

Name: _____ Date: _____

Vertex Form of a Quadratic

UNIT QUESTION: How are real life scenarios represented by quadratic functions?

Today's Question: How do we graph quadratics in vertex form using transformations?

MCC9-12.F.BF.3

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

Vertex: (h,k)

Vertex: The middle point of the graph also know at the maximum or minimum of the parabola.

The Parent Function: $y = x^2$

Type of Transformation	Notation	Change to Graph
Vertical Shift	$y = x^2 \pm K$	moves the graph up or down
Horizontal Shift	$y = (x - h)^2$	opposite sign -h moves right +h moves left
Reflection over X axis	$y = -x^2$	reflects over the x axis
Vertical Stretch and Shrink	$y = ax^2$	$a > 1$ vertical stretch $0 < a < 1$ vertical shrink

Examples:

Describe the transformations of the parent graph for each equation.

1. $f(x) = x^2 + 7$

up 7

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

reflection over x axis
left 5
down 2

3. $f(x) = \frac{1}{2}(x-10)^2$

right 10
v. shrink

Write the equation in vertex form of the quadratic equation that has been...

4. shifted to the right 2 and up 6

$y = (x-2)^2 + 6$

5. reflected over the x-axis and shifted left 8

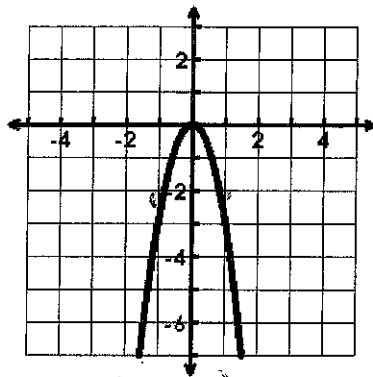
$y = -(x+8)^2$

6. Stretch by 4, shifted right 4, and moved down 17

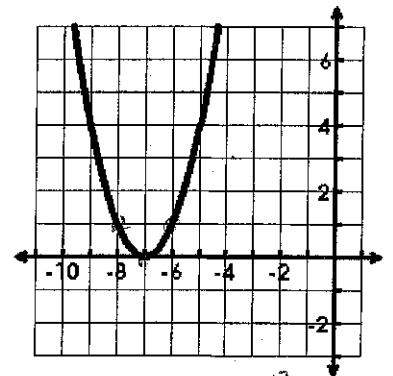
$y = 4(x-4)^2 - 17$

Describe the transformations and write an equation for each quadratic function.

1. Identify Vertex
2. Identify any Reflections
3. Stretches/Shrinks
 - a. In the parent function, the next point after the vertex is over 1 and down 1
 - b. Identify slope from vertex to first point after vertex

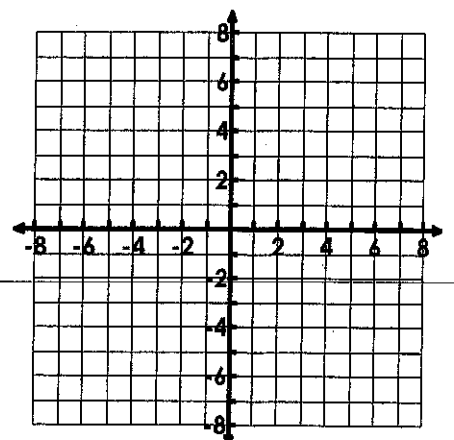
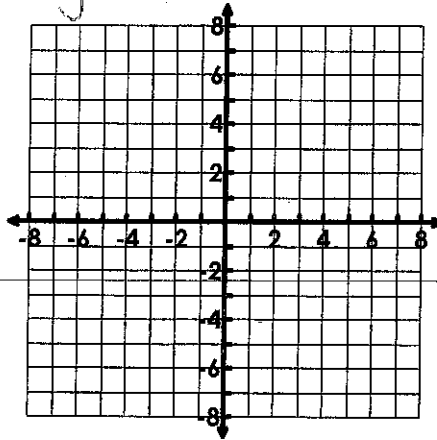
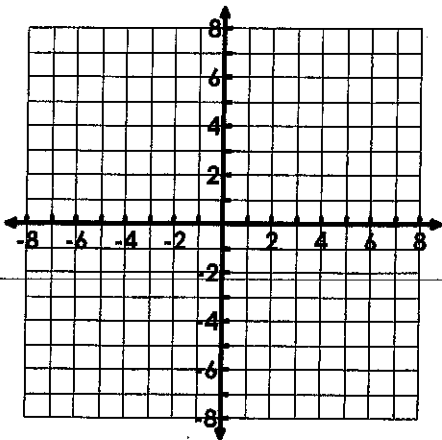


$v: (0, 0)$
 $y = -2(x)^2$ or $-2x^2$



$y = (x+7)^2$

Graph the following equations.



a: _____
h: _____
k: _____

a: _____
h: _____
k: _____

a: _____
h: _____
k: _____

Transformations of Graphs

Describe the transformations that are applied.

