NAME: _____ PERIOD: _____

# UNIT 5

## QUADRATIC FUNCTIONS

## Packet 3

## VERTEX AND VERTEX FORM

Notes and Practice – Standard Form – Finding a Vertex

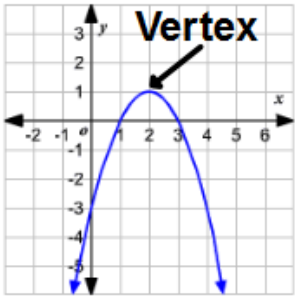
Notes and Practice – Vertex Form – Finding a Vertex

Notes and Practice – Converting to Vertex Form

Notes and Practice – Vertex Form – Transformations

Notes and Practice – Mixed Review

## Finding a Vertex when in Standard Form $f(x) = ax^2 + bx + c$




**Step 1:** From standard form identify the a, b, and c.

**Step 2:** Find the x-coordinate by using the formula $\frac{-b}{2a}$

**Step 3:** Find the y-coordinate by substituting into the original function.

**EX1.** $f(x) = 2x^2 + 4x - 1$

a = ____ b = ____ c = ____

**EX2.** $f(x) = x^2 - 4x + 3$

a = ____ b = ____ c = ____

**EX3.** $f(x) = x^2 + 6x - 9$

a = ____ b = ____ c = ____

**EX4.** $f(x) = 8x^2 + 2x - 5$

a = ____ b = ____ c = ____

**EX5.** $f(x) = 2x^2 + 3x - 7$

a = ____ b = ____ c = ____

**EX6.** $f(x) = x^2 - 13x + 9$

a = ____ b = ____ c = ____

**You Try: Find the Vertex of the following:**

1. $f(x) = x^2 + 8x - 1$

a = ____ b = ____ c = ____

2. $f(x) = 3x^2 + 6x - 10$

a = ____ b = ____ c = ____

3. $f(x) = 2x^2 - 4x + 9$

a = ____ b = ____ c = ____

4. $f(x) = x^2 - 10x + 1$

a = ____ b = ____ c = ____

5. $f(x) = 2x^2 - 8x + 3$

a = ____ b = ____ c = ____

6. $f(x) = 4x^2 + 4x - 11$

a = ____ b = ____ c = ____

7. $f(x) = -2x^2 + 8x - 14$

a = ____ b = ____ c = ____

8. $f(x) = -3x^2 - 12x + 9$

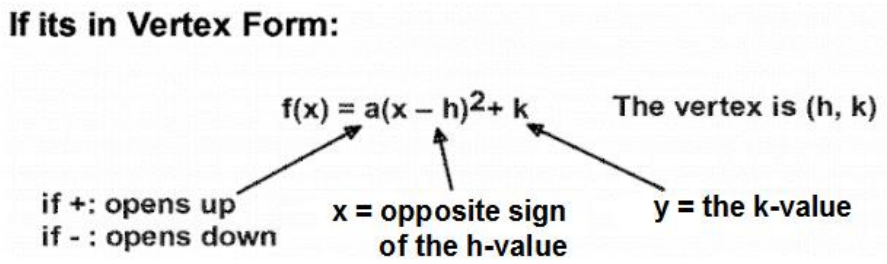
a = ____ b = ____ c = ____

9. $f(x) = 4x^2 - 8x = -5$

a = ____ b = ____ c = ____

## Finding a Vertex when in Vertex Form $f(x) = a(x - h)^2 = k$

**If its in Vertex Form:**




**Example: $f(x) = -2(x - 5)^2 + 4$**

**Direction: Opens** _____

**Vertex:** _____

**A.O.S.:**

1. **$f(x) = (x - 4)^2 + 3$** Direction (circle): Opens _____

   Vertex: _____ Axis of Symmetry: _____

2. **$f(x) = -4(x + 8)^2 + 2$** Direction (circle): Opens _____

   Vertex: _____ Axis of Symmetry: _____

3. **$f(x) = 2(x + 2)^2 - 4$** Direction (circle): Opens _____

   Vertex: _____ Axis of Symmetry: _____

4. **$f(x) = (x - 4)^2 + 2$** Direction (circle): Opens _____

   Vertex: _____ Axis of Symmetry: _____

5. **$f(x) = -2(x + 2)^2$** Direction (circle): Opens _____

   Vertex: _____ Axis of Symmetry: _____

6. **$f(x) = -(x + 1)^2 + 6$** Direction (circle): Opens _____

   Vertex: _____ Axis of Symmetry: _____

## Converting to Vertex Form by Completing the Square:

**Example 1:** $y = x^2 + 8x + 2$

**Example 2:** $y = x^2 - 4x + 10$

**Example 3:** $y = x^2 - 2x - 5$

**Example 4:** $y = x^2 - 4x - 7$

**Example 5:** $y = 3x^2 + 12x - 9$

**Example 6:** $y = 4x^2 + 24x - 8$

**You Try: Convert the following to vertex form by completing the square.**

**1.** $y = x^2 - 2x - 2$

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

