Graphs of Quadratic Functions

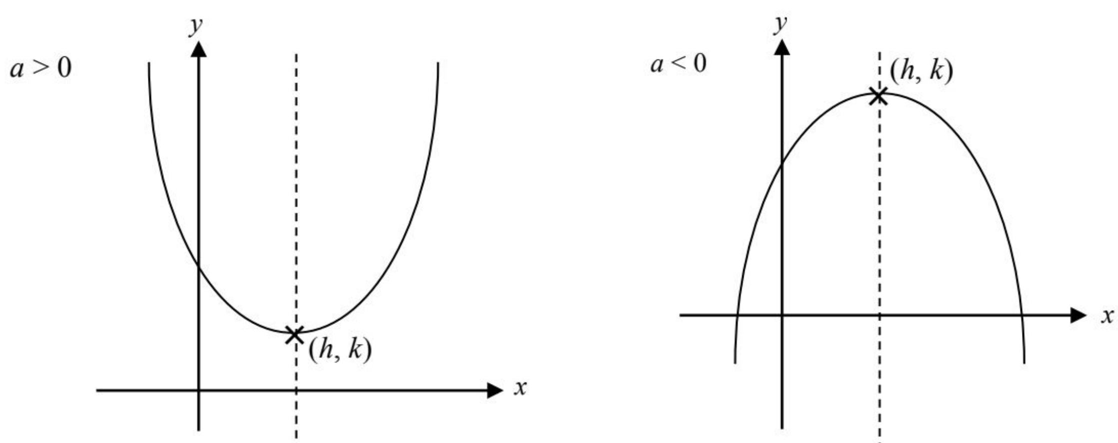
UNIT 3.1 :
Graphs of $y = ax^2 - bx + c$

Quadratic function
We know that quadratic function is a polynomial function of the form $y = ax^2 - bx + c$.
We know that we can plot quadratic graphs when we substitute a particular value of x into the equation to find y.For instance, given the equation $y = -0.5x^2 + 5x + 4$, we can deduce the respective values of y by substituting the value of x into the equation.

UNIT 3.1 :
Sketch of Quadratic Function Graphs: $y = \pm(x - h)^2 + k$

Understanding Perfect Square Functions

We can use the method of **"completing the square"** to find turning point of the quadratic functions.



Let the quadratic function be $f(x) = ax^2 + bx + c$.

$$
\begin{aligned}
f(x) &= ax^2 + bx + c \\
&= x^2 + \left(\frac{b}{a}\right)x + \frac{c}{a} \\
&= x^2 + \left(\frac{b}{a}\right)x + \left(\frac{b}{a}\right)^2 + \frac{c}{a} - \left(\frac{b}{a}\right)^2 \\
&= \left(x + \frac{b}{a}\right)^2 + k
\end{aligned}
$$

Summary:

The following information can be obtained from a quadratic function in the form
$y = \pm(x - p)^2 + q$.

Shape of graph's curve	$+(x-p)^2$: ∪-shaped $-(x-p)^2$: ∩-shaped
Line of symmetry	$x = p$
Turning point (lies on the line of symmetry)	(p, q); $+(x-p)^2$: Minimum $-(x-p)^2$: Maximum
Point at which the graph cuts the y-axis	let $x = 0$ to find y
Point at which the graph cuts the x-axis	let $y = 0$ to find x

UNIT 3.3 :
Sketch of Quadratic Function Graphs: $y = \pm(x - h)^2 + k$

The following information can be obtained from a quadratic function in the form
$y = \pm(x - a)(x - b)$

Shape of graph's curve	$+(x-a)(x-b)$: $\cup$-shaped $-(x-a)(x-b)$: $\cap$-shaped
Point at which the graph cuts the x-axis	$(a, 0), (b, 0)$
Point at which the graph cuts the y-axis	$(0, \pm ab)$ [sign dependent on sign of x^2 term]
Line of symmetry	$x = \frac{1}{2}(a+b)$
Turning point	x-coordinate: lies on the line of symmetry y-coordinate: substitute value of x-coordinate into function $+(x-a)(x-b)$: Minimum $-(x-a)(x-b)$: Maximum

UNIT 3.4 :
Plotting of Quadratic Graphs

Plotting on Graph Paper
You have learnt to solve equations graphically in the previous section. Now we need to know how to plot a graph to estimate the solutions of a given equation. Similar to plotting straight-line graphs, typically plotting a quadratic graph has the following procedure:

1. Draw a table of values based on the range of x-values given.
2. Using a ruler, draw and label both axes using the scales and indicate the scales at one corner of the graph paper.
3. Plot all ordered pairs from your table, marking it with a “X”.
4. Join the points smoothly. You may use French Curve if necessary.
5. Label the equation(s) beside the graph(s) respectively.