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NOTES: Section 9.4 – Graphing Quadratic Functions

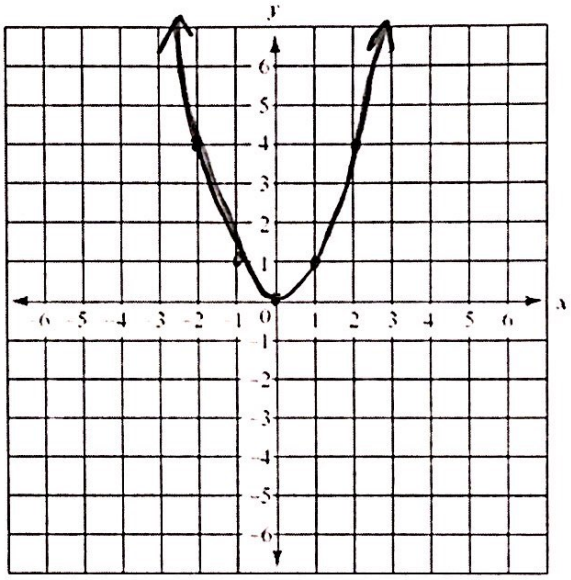
Goals: #1 - I can graph a quadratic function.

Homework: Section 9.4 Worksheet

Exploration #1: Graph the following function using a table of values.

1. $y = x^2$

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



a. Make some observations about your graph:

U shaped, all positive outputs, happy face, symmetrical

b. Do you know what this shape is called?

parabola

c. Do you know what type of function this is?

quadratic

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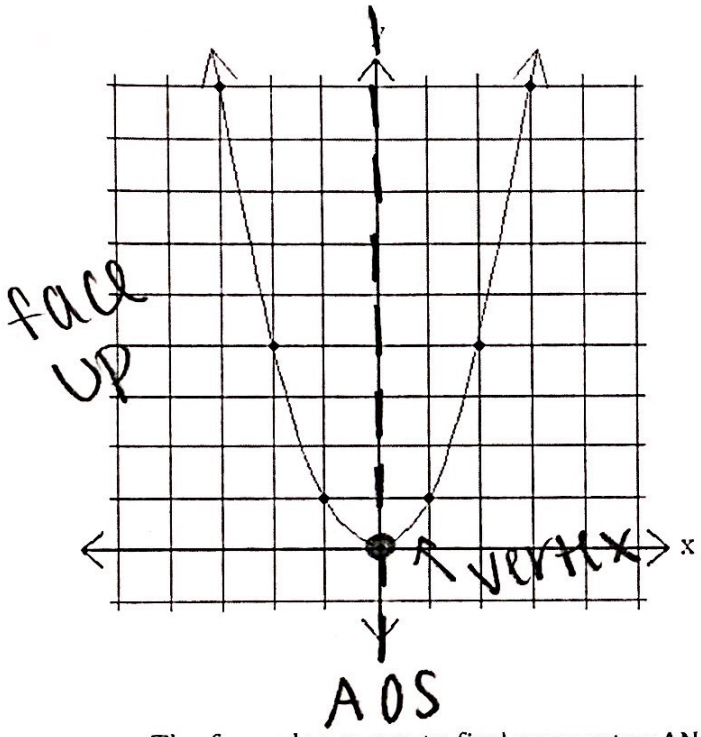
Notes:

A quadratic function is a function that can be written in the standard form: $y = ax^2 + bx + c$

The graph of a quadratic function is a parabola.



Characteristics of Quadratic Functions:

- Parabolas can open up or down
- The lowest or highest point on a parabola is called the vertex. (AOS)
- The axis of symmetry divides the parabola into mirror images and passes through the vertex.

The formula we use to find our vertex AND axis of symmetry is: $x = \frac{-b}{2a}$.

Example #1: Identify the values of a, b, and c in the functions.

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

   $a = 1$
   $b = 2$
   $c = -3$

2. $y = -5x^2 + 5$

   $a = -5$
   $b = 0$
   $c = 5$

You practice: Identify the values of a, b, and c in the functions.

1. $y = -3x^2 - 9x - 12$

   $a = -3$
   $b = -9$
   $c = -12$

2. $y = 4x^2 + x$

   $a = 4$
   $b = 1$
   $c = 0$

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Example #2: Identify the graph's axis of symmetry (AOS), vertex, and tell whether the graph opens up or down.

1. $y = 5x^2 + 10x + 7$ (a, b, c)

$x = \frac{-b}{2a} = \frac{-10}{2(5)} = \frac{-10}{10} = -1$

$y = 5(-1)^2 + 10(-1) + 7$

$5 - 10 + 7 = 2$

AOS: $x = -1$

vertex: $(-1, 2)$

opens: up (a is +)

2. $y = -2x^2 + 4x - 1$ (a, b, c)

$x = \frac{-b}{2a} = \frac{-4}{2(-2)} = \frac{-4}{-4} = 1$

$y = -2(1)^2 + 4(1) - 1$

$= -2 + 4 - 1 = 1$

AOS: $x = 1$

vertex: $(1, 1)$

opens: down (a is -)

3. $y = 5x^2 - 1$ (a, c)

$x = \frac{-b}{2a} = \frac{0}{2(5)} = 0$

$y = 5(0)^2 - 1$

$= 0 - 1 = -1$

AOS: $x = 0$

vertex: $(0, -1)$

opens: up (a is +)

4. $y = -x^2 + 6x - 10$ (a, b, c)

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

$y = -(3)^2 + 6(3) - 10$

$-9 + 18 - 10 = -1$

AOS: $x = 3$

vertex: $(3, -1)$

opens: down (a is -)

You practice: Identify the graph's axis of symmetry (AOS), vertex, and tell whether the graph opens up or down.

