



22137304



MATHEMATICS
STANDARD LEVEL
PAPER 2

Candidate session number

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Friday 10 May 2013 (morning)

Examination code

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1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- A graphic display calculator is required for this paper.
- Section A: answer all questions in the boxes provided.
- Section B: answer all questions in the answer booklet provided. Fill in your session number on the front of the answer booklet, and attach it to this examination paper and your cover sheet using the tag provided.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the **Mathematics SL information booklet** is required for this paper.
- The maximum mark for this examination paper is [90 marks].



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4. [Maximum mark: 6]

$$-x - y + z = 2.5$$

Consider the system of equations $x + y = 1$

$$-2x - y + 2z = -3$$

This system can be represented by the matrix equation $AX = B$, where $X = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$.

(a) (i) Write down the matrix A .

(ii) Write down the matrix A^{-1} . [3 marks]

(b) Hence, find X . [3 marks]

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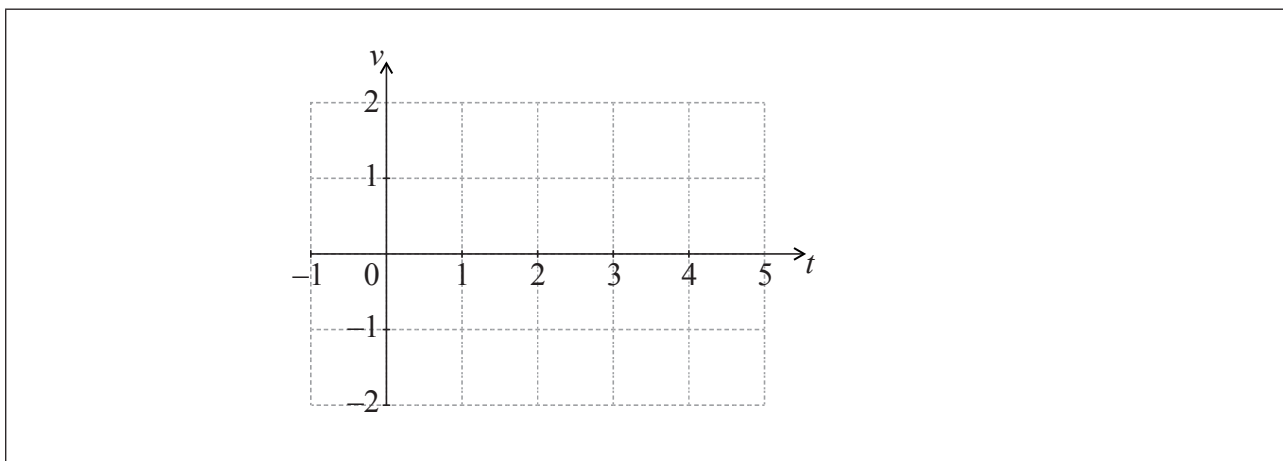
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5. [Maximum mark: 8]

The velocity of a particle in ms^{-1} is given by $v = e^{\sin t} - 1$, for $0 \leq t \leq 5$.

(a) On the grid below, sketch the graph of v . [3 marks]



- (b) (i) Write down the positive t -intercept.
- (ii) Find the total distance travelled by the particle in the first five seconds. [5 marks]

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6. [Maximum mark: 6]

Let f and g be functions such that $g(x) = 2f(x+1) + 5$.

(a) The graph of f is mapped to the graph of g under the following transformations:

vertical stretch by a factor of k , followed by a translation $\begin{pmatrix} p \\ q \end{pmatrix}$.

Write down the value of

(i) k ;

(ii) p ;

(iii) q .

[3 marks]

(b) Let $h(x) = -g(3x)$. The point $A(6, 5)$ on the graph of g is mapped to the point A' on the graph of h . Find A' .

[3 marks]

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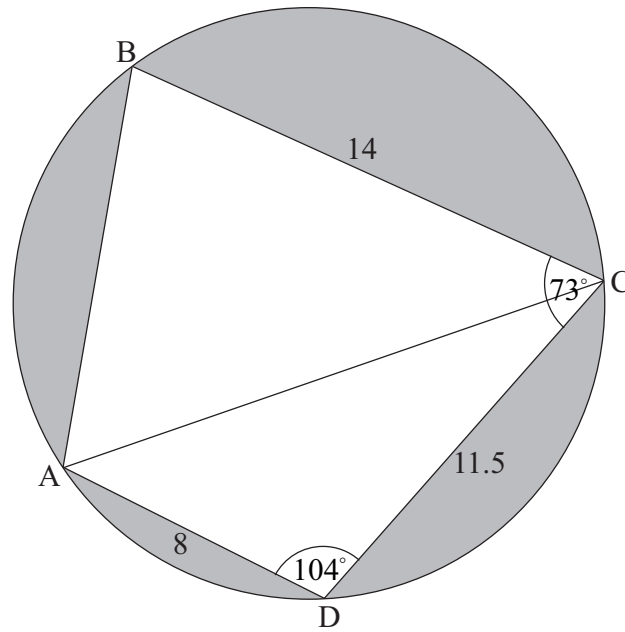
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SECTION B

Answer **all** questions in the answer booklet provided. Please start each question on a new page.

