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Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

A-level MATHEMATICS

Paper 2

Thursday 12 June 2025

Afternoon

Time allowed: 2 hours

Materials

- You must have the AQA Formulae for A-level Mathematics booklet.
- You should have a graphical or scientific calculator that meets the requirements of the specification.

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer each question in the space provided for that question.
- 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 **not** write outside the box around each page or on blank pages.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.

For Examiner's Use	
Question	Mark
1	
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TOTAL	



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Section AAnswer **all** questions in the spaces provided.

- 1** Describe the single transformation which maps the curve with the equation

$$y = \ln x$$

onto the curve with the equation

$$y = 2 \ln x$$

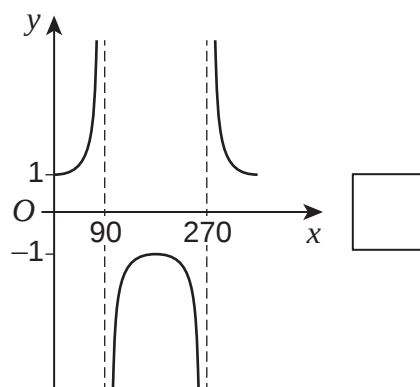
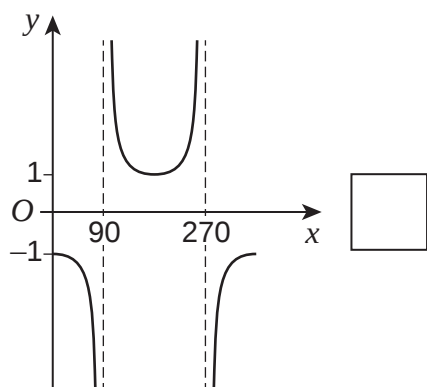
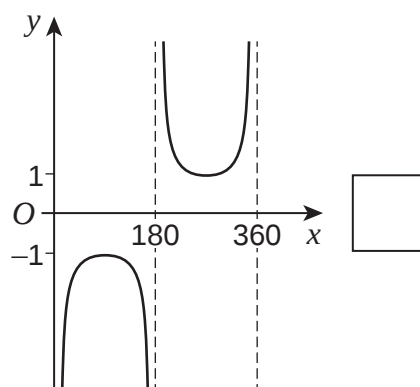
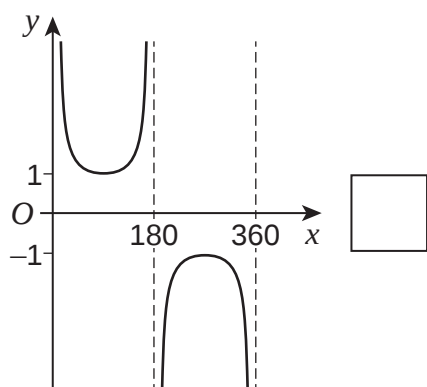
Tick (✓) **one** box.**[1 mark]**Stretch, scale factor 2, parallel to the y -axis☐Stretch, scale factor $\frac{1}{2}$, parallel to the x -axis☐Translation $\begin{bmatrix} 2 \\ 0 \end{bmatrix}$ ☐Translation $\begin{bmatrix} 0 \\ 2 \end{bmatrix}$ ☐

- 2 One of the diagrams below shows the graph of $y = \operatorname{cosec} x^\circ$ for $0 \leq x \leq 360$

Identify the correct graph.

Tick (✓) **one** box.

[1 mark]