Function	a	h	k
$y = 3(x - 4)^2 + 5$	3 v. stretch	$h = 4$ right	$k = 5$ up
$y = \frac{2}{3}(x + 5)^2 - 3$	$\frac{2}{3}$ v. shrink	$h = -5$ left	$k = -3$ down
$(x - 2)^2$	$a = 1$ none	$h = 2$ right	$k = 0$ no shift
$-x^2 - 5$	$a = -1$	$h = 0$ no shift	$k = -5$ down
$\frac{4}{3}(x + 2)^2 + 4$	$a = \frac{4}{3}$ v. stretch	$h = -2$ left	$k = 4$ up

Write a description of the transformations on the functions above.

1. _____
2. _____
3. _____
4. _____
5. _____

Match the numbered functions with their lettered graphs.

1. x^2	A	2. $x^2 + 1$	F	3. $(x + 1)^2$	C
4. $(x + 1)^2 + 1$	D	5. $(x + 1)^2 - 1$	H	6. $(x - 1)^2 + 1$	E
7. $(x - 1)^2 - 1$	B	8. $-(x + 1)^2$	G	9. $-(x - 1)^2$	I

<p>A.</p>	<p>B.</p>	<p>C.</p>
<p>D.</p>	<p>E.</p>	<p>F.</p>
<p>G.</p>	<p>H.</p>	<p>I.</p>

Review: Select three of the ordered pairs below that could be added to the set so that f remains a function.

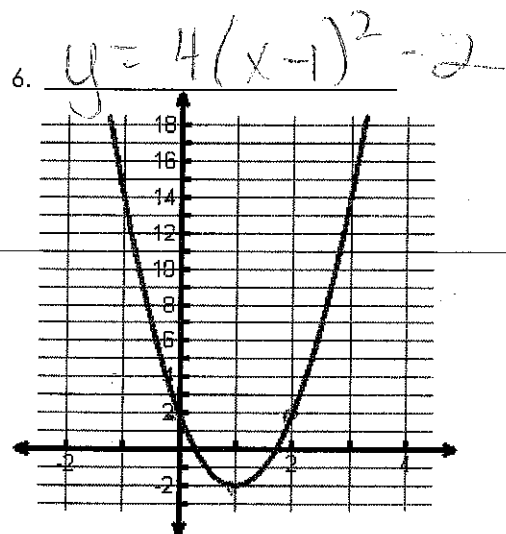
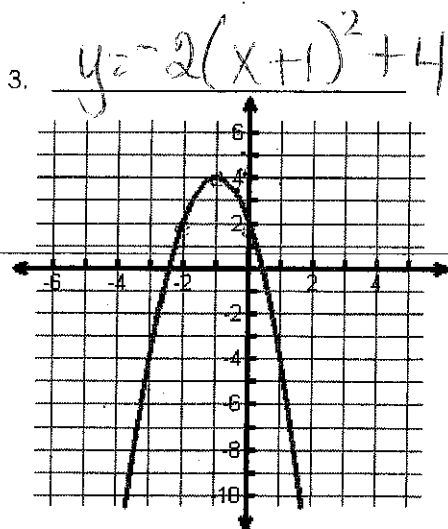
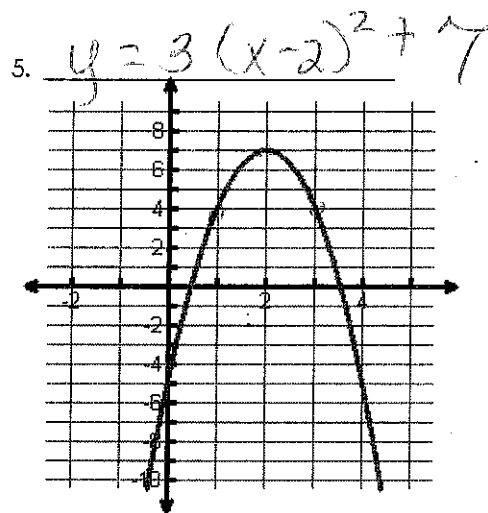
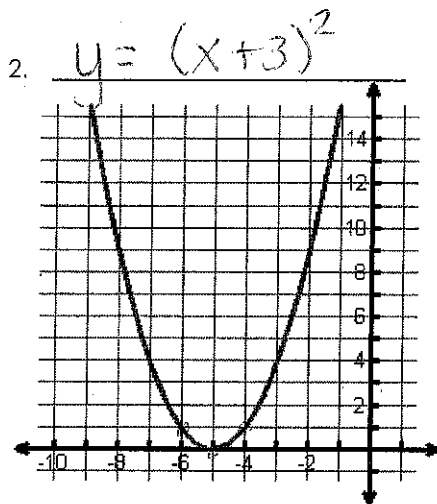
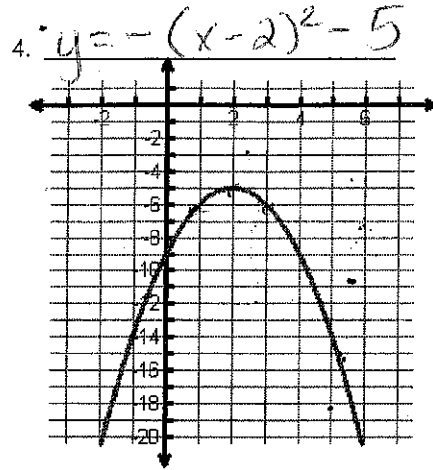
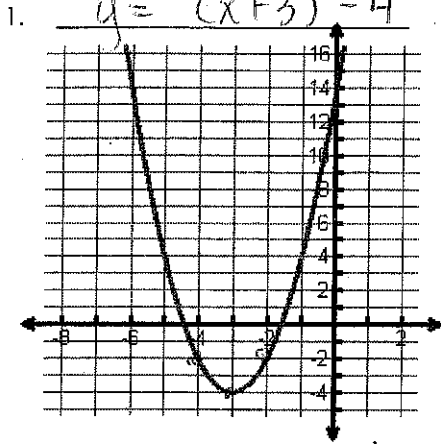
x	$f(x)$
-5	3
0	6
3	-2
4	0