8. [Maximum mark: 14]

The diagram shows a circle of radius 8 metres. The points ABCD lie on the circumference of the circle.



$BC = 14 \text{ m}$, $CD = 11.5 \text{ m}$, $AD = 8 \text{ m}$, $\hat{ADC} = 104^\circ$, and $\hat{BCD} = 73^\circ$

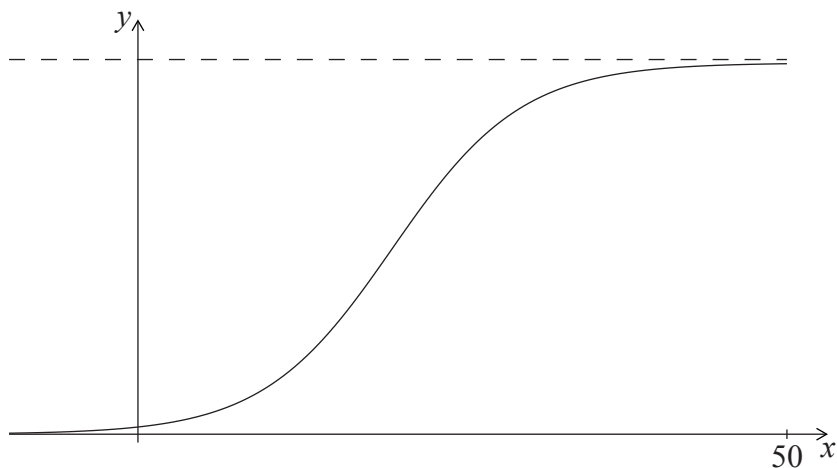
- (a) Find AC. [3 marks]
- (b) (i) Find \hat{ACD} .
- (ii) Hence, find \hat{ACB} . [5 marks]
- (c) Find the area of triangle ADC. [2 marks]
- (d) Hence or otherwise, find the total area of the shaded regions. [4 marks]



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9. [Maximum mark: 15]

Let $f(x) = \frac{100}{(1 + 50e^{-0.2x})}$. Part of the graph of f is shown below.



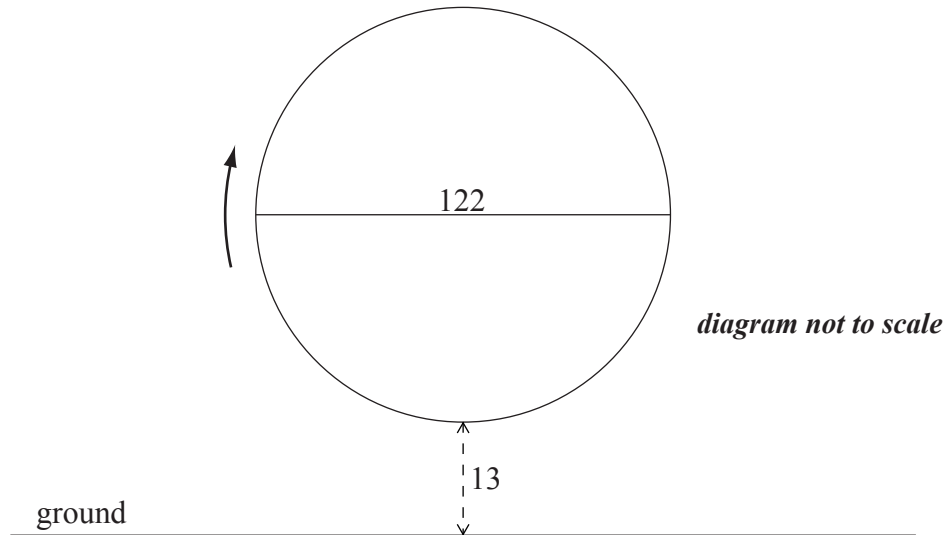
- (a) Write down $f(0)$. [1 mark]
- (b) Solve $f(x) = 95$. [2 marks]
- (c) Find the range of f . [3 marks]
- (d) Show that $f'(x) = \frac{1000e^{-0.2x}}{(1 + 50e^{-0.2x})^2}$. [5 marks]
- (e) Find the maximum rate of change of f . [4 marks]



Do **NOT** write solutions on this page.

10. [Maximum mark: 16]

A Ferris wheel with diameter 122 metres rotates clockwise at a constant speed. The wheel completes 2.4 rotations every hour. The bottom of the wheel is 13 metres above the ground.



A seat starts at the bottom of the wheel.

- (a) Find the maximum height above the ground of the seat. [2 marks]

After t minutes, the height h metres above the ground of the seat is given by

$$h = 74 + a \cos bt .$$

- (b) (i) Show that the period of h is 25 minutes.
(ii) Write down the **exact** value of b . [2 marks]
- (c) Find the value of a . [3 marks]
- (d) Sketch the graph of h , for $0 \leq t \leq 50$. [4 marks]
- (e) In one rotation of the wheel, find the probability that a randomly selected seat is at least 105 metres above the ground. [5 marks]



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Answers written on this page
will not be marked.



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