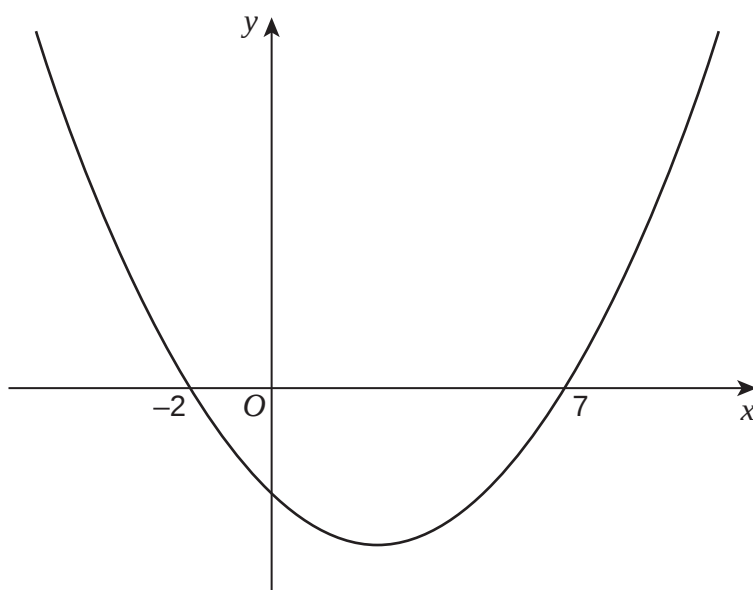


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3

The diagram shows the graph with equation $y = (x + 2)(x - 7)$ 

Solve the inequality.

$$(x + 2)(x - 7) > 0$$

Tick (✓) **one** box.**[1 mark]**

$x \in (-\infty, -2) \cap (7, \infty)$

☐

$x \in (-\infty, -2) \cup (7, \infty)$

☐

$x \in (-\infty, -2] \cap [7, \infty)$

☐

$x \in (-\infty, -2] \cup [7, \infty)$

☐


4 Solve the equation

$$5^{x-1} = 20$$

Give your answer in an exact form.

[2 marks]

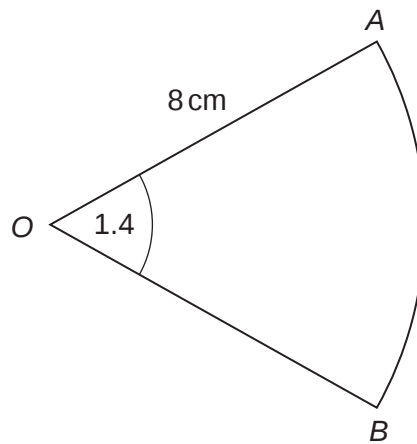
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5

The diagram shows a sector AOB of a circle with centre O and radius 8 cm.



The angle AOB is 1.4 radians.

Find the area of the sector.

[2 marks]



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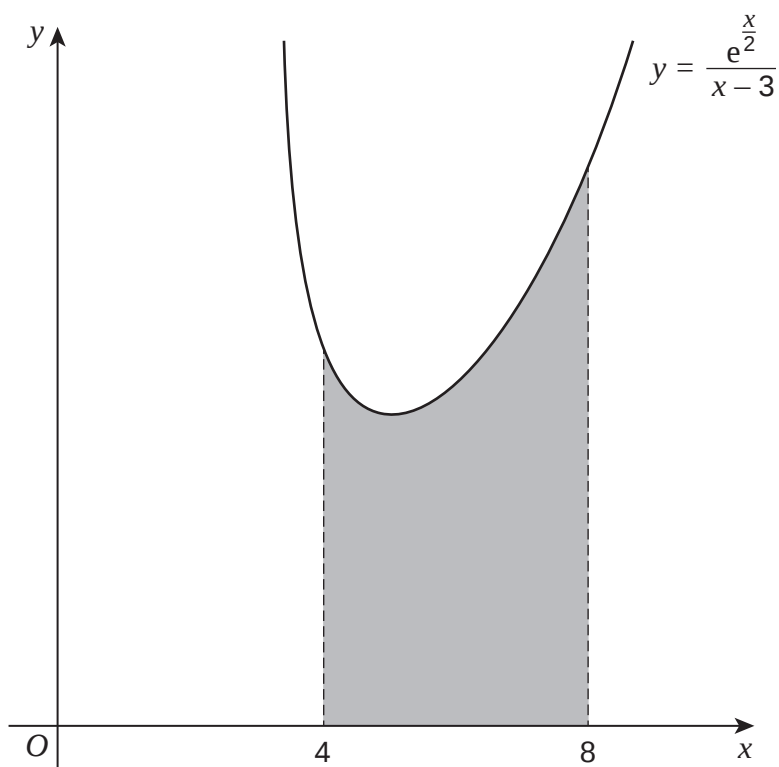
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0 7

- 6 The curve with equation $y = \frac{e^{\frac{x}{2}}}{x-3}$ is shown in the diagram.



The region shaded is bounded by the curve, the x -axis, and the lines $x = 4$ and $x = 8$

The trapezium rule with six ordinates (5 strips) is to be used to find an approximate value for the area of the shaded region.

