

INTERNATIONAL BACCALAUREATE
Mathematics: applications and interpretation
MAI

EXERCISES [MAI 2.2]
QUADRATICS

A. Paper 1 questions (SHORT)

1. [Maximum mark: 30]

Complete the following table for the three quadratic functions below

	$y = 2x^2 - 12x + 10$	$y = 2x^2 - 12x + 18$	$y = 2x^2 - 12x + 23$
y-intercept			
Roots			
Factorisation (if possible)			
axis of symmetry			
Vertex			
Vertex form $f(x) = a(x - h)^2 + k$			
Solve $f(x) \geq 0$			
Solve $f(x) > 0$			
Solve $f(x) \leq 0$			
Solve $f(x) < 0$			

2. [Maximum mark: 12]

Consider the quadratic $y = 4x^2 - 120x + 800$

- (a) (i) Find the roots.
 (ii) **Hence** express the quadratic in the form $y = a(x - x_1)(x - x_2)$ [3]
- (b) (i) Find the coordinates of the vertex.
 (ii) **Hence** express the quadratic in the form $y = a(x - h)^2 + k$
 (iii) Write down the equation of the axis of symmetry
 (iv) Write down the minimum value of y [5]
- (c) Write down the y - intercept of the quadratic [1]
- (d) Draw the graph of the quadratic on the diagram below. [3]

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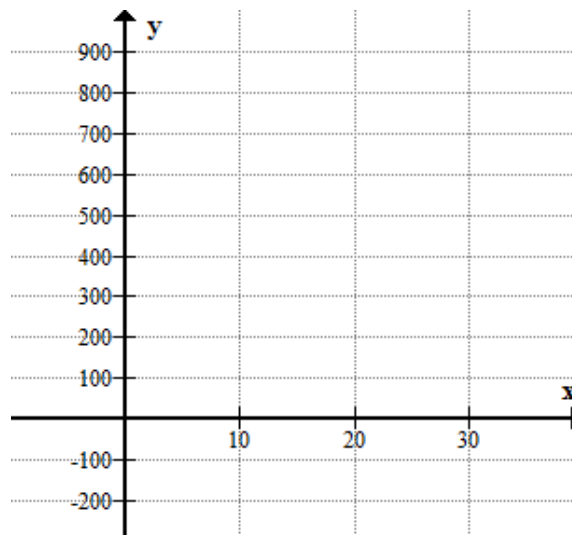
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3. [Maximum mark: 14]

Consider the quadratic $y = -4x^2 + 120x - 800$

- (a) (i) Find the roots.
 (ii) **Hence** express the quadratic in the form $y = a(x - x_1)(x - x_2)$ [3]
- (b) (i) Find the coordinates of the vertex.
 (ii) **Hence** express the quadratic in the form $y = a(x - h)^2 + k$
 (iii) Write down the equation of the axis of symmetry
 (iv) Write down the maximum value of y [5]
- (c) Write down the y - intercept of the quadratic [1]
- (d) Draw the graph of the quadratic on each of the diagrams below. [5]

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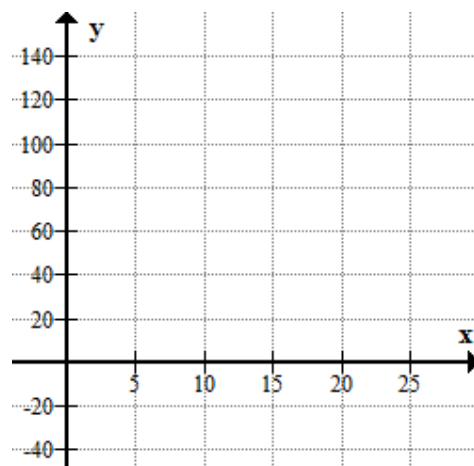
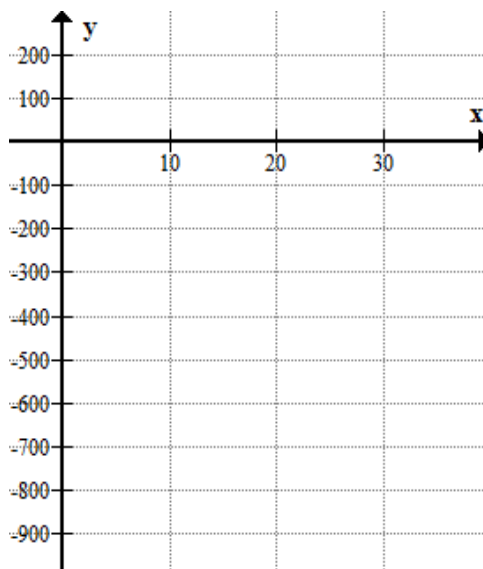
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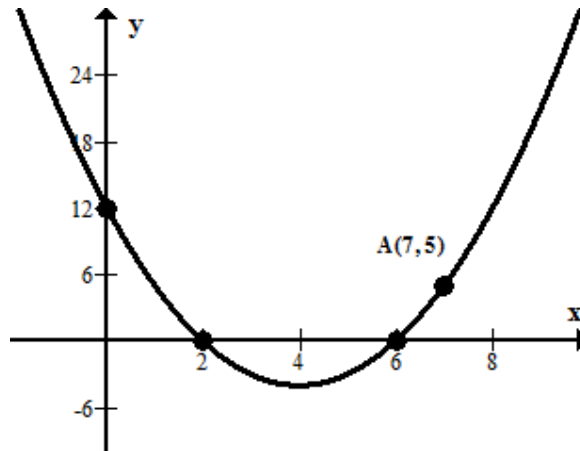
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4. [Maximum mark: 5]

