



**MATHEMATICS
STANDARD LEVEL
PAPER 2**

Thursday 6 May 2010 (morning)

1 hour 30 minutes

Candidate session number

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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 of Section A in the spaces provided.
- Section B: answer all of Section B on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the number of sheets used in the appropriate box on your cover sheet.
- Unless otherwise stated in the question, all numerical answers must be given exactly or correct to three significant figures.



Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. In particular, solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

SECTION A

Answer **all** the questions in the spaces provided. Working may be continued below the lines, if necessary.

1. [Maximum mark: 5]

Let $A = \begin{pmatrix} 1 & 2 & -3 \\ -1 & -1 & 4 \\ 2 & 4 & -3 \end{pmatrix}$ and $B = \begin{pmatrix} 2 \\ -3 \\ 1 \end{pmatrix}$.

(a) Write down A^{-1} . [2 marks]

(b) Solve $AX = B$. [3 marks]

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2. [Maximum mark: 6]

Consider the arithmetic sequence 3, 9, 15, ..., 1353.

- (a) Write down the common difference. [1 mark]
- (b) Find the number of terms in the sequence. [3 marks]
- (c) Find the sum of the sequence. [2 marks]

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3. [Maximum mark: 7]

Let $f(x) = x \cos x$, for $0 \leq x \leq 6$.

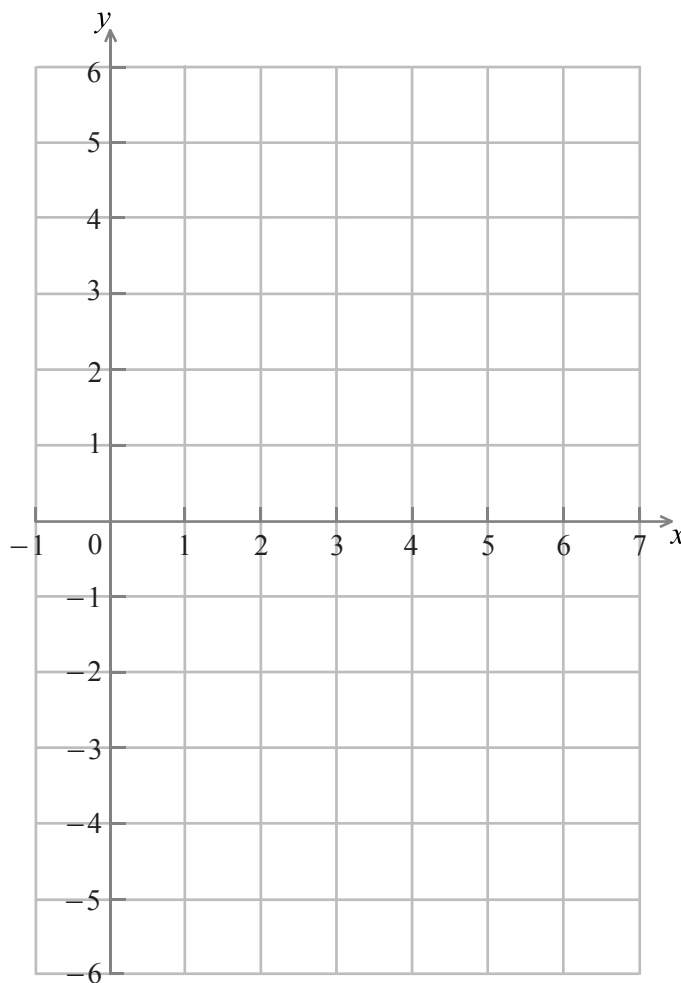
(a) Find $f'(x)$.

[3 marks]

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(b) On the grid below, sketch the graph of $y = f'(x)$.

[4 marks]



4. [Maximum mark: 6]

The following frequency distribution of marks has mean 4.5.

Mark	1	2	3	4	5	6	7
Frequency	2	4	6	9	x	9	4

(a) Find the value of x . [4 marks]

(b) Write down the standard deviation. [2 marks]

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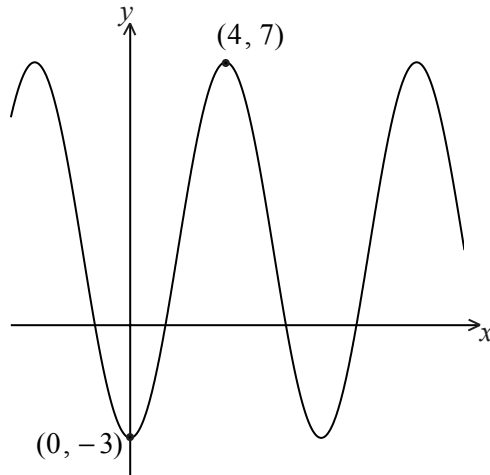
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5. [Maximum mark: 7]

The graph of $y = p \cos qx + r$, for $-5 \leq x \leq 14$, is shown below.



There is a minimum point at $(0, -3)$ and a maximum point at $(4, 7)$.

(a) Find the value of

(i) p ;

(ii) q ;

(iii) r .

[6 marks]

(b) The equation $y = k$ has exactly **two** solutions. Write down the value of k .

[1 mark]

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6. [Maximum mark: 7]

The acceleration, $a \text{ ms}^{-2}$, of a particle at time t seconds is given by

$$a = \frac{1}{t} + 3 \sin 2t, \text{ for } t \geq 1.$$

The particle is at rest when $t = 1$.