Some of the values required to obtain this approximation are shown in the table below.

x	4	4.8	5.6	6.4	7.2	8
y	7.3891	6.1240	6.3249		8.7139	10.9196

- 6 (a) (i) Find the y -value that is missing from the table.

[1 mark]



- 6 (a) (ii)** Use the trapezium rule with six ordinates (5 strips) to find an approximate value for the area of the shaded region.

Give your answer to **five** significant figures.

[3 marks]

- 6 (b)** A student finds an improved approximation for the area of the shaded region by using the trapezium rule with 11 ordinates.

The student correctly obtains 29.759 as their improved approximation.

The student claims that the exact area must be greater than 29.759

Without further calculation, explain whether or not the student is correct.

[2 marks]

Turn over ►



7 The point A lies on the curve with equation

$$y = x^3 + px^2 + qx + 12$$

7 (a) Given that A has coordinates $(-5, 37)$, show that

$$5p - q = 30$$

[2 marks]

7 (b) Given that A is a stationary point, show that

$$10p - q = 75$$

[3 marks]



- 8 (c)** State the **two** values of x between 0° and 360° for which the value of N in part **(b)** is **not** valid.

[1 mark]

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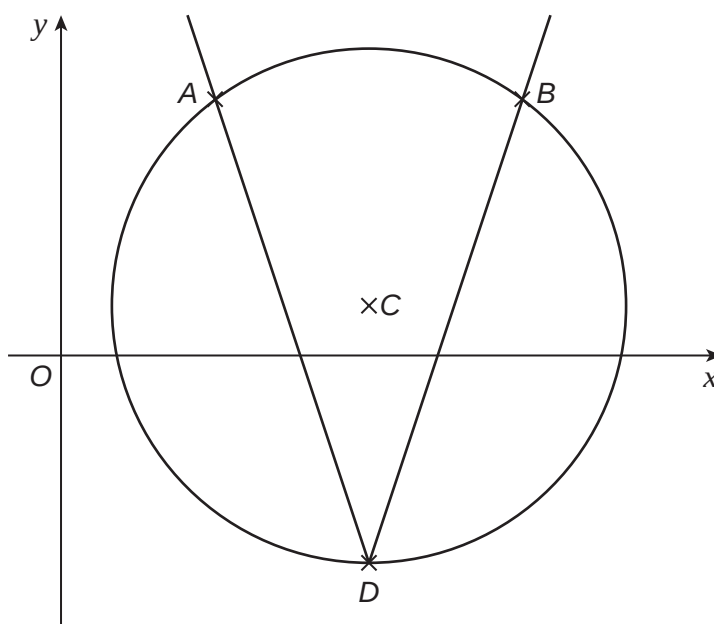
- 9** A circle with centre C has equation

$$(x - 12)^2 + (y - 2)^2 = 100$$

The graph with equation

$$y = |3x - 36| - 8$$

intersects the circle at the points A , B and D as shown in the diagram.



Point D is vertically below point C

- 9 (a)** State the coordinates of C

[1 mark]

- 9 (b)** State the coordinates of D

[1 mark]



9 (c) The coordinates of A are $(a,10)$

Find the value of a

Fully justify your answer.

[3 marks]

9 (d) (i) Find, in radians, the angle ADB

Give your answer to **three** significant figures.

[2 marks]

9 (d) (ii) Hence or otherwise find the length of the minor arc AB

Give your answer to **three** significant figures.

[2 marks]

Turn over ►



10 A curve C has equation

$$y = x^k \ln x \text{ for } x > 0$$

where k is a positive integer.

10 (a) Show that

$$\frac{dy}{dx} = x^{k-1} [A + k \ln x]$$

where A is a constant to be found.

[4 marks]

10 (b) Hence show that the y -coordinate of the stationary point of C can be written as $-\frac{1}{ke}$

Fully justify your answer.

[5 marks]



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- 10 (c)** Given that the stationary point of C has coordinates $\left(\frac{1}{e}, -\frac{1}{e}\right)$ state the value of k

[1 mark]

- 10 (d)** Prove that C does **not** have a point of inflection.

[3 marks]

TURN OVER FOR SECTION B

Turn over ►



Section B

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

11

An object is pulled along a horizontal surface. The normal reaction between the surface and the object is 125 newtons.

