



88117301

**MATHEMATICS
STANDARD LEVEL
PAPER 1**

Wednesday 2 November 2011 (afternoon)

1 hour 30 minutes

Candidate session number

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Examination code

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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.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions in the boxes provided.
- Section B: answer all questions 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 should be given exactly or correct to three significant figures.



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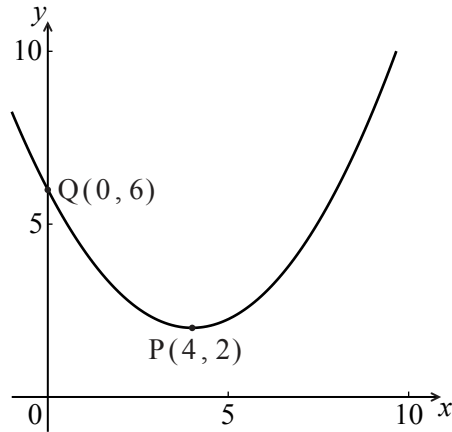
Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

SECTION A

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

1. [Maximum mark: 6]

Let f be a quadratic function. Part of the graph of f is shown below.



The vertex is at $P(4, 2)$ and the y -intercept is at $Q(0, 6)$.

(a) Write down the equation of the axis of symmetry. [1 mark]

The function f can be written in the form $f(x) = a(x - h)^2 + k$.

(b) Write down the value of h and of k . [2 marks]

(c) Find a . [3 marks]

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Do **NOT** write solutions on this page. Any working on this page will **NOT** be marked.

SECTION B

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

8. [Maximum mark: 18]

The line L_1 passes through the points $P(2, 4, 8)$ and $Q(4, 5, 4)$.

(a) (i) Find \vec{PQ} .

(ii) Hence write down a vector equation for L_1 in the form $\mathbf{r} = \mathbf{a} + s\mathbf{b}$. [4 marks]

The line L_2 is perpendicular to L_1 , and parallel to $\begin{pmatrix} 3p \\ 2p \\ 4 \end{pmatrix}$, where $p \in \mathbb{Z}$.

(b) (i) Find the value of p .

(ii) Given that L_2 passes through $R(10, 6, -40)$, write down a vector equation for L_2 . [7 marks]

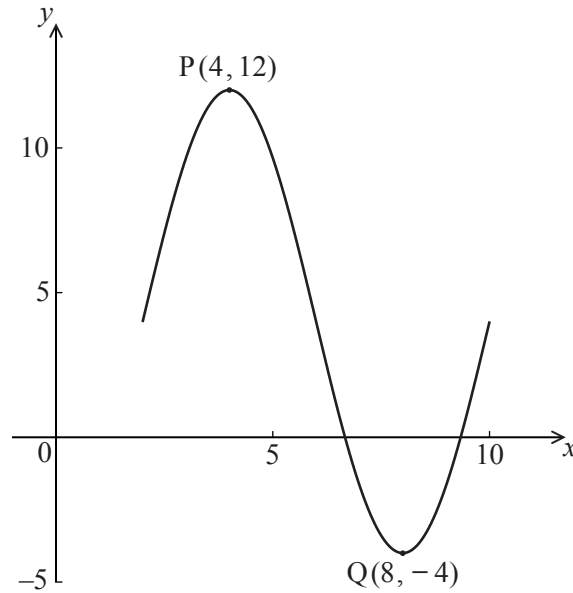
(c) The lines L_1 and L_2 intersect at the point A . Find the x -coordinate of A . [7 marks]



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9. [Maximum mark: 14]

The following diagram shows the graph of $f(x) = a \sin(b(x-c)) + d$, for $2 \leq x \leq 10$.



There is a maximum point at $P(4, 12)$ and a minimum point at $Q(8, -4)$.

(a) Use the graph to write down the value of

(i) a ;

(ii) c ;

(iii) d .

[3 marks]

(b) Show that $b = \frac{\pi}{4}$.

[2 marks]

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

[3 marks]

(d) At a point R, the gradient is -2π . Find the x -coordinate of R.

[6 marks]



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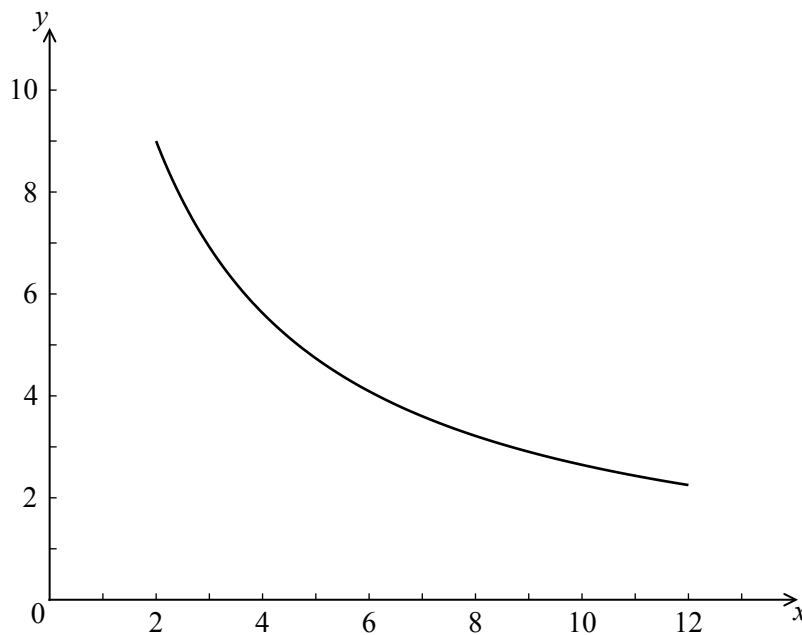
10. [Maximum mark: 13]

Let $f(x) = \frac{1}{4}x^2 + 2$. The line L is the tangent to the curve of f at $(4, 6)$.

(a) Find the equation of L .

[4 marks]

Let $g(x) = \frac{90}{3x+4}$, for $2 \leq x \leq 12$. The following diagram shows the graph of g .



(b) Find the area of the region enclosed by the curve of g , the x -axis, and the lines $x = 2$ and $x = 12$. Give your answer in the form $a \ln b$, where $a, b \in \mathbb{Z}$.

[6 marks]

(c) The graph of g is reflected in the x -axis to give the graph of h . The area of the region enclosed by the lines L , $x = 2$, $x = 12$ and the x -axis is 120 cm^2 .

Find the area enclosed by the lines L , $x = 2$, $x = 12$ and the graph of h .

[3 marks]



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not be marked.



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