Name: ______________________

Details of a Quadratic from the Equations & the Graph

EXAMPLE 1. Standard form: $f(x) = x^2 - 6x + 8$

$f(x) = x^2 - 6x\boxed{+8}$

y-int: $\underline{(\mathbf{0,8})\ \boldsymbol{or}\ \boldsymbol{y = 8}}$

Factored form: $f(x) = (x-2)(x-4)$

$What\ x's\ make\ (x-2) = 0 \quad or \quad (x-4) = 0$

$x = 2 \qquad or \qquad x = 4$

Zeros/x-int: $\underline{\boldsymbol{x = 2\ \ and\ \ x = 4\ \ or\ (2,0)\ and\ (4,0)}}$

Vertex Form: $f(x) = \left(x\underline{-3}\right)^2\underline{-1}$

Vertex: $\underline{(\mathbf{+3,-1})}$

Compare the vertex to vertex form. Notice anything?

For the intervals below, write as LOWEST, HIGHEST.

The <u>domain is x</u>, and the <u>range is y</u>.

The x's are unlimited: -forever to +forever

Domain: $-\infty, \infty$ **Range:** $\mathbf{-1}, \infty$

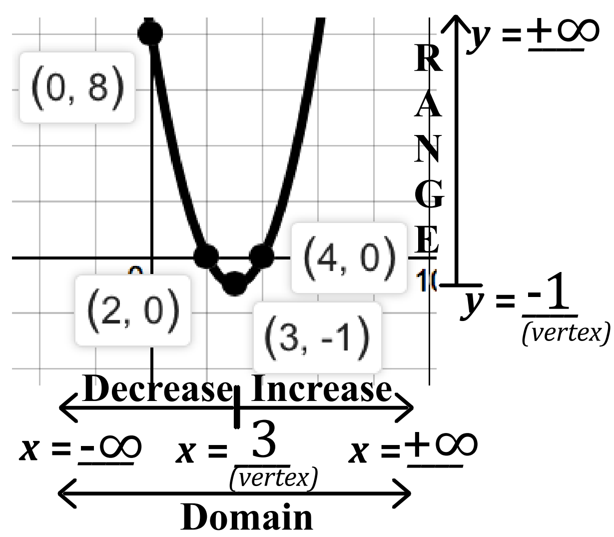
The y's are limited below by the vertex: y = -1 to +forever

The part that goes UP is on the right, starting at the vertex, where x = 3.

Interval of Increase: $\mathbf{3}, \infty$

Interval of Decrease: $-\infty, \mathbf{3}$

The part that goes DOWN is on the left, ending at the vertex, where x = 3.



The only place where a quadratic stops is at the vertex (turning point). The rest of the time, it continues forever.

So, to describe its movement, I use the infinity symbol:

-∞ means smallest forever & +∞ means biggest forever

EXAMPLE 2. Standard form: $f(x) = -5x^2 + 10x + 15$

$f(x) = -5x^2 + 10x\boxed{+15}$

y-int: $\underline{(\mathbf{0,15})\ \boldsymbol{or}\ \boldsymbol{y = 15}}$

Factored form: $f(x) = -5(x-3)(x+1)$

$What\ x's\ make\ (x-3) = 0 \quad or \quad (x+1) = 0?$

$x = 3 \quad or \qquad x = -1$

Zeros/x-int: $\underline{\boldsymbol{x = -1\ \ and\ \ x = 3\ \ or\ (-1,0)\ and\ (3,0)}}$

Vertex Form: $f(x) = -5\left(x\underline{-1}\right)^2\underline{+20}$

Vertex: $\underline{(\mathbf{1,20})}$

Compare the vertex to vertex form. Notice anything?

For the intervals below, write as LOWEST, HIGHEST.

The <u>domain is x</u>, and the <u>range is y</u>.