The object experiences a constant frictional force of 40 newtons.

Find the value of the coefficient of friction.

Circle your answer.

[1 mark]

0.245

0.32

0.5

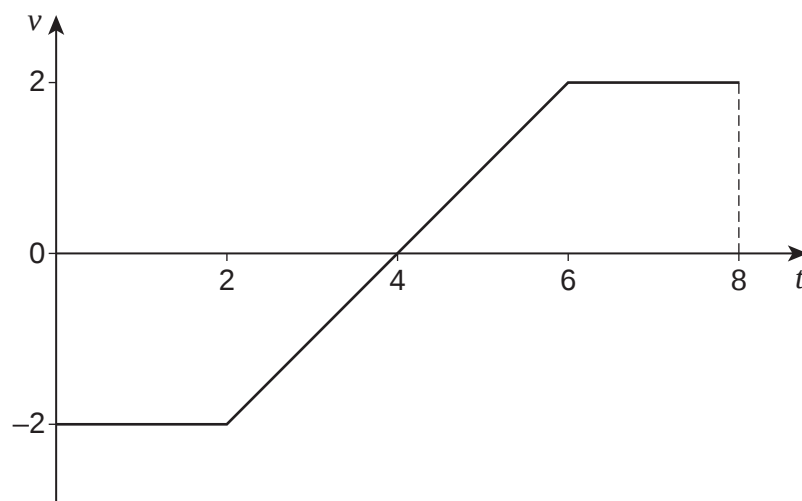
3.125



12

A particle moves in a straight line for 8 seconds.

The velocity v , in m s^{-1} , of the particle at time t seconds is shown in the diagram.



Find the displacement, in metres, of the particle after 8 seconds.

Circle your answer.

[1 mark]

-12

0

6

12

Turn over for the next question

Turn over ►



- 13** A car moves, in a straight line on a horizontal road, from a point A to a point B
- The distance AB is 225 metres.
- At the point B , the velocity of the car is 30 m s^{-1}
- The car is modelled as having a constant acceleration of 2 m s^{-2}

- 13 (a)** Show that the car starts from rest at point A

[2 marks]

- 13 (b)** The car continues to move past the point B in the same straight line.
- Explain why the model would eventually become invalid.

[1 mark]



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15 (c) A third force, $\mathbf{F}_3$, acts upon the particle so that the particle is in equilibrium.

15 (c) (i) State the magnitude of $\mathbf{F}_3$

[1 mark]

15 (c) (ii) State the bearing on which $\mathbf{F}_3$ acts.

[1 mark]

Turn over for the next question

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- 17** A triangle has vertices A , B and C with position vectors given by

$$\overrightarrow{OA} = \begin{bmatrix} -3 \\ 5 \\ 1 \end{bmatrix}, \quad \overrightarrow{OB} = \begin{bmatrix} 5 \\ 4 \\ -2 \end{bmatrix} \quad \text{and} \quad \overrightarrow{OC} = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}$$

- 17 (a) (i)** Find $\overrightarrow{AB}$

[1 mark]

- 17 (a) (ii)** Find the magnitude of $\overrightarrow{AB}$

[1 mark]

- 17 (b)** Hence show that triangle ABC is a scalene triangle.

[5 marks]



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18 (b) (i) The child moves from C to B

State what happens to the reaction force at B during this movement.

[1 mark]

18 (b) (ii) Having reached B , the child steps off the platform.

State what happens to the tension in the chain during this movement.

[1 mark]

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- 19** The displacement, $\mathbf{s}$ metres, of a particle P , at time t seconds, is given by

$$\mathbf{s} = (2t^3)\mathbf{i} + (2t^2 + qt)\mathbf{j}$$

- 19 (a)** Find an expression for the velocity of particle P after t seconds.

[2 marks]

- 19 (b)** The acceleration, $\mathbf{a} \text{ m s}^{-2}$, of a particle Q , at time t seconds, is given by

$$\mathbf{a} = 6t\mathbf{i} + 7\mathbf{j}$$

Particle Q has an initial velocity of $4\mathbf{j} \text{ m s}^{-1}$

Particles P and Q are moving parallel to each other when $t = 2$

Find the value of q

[6 marks]



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END OF QUESTIONS



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3 6



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