



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

Thursday 8 June 2023

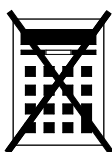
Morning

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.



J U N 2 3 8 3 6 5 1 0 1

IB/G/Jun23/E11

8365/1

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

Do not write
outside the
box

1 The function f is given by $f(x) = 2x + 1$

1 (a) Work out x when $f(x) = -5$

[2 marks]

$x =$ _____

1 (b) The function g is given by $g(x) = x^2$

Work out $fg(3)$

[2 marks]

Answer _____



2 Factorise fully $6x^2y + 21xy$

[2 marks]

Answer _____

3 (a) Circle the transformation matrix that represents a reflection in the line $y = -x$

[1 mark]

$$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$$

$$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

3 (b) Show that

$$\begin{pmatrix} 2 & 4 \\ -1 & -3 \end{pmatrix} \begin{pmatrix} -3 & -4 \\ 1 & 2 \end{pmatrix} = k \mathbf{I} \quad \text{where } k \text{ is an integer.}$$

[2 marks]



4 $S(7, 2)$ and $T(5, -4)$ are points on a straight line.

4 (a) Work out the gradient of the line.

[2 marks]

Answer _____

4 (b) Work out the distance between S and T .

Give your answer in the form $a\sqrt{b}$ where a and b are both integers greater than 1

[3 marks]

Answer _____ units



- 5 X_n and Y_n are the n th terms of two sequences.

$$X_n = (n - 1)(n + 1)$$

$$Y_n = (n + 1)(n + 2)$$

Prove that every term of the sequence with n th term $Y_n - X_n$ is a multiple of 3

[3 marks]

Turn over for the next question



6 The equation of a curve is $y = x^6 + 4x^2 - 7$

Work out the equation of the tangent to the curve at the point $(1, -2)$

Give your answer in the form $y = mx + c$

[4 marks]

Answer _____



7

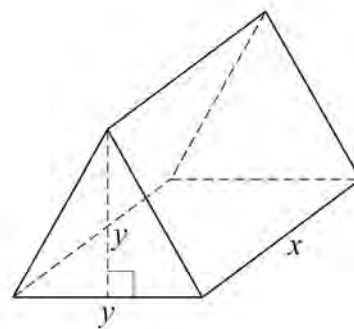
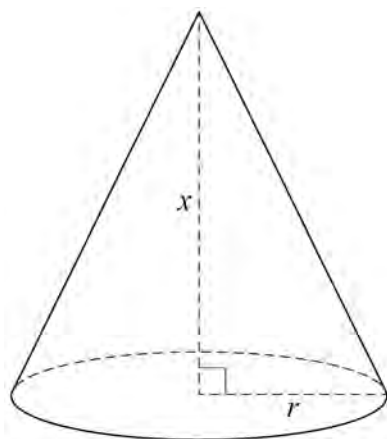
The diagram below shows a cone and a prism.

All measurements are in cm

The cone has base radius r and perpendicular height x .

The prism has a triangular cross section with base y and perpendicular height y .

The length of the prism is x .



$$\text{Volume of a cone} = \frac{1}{3} \times \text{area of base} \times \text{perpendicular height}$$

The volume of the cone is **four** times the volume of the prism.

Express r in terms of y .

[4 marks]

$$r = \underline{\hspace{10cm}}$$



9

Rearrange $w = \frac{y^2 + 5}{y^2 - 2}$ to make y the subject.

[4 marks]

Answer _____

Turn over for the next question

*Do not write
outside the
box*



10

Rationalise the denominator and simplify fully

$$\frac{1+\sqrt{5}}{3-\sqrt{5}}$$

[4 marks]

Answer _____



Do not write
outside the
box

11

$$y = \frac{1}{12}x^4 + 3x^2 + 4$$

Work out the **positive** value of x for which $\frac{d^2y}{dx^2} = 55$

[3 marks]

$x =$ _____

Turn over for the next question

7

Turn over ►



12 (a) Write down the value of x for $0^\circ \leq x \leq 360^\circ$ when $\sin x = -1$

[1 mark]

$x =$ _____

12 (b) Work out the values of y for $0^\circ \leq y \leq 360^\circ$ when $\sqrt{3} \tan y = 1$

[3 marks]

Answer _____



Do not write
outside the
box

13

Write $\frac{2x-3}{x} - \frac{1}{3x} + 1$ as a single fraction.

Give your answer in its simplest form.

[3 marks]

Answer _____

Turn over for the next question

7

Turn over ►

14

Solve $\frac{8}{x} + 3x \leq 10$ where x is positive.

[4 marks]

Answer _____

Do not write
outside the
box



Do not write
outside the
box

15

Solve $\left(x^{\frac{1}{2}} - x^{\frac{3}{2}}\right)^2 = x^2 + x$

[4 marks]

Answer _____

16

The expansions of $(1 + 12x)^4$ and $(a + 4x)^3$ have the same coefficient of x^2 Work out the value of a .

[4 marks]

 $a =$ _____

12

Turn over ►



There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



There are no questions printed on this page

*Do not write
outside the
box*

**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.