The x's are unlimited: -forever to +forever

Domain: $-\infty, \infty$ **Range:** $-\infty, \mathbf{20}$

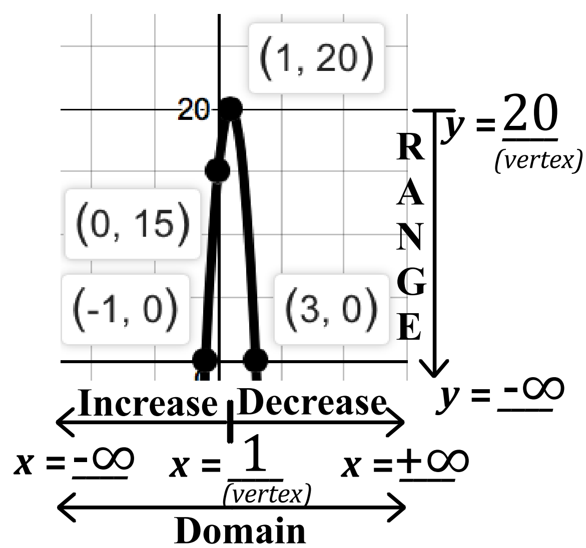
The y's are limited above by the vertex:-forever to y = 20

The part that goes UP is on the left, ending at the vertex, where x = 1.

Interval of Increase: $-\infty, \mathbf{1}$

Interval of Decrease: $\mathbf{1}, \infty$

The part that goes DOWN is on the right, starting at the vertex, where x = 1.



1. Standard form: $f(x) = -x^2 + 6x - 8$

y-int: ____________

Factored form: $f(x) = -(x - 2)(x - 4)$

Zeros/x-int: ____________

Vertex Form: $f(x) = -(x - 3)^2 + 1$

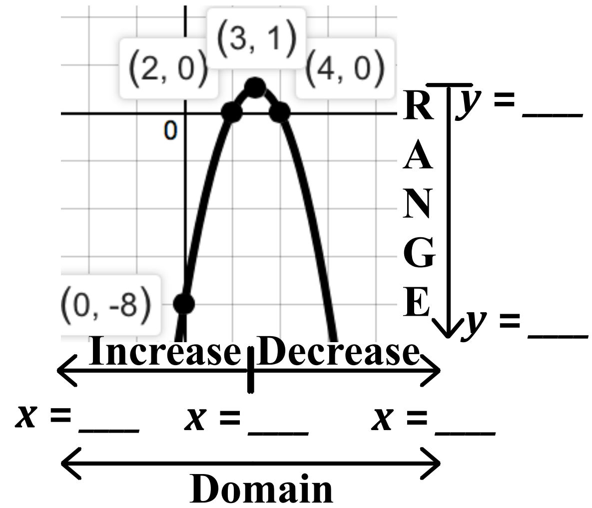
Vertex: ____________

Compare the vertex to vertex form. Notice anything?

For the intervals below, write as LOWEST, HIGHEST.

Domain: _______ , _______ Range: _______ , _______

Interval of Increase: _______ , _______ Interval of Decrease: _______ , _______



2. Standard form: $f(x) = x^2 + 2x - 3$

y-int: ____________

Factored form: $f(x) = (x + 3)(x - 1)$

Zeros/x-int: ____________

Vertex Form: $f(x) = (x + 1)^2 - 4$

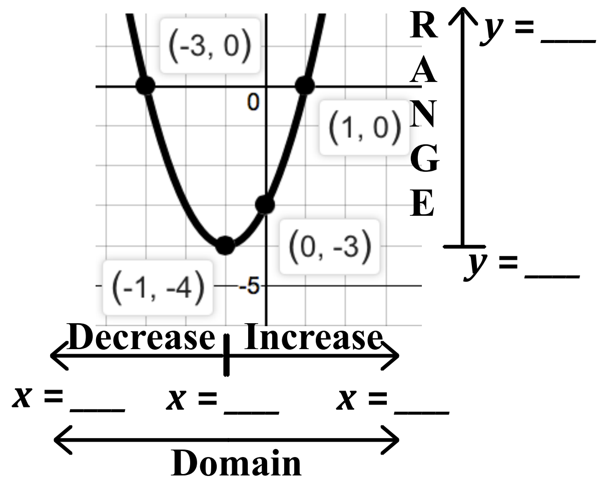
Vertex: ____________

Compare the vertex to vertex form. Notice anything?

