Name "Teacher" 1/2 Date April 4, 2018 Section 2.Q.3

Vertex Form of a Quadratic Function

$$f(x) = a(x-h)^2 + k;\ \text{Vertex: } (h,k)$$

a
indicates opening + up or down, − normal width, narrower, or wider width.
integer → fraction

h
indicates a horizontal translation $(x+h)^2$ (movement left or right on the x-axis)
$(x-h)^2$

k
indicates a vertical translation (movement up or down on the y-axis)
positive (k) → negative (k)

Parent Quadratic Function Written in a Vertex Form

$$y = f(x) = 1(x-0)^2 + 0;\ \text{Vertex: } (0,0) \quad y = x^2$$

Graph the quadratic function given in vertex form.

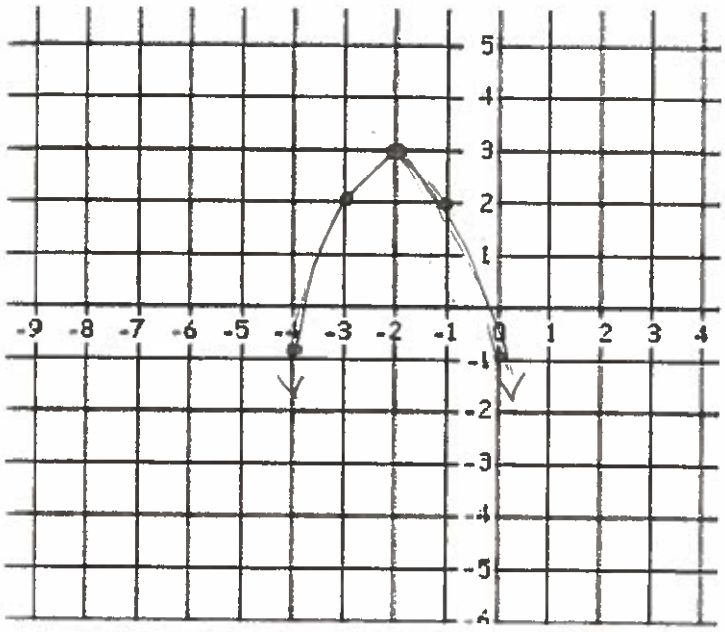
1) Identify the vertex.
2) Choose 2 points on the left or right arm of the function.
3) Identify the axis of symmetry.
4) Reflect the points over the axis of symmetry.
5) Identify the transformations (shift up, down, right, left, or reflect over x-axis).

Ex. 1 $f(x) = -(x+2)^2 + 3$ $h = -2$, $k = 3$
$(x-h)$

Vertex: $(-2, 3)$

Table:

x	$-(x+2)^2+3$	y	$f(x) = y$	(x, y)
-2	$-(-2+2)^2+3$	3	$f(-2) = 3$	$(-2, 3)$
-1	$-(-1+2)^2+3$	2	$f(-1) = 2$	$(-1, 2)$
0	$-(0+2)^2+3$	-1	$f(0) = -1$	$(0, -1)$



Axis of Symmetry (AOS):

YOX $x = -2$

Transformations:

$a = -1$ → ROX, normal width
$h = -2$ → shift left 2 units
$k = 3$ → shift up 3 units

You Try 2 $f(x) = \frac{1}{2}(x-1)^2 + 3$ $h = 1$ $k = 3$

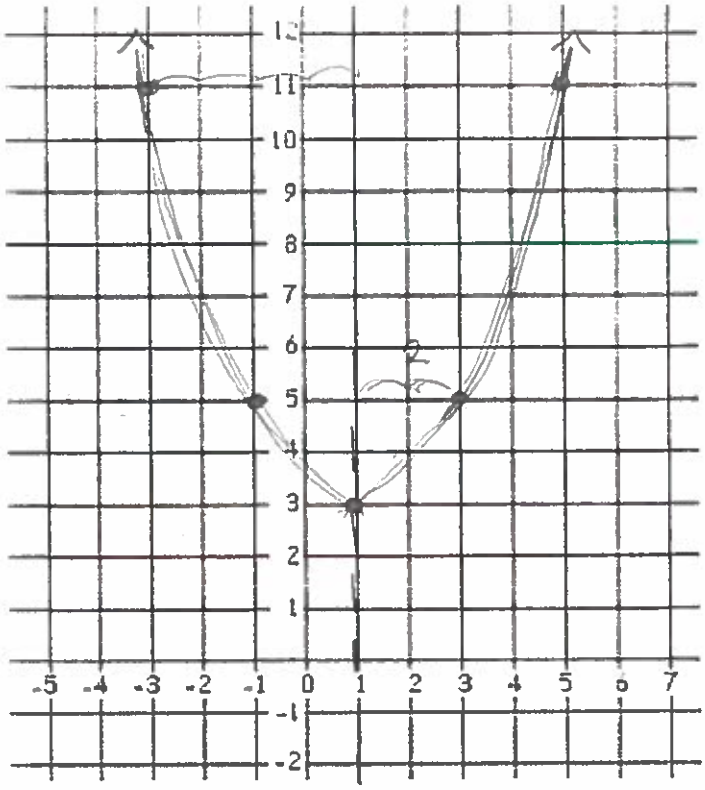
Vertex: $(1, 3)$

Table:

x	$\frac{1}{2}(x-1)^2+3$	y	$f(x) = y$	(x, y)
1	$\frac{1}{2}(1-1)^2+3$	3	$f(1)=3$	$(1,3)$
3	$\frac{1}{2}(3-1)^2+3$	5	$f(3)=5$	$(3,5)$
5	$\frac{1}{2}(5-1)^2+3$	11	$f(5)=11$	$(5,11)$

**How did we choose x-values?

go by 2 b/c of 1/2



Axis of Symmetry (AOS):

VOX $x = 1$

Transformations:

$a = \frac{1}{2}$ ⟶ wider

$h = 1$ ⟶ shifted 1 to the right

k ⟶ shifted up 3 units

Matching

Match the function to its transformation from the parent function, $y = x^2$. Not all options will be used. Then, for each function, identify the ordered pair of the vertex, (h, k).

1. g $f(x) = x^2 + 8$
2. i $f(x) = (x-9)^2$
3. h $f(x) = (x+2)^2$ $(x - \underbrace{-2}_{h})^2$
4. f $f(x) = -x^2 + 3$
5. e $f(x) = 4x^2$
6. a $f(x) = \frac{1}{5}x^2$
7. c $f(x) = 2(x-3)^2 + 1$
8. b $f(x) = -x^2$
9. j $f(x) = \frac{1}{5}(x+3)^2 - 4$

A. Wider

B. Reflected over the x-axis

C. Narrower, Shifted Right, Shifted Up

D. Reflected over the y-axis

E. Narrower

F. Reflected over the x-axis, shifted up

G. Shifted Up

H. Shifted Left

I. Shifted Right

J. Wider, Shifted Left, Shifted Down