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Chapter 1: Quadratic Functions (Setter: Nigel Yap)

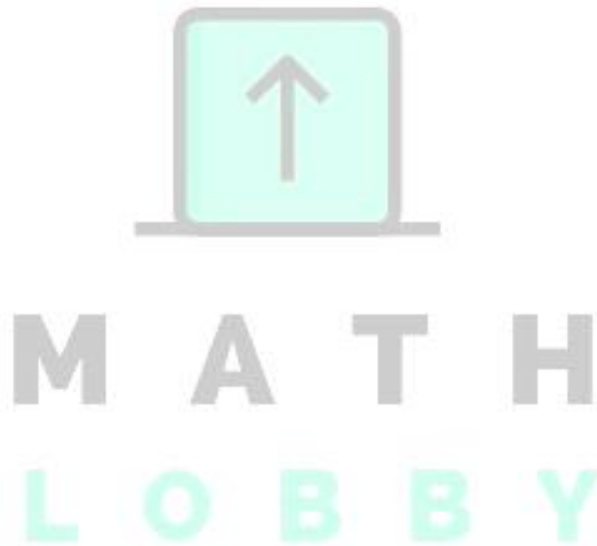
Chapter Overview:

1. Sketching graph of $y = a(x - p)(x - q)$
2. Completing the square
3. Minimum/maximum value of quadratic function
4. Sketching graph of $y = a(x - h)^2 + k$, where curve cuts x-axis
5. Sketching graph of $y = a(x - h)^2 + k$, where curve does not cut x-axis
6. Conditions for quadratic curve to lie completely above or below x-axis
7. Projectile motion

1. Sketching graph of $y = a(x - p)(x - q)$

- i) Factorise $x^2 - x - 6$ and write down the coordinates of the turning point of the graph of $y = x^2 - x - 6$.
ii) Hence, sketch the graph and write the minimum value of the function $y = x^2 - x - 6$.

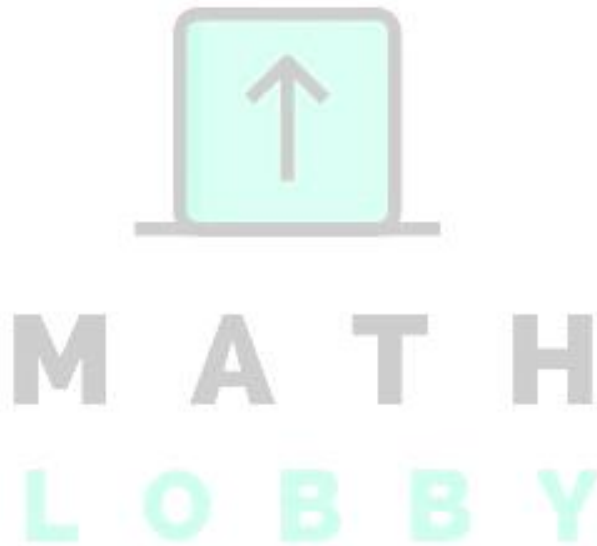
Solution:



2. Completing the square

- Express each of the following expressions in the form of $a(x - h)^2 + k$.
 - i) $x^2 + 18x$
 - ii) $x^2 - 6x$
 - iii) $x^2 + 10x - 4$
 - iv) $3x^2 - 6x + 9$

Solution:



3. Minimum/maximum value of quadratic function

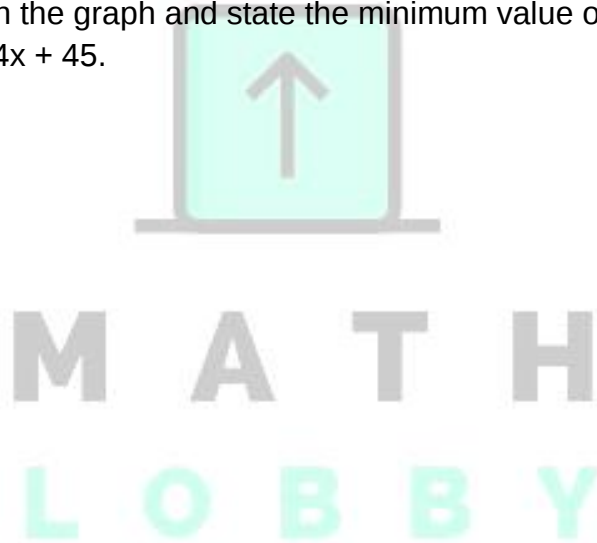
- Given an explanation as to why $5(x - 4)^2 - 7$ can never be less than -7 .