For the intervals below, write as LOWEST, HIGHEST.

Domain: _______ , _______ Range: _______ , _______

Interval of Increase: _______ , _______ Interval of Decrease: _______ , _______



3. Standard form: $f(x) = 4x^2 + 24x + 20$

y-int: ____________

Factored form: $f(x) = 4(x + 1)(x + 5)$

Zeros/x-int: ____________

Vertex Form: $f(x) = 4(x + 3)^2 - 16$

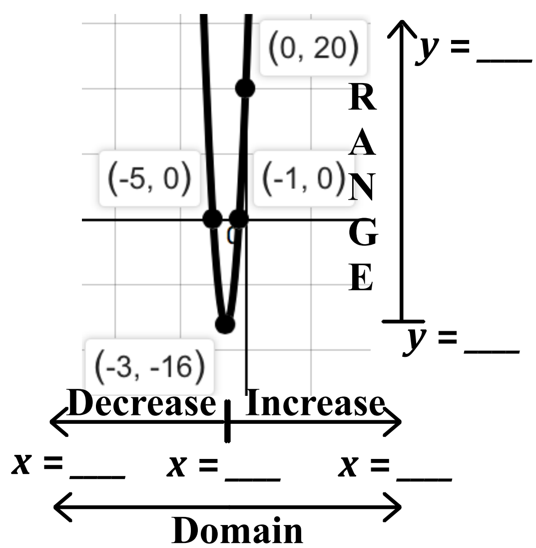
Vertex: ____________

Compare the vertex to vertex form. Notice anything?

For the intervals below, write as LOWEST, HIGHEST.

Domain: _______ , _______ Range: _______ , _______

Interval of Increase: _______ , _______ Interval of Decrease: _______ , _______



4. Standard form: $f(x) = -x^2 - 8x - 7$

y-int: ___________

Factored form: $f(x) = -(x+7)(x+1)$

Zeros/x-int: ___________

Vertex Form: $f(x) = -(x+4)^2 + 9$

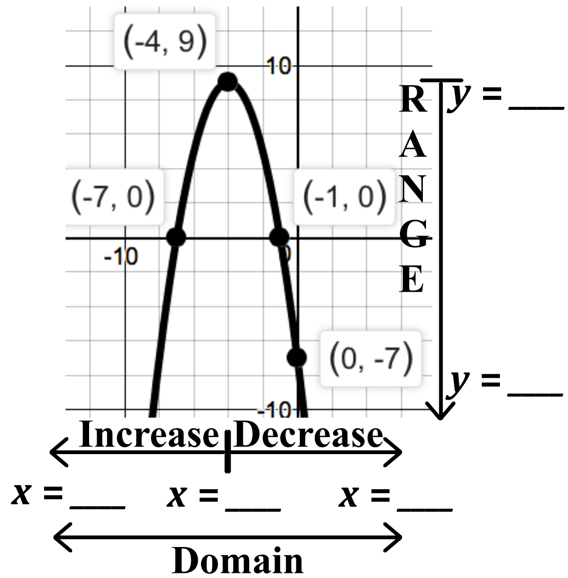
Vertex: ___________

Compare the vertex to vertex form. Notice anything?

For the intervals below, write as LOWEST, HIGHEST.

Domain: ______ , ______ Range: ______ , ______

Interval of Increase: ______ , ______ Interval of Decrease: ______ , ______



5. Standard form: $f(x) = -3x^2 + 24x - 21$

y-int: ___________

Factored form: $f(x) = -3(x-1)(x-7)$

Zeros/x-int: ___________

Vertex Form: $f(x) = -3(x-4)^2 + 27$

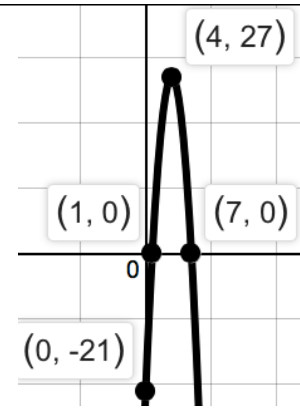
Vertex: ___________

Compare the vertex to vertex form. Notice anything?