The parabola of a quadratic is shown below. The x -intercepts are $x = 2$ and $x = 6$.
The y -intercept is $y = 12$. The curve passes through the point $A(7,5)$.



Without finding the equation of the curve and by just using the symmetry of the graph

- (a) Write down the equation of the axis of symmetry. [1]
- (b) Find the value of y for $x = 8$. Justify your answer. [2]
- (c) Find the value of y for $x = 1$. Justify your answer. [2]

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5. [Maximum mark: 4]

- (a) Solve the equation $x^2 - 3x - 10 = 0$. [2]
- (b) Factorize $x^2 - 3x - 10$. [2]

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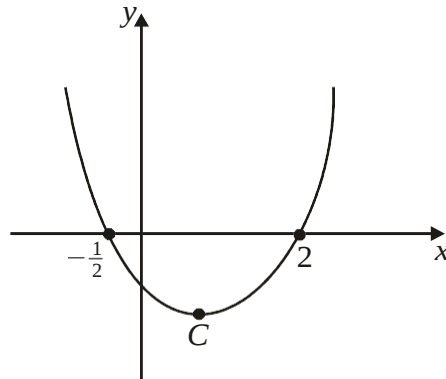
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6. [Maximum mark: 4]

The diagram represents the graph of the function $f: x \mapsto (x-p)(x-q)$.



(a) Write down the values of p and q . [2]

(b) The function has a minimum value at the point C. Find the x -coordinate of C. [2]

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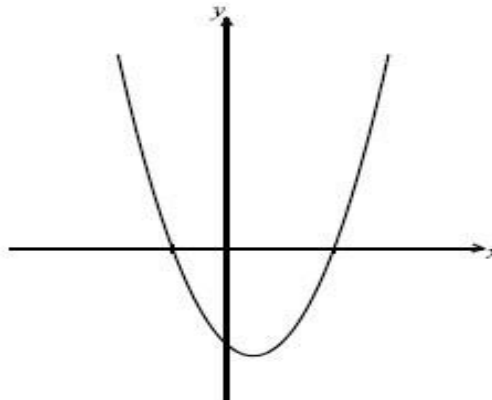
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7. [Maximum mark: 2]

The following diagram shows part of the graph of f , where $f(x) = x^2 - x - 2$.



(a) Find both x -intercepts. [2]

(b) Find the x -coordinate of the vertex. [2]

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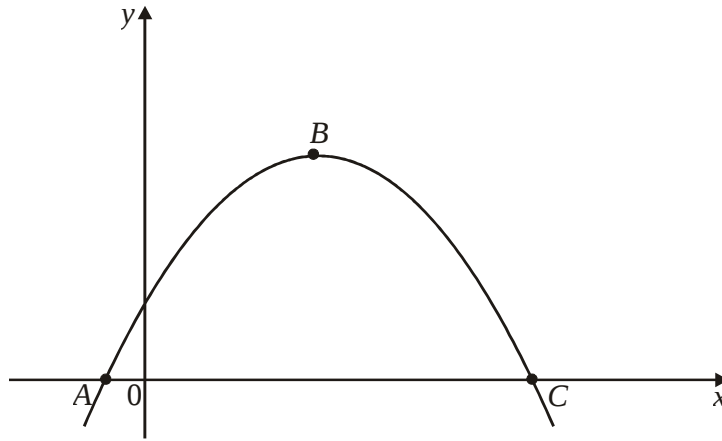
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8. [Maximum mark: 4]

The diagram shows the parabola $y = (7 - x)(1 + x)$. The points A, C are the x -intercepts and the point B is the maximum point. Find the coordinates of A, B and C.



