2.2 Quadratic Functions & Graphs

Question Paper

Course	DP IB Maths
Section	2. Functions
Topic	2.2 Quadratic Functions & Graphs
Difficulty	Medium

Time allowed: 70

Score: /53

Percentage: /100

Question 1a

The curve C has equation $y = x^2 - 3x + 2$.

(a) Find the coordinates of any points where C intersects the coordinate axes.

[3 marks]

Question 1b

(b) Sketch the graph of C, showing clearly all points of intersection with the coordinate axes.

[3 marks]

Question 2a

(a) Write the quadratic function $y = x^2 + 8x - 9$ in the form $y = a(x + b)^2 + c$ where a, b and c are integers to be found.

[2 marks]

Question 2b

(b) Write down the minimum point on the graph of $y = x^2 + 8x - 9$.

[1 mark]

Question 2c

(c) Sketch the graph of $y = x^2 + 8x - 9$, clearly labelling the minimum point and any point where the graph intersects the coordinate axes.

[3 marks]

Question 3a

(a) Solve the equation $2x^2 + x - 6 = 0$.

[2 marks]

Question 3b

(b) Find the coordinates of the turning point on the graph of $y = 2x^2 + x - 6$.

[3 marks]

Question 3c

(c) Sketch the graph of $y = 2x^2 + x - 6$, labelling the turning point and any points where the graph crosses the coordinate axes.

[2 marks]

Question 4a

(a) Find the minimum value of the function $f(x) = x^2 + 4x + 5$.

[3 marks]

Question 4b

(b) Hence, or otherwise, prove that the function $f(x) = x^2 + 4x + 5$ has no real roots.

[2 marks]

Question 5

The function $f(x) = kx^2 + 2kx - 3$ has two distinct real roots.
Show that $k < -3$ or $k > 0$.

[3 marks]

Question 6

The equation $2x^2 - 4x + 3 - 2k = 0$ has real roots.
Find the possible values of k.

[3 marks]

Question 7

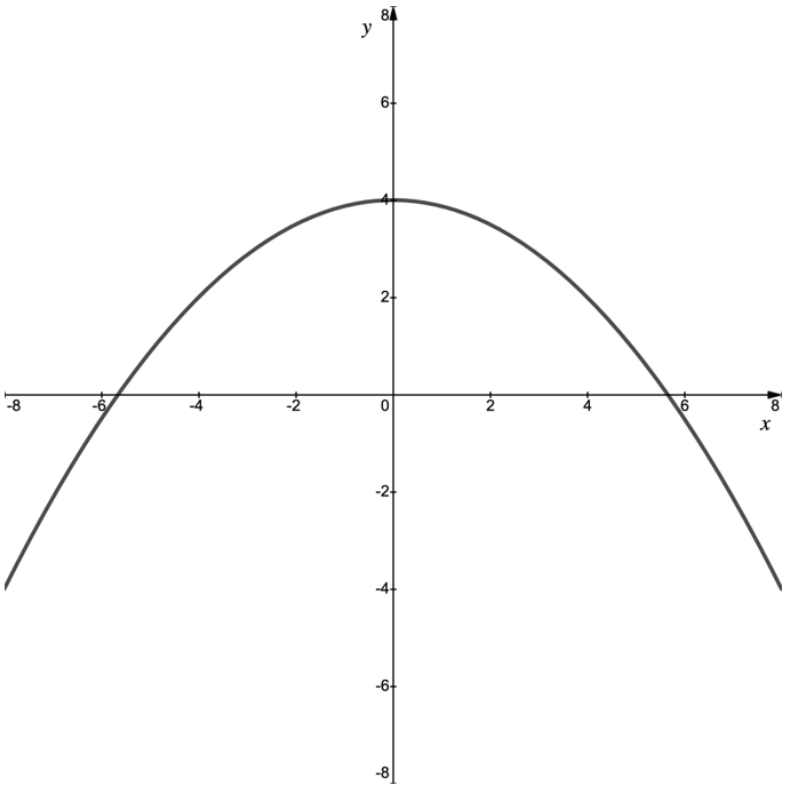
The equation $y = x^2 + px + q$ has no real roots. Show that $p^2 < 4q$.

