

## Lesson 37

## Graphing the Quadratic Equations

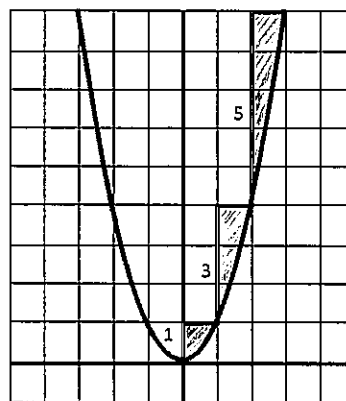
**Quadratic Function:** a function that can be written in the form  $y = ax^2 + bx + c$ , where  $a \neq 0$ .

**Standard Form of a Quadratic Function:**  $f(x) = ax^2 + bx + c$ , where  $a \neq 0$ .

**Quadratic Parent Function:**  $y = x^2$  or  $f(x) = x^2$

x	$y = x^2$
-2	4
-1	1
0	0
1	1
2	4

To graph the parent function of the parabola, you need to start with the Vertex. Then determine if the parabola opens up or down. Finally, move up or down the odd numbers and then over one. If the number in front of  $x^2$  is not one, multiple the odd numbers by that value.



**Parabola:** the graph of a quadratic function, a U-shaped curve

**Axis of Symmetry:** the line of symmetry that cuts the graph into 2 equal halves,  $y = \frac{-b}{2a}$

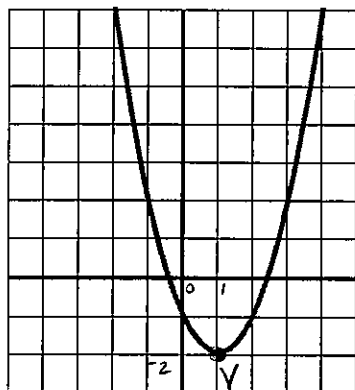
**Vertex:** the highest or lowest point of a parabola. The place where the parabola touches the axis of symmetry.

**Maximum Point:** the vertex of the parabola when the graph opens down

**Minimum Point:** the vertex of the parabola when the graph opens up

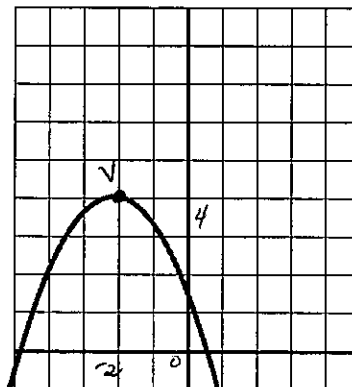
Examples: Identify the vertex of each graph. Is the vertex a minimum or a maximum?

1.



$V(1, -2)$   
Minimum

2.

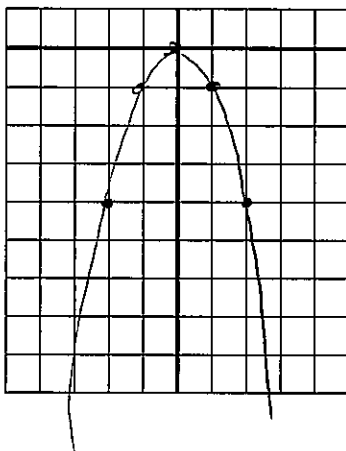


$V(-2, 4)$   
Maximum

Examples: Make a table of values and graph the quadratic function.

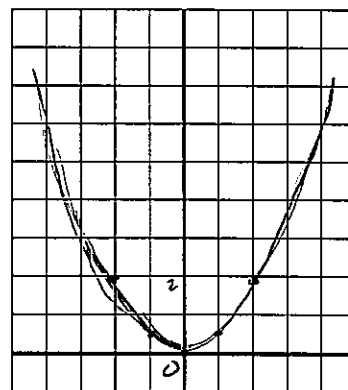
3.  $y = -x^2$

x	y
-2	-4
-1	-1
0	0
1	-1
2	-4



4.  $y = \frac{1}{2}x^2$

x	y
-2	2
-1	$\frac{1}{2}$
0	0
1	$\frac{1}{2}$
2	2



Graphing the parabola represented by the quadratic equation:  $y = ax^2 + bx + c$ , where  $a \neq 0$ .

Steps to follow:

1. List off the values for  $a$ ,  $b$ , and  $c$ .
2. Calculate the equation for the axis of symmetry,  $x = \frac{-b}{2a}$
3. Use the equation for the axis of symmetry to find the vertex.  
Plug the number into the function for  $x$  to solve for  $y$ .
4. Determine if the parabola opens up or down.
5. Is the vertex a maximum or minimum?
6. Create a table of values. Put the vertex in the middle of the table.
7. Plot the points from the table and connect the dots.
8. Label the axis of symmetry, vertex and  $y$  - intercept on the parabola.

Example: Graph the parabola represented by the quadratic equation.

5.  $f(x) = x^2 - 6x + 9$

$a = 1$        $x = \frac{-b}{2a}$

$b = -6$        $x = \frac{+6}{2(1)} = 3$

$c = 9$

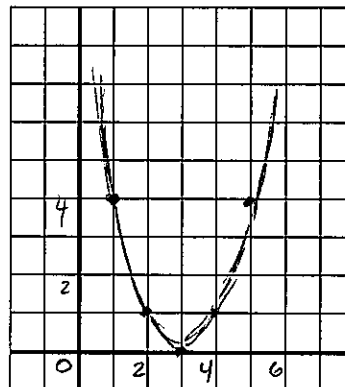
$f(1) = 1 - 6 + 9 = 4$

$f(2) = 4 - 12 + 9 = 1$

$f(3) = 9 - 18 + 9 = 0$

$f(4) = 16 - 24 + 9 = 1$

x	y
1	4
2	1
3	0
4	1
5	4



$f(5) = 25 - 30 + 9 = 4$

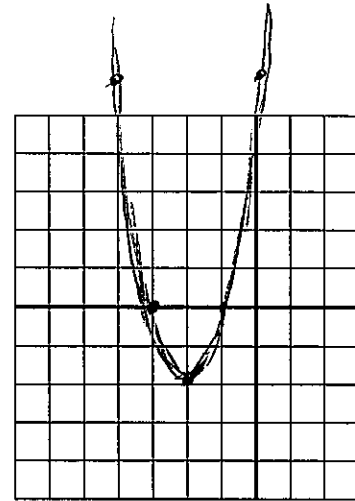
$$6. y = 2x^2 + 8x + 6$$

$$a = 2 \quad x = \frac{-8}{2(2)}$$

$$b = 8 \quad = \frac{-8}{4}$$

$$c = 6 \quad = -2$$

x	y
-4	6
-3	0
-2	-2
-1	0
0	6



$$\begin{aligned} y(-4) &= 2(-4)^2 + 8(-4) + 6 \\ &= 32 - 32 + 6 \\ &= 6 \end{aligned}$$

$$\begin{aligned} y(-3) &= 2(-3)^2 + 8(-3) + 6 \\ &= 18 - 24 + 6 \\ &= 0 \end{aligned}$$

$$\begin{aligned} y(-2) &= 2(-2)^2 + 8(-2) + 6 \\ &= 8 - 16 + 6 \\ &= -2 \end{aligned}$$

$$\begin{aligned} y(-1) &= 2(-1)^2 + 8(-1) + 6 \\ &= 2 - 8 + 6 = 0 \end{aligned}$$

$$\begin{aligned} y(0) &= 2(0)^2 + 8(0) + 6 \\ &= 6 \end{aligned}$$