1. $y = x^2 - 2x - 3$ (a, b, c)

$x = \frac{-b}{2a} = \frac{-(-2)}{2(1)} = \frac{2}{2} = 1$

$y = (1)^2 - 2(1) - 3$

$1 - 2 - 3 = -4$

AOS: $x = 1$

vertex: $(1, -4)$

opens: up (a is +)

2. $y = -x^2 + 1$ (a, c)

$x = \frac{-b}{2a} = \frac{0}{2(-1)} = 0$

$y = -(0)^2 + 1$

$= 0 + 1 = 1$

AOS: $x = 0$

vertex: $(0, 1)$

opens: down (a is -)

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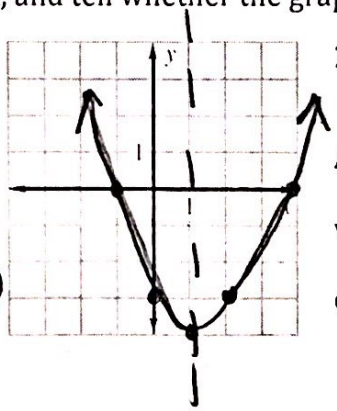
Example #3: Graph the function by completing the table. Identify the graph's axis of symmetry (AOS), vertex, and tell whether the graph opens up or down.

1. $y = \overset{a}{x^2} - \overset{b}{2x} - \overset{c}{3}$



AOS: $x = 1$

vertex: $(1, -4)$

opens: up (a is +)

vertex

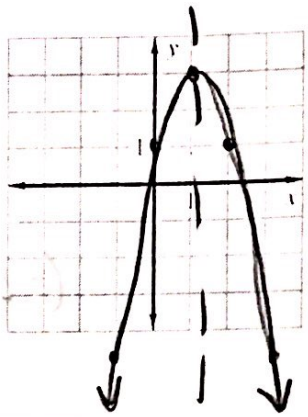
x	-1	0	1	2	3
y	0	-3	-4	-3	0

$x = \frac{-b}{2a} = \frac{-(-2)}{2(1)} = \frac{2}{2} = 1$

$y = (1)^2 - 2(1) - 3$

$1 - 2 - 3 = -4$

2. $y = \overset{a}{-2}x^2 + \overset{b}{4}x + \overset{c}{1}$



AOS: $x = 1$

vertex: $(1, 3)$

opens: down (a is −)

vertex

x	-1	0	1	2	3
y	-5	1	3	1	-5

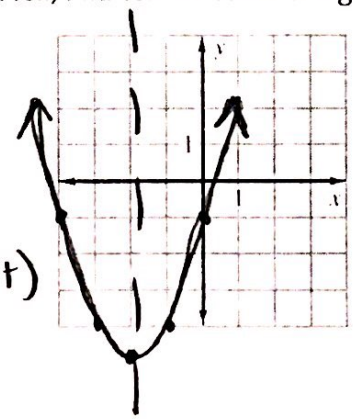
$x = \frac{-b}{2a} = \frac{-(4)}{2(-2)} = \frac{-4}{-4} = 1$

$y = -2(1)^2 + 4(1) + 1$

$-2 + 4 + 1 = 3$

You practice: Graph the function by completing the table. Identify the graph's axis of symmetry (AOS), vertex, and tell whether the graph opens up or down.

1. $y = \overset{a}{x^2} + \overset{b}{4}x - \overset{c}{1}$



AOS: $x = -2$

vertex: $(-2, -5)$

opens: up (a is +)

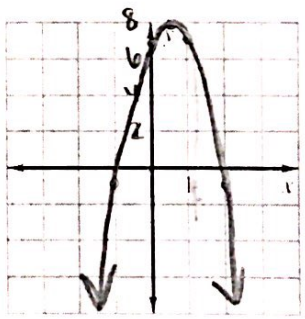
x	-4	-3	-2	-1	0
y	-1	-4	-5	-4	-1

$x = \frac{-b}{2a} = \frac{-4}{2(1)} = \frac{-4}{2} = -2$

$y = (-2)^2 + 4(-2) - 1$

$4 - 8 - 1 = -5$

2. $y = \overset{a}{-4}x^2 + \overset{b}{4}x + \overset{c}{7}$



AOS: $x = \frac{1}{2}$

vertex: $(\frac{1}{2}, 8)$

opens: down (a is −)

x	-1	0	$\frac{1}{2}$	1	2
y	-1	7	8	7	-1

$x = \frac{-b}{2a} = \frac{-4}{2(-4)} = \frac{-4}{-8} = \frac{1}{2}$

$y = -4(\frac{1}{2})^2 + 4(\frac{1}{2}) + 7$

$= -1 + 2 + 7$

$= 8$