**3.** $y = x^2 - 6x + 2$

**4.** $y = x^2 + 12x + 3$

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

**6.** $y = x^2 + 8x - 1$

**7.** $y = x^2 - 16x + 15$

**8.** $y = x^2 + x - 2$

**9.** $y = x^2 - x - 1$

**10.** $y = x^2 + 8x + 5$

**11.** $y = x^2 - 10x + 7$

**12.** $y = x^2 + 2x - 3$

## Using Vertex Form to Determine Transformations:

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

Shows 2 things:
* If (-) graph reflects
* If less than 1, graph will be wider. This is called a vertical shrink.
* If greater than 1, graph will be thinner. This is called a vertical stretch.

Horizontal Shift
* If (-) move right
* If (+) move left

Vertical Shift
* If (-) move down
* If (+) move up

**Example**

$f(x) = -5(x + 4)^2 - 6$

a = -5, therefore...
* The graph reflects
* There is a vertical stretch meaning graph will get thinner.

(x + 4) tells me:
* Graph moves left 4

- 6 on the end tells me:
* Graph moves down 6

**Identify the transformations for each of the following:**

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

   Reflection? Yes / No

   V.S. _____

   H.S. _____

   Dilation _____

2. $f(x) = -(x - 6)^2 - 7$

   Reflection? Yes / No

   V.S. _____

   H.S. _____

   Dilation _____

3. $f(x) = \frac{1}{2}(x + 8)^2 + 5$

   Reflection? Yes / No

   V.S. _____

   H.S. _____

   Dilation _____

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

   Reflection? Yes / No

   V.S. _____

   H.S. _____

   Dilation _____

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

   Reflection? Yes / No

   V.S. _____

   H.S. _____

   Dilation _____

6. $f(x) = -\frac{1}{2}(x - 8)^2 + 3$

   Reflection? Yes / No

   V.S. _____

   H.S. _____

   Dilation _____

## Mixed Review:

**Find the vertex and the AOS of the following:**

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

2. $f(x) = x^2 - 2x - 8$

3. $f(x) = x^2 + 16x - 22$

4. $f(x) = \frac{1}{2}(x + 3)^2 - 4$

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

6. $f(x) = -2(x - 3)^2 + 1$

**Convert to Vertex Form by completing the square. Identify the vertex and AOS:**

7. $f(x) = x^2 - 2x - 48$

8. $f(x) = x^2 + 12x + 20$

9. $f(x) = x^2 - 8x - 48$

**Identify the transformations of the following:**

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

Reflection? Yes / No

V.S. _____

H.S. _____

Dilation _____

11. $f(x) = -(x - 6)^2 - 7$

Reflection? Yes / No

V.S. _____

H.S. _____

Dilation _____

12. $f(x) = \frac{1}{2}(x + 8)^2 + 5$

Reflection? Yes / No

V.S. _____

H.S. _____

Dilation _____