

AQA AS-Level Further Maths 2026 Paper

1

Do not turn over the page until instructed to do so.

This assessment is out of 80 marks and you will be given 90 minutes.

When you are asked to by your teacher write your **full name** below

Name:

Total Marks: / 80

- 1 Which of the following is a vector which is not perpendicular to the line with vector equation $\mathbf{r} = 2\mathbf{i} + 3\mathbf{j} - \mathbf{k} + \lambda (2\mathbf{i} + 4\mathbf{j} - \mathbf{k})$?

$$\begin{pmatrix} 1 \\ 1 \\ 6 \end{pmatrix}$$

$$\begin{pmatrix} 2 \\ 0 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} 0 \\ -1 \\ -4 \end{pmatrix}$$

$$\begin{pmatrix} 1 \\ 2 \\ -2 \end{pmatrix}$$

[1 mark]

- 2 \mathbf{A} is a square $n \times n$ matrix.
If $\det(\mathbf{A}) = 6$ what is $\det(\mathbf{A}^{-1})$?

6

$\frac{1}{6}$

36

1

[1 mark]

- 3 Let $z = 3 + 2i$ be a root of $p(z) = z^2 - (5 + i)z + (8 + i)$. Which is the other root?

$3 - 2i$

$-3 - 2i$

$2 - i$

$2 + i$

[1 mark]

- 4 Find $\sum_{r=3}^{10} r^2$

380

371

385

384

[1 marks]

- 5 a) Using the standard MacLaurin expansions find the first three terms in the series expansion of $y = \cosh(ix)$.

[4 marks]

- b) Hence, suggest an identity relating $\cosh(ix)$ to a trigonometric function.

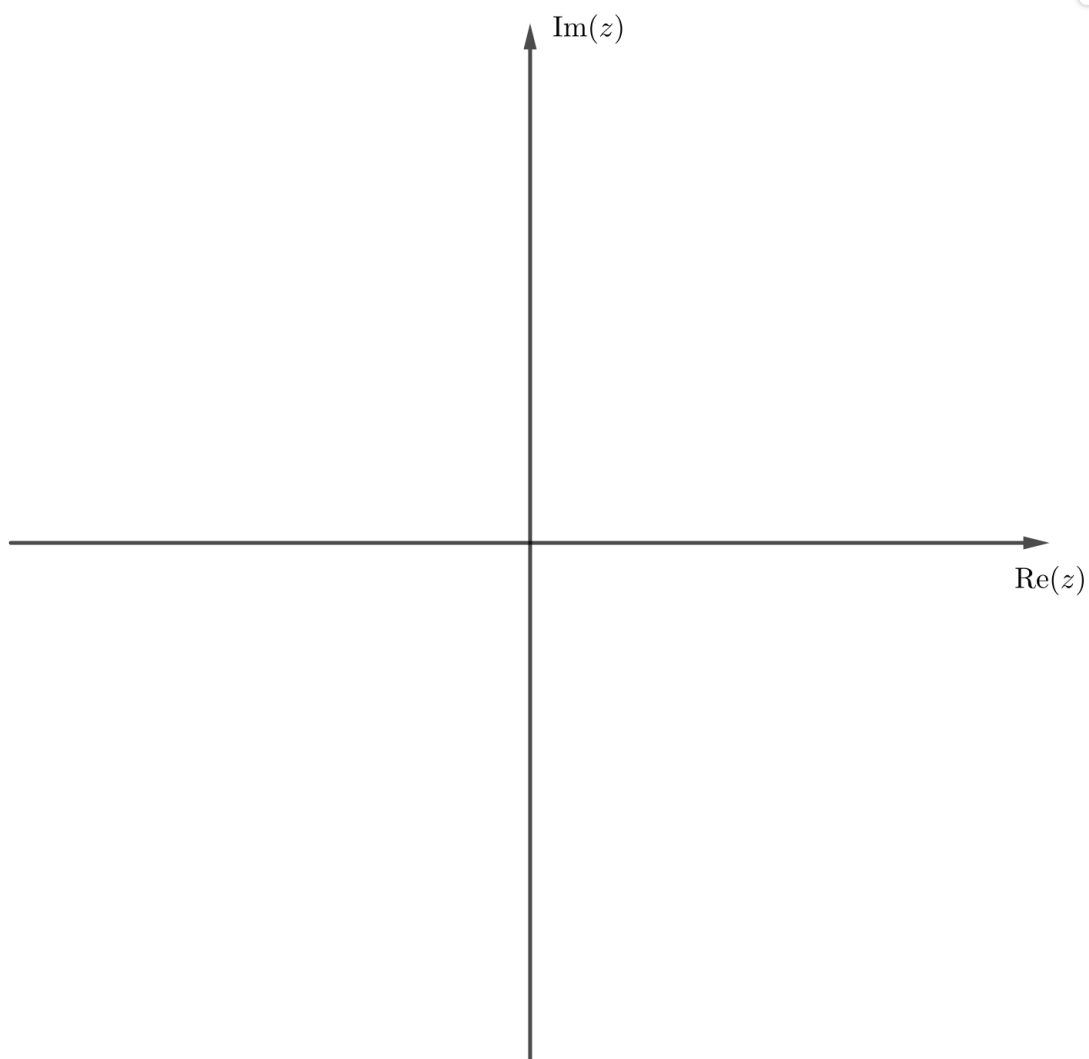
[1 mark]

