

6. [Maximum mark: 6]

Let $f(x) = px^2 + (10 - p)x + \frac{5}{4}p - 5$.

(a) Show that the discriminant of $f(x)$ is $100 - 4p^2$. [3]

(b) Find the values of p so that $f(x) = 0$ has two **equal** roots. [3]

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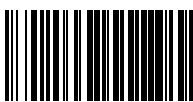
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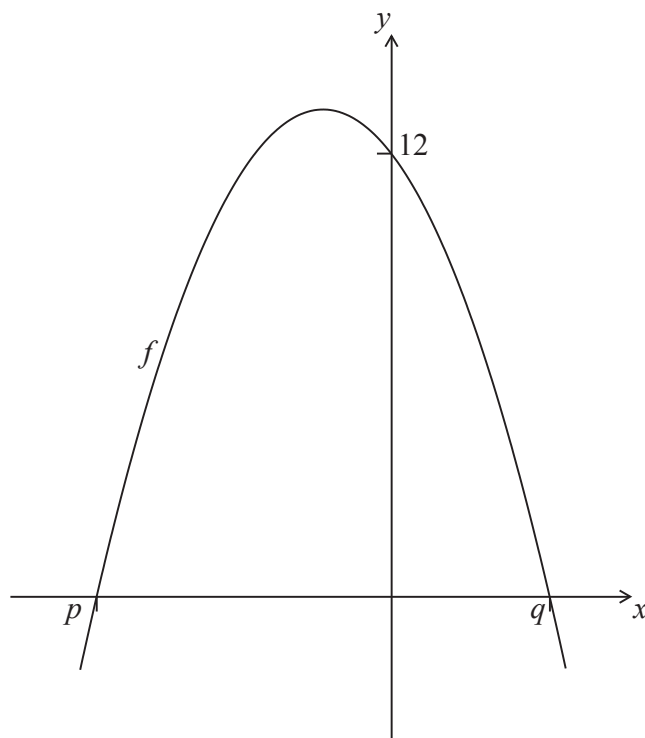
Do **not** write solutions on this page.

Section B

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

8. [Maximum mark: 15]

Let $f(x) = a(x + 3)(x - 1)$. The following diagram shows part of the graph of f .



The graph has x -intercepts at $(p, 0)$ and $(q, 0)$, and a y -intercept at $(0, 12)$.

(a) (i) Write down the value of p and of q .

(ii) Find the value of a .

[6]

(b) Find the equation of the axis of symmetry of the graph of f .

[3]

(c) Find the largest value of f .

[3]

The function f can also be written as $f(x) = a(x - h)^2 + k$.

(d) Find the value of h and of k .

[3]

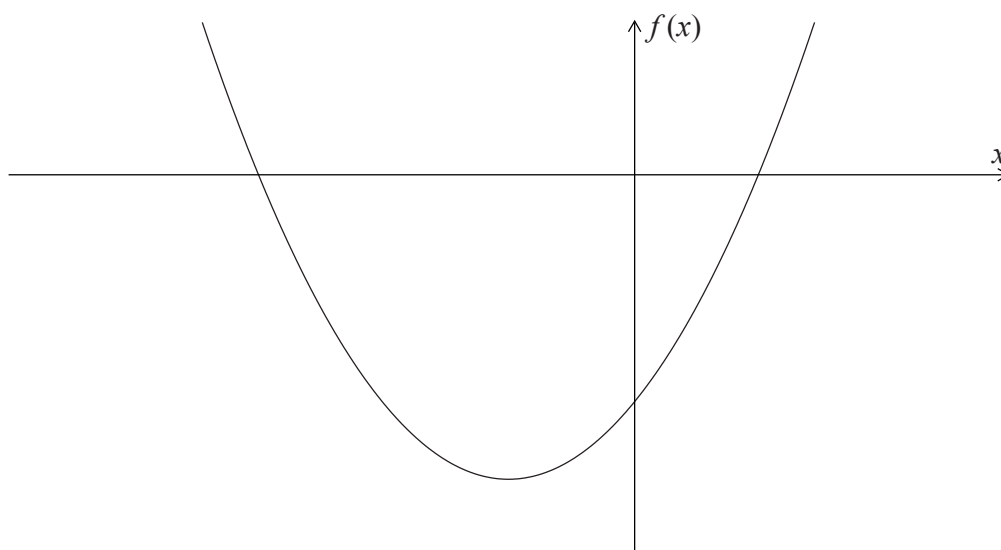


SECTION A

[illegible]

2. [Maximum mark: 6]

The diagram below shows part of the graph of $f(x) = (x-1)(x+3)$.