For the intervals below, write as LOWEST, HIGHEST.

Domain: ______ , ______ Range: ______ , ______

Interval of Increase: ______ , ______ Interval of Decrease: ______ , ______



6. Standard form: $f(x) = x^2 + 8x + 7$

y-int: ___________

Factored form: $f(x) = (x+7)(x+1)$

Zeros/x-int: ___________

Vertex Form: $f(x) = (x+4)^2 - 9$

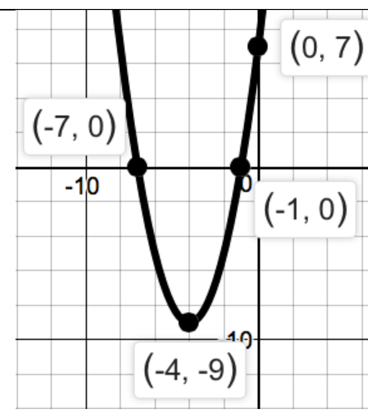
Vertex: ___________

Compare the vertex to vertex form. Notice anything?

For the intervals below, write as LOWEST, HIGHEST.

Domain: ______ , ______ Range: ______ , ______

Interval of Increase: ______ , ______ Interval of Decrease: ______ , ______



Now, we need to work on using correct interval notation. So far, you have written your DOMAIN, RANGE, Interval of INCREASE and Interval of DECREASE as "lowest, highest." While this format is correct, it is also incomplete.

The incomplete notation you have used tells us where the interval starts and where it ends. But it does not tell us whether the start and end are part of the interval ("included") or not part of the interval.

Think of it like "greater than or equal to" instead of simply "greater than"

[&] mean "or equal to," whereas (&) mean "but not equal to"

Translate our inequality symbols using the examples below.

EXAMPLE 3. $-2 \leq x \leq 5$ Interval: $[-2, 5]$	**EXAMPLE 4.** $-2 < x < 5$ Interval: $(-2, 5)$	**EXAMPLE 5.** $-2 < x \leq 5$ Interval: $(-2, 5]$	7. $-2 \leq x < 5$ Interval:	8. $3 < x \leq 7$ Interval:
9. $3 \leq x \leq 7$ Interval:	10. $3 \leq x < 7$ Interval:	11. $3 < x < 7$ Interval:	12. $-8 < y \leq -4$ Interval:	13. $-8 \leq y \leq -4$ Interval:

Nothing can be equal to infinity, which means that ∞ will never be included.

Meaning: Infinity will **always** be $(-\infty$ **or** $, \infty)$ *and* ***never*** *next to* $[-\infty$ **or** $, \infty]$

14. $-\infty < x \leq 5$ Interval:	15. $-\infty < x < 5$ Interval:	16. $7 < y < \infty$ Interval:	17. $7 < y < \infty$ Interval:	18. $-\infty < x < \infty$ Interval:

For **intervals of increase and decrease**, the vertex (turning point) is neither increasing nor decreasing, so it will not be included in either.

Meaning: Intervals of <u>increase and decrease</u> are always (−∞, vertex) or (vertex, ∞)

19. Increase: $6, \infty$ should be: __ $6, \infty$ __	20. Decrease: $-\infty, 6$ should be: __$-\infty, 6$ __	21. Increase: $-\infty, -4$ should be: __$-\infty, -4$ __	22. Decrease: $-4, \infty$ should be: __$-4, \infty$__

For **domain and range**, the vertex is a part of the graph, which means it is included in both the domain and the range.

Meaning: the <u>domain and range</u> will always be either: (−∞,∞), [vertex, ∞) or (−∞, vertex]

23. Domain: $-\infty, \infty$ should be: __$-\infty, \infty$__	24. Range: <u>$5, \infty$</u> should be: __ $5, \infty$__	25. Range: $-\infty, 7$ should be: __$-\infty, 7$__	26. Domain: $-\infty, \infty$ should be: __$-\infty, \infty$__

Using the notation that you now know, go back to questions 1-6 and put the correct brackets on the Domain, Range and Intervals of Increase and Decrease.