- 6** Find the volume of the solid formed when the region enclosed between $y = x^2$ and $y = 6x - x^2$ is rotated through 360° about the x -axis.

[5 marks]

- 7 a) Sketch, on the argand diagram below, the locus of the points which satisfy $|z - 6i| = 5$

[2 marks]



- b)** Point P is the only point that lies on both C and the half line $\arg(z) = \arctan(k)$, where k is a positive constant.

Find the value of k , giving your answer in exact form.

[3 marks]

- c)** Find, in the form $a + bi$ the coordinates of the point P , giving the values of a and b to 3 significant figures.

[3 marks]

8) a) Prove that

$$\operatorname{arsinh}(x) = \ln \left(x + \sqrt{x^2 + 1} \right)$$

[4 marks]

- b)** Find, in exact form, the solutions of the equation,

$$2 \cosh^2(x) + \sinh(x) = 5$$

[4 marks]

9 a) Show that $(r + 2)^2 - (r - 1)^2 = 6r + 3$

[1 marks]

b) Hence, using the method of differences, find an expression for

$$\sum_{r=1}^n 2r + 1$$

[4 marks]

10 A curve, C_1 , has equation

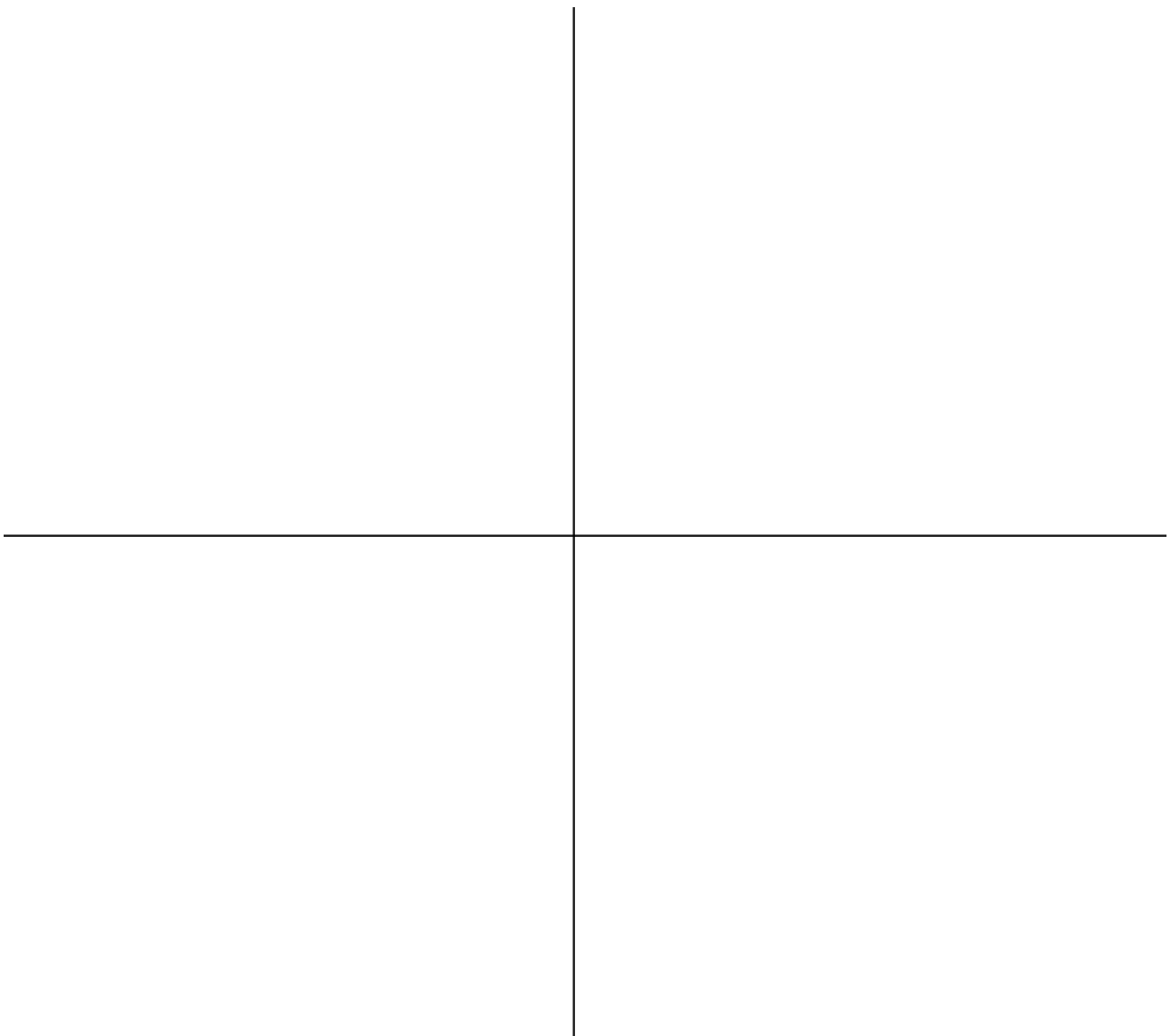
$$y = \frac{3x + 5}{2x - 7}$$

a) Write down the equations of the asymptotes of the curve C_1 .

[2 marks]

b) Sketch, on the axes below the graph of C_1 , indicating any intersections with the axes.

[3 marks]



c) Hence, solve the inequality

$$\frac{3x + 5}{2x - 7} > 3x - 3$$

[4 marks]

11 The roots of the polynomial

$$p(x) = 27x^3 - 78x^2 + cx - 8$$

are in a geometric progression. Find the value of c .

[5 marks]

12 a) (i) Sketch the polar curve $r = 2 + 3 \cos (\theta)$, $0 \leq \theta \leq 2\pi$.