(a) Write down the x -intercepts of the graph of f . [2 marks]

(b) Find the coordinates of the vertex of the graph of f . [4 marks]

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7. [Maximum mark: 6]

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

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6. [Maximum mark: 7]

Consider the equation $x^2 + (k-1)x + 1 = 0$, where k is a real number.

Find the values of k for which the equation has two **equal** real solutions.

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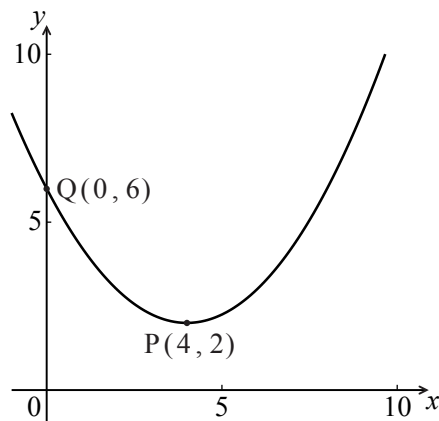
Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

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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7. [Maximum mark: 8]

Let $f(x) = \frac{1}{2}x^2 + kx + 8$, where $k \in \mathbb{Z}$.

- (a) Find the values of k such that $f(x) = 0$ has two equal roots. [4 marks]
- (b) Each value of k is equally likely for $-5 \leq k \leq 5$. Find the probability that $f(x) = 0$ has no roots. [4 marks]

[illegible]

7. [Maximum mark: 7]

Consider $f(x) = 2kx^2 - 4kx + 1$, for $k \neq 0$. The equation $f(x) = 0$ has two equal roots.

(a) Find the value of k . [5 marks]

(b) The line $y = p$ intersects the graph of f . Find all possible values of p . [2 marks]

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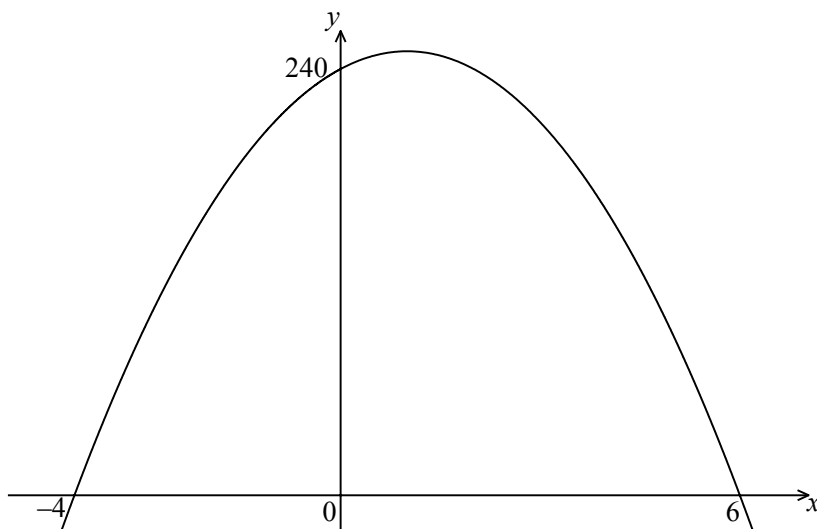
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Do **NOT** write solutions on this page. Any working on this page will **NOT** be marked.

9. [Maximum mark: 15]

The following diagram shows part of the graph of a quadratic function f .



The x -intercepts are at $(-4, 0)$ and $(6, 0)$, and the y -intercept is at $(0, 240)$.

(a) Write down $f(x)$ in the form $f(x) = -10(x - p)(x - q)$. [2 marks]

(b) Find another expression for $f(x)$ in the form $f(x) = -10(x - h)^2 + k$. [4 marks]

(c) Show that $f(x)$ can also be written in the form $f(x) = 240 + 20x - 10x^2$. [2 marks]

A particle moves along a straight line so that its velocity, $v \text{ ms}^{-1}$, at time t seconds is given by $v = 240 + 20t - 10t^2$, for $0 \leq t \leq 6$.

(d) (i) Find the value of t when the speed of the particle is greatest.

(ii) Find the acceleration of the particle when its speed is zero. [7 marks]

