inte	ger, all the	digits are use	ed exactly one	ce.		
Tł	ne integers a	are					
	gre	ater than 4	0 000 <b>and</b>	d odd.			
Н	ow many dif	ferent integ	gers can be r	made?			
	ou <b>must</b> sho						
							[3 marks]
_							
_							
_							
		Δn	swer				
		All					
			FND OF	QUESTIONS	3		
					-		

3







Question number	Additional page, if required. Write the question numbers in the left-hand margin.



Question number	Additional page, if required. Write the question numbers in the left-hand margin.



Question number	Additional page, if required. Write the question numbers in the left-hand margin.



Question number	Additional page, if required. Write the question numbers in the left-hand margin.



There are no questions printed on this page DO NOT WRITE ON THIS PAGE ANSWER IN THE SPACES PROVIDED

### Copyright information

For confidentiality purposes, all acknowledgements of third-party copyright material are published in a separate booklet. This booklet is published after each live examination series and is available for free download from www.aqa.org.uk.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team.

Copyright © 2023 AQA and its licensors. All rights reserved.





Do not write outside the