[2 marks]

(ii) What is the maximum value of r ?

[1 mark]

- b)** The graph of the curve $r = 2 \sin^2(\theta)$ is now added to the plot.
Find the polar coordinates of the points of intersection.

[4 marks]

13 An indoor activity centre has two glider tracks (a bit like a zipline)

The floorpan of the centre is a rectangle of length 100 m (the x -direction) and width of 50 m (y -direction)

One glider track connects a point 40 m above the position with coordinate $A(100,0)$ with a point 25 m above the position with coordinate $B(0,40)$.

The other glider track begins at the point $C(100,50,35)$ with the point $D(10,20,20)$.

Stating any assumptions that you make, determine if it would be possible for two people who are 1.78m tall to collide when using these tracks.

[8 marks]

14 The matrix \mathbf{A} is given by

$$\mathbf{A} = \begin{pmatrix} 3 & k \\ 0 & 1 \end{pmatrix}$$

- a) Given that the image of $P(3, -2)$ is $P'(5, -2)$ find the value of k .

[2 marks]

For the remainder of the question use the value of k found in (a).

- b) For the matrix \mathbf{A} given above verify that $(\mathbf{A}^{-1})^T = (\mathbf{A}^T)^{-1}$

[4 marks]

- c) A shape of area 4 cm² is transformed by the matrix \mathbf{A}^3 . What is the area of the resulting shape?

[1 mark]

- d)** By calculating \mathbf{A}^2 and \mathbf{A}^3 make a conjecture about the form of \mathbf{A}^n and prove it.

[5 marks]

- e) Let \mathbf{B} be a general non-singular $n \times n$ matrix. Prove the general result,

$$(\mathbf{B}^{-1})^T = (\mathbf{B}^T)^{-1}$$

[4 marks]

