

PENANG SANGAM HIGH SCHOOL
DEPARTMENT OF MATHEMATICS/PHYSICS
YEAR 11 MATHEMATICS - WEEK 15

STRAND 4

GRAPHS

4.1 GRAPHS

Learning Objective

At the end of this lesson, students should be able to:

- Draw quadratic graphs

Graphing Quadratic Functions

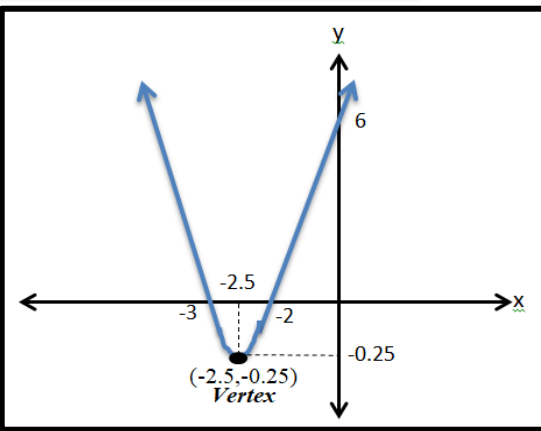
- ❖ Quadratic graphs are either “U shaped” or “∩ shaped”.
- ❖ It has a turning point.
- ❖ The graph will be symmetrical about the turning point (vertex).
- ❖ To sketch the graph of a quadratic function of the form $y = ax^2 + bx + c$:
 1. Calculate the y – intercept: Let $x = 0$ and solve for y.
 2. Calculate the x – intercept: Let $y = 0$ and solve for x.
 3. Calculate the coordinates for the vertex
 - The x – coordinate is the midpoint between the two x – intercepts.
 - By substituting this value of x in the equation, the y – coordinate is obtained.
 4. Check the coefficient of x^2
 - If it is positive, the graph has the shape U
 - If it is negative, the graph has the shape ∩
 5. Plot the points and sketch.

Example: Sketch $y = x^2 + 5x + 6$

y-intercept: Let $x = 0$ $y = x^2 + 5x + 6$ $y = (0)^2 + 5(0) + 6$ $y = 6$ \therefore y – intercept is (0, 6)	x-intercept: Let $y = 0$ $y = x^2 + 5x + 6$ $0 = x^2 + 5x + 6$ (Factorize) $0 = (x + 3)(x + 2)$
	$x + 3 = 0$ $x + 2 = 0$ $x + 3 - 3 = 0 - 3$ $x + 2 - 2 = 0 - 2$ $x = -3$ $x = -2$ \therefore x – intercept is (-3, 0) and (-2, 0)

The coefficient of x^2 is 1
 \therefore the shape will be U

Vertex: $x = \text{midpoint of x-coordinates}$ $x = \frac{(-2 + -3)}{2}$ $x = -2.5$ \therefore the vertex is (-2.5, -0.25)	$y = x^2 + 5x + 6$ $y = (-2.5)^2 + 5(-2.5) + 6$ $y = -0.25$
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Vertex Form of A Quadratic Function

- ❖ The vertex form of quadratic equation is given as:

$y = a(x - k)^2 + h$

Where the coordinates for the vertex is (k, h)

- ❖ The line of symmetry is $x = k$

❖ For x-intercept let $y = 0$ and for y-intercept let $x = 0$.

Example: Sketch the graph of $y = 3(x - 2)^2 - 4$.

x-intercept: let $y = 0$ and solve for x

$$y = 3(x - 2)^2 - 4$$

$$0 = 3(x - 2)^2 - 4$$

$$0 + 4 = 3(x - 2)^2 - 4 + 4$$

$$\frac{4}{3} = \frac{3(x - 2)^2}{3}$$

$$\sqrt{\frac{4}{3}} = \sqrt{(x - 2)^2}$$

$$\pm 1.15 = x - 2$$

$$x - 2 = 1.15$$

$$x - 2 = -1.15$$

$$x - 2 + 2 = 1.15 + 2 \quad x - 2 + 2 = -1.15 + 2$$

$$x = 3.15$$

$$x = 0.85$$

y-intercept: let $x = 0$ and solve for y

$$y = 3(x - 2)^2 - 4.$$

$$y = 3(0 - 2)^2 - 4$$

$$y = 8$$

∴ y-intercept is (0,8)

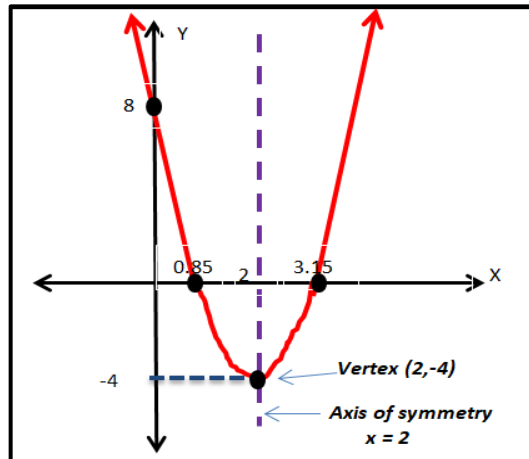
Pull out the values for h and k .

$$h = 2; k = -4$$

$$\therefore \text{vertex} = (2, -4)$$

Axis of symmetry

$$\text{At } x = 2$$



Exercise

1. Sketch the graph of the following giving the coordinates of the vertex and the equation of the axis of symmetry:

$$y = 2(x - 3)^2 - 3.$$

2. Change the following equations in the form $f(x) = a(x - h)^2 + k$ using perfect square and sketch its graph showing the intercepts and vertex.

$$y = x^2 - 2x + 3$$