Warmup:

Evaluate the following functions:

y = f(x) at the right

$g(x) = 3x + 4$ $\qquad$ $h(x) = -2x + 1$

1) $g(2) = 10$ $\qquad$ 2) $h(-1) = 3$

3) $g(x) = 130$ $\qquad$ 4) $h(x) = 2211$

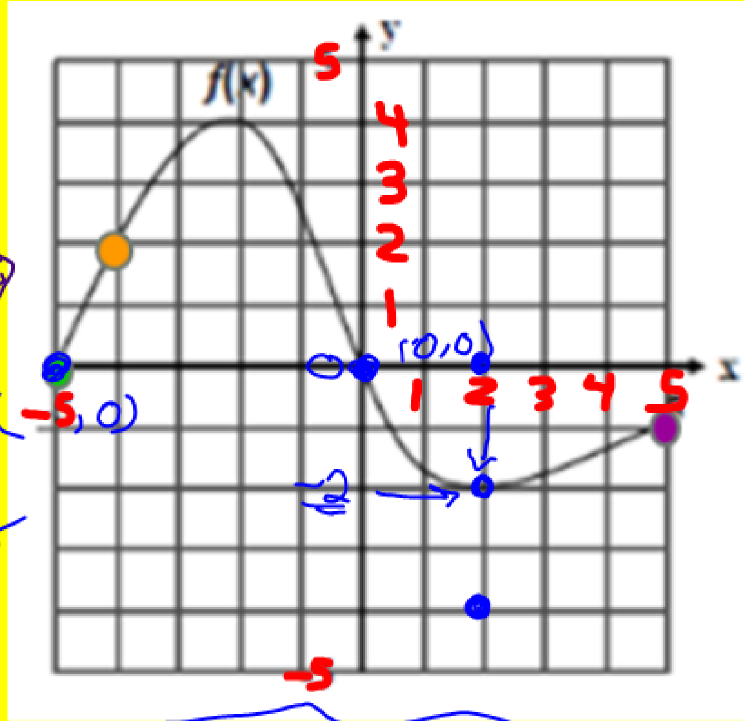
$x = 42$ $\qquad$ $130 = 3x + 4$ $\qquad$ $2211 = -2x + 1$ $\qquad$ $x = -1105$

5) $f(2) = -2$ $\qquad$ 6) $f(x) = 0$

$(2, -2)$ $\qquad$ $(0, 0)$

$(-5, 0)$

$x = 0$ & -5



#1) $(2, 10)$

#3) $(42, 130)$

#2) $(-1, 3)$

#4) $(-1105, 2211)$

HW #9 Answer Key

1. Evaluate the following expressions given the functions . $g(x) = -3x + 1$ $f(x) = 5 - 7x$

a. $g(10) = -3 \cdot 10 + 1$
$= -30 + 1$
$g(10) = -29$

b. $f(3) = 5 - 7 \cdot 3$
$= 5 - 21$
$f(3) = -16$

c. $g(-2) = -3 \cdot -2 + 1$
$= 6 + 1$
$g(-2) = 7$

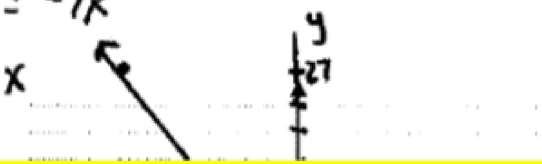
d. $f(-7) = 5 - 7 \cdot -7$
$= 5 + 49$
$f(-7) = 54$

e. Find x if $g(x) = 16$

$16 = -3x + 1$
$15 = -3x$
$-5 = x$

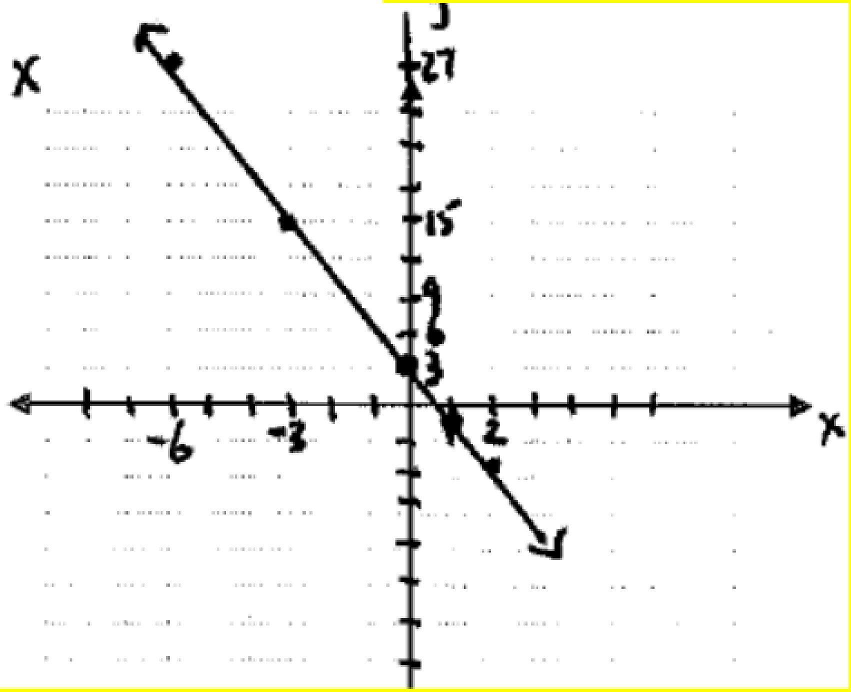
f. Find x if $f(x) = 23$

$23 = 5 - 7x$
$18 = -7x$
$\frac{-18}{7} = x$



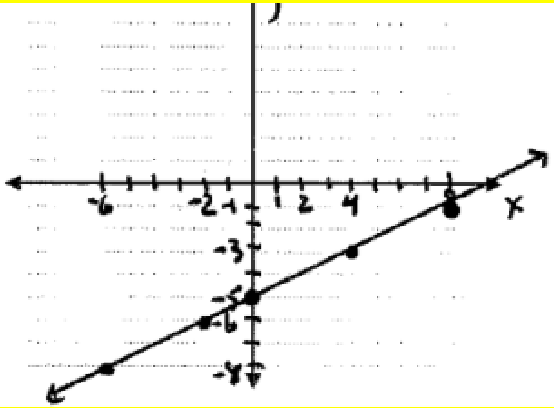
2. Given $f(x) = 3 - 4x$. Fill in the table and then sketch a graph.

x	$f(x)$
-6	27
-3	15
0	3
1	-1
2	-5



3. Given $f(x)=\frac{1}{2}x-5$. Fill in the table and then sketch a graph.

x	$f(x)$
-6	-8
-2	-6
0	-5
4	-3
8	-1



4. Translate the following statements into coordinate points, then plot them.

a. $f(-1) = 1$ $(-1, 1)$

b. $f(2) = 7$ $(2, 7)$

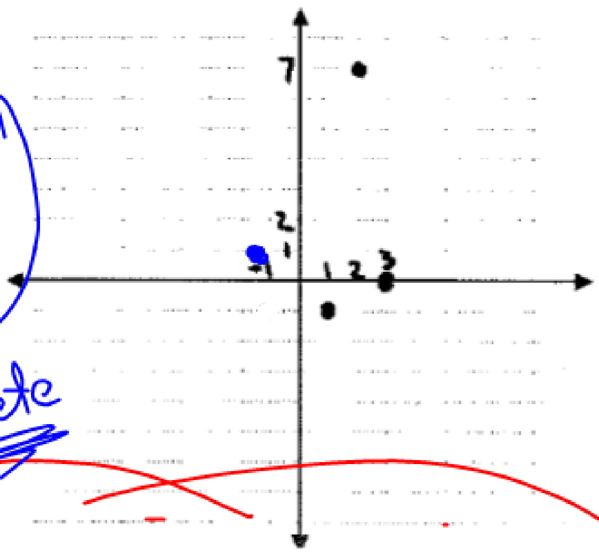
c. $f(1) = -1$ $(1, -1)$

d. $f(3) = 0$ $(3, 0)$

$f(x) = y$

Finite Points

discrete



Domain : $\{-1, 1, 2, 3\}$

Range : $\{-1, 0, 1, 7\}$

5. Given this graph of the function f(x):

Find:

a. $f(-1) =$ 2

b. $f(4) =$ 5

c. $f(3) =$ 2

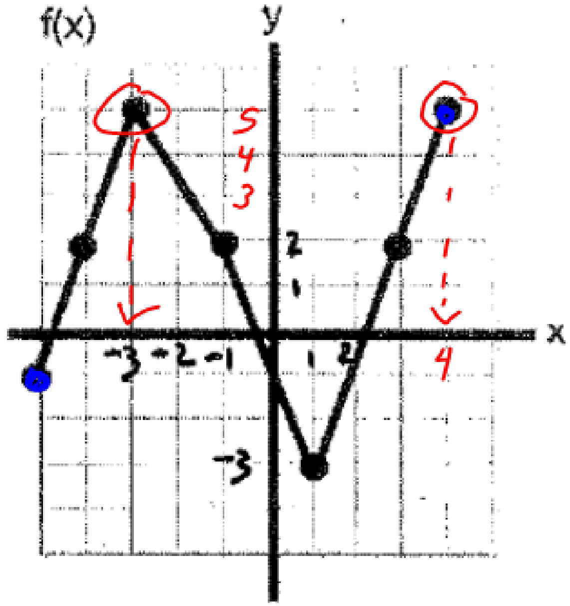
d. x when $f(x) = -3$ x = 1

e. $f(-5) =$ -1

f. x when $f(x) = 5$ x = -3 & +4

Infinite Points

continuous



Domain : (-5, 4)

[-5, 4]

Range : ~~[5, 3]~~

[-3, 5]

6. Given this graph of the function f(x):

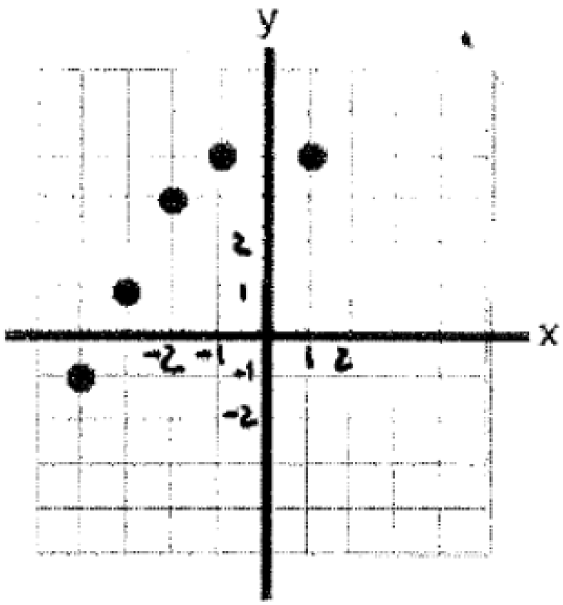
Find:

a. $f(-2) =$ 3

b. x when $f(x) = 1$ x = -3

c. $f(1) =$ 4

d. x when $f(x) = -1$ x = -4



E.Q.

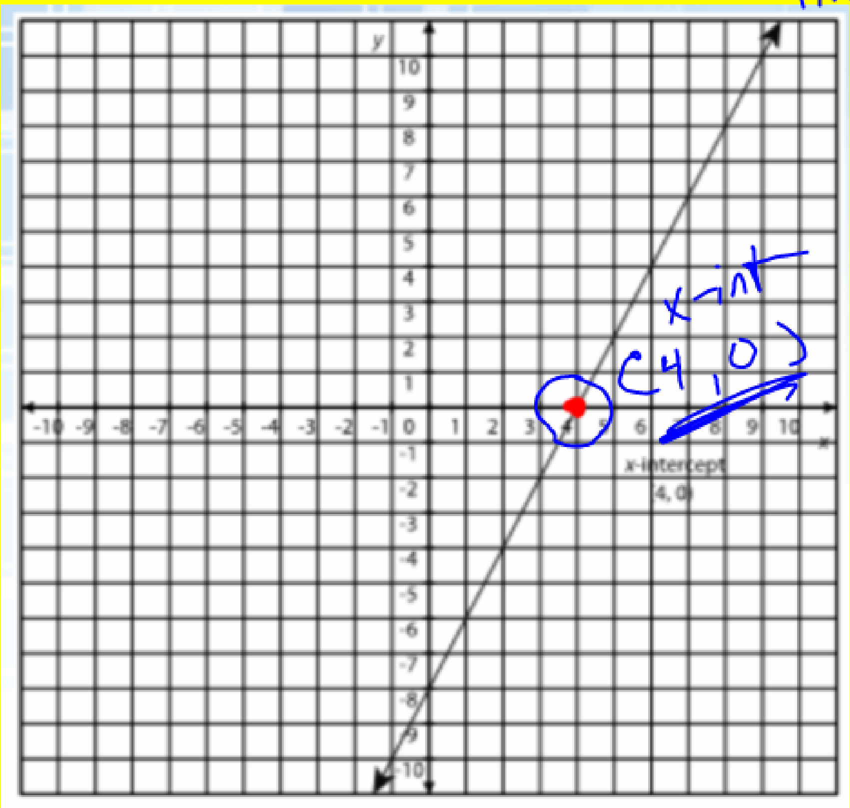
How do I interpret key features of graphs in context?

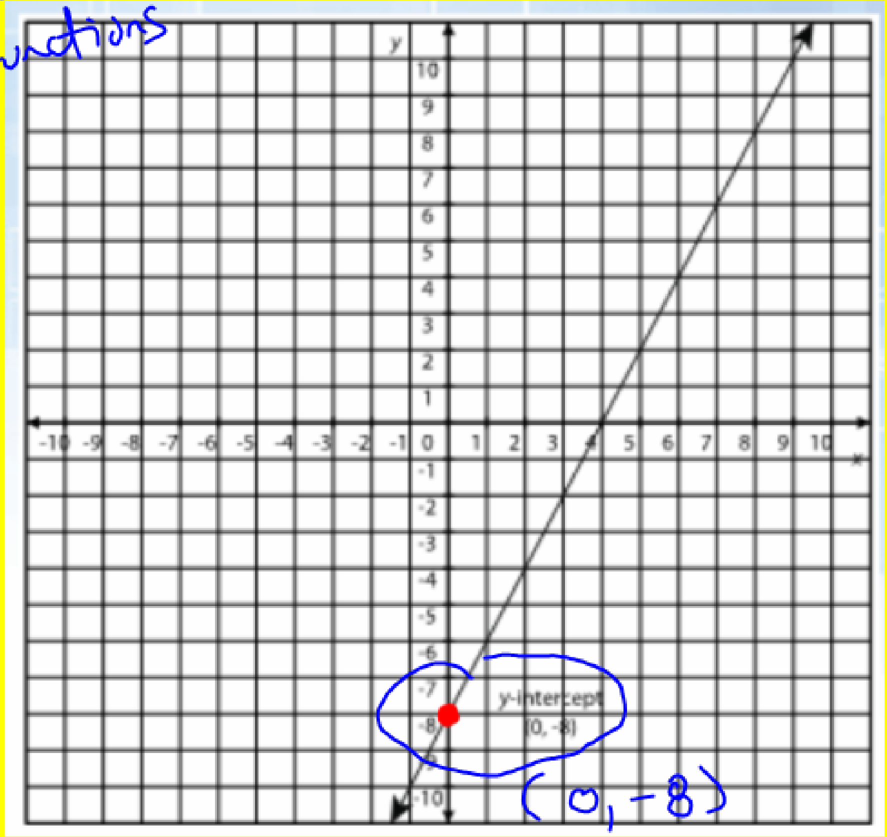
Intercepts

- One of the first characteristics of a graph that we can observe are the **intercepts**, where a function crosses the *x*-axis and *y*-axis.
  - max of 1
  - The *y*-intercept is the point at which the graph crosses the *y*-axis, and is written as (0, *y*).
  - can have more than 1.
  - The ***x*-intercept** is the point at which the graph crosses the *x*-axis, and is written as (*x*, 0).

Intercepts

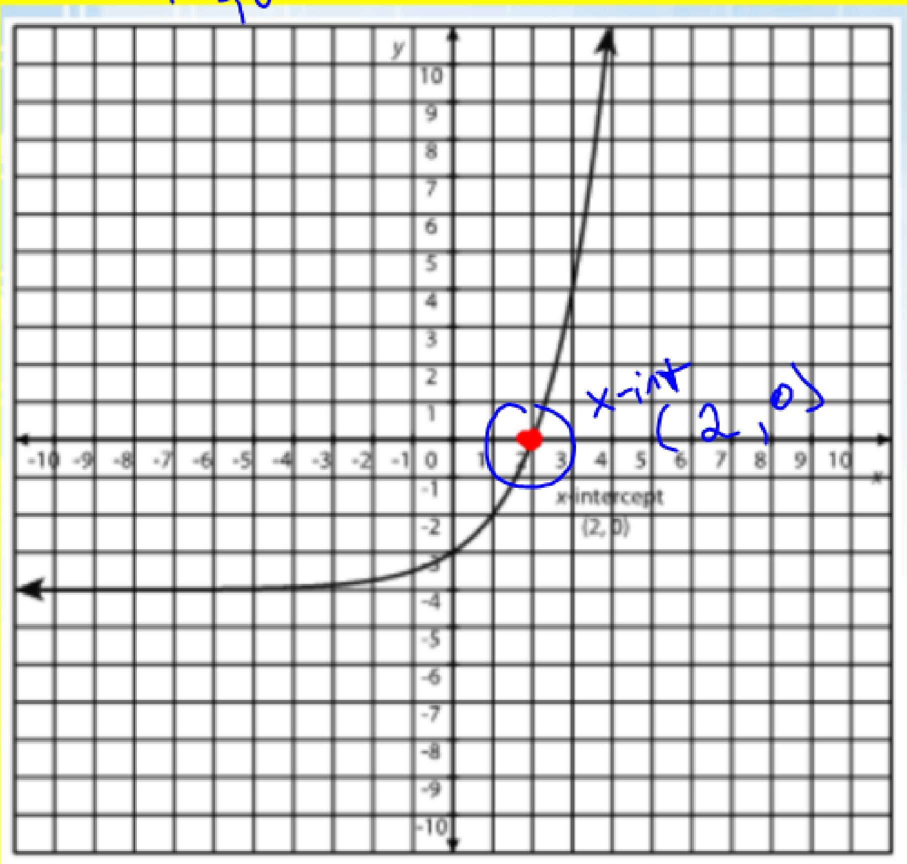
linear functions

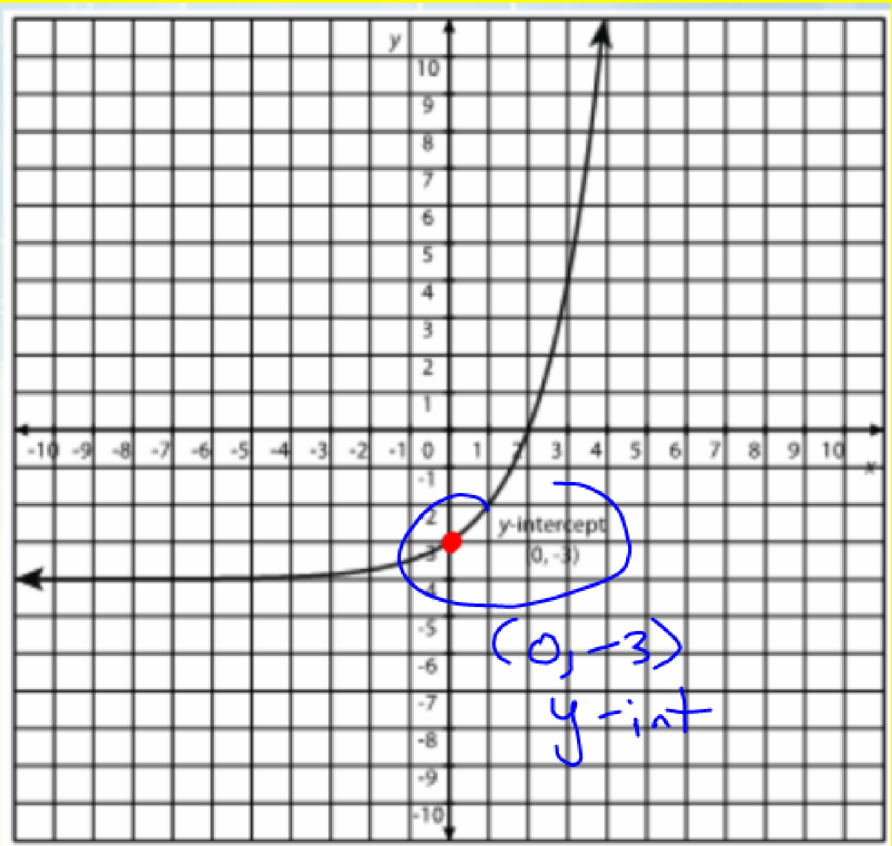




~~Unity~~ exponential functions

Intercepts



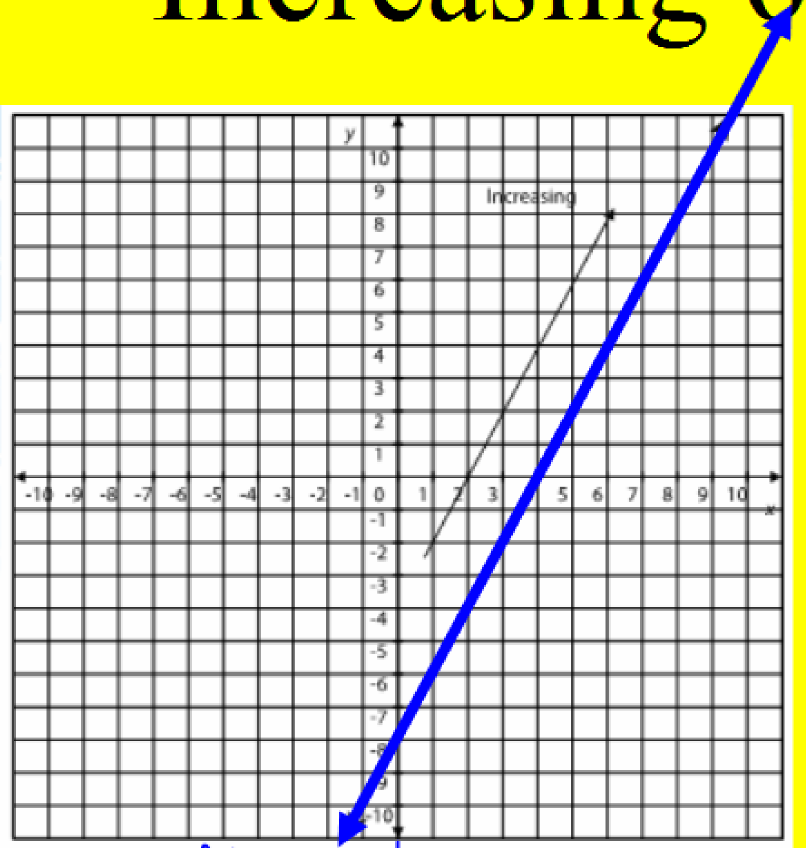


Increasing or Decreasing?

- Another characteristic of graphs that we can observe is whether the graph represents a function that is increasing or decreasing.
- When determining whether intervals are increasing or decreasing, focus just on the *y*-values.
- Begin by reading the graph from left to right and notice what happens to the graphed line. If the line goes up from left to right, then the function is increasing. If the line is going down from left to right, then the function is decreasing.
- A function is said to be constant if the graphed line is horizontal, neither rising nor falling.

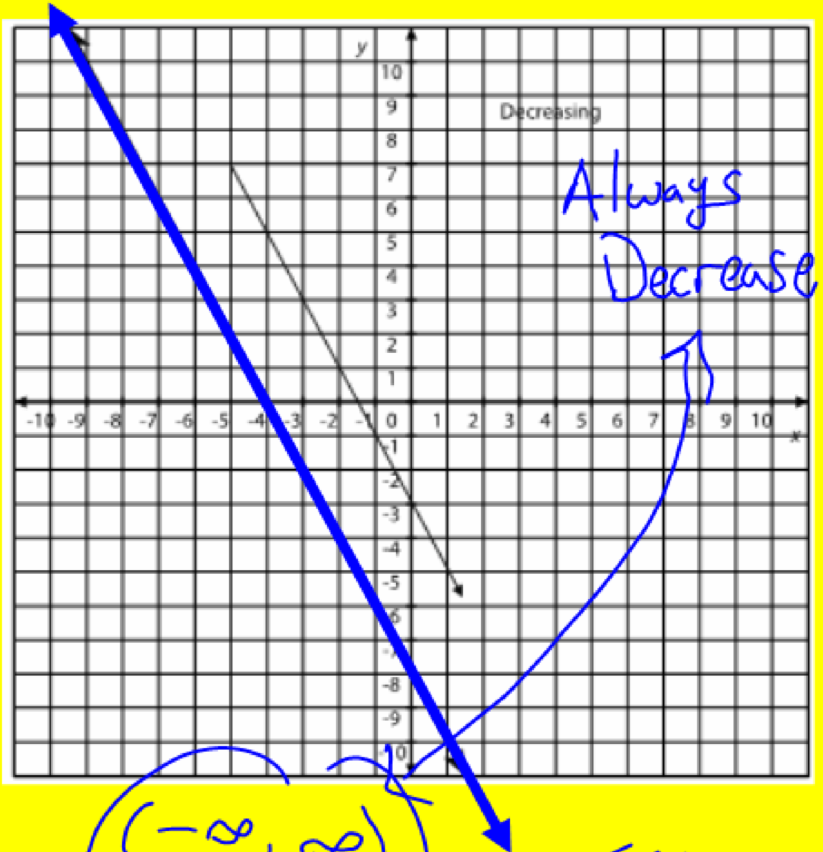
write the intervals using the x-values

Increasing or Decreasing?



Always Increasing.

$(-\infty, \infty)$

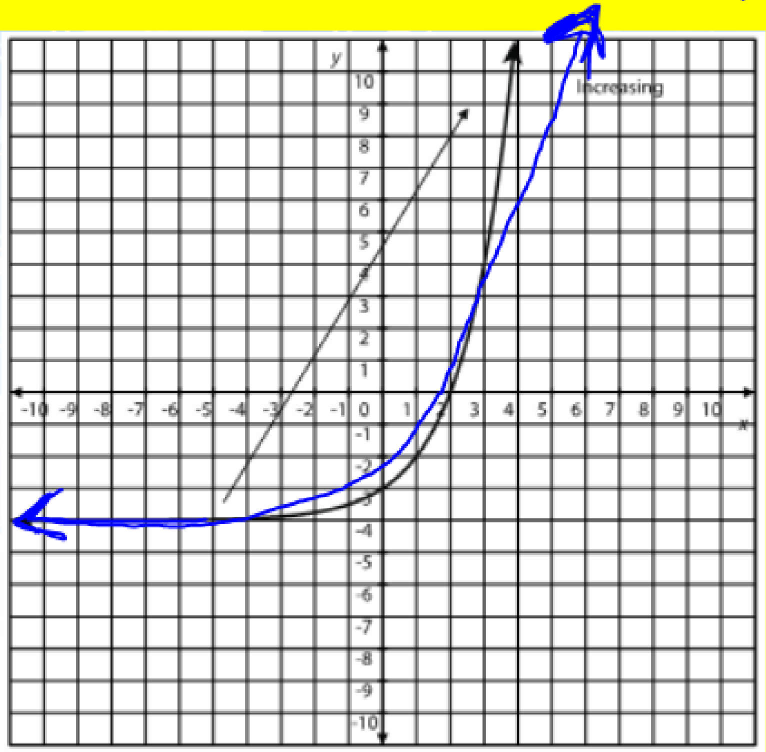


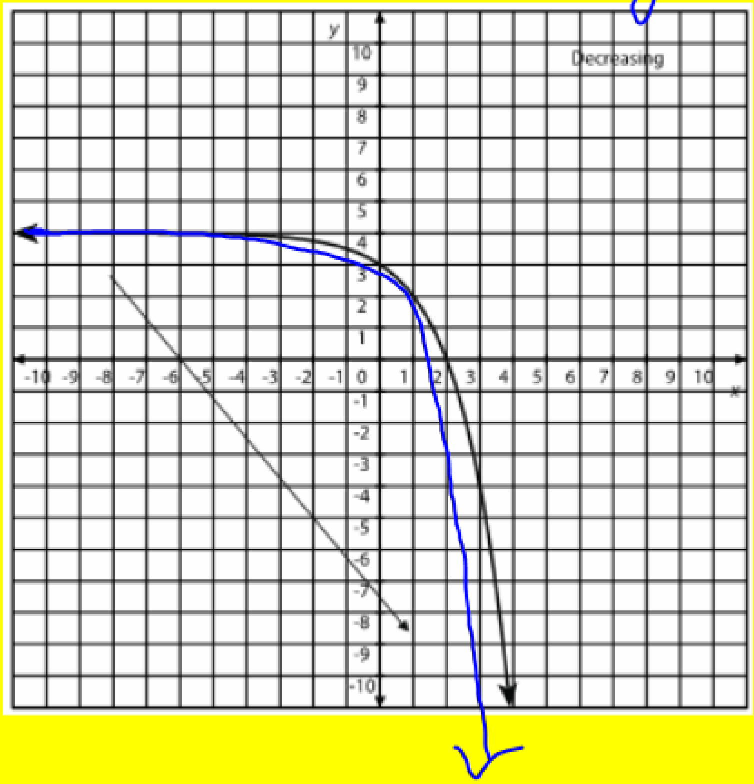
Always Decrease

$(-\infty, \infty)$

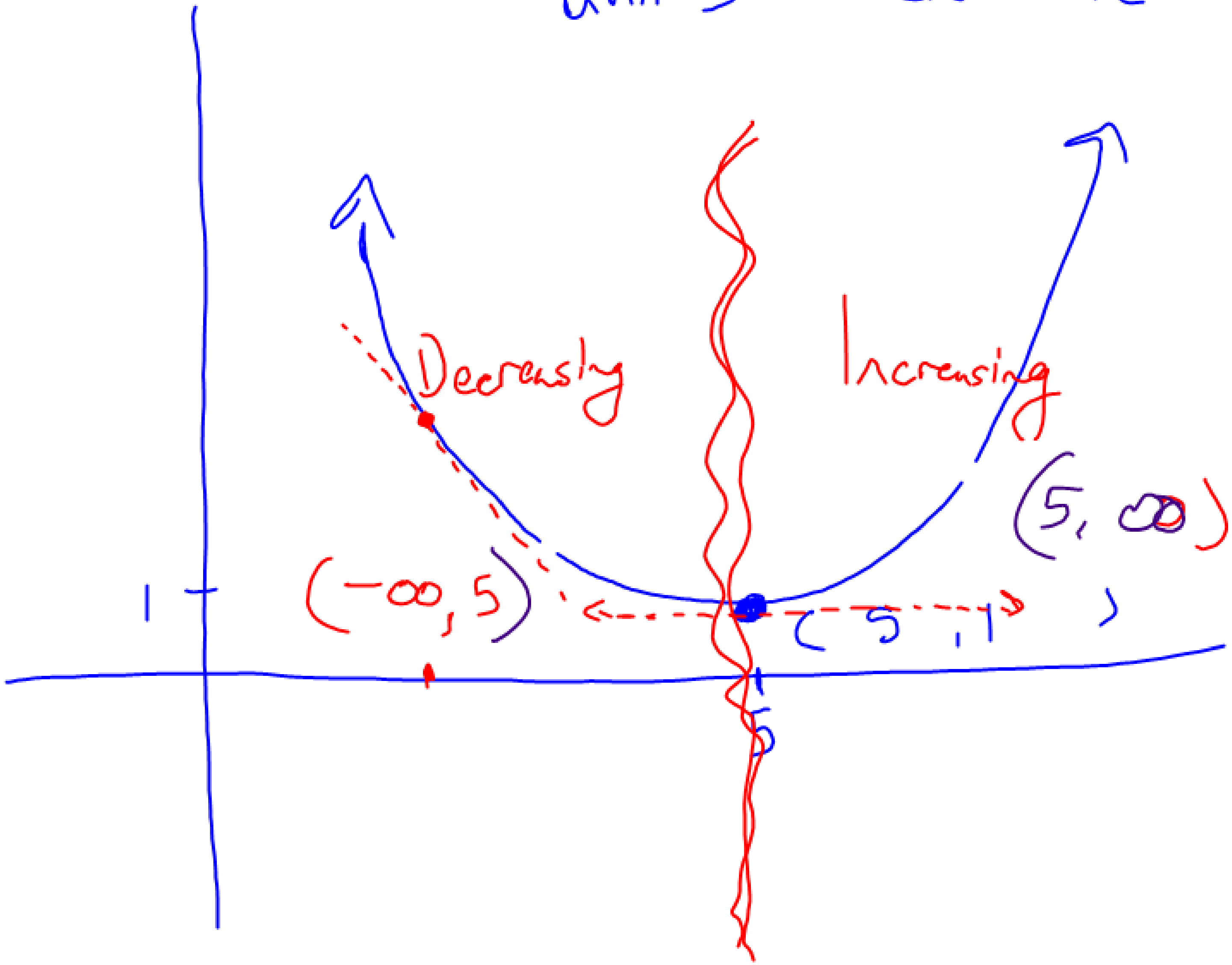
Increase: $\underbrace{(-\infty\ ,\ \infty\ )}$

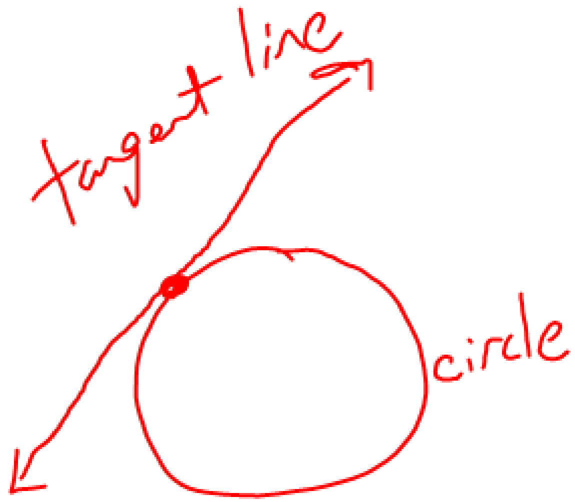
Decreasing: $(-\infty, \infty)$





unit 3 Quadratic





tangent line
circle

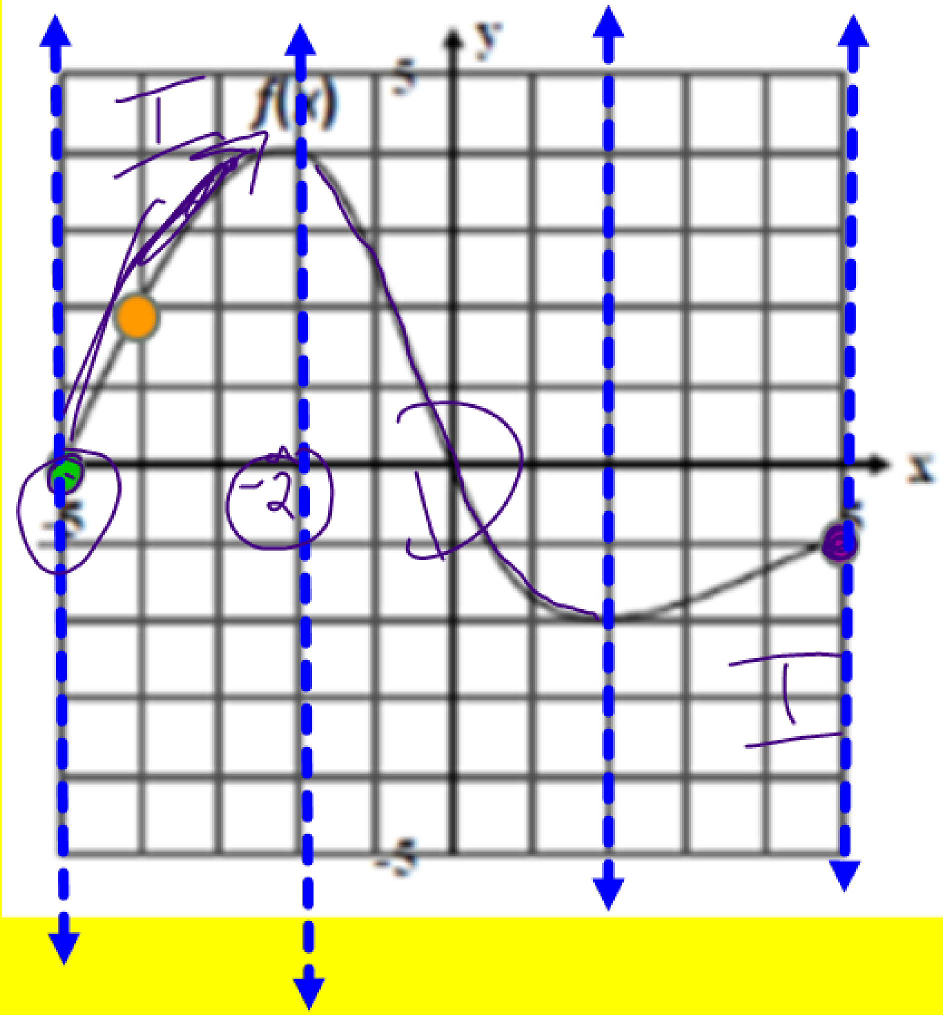
Increasing or Decreasing?

Increasing

~~(-5, 4)~~

(-5, -2)

(2, 5)



Decreases

(-2, 2)

Positive or Negative?

- An **interval** is a continuous series of values. (**Continuous** means "having no breaks.") A function is **positive** on an interval if the *y*-values are greater than zero for all *x*-values in that interval.
- A function is positive when its graph is above the *x*-axis.
- Begin by looking for the *x*-intercepts of the function.
- Write the *x*-values that are greater than zero using ~~inequality~~ notation.
  interval,

x-intercept, "parenthesis"

or

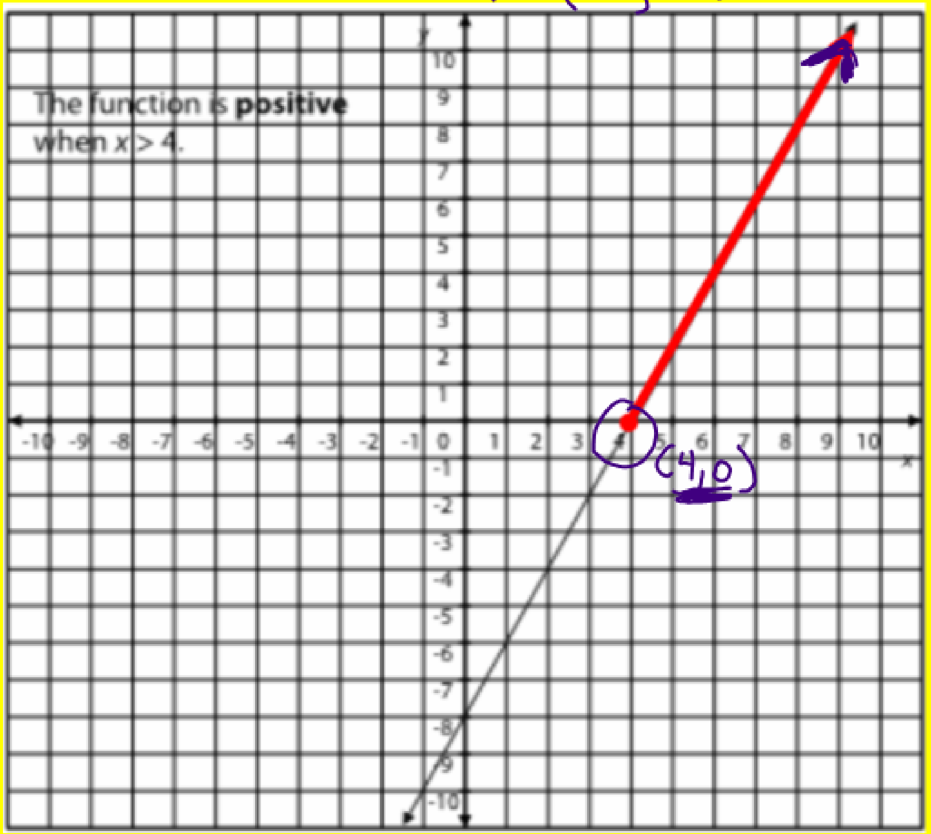
end points
(# or ∞)
↓
bracket

Positive or Negative?

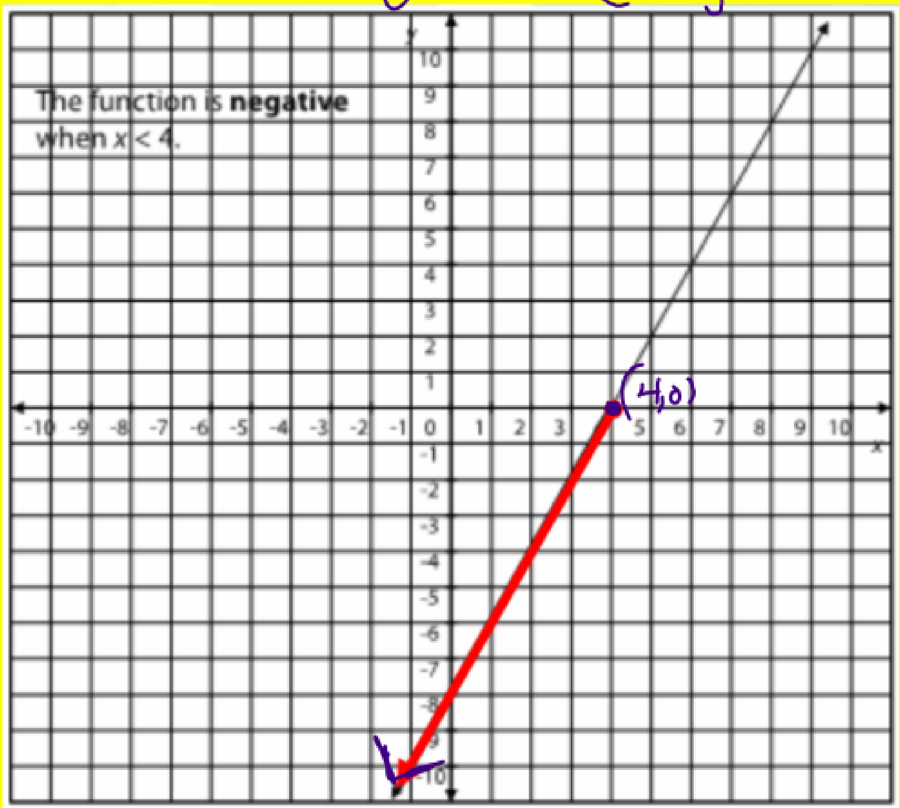
- A function is **negative** on an interval if the *y*-values are less than zero for all *x*-values in that interval.
- The function is negative when its graph is below the *x*-axis.
- Again, look for the *x*-intercepts of the function.
- Write the *x*-values that are less than zero using ~~inequality~~ notation.
  interval

Positive or Negative?

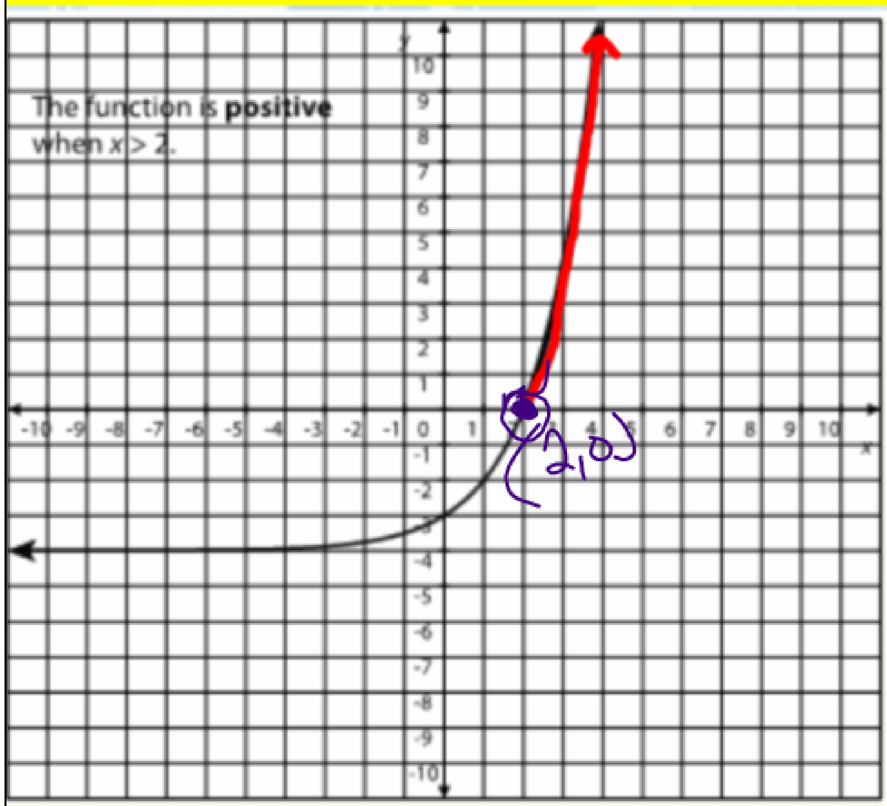
Positive: $(4, \infty)$

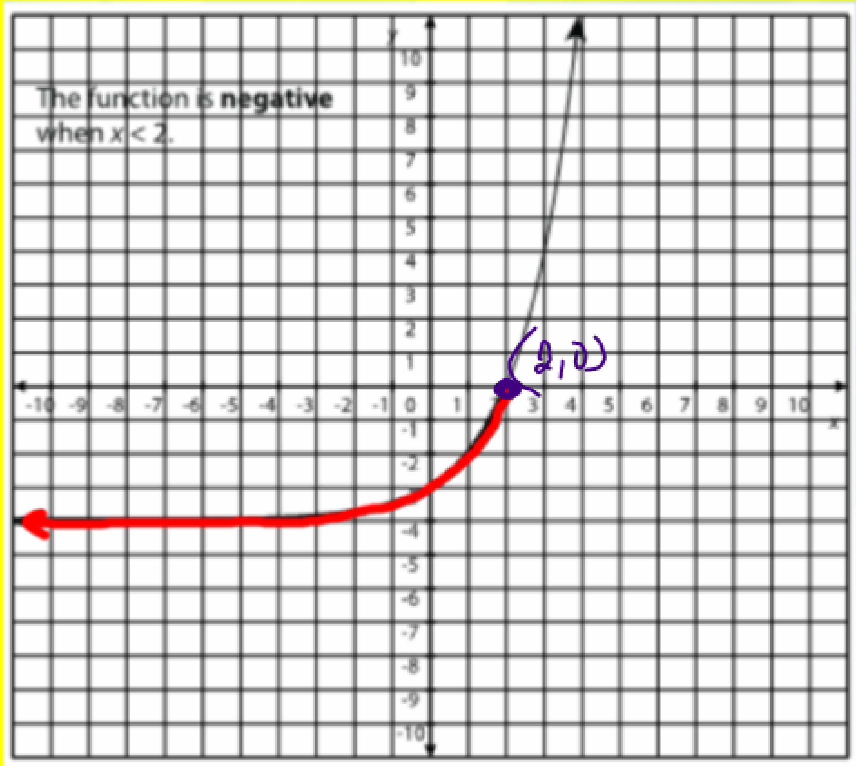


Negative: $(-\infty, 4)$



Positive or Negative?





Positive: $(2, \infty)$

Negative: $(-\infty, 2)$

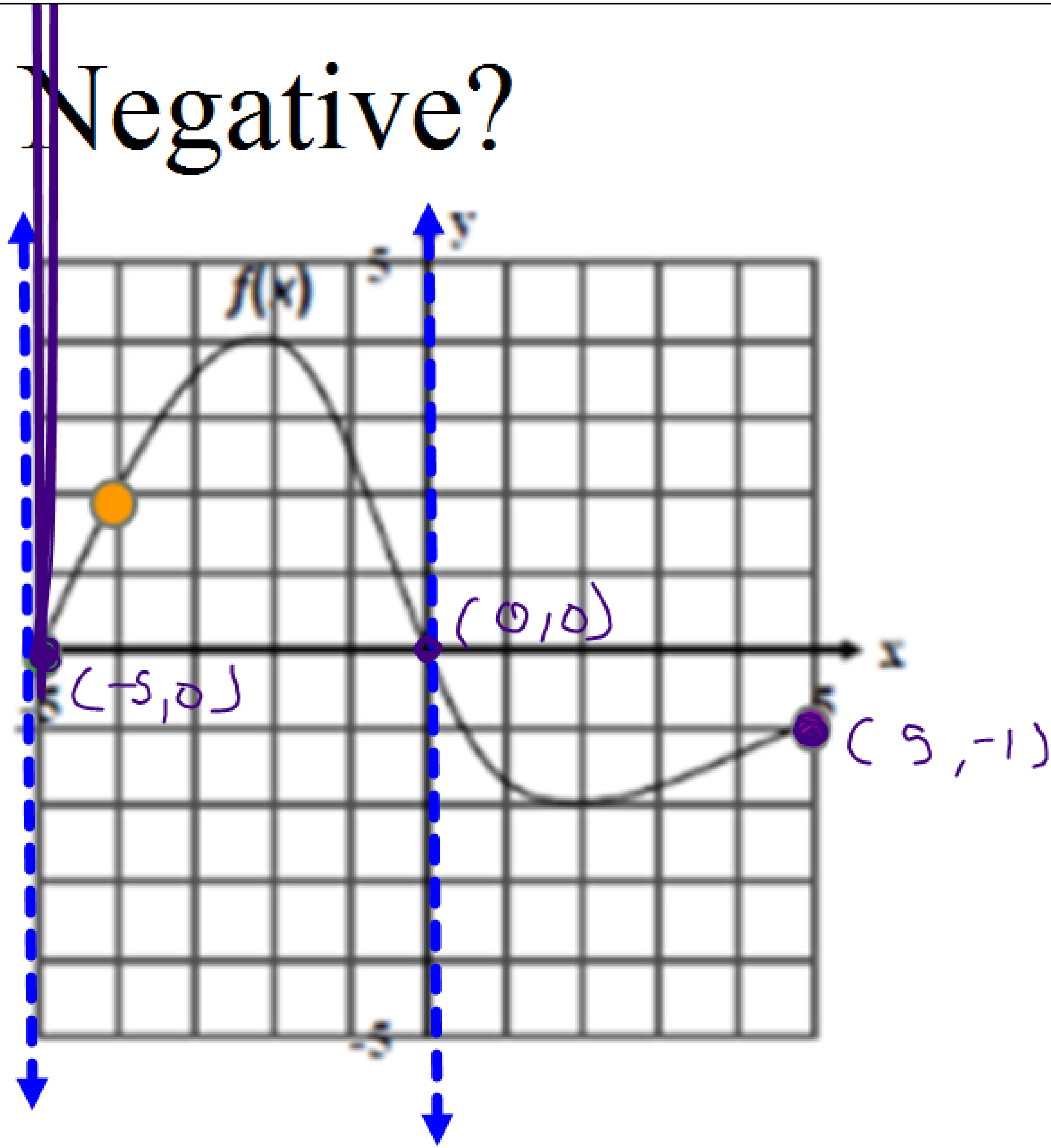
Positive or Negative?

Positive

(-5, 0)

Negative

(0, 5]



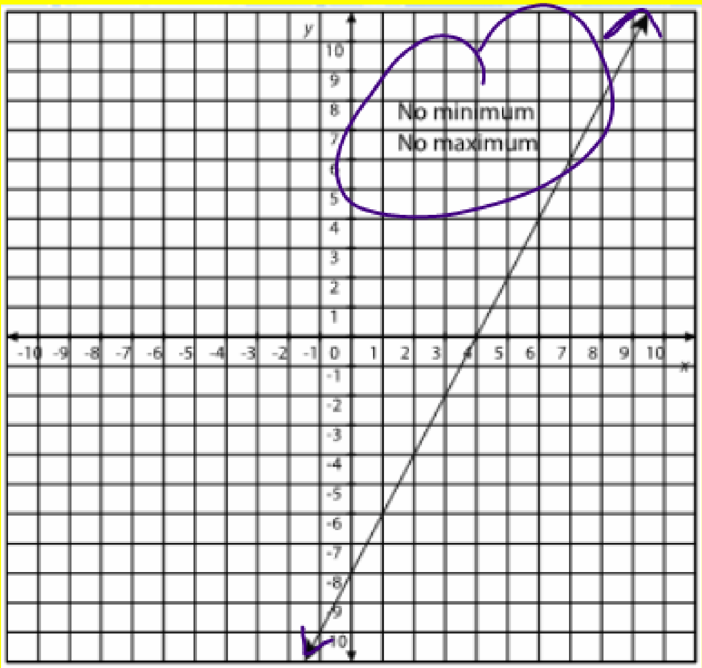
Extrema?

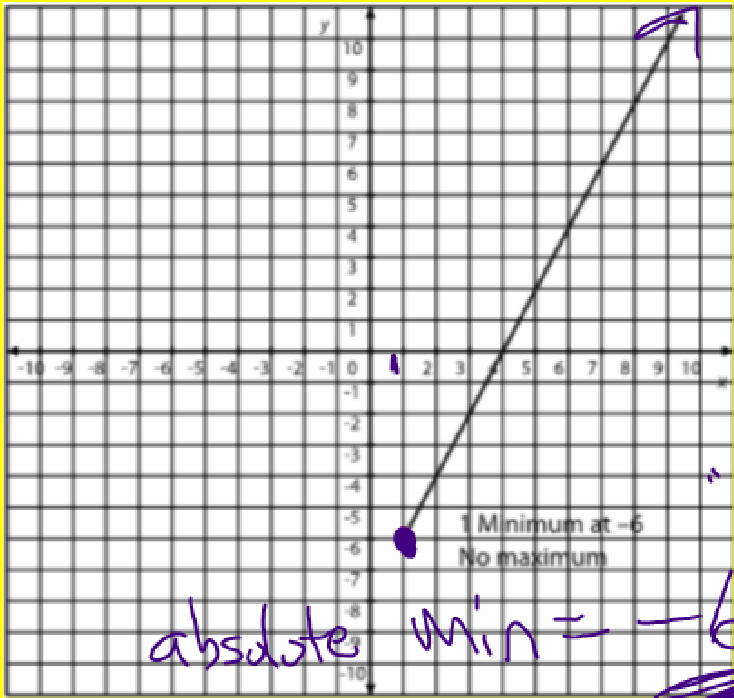
- Graphs may contain **extrema**, or minimum or maximum points.
- A **relative minimum** is the point that is the lowest, or the *y*-value that is the least for a particular interval of a function.
- A **relative maximum** is the point that is the highest, or the *y*-value that is the greatest for a particular interval of a function.

- absolute max/min: the highest or lowest point.

Extrema?

- The **domain** of a function is the set of all inputs, or *x*-values of a function.
- Compare the following two graphs. The graph on the left is of the function $f(x) = 2x - 8$. The graph on the right is of the same function, but the domain is for $x \geq 1$. The minimum of the function is –6.





No max

"y"

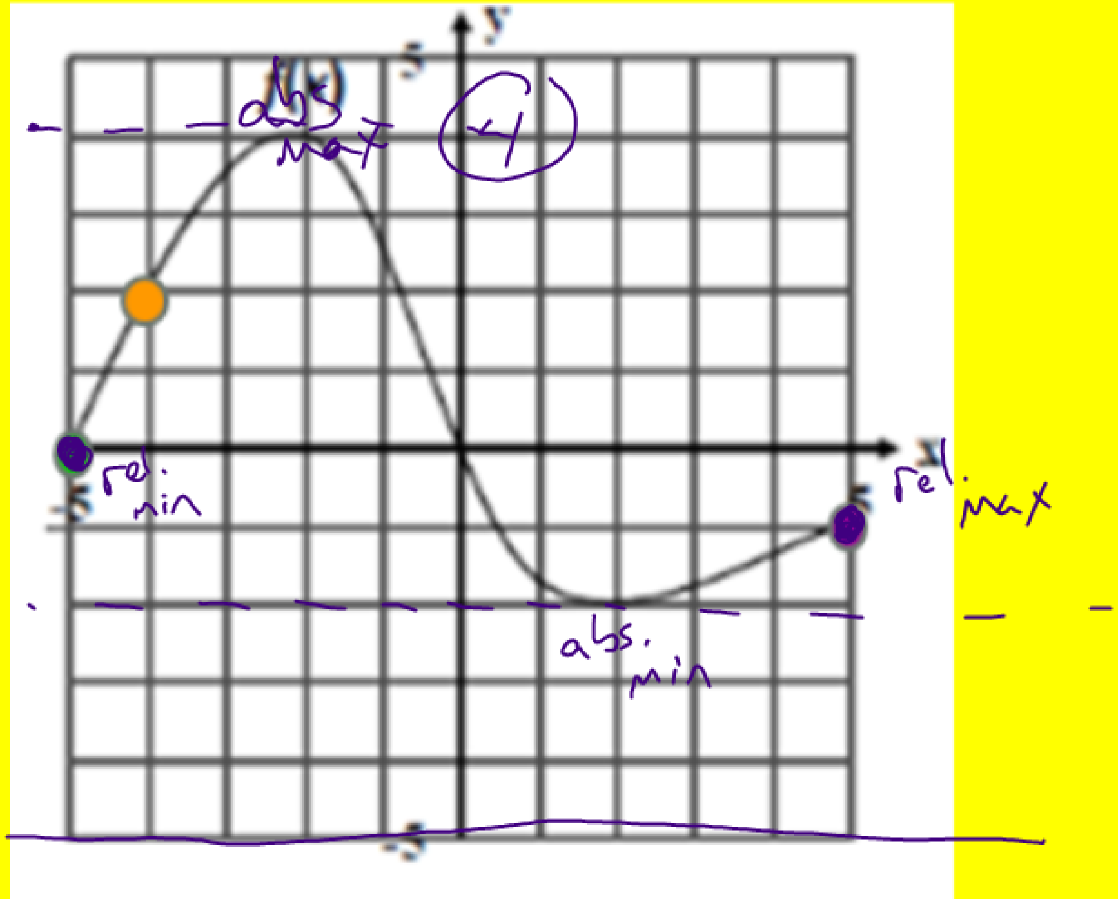
Extrema?

abs. max = 4

rel. max. = −1

abs. min. = −2

rel. min. = 0

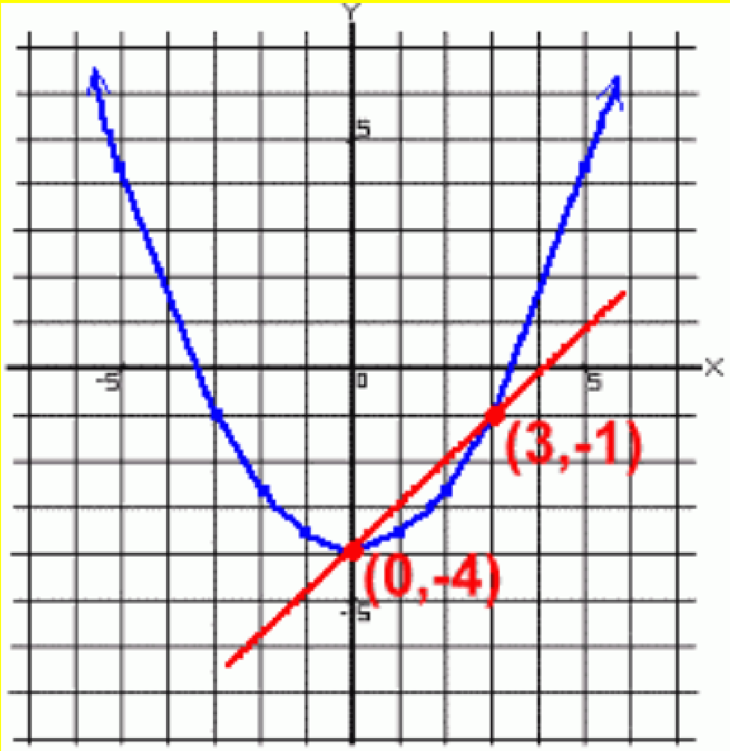


Average Rate of Change

- Recall that rate of change is another term for **slope**
- Slope mainly refers to linear functions since the rate of change is **constant**
- For other functions we find the **average** rate of change
- We calculate the average rate of change the same way we calculate slope

Average Rate of Change

Given y = f(x) at the right, find the average rate of change between the points (0 , -4) and (3 , -1)