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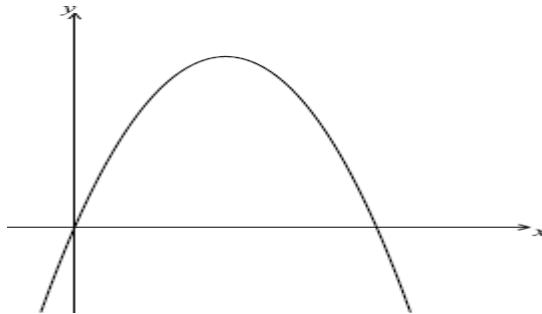
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9. [Maximum mark: 7]

Let $f(x) = 8x - 2x^2$. Part of the graph of f is shown below.



- (a) Find the x -intercepts of the graph. [4]
- (b) (i) Write down the equation of the axis of symmetry.
- (ii) Find the y -coordinate of the vertex. [3]

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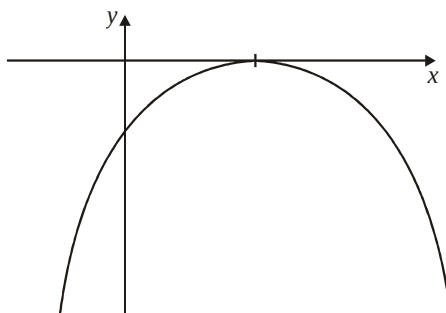
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10. [Maximum mark: 5]

The following diagram shows the graph of function $y = ax^2 + bx + c$.

Complete the table next to the graph to show whether each expression is positive (+), negative (-) or zero (0).

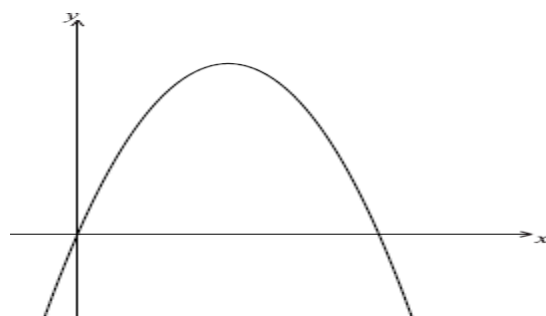


Expression	+	-	0
a			
c			
$b^2 - 4ac$			
$-\frac{b}{2a}$			
b			

11. [Maximum mark: 5]

The following diagram shows the graph of function $y = ax^2 + bx + c$.

Complete the table next to the graph to show whether each expression is positive (+), negative (-) or zero (0).

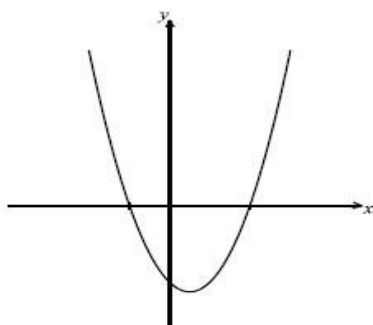


Expression	+	-	0
a			
c			
$b^2 - 4ac$			
$-\frac{b}{2a}$			
b			

12. [Maximum mark: 5]

The following diagram shows the graph of function $y = ax^2 + bx + c$.

Complete the table next to the graph to show whether each expression is positive (+), negative (-) or zero (0).



Expression	+	-	0
a			
c			
$b^2 - 4ac$			
$-\frac{b}{2a}$			
b			

13. [Maximum mark: 4]

(a) Find the vertex of $f(x) = x^2 - 6x + 14$ [2]

(b) Express the function in the form $f(x) = (x - h)^2 + k$ [2]

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14. [Maximum mark: 4]

Consider the function $f(x) = 2x^2 - 8x + 5$.

(a) Express $f(x)$ in the form $a(x - p)^2 + q$, where $a, p, q \in \mathbb{Z}$. [3]

(b) Find the minimum value of $f(x)$. [1]

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15. [Maximum mark: 4]

(a) Find the vertex of $f(x) = 2x^2 + 2x + 2$ [2]

(b) Express the function in the form $f(x) = a(x - h)^2 + k$ [2]

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16. [Maximum mark: 4]

(a) Find the vertex of $f(x) = -x^2 - x - 1$ [2]

(b) Express the function in the form $f(x) = a(x - h)^2 + k$ [2]

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17. [Maximum mark: 5]

Find the points of intersection between $y = x^2 - 5x + 3$ and $y = 3x - 9$
and sketch a graph to demonstrate the result.

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18. [Maximum mark: 5]

Find the point of intersection between $y = x^2 - 5x + 3$ and $y = 3x - 13$
and sketch a graph to demonstrate the result.

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19. [Maximum mark: 5]

Find the points of intersection (if any) between $y = x^2 - 5x + 3$ and $y = 3x - 15$
and sketch a graph to demonstrate the result.

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20. [Maximum mark: 5]

Find the points of intersection (if any) between $y = x^2 - 3$ and $y = 5 - x^2$
and sketch a graph to demonstrate the result.

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