Solution:

4. Sketching graph of $y = a(x - h)^2 + k$, where curve cuts x-axis

- i) Complete the square for $3x^2 - 24x + 45$ and write down the coordinates of the turning point of the graph of $f(x) = 3x^2 - 24x + 45$.
- ii) Hence, sketch the graph and state the minimum value of the function $f(x) = 3x^2 - 24x + 45$.

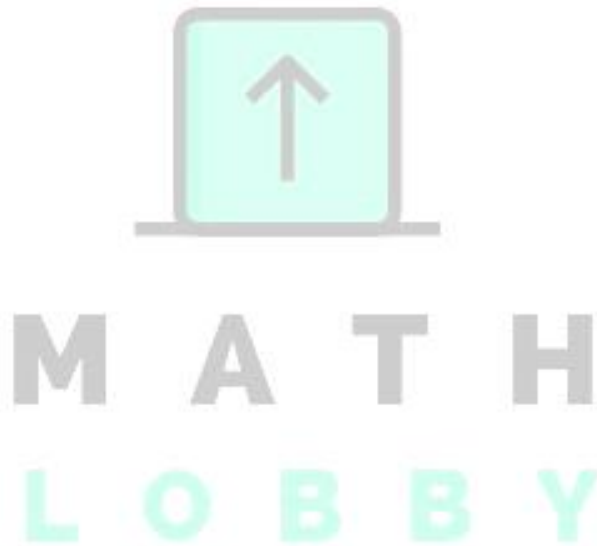
Solution:



5. Sketching graph of $y = a(x - h)^2 + k$, where curve does not cut x-axis

- Sketch the graph of $y = 2x^2 + 4x + 6$, writing down its maximum or minimum value, and the value of x at which the maximum or minimum occurs.

Solution:



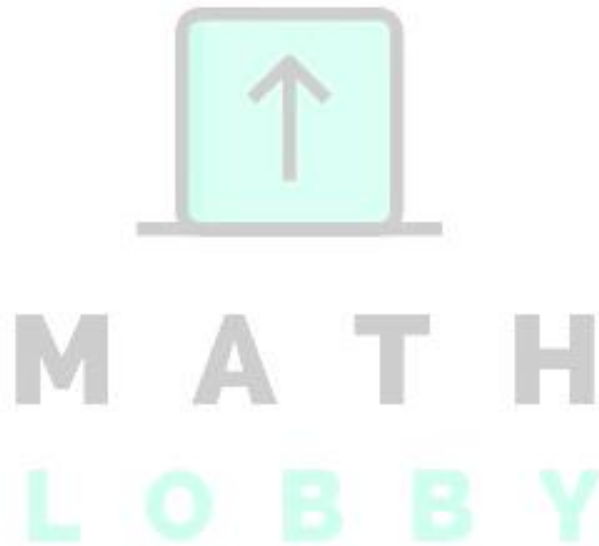
6. Conditions for quadratic curve to lie completely above or below x-axis

- Does any of the following curve lie completely above or below the x-axis? Give a reason to support your answer.

i) $f(x) = -3x^2 - 18x - 30$

ii) $f(x) = \frac{1}{4}x^2 + 4x + 20$

Solution:



7. Projectile motion

- The height, h metres, of an artillery round fired can be modelled by the equation $h = -0.8x^2 + 24x + 64$, where x is the horizontal distance travelled by the artillery round in metres. Find
 - i) the maximum height reached by the artillery round and the corresponding horizontal distance travelled,
 - ii) the horizontal distance travelled by the artillery round before it hits the target.

Solution:

