vertex *down* *vertex* *UP*

5C – Comparing Functions

5D – Transformations

5B – Graphs of Quadratics and Exponentials

❖ <u>Vocabulary, Formulas, Theories</u>:

- **Quadratic Function**: a function where the degree (or largest exponent) is __2__. The graph is a

  parabola that opens __*up or down*__. The standard form of a quadratic function is written as

  __$y = ax^2 + bx + c$__ where __$a \neq 0$__.

- **Vertex Form**: an algebraic representation of a parabola. It's written as __$y = a(x-h)^2 + k$__

  where __$a \neq 0$__ and the vertex is __(h, k)__. That's when the parabola opens

  __*up or down*__. If it opens __*left or right*__, it's written as __$x = a(y-k)^2 + h$__

  where __$a \neq 0$__ and the vertex is __(h, k)__.

- **Exponential Function**: a function that has a variable as an _____ . It takes the
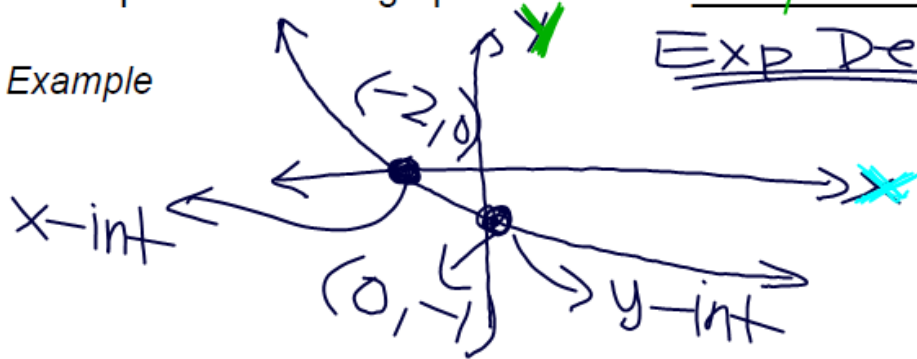
- **Exponential Function**: a function that has a variable as an ___*exponent*___ . It takes the form: ___$y = a \cdot b^x$___ where ___$a > 0$___ and either b is between 0 and 1 or greater than 1.

  This is written algebraically as ___$0 < b < 1$___ or ___$b > 1$___

- **Intercepts**: the x-intercept is the point where the graph crosses the ___$x-axis$___ and the y-intercept is where the graph crosses the ___$y-axis$___ .
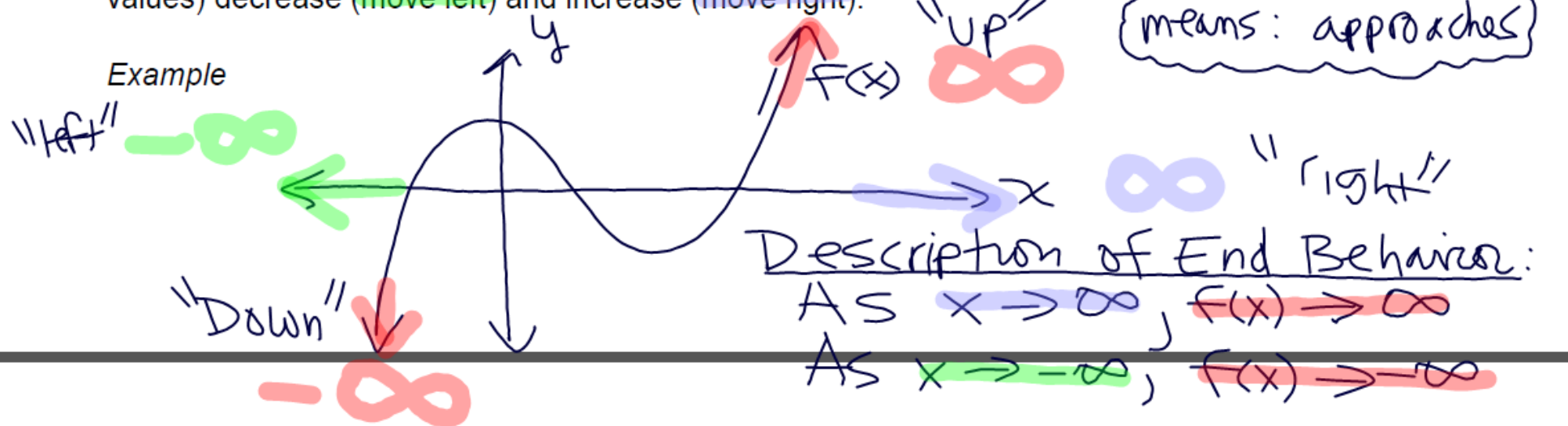
  Example

  Exp Decay

  $x-int @ -2$

  $y-int @ -1$

- **End Behavior**: the direction of the vertical values (ex: _____) as the horizontal values (ex: x values) decrease (move left) and increase (move right).

  Example

- **End Behavior**: the direction of the vertical values (ex: __y–values__) as the horizontal values (ex: x ☺

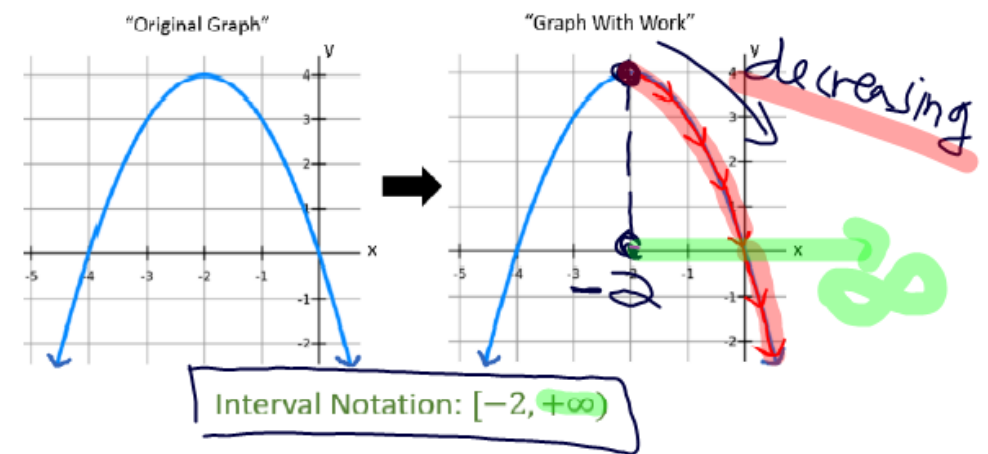 values) decrease (move left) and increase (move right).

  Example

  "left" $-\infty$

  "Down" $-\infty$

  "up" ∞

  "f(x)"

  means: approaches

  $\rightarrow$ x ∞ "right"

  Description of End Behavior:
  AS X $\rightarrow \infty$, f(x) $\rightarrow \infty$
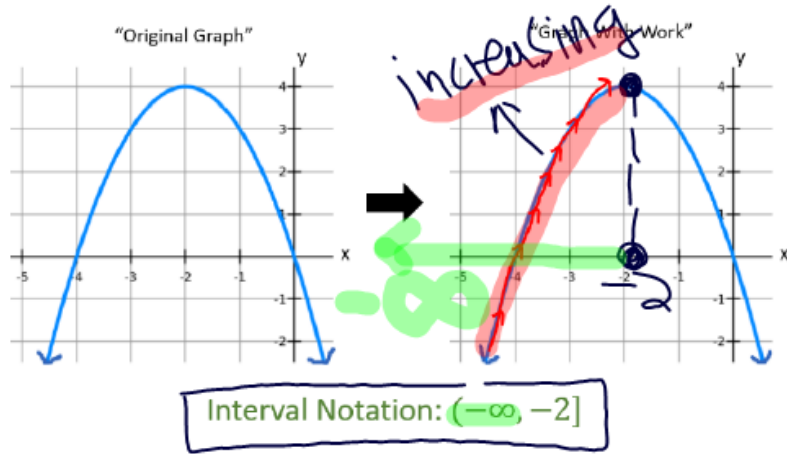 AS X $\rightarrow -\infty$, f(x) $\rightarrow -\infty$

- **Increasing/Decreasing Intervals**: an interval represented by the _____

  where the vertical y values are _____. See the example below:

  y values are increasing from negative infinity to x = -2   y values are decreasing from x = -2 to positive infinity

- **Increasing/Decreasing Intervals**: an interval represented by the _horizontal x-values_

  where the vertical y values are _increasing or decreasing_. See the example below:

  y values are increasing from negative infinity to x = -2   y values are decreasing from x = -2 to positive infinity

  "Original Graph"   "Graph With Work"   "Original Graph"   "Graph With Work"

  increasing   *decreasing*

  Interval Notation: $(-\infty, -2]$ Interval Notation: $[-2, +\infty)$

- **System of Equations**: a set of two or more equations with more than one variable.

- **Solution to a System of Equations**: the solution(s) to a system of equations (a set of two or more equations) is represented on a graph by the intersection(s)

EX1) Identify the x-intercepts and y-intercept of the equation: $y = x^2 + x - 20$.

x-int @ -5 and 4

y-int @ -20
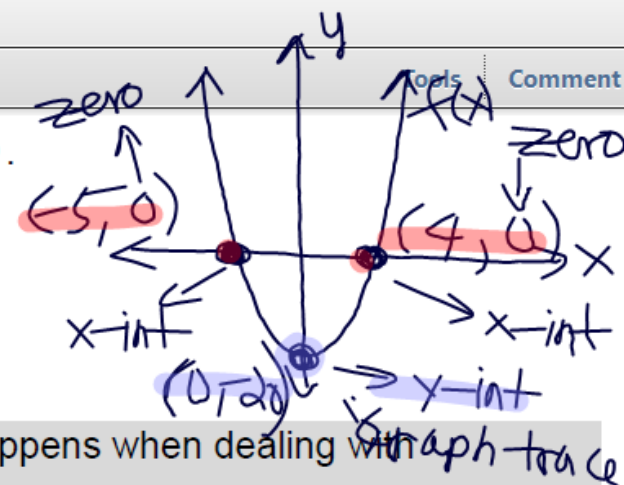
Plug 0 for x: $0^2 + 0 - 20 = -20$

f(x)

zero

(-5, 0)

x-int

(0, -20)

y

zero

(4, 0)

x-int

y-int

graph-trace

Some functions can be identified as increasing or decreasing. That often happens when dealing with exponential functions.

▶ Video - "Increasing and Decreasing Functions - Example" - MathontheWeb (2:04)

EX2) Determine whether the function is increasing or decreasing.

    a. $y = 2^{x-3}$

    b. $y = 3^{-x+1}$

Some functions can be identified as increasing or decreasing. That often happens when dealing with exponential functions.

▶ Video - "Increasing and Decreasing Functions - Example" - MathontheWeb (2:04)

EX2) Determine whether the function is increasing or decreasing.

a. $y = 2^{x-3}$

b. $y = 3^{-x+1}$

a)

y-int

INCREASING

b)

y-int

DECREASING