Find the velocity of the particle when $t = 5$.

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7. [Maximum mark: 7]

Evan likes to play two games of chance, A and B.

For game A, the probability that Evan wins is 0.9. He plays game A seven times.

- (a) Find the probability that he wins exactly four games. [2 marks]

For game B, the probability that Evan wins is p . He plays game B seven times.

- (b) Write down an expression, in terms of p , for the probability that he wins exactly four games. [2 marks]

- (c) Hence, find the values of p such that the probability that he wins exactly four games is 0.15. [3 marks]

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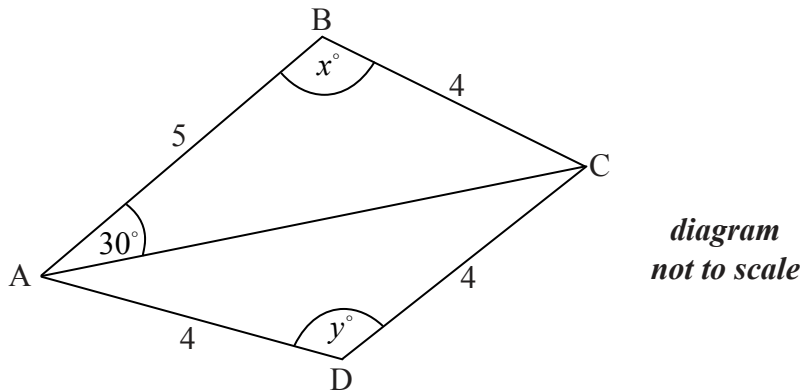
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SECTION B

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

8. [Maximum mark: 14]

The diagram below shows a quadrilateral ABCD with obtuse angles $\hat{A}BC$ and $\hat{A}DC$.



$AB = 5 \text{ cm}$, $BC = 4 \text{ cm}$, $CD = 4 \text{ cm}$, $AD = 4 \text{ cm}$, $\hat{B}AC = 30^\circ$, $\hat{A}BC = x^\circ$, $\hat{A}DC = y^\circ$.

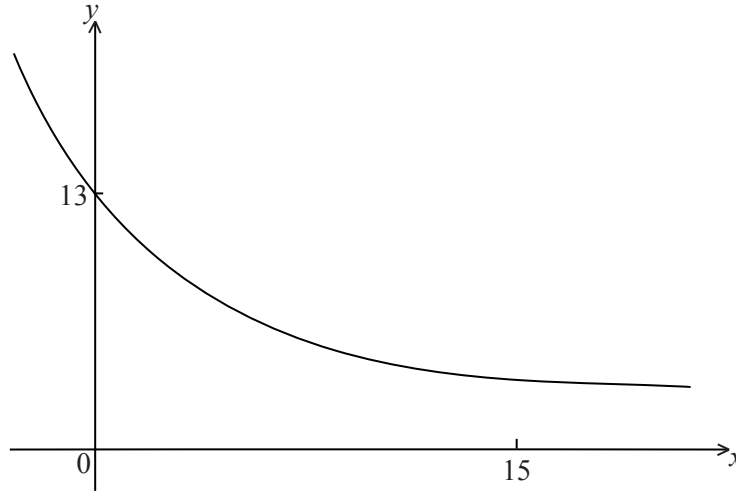
- (a) Use the cosine rule to show that $AC = \sqrt{41 - 40 \cos x}$. [1 mark]
- (b) Use the sine rule in triangle ABC to find another expression for AC. [2 marks]
- (c) (i) Hence, find x , giving your answer to two decimal places.
(ii) Find AC. [6 marks]
- (d) (i) Find y .
(ii) Hence, or otherwise, find the area of triangle ACD. [5 marks]



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9. [Maximum mark: 16]

Let $f(x) = Ae^{kx} + 3$. Part of the graph of f is shown below.



The y -intercept is at $(0, 13)$.

- (a) Show that $A = 10$. [2 marks]
- (b) Given that $f(15) = 3.49$ (correct to 3 significant figures), find the value of k . [3 marks]
- (c) (i) Using your value of k , find $f'(x)$.
(ii) Hence, explain why f is a decreasing function.
(iii) Write down the equation of the horizontal asymptote of the graph f . [5 marks]

Let $g(x) = -x^2 + 12x - 24$.

- (d) Find the area enclosed by the graphs of f and g . [6 marks]



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10. [Maximum mark: 15]

The weights of players in a sports league are normally distributed with a mean of 76.6 kg, (correct to three significant figures). It is known that 80 % of the players have weights between 68 kg and 82 kg. The probability that a player weighs less than 68 kg is 0.05.

(a) Find the probability that a player weighs more than 82 kg. [2 marks]

(b) (i) Write down the standardized value, z , for 68 kg.

(ii) Hence, find the standard deviation of weights. [4 marks]

To take part in a tournament, a player's weight must be within 1.5 standard deviations of the mean.

(c) (i) Find the set of all possible weights of players that take part in the tournament.

(ii) A player is selected at random. Find the probability that the player takes part in the tournament. [5 marks]

Of the players in the league, 25 % are women. Of the women, 70 % take part in the tournament.

(d) Given that a player selected at random takes part in the tournament, find the probability that the selected player is a woman. [4 marks]