- A. (-3, -2)
- B. (4, 2)
- C. (0, -1)
- D. (1, 6)
- E. (2, 3)
- F. (-5, 9)

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Graphing Quadratics in Vertex Form

Use the graph to write an equation for vertex form.



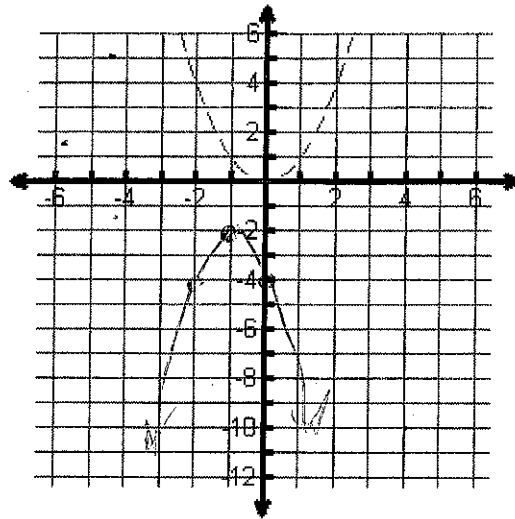
Graph the following equations and fill in the missing information. Describe the characteristics in words. The parent graph has been graphed with a dashed line for a reference.

1. $f(x) = -2(x+1)^2 - 2$

Vertex: $(-1, -2)$ A.O.S. _____

x	f(x)
-3	
-2	
-1	
0	
1	

a: _____
h: _____
k: _____

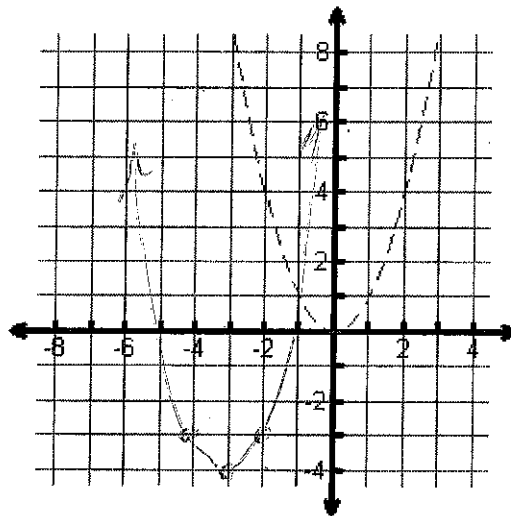


2. $f(x) = (x+3)^2 - 4$

Vertex: $(-3, -4)$ A.O.S. _____

x	f(x)

a: _____
h: _____
k: _____



3. $f(x) = -x^2 + 4$

Vertex: $(0, 4)$ A.O.S. _____

x	f(x)

a: _____
h: _____
k: _____