[2 marks]

Question 8a

The graph below shows the curve $f(x) = 4 - \frac{x^2}{8}$.

The curve is to be used as the model for the arch on a bridge where the water level under the bridge is represented by the x-axis. All measurements are in meters.



(a) Write down the maximum height of the bridge above the water.

[1 mark]

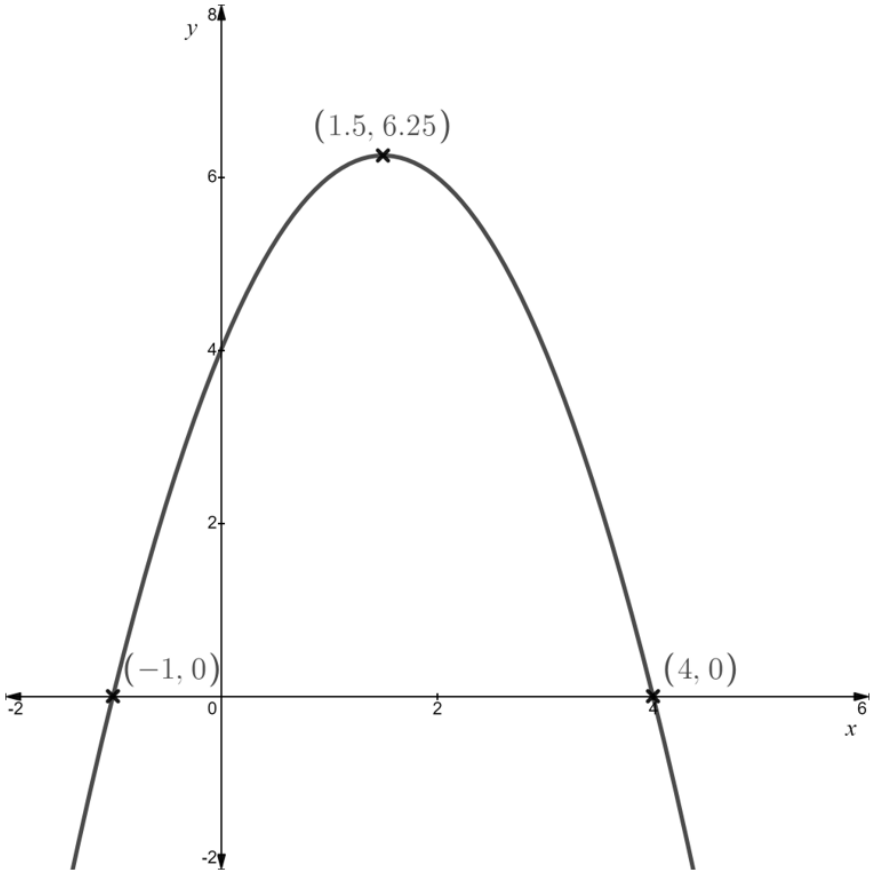
Question 8b

(b) Show that the bridge is wide enough to span a river of width 11m.

[3 marks]

Question 9a

The diagram below shows the graph of $y = f(x)$, where $f(x)$ is a quadratic function.
The intercepts with the x-axis and the turning point have been labelled.



(a) Write down the equation of the axis of symmetry for the graph of $y = f(x)$.

[1 mark]

Question 9b

(b) The function $f(x)$ can be written in the form of $f(x) = a(x - h)^2 + k$.
Find the values of a, h and k.

[3 marks]

Question 10

Solve the equation $x^4 - 13x^2 + 36 = 0$.

[3 marks]

Question 11

Solve $x^{\frac{2}{5}} + x^{\frac{1}{5}} = 6$.

[4 marks]

Question 12a

Let $f(x) = 2px^2 + (2p - 5)x + p - \frac{5}{2}$, for $x \in \mathbb{R}$, where $p \in \mathbb{Q}$.

(a) Show that the discriminant of f is $-4p^2 + 25$.

[3 marks]

Question 12b

(b) Find the values of p so that the function $f(x)$ has two **distinct** roots.

[3 marks]