

9.1: Exploring Quadratic Functions (F.IF.7.a, A.CED.2, F.IF.4, F.BF.3)

Objective: SWBAT graph quadratic functions and analyze various changes to standard form

Essential Understanding A quadratic function is a type of nonlinear function that models certain situations where the rate of change is not constant. The graph of a quadratic function is a symmetric curve with a highest or lowest point corresponding to a maximum or minimum value.

Quadratic Function Standard Form:

a and b are _____

Graphs:

a \neq 0 (would be a _____)

c is the _____

Graph of a quadratic is a _____

Changing the value of "a"

a.) $f(x) = x^2$ (the _____)

b.) $y = 3x^2$

c.) $y = 5x^2$

x	y
-2	
-1	
0	
1	
2	

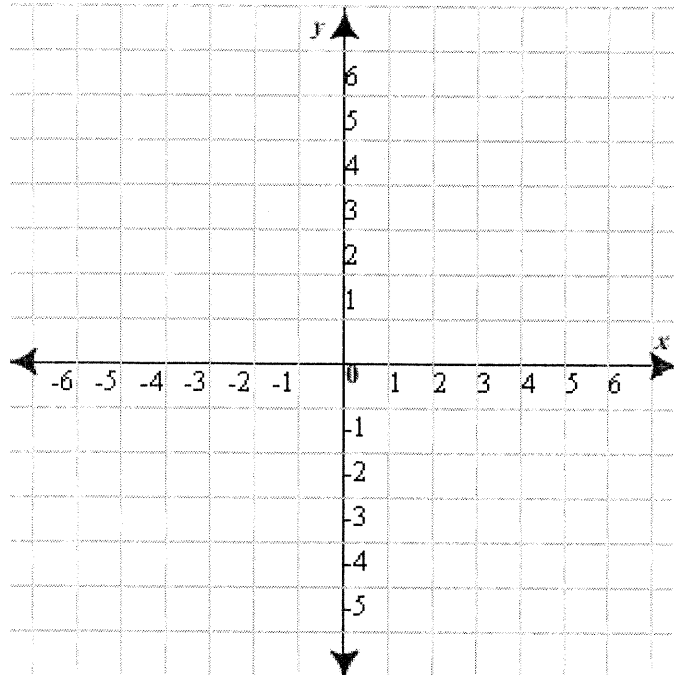
x	y
-2	
-1	
0	
1	
2	

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

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

x	y
-2	
-1	
0	
1	
2	

x	y
-2	
-1	
0	
1	
2	



If "a" is positive, _____

If "a" is negative, _____

As "a" gets bigger than 1 _____

As "a" gets smaller than 1 _____

Changing the value of the constant "C"

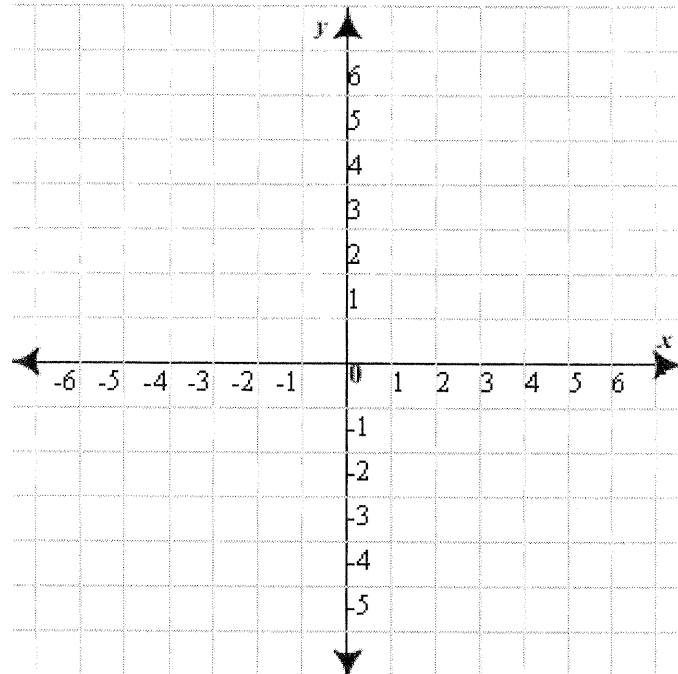
a.) $f(x) = x^2$ (the _____)

b.) $y = x^2 + 3$

c.) $y = x^2 - 4$

x	y
-2	
-1	
0	
1	
2	

x	y
-2	
-1	
0	
1	
2	

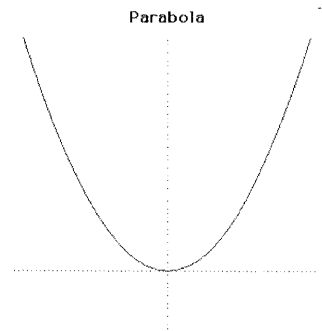


d.) $y = x^2 - 5$

x	y
-2	
-1	
0	
1	
2	

Effects of changing the constant: _____

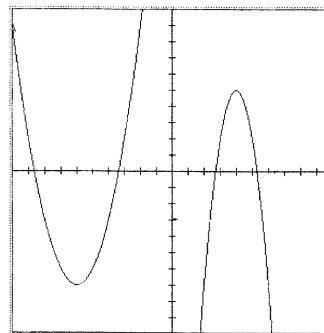
Axis of Symmetry: _____



Vertex: _____

- If parabola opens UPWARD, the VERTEX is the _____ point or lowest point
- If parabola opens DOWNWARD, the VERTEX is the _____ point or highest point.

Minimum Point:



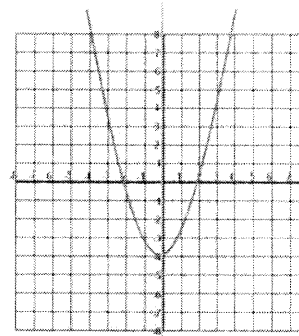
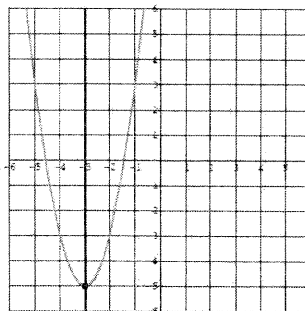
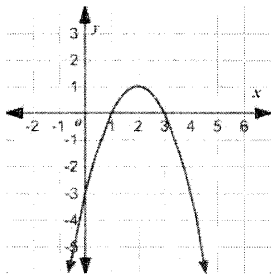
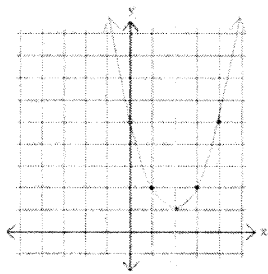
Maximum Point:

DOMAIN and RANGE

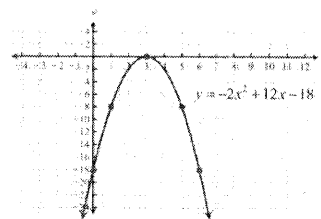
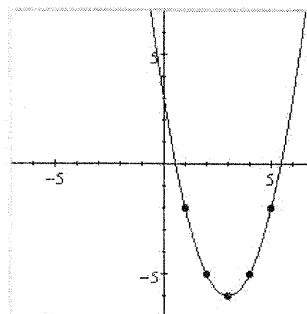
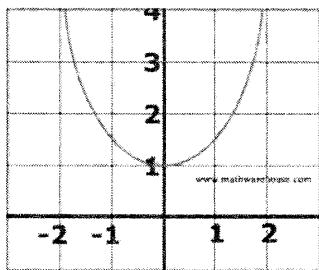
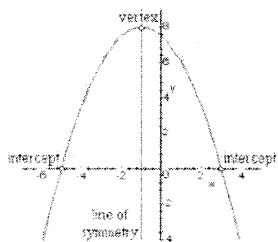
Domain: _____

Range: _____

Ex1: Identify the axis of symmetry, vertex and whether it is a minimum or maximum, and the domain and range.



You Try....



Ex 2: Tell whether each parabola opens up or down and whether the vertex is a maximum or minimum

a. $y = 4x^2$

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

c. $y = 2x - x^2$

Graphing Calculator Exploration

Graph the following functions with your graphing calculator, sketch the graphs below and identify the domain and range of each function.

1. $y = 4x^2 - 3$

2. $y = -3x^2$

3. $y = x^2 + 6$

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

5. $y = \sqrt{x}$

6. $y = |x|$

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Objective: SWBAT graph quadratic functions and analyze various changes to standard form

Essential Understanding A quadratic function is a type of nonlinear function that models certain situations where the rate of change is not constant. The graph of a quadratic function is a symmetric curve with a highest or lowest point corresponding to a maximum or minimum value.

Quadratic Function Standard Form:

$$y = ax^2 + bx + c$$

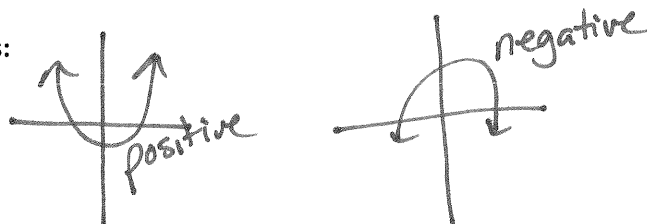
↳ leading coefficient

a and b are Coefficients

a ≠ 0 (would be a line bx+c)

c is the Constant

Graphs:



Changing the value of "a"

a.) $f(x) = x^2$ (the "parent function")

b.) $y = 3x^2$
 $a = 3$

vs

c.) $y = 5x^2$
 $a = 5$

x	y
-2	12
-1	3
0	0
1	3
2	12

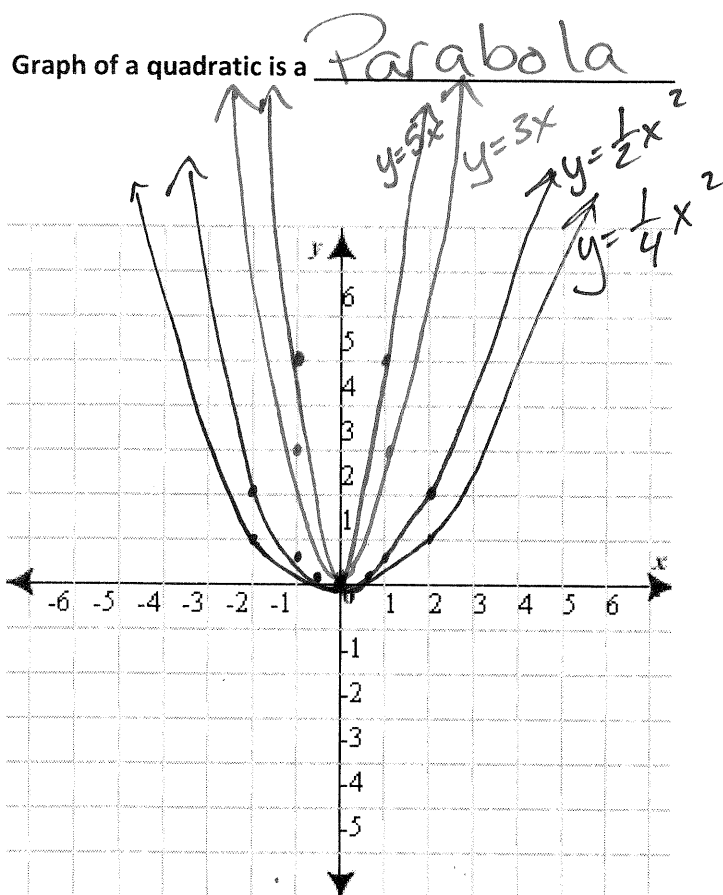
x	y
-2	20
-1	5
0	0
1	5
2	20

d.) $a = \frac{1}{2}$
 $y = \frac{1}{2}x^2$

x	y
-2	2
-1	0.5
0	0
1	0.5
2	2

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

x	y
-2	1
-1	0.25
0	0
1	0.25
2	1



If "a" is positive, parabola opens up (smile)

If "a" is negative, opens down (frown)

As "a" gets bigger than 1 gets skinnier - "Stretches" up

As "a" gets smaller than 1 gets wider - "Shrinks" down

Changing the value of the constant "C"

a.) $f(x) = x^2$ (the parent function)

b.) $y = x^2 + 3$

$C = 3$

x	y
-2	7
-1	4
0	3
1	4
2	7

c.) $y = x^2 - 4$

$C = -4$

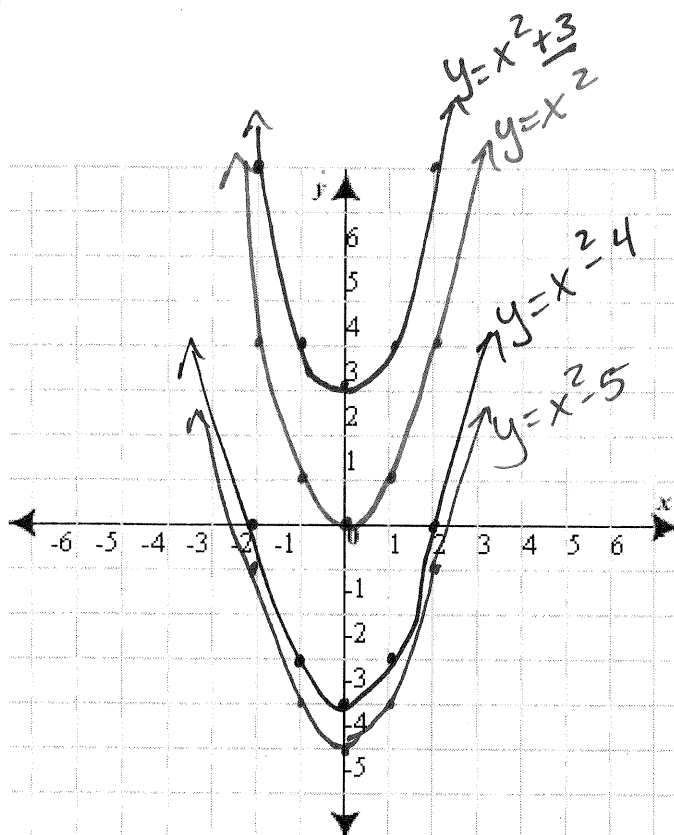
x	y
-2	0
-1	-3
0	-4
1	-3
2	0

d.) $y = x^2 - 5$

$C = -5$

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

C is the y-int

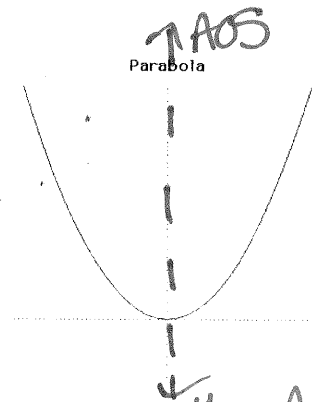


Effects of changing the constant:

$+C$ shifts graph UP
 $-C$ shifts graph DOWN

Axis of Symmetry:

the line that divides parabola into 2 congruent halves (same size)



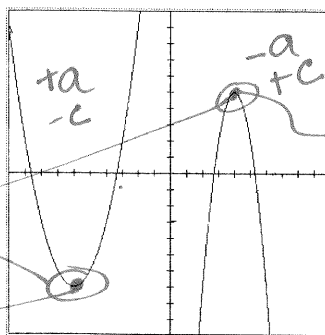
Vertex:

The highest (max) (or) lowest (min) point on the AoS.

- If parabola opens UPWARD, the VERTEX is the Minimum point or lowest point
- If parabola opens DOWNWARD, the VERTEX is the Maximum point or highest point.

Minimum Point:

Maximum Point:



exact point is the vertex

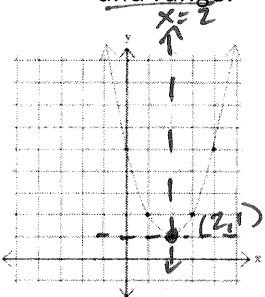
exact pt is vertex

DOMAIN and RANGE

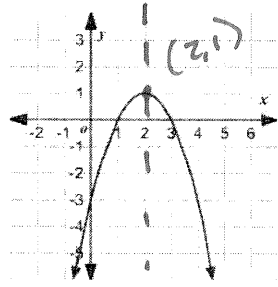
Domain: set of all possible x-values (how far left and right graph will be $x = \text{○}$ will go)

Range: set of all possible y-values (how high or low the graph will go) \hookrightarrow will be $y \leq$ or $y \geq$

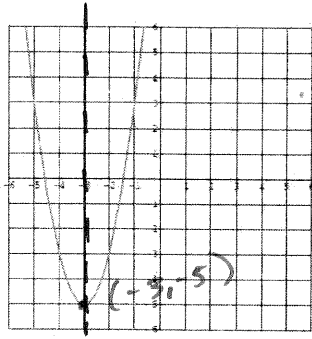
Ex1: Identify the axis of symmetry, vertex and whether it is a minimum or maximum, and the domain and range.



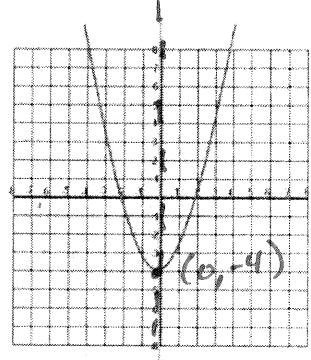
AoS: $x=2$
 V: min $(2, 1)$
 D: all real #s
 R: $y \geq 1$



AoS: $x=2$
 v: max $(2, 1)$
 D: \mathbb{R}
 R: $y \leq 1$

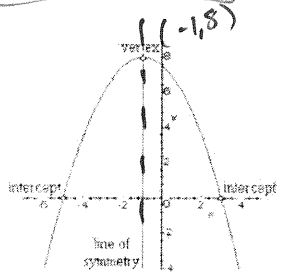


AoS: $x=-3$
 V: min $(-3, -5)$
 D: \mathbb{R}
 R: $y \geq -5$

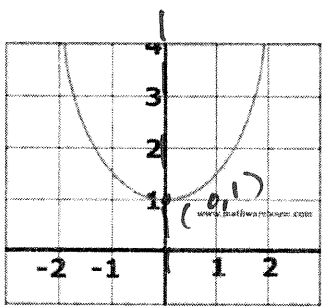


AoS: $x=0$
 V: min $(0, -4)$
 D: \mathbb{R}
 R: $y \geq -4$

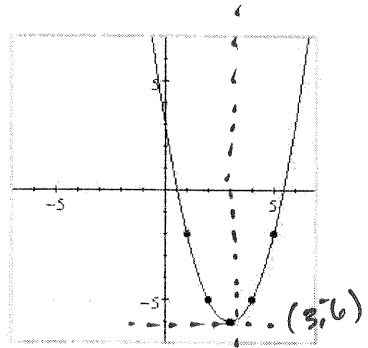
you try



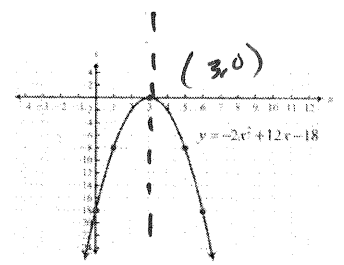
AoS: $x=-1$
 V: max $(-1, 8)$
 D: \mathbb{R}
 R: $y \leq 8$



AoS: $x=0$
 v: min $(0, 1)$
 D: all real #s
 R: $y \geq 1$



AoS: $x=3$
 V: min $(3, -6)$
 D: \mathbb{R}
 R: $y \geq -6$



AoS: $x=3$
 v: max $(3, 0)$
 D: \mathbb{R}
 R: $y \leq 0$

Ex 2: Tell whether each parabola opens up or down and whether the vertex is a maximum or minimum

a. $y = 4x^2$ $a = +4$
 opens up
 minimum

b. $y = -3x^2 + 2$ $a = -3$
 opens down
 maximum

c. $y = 2x(-x^2)$ $a = -1$
 opens down
 maximum

Graphing Calculator Exploration

Graph the following functions with your graphing calculator, sketch the graphs below and identify the domain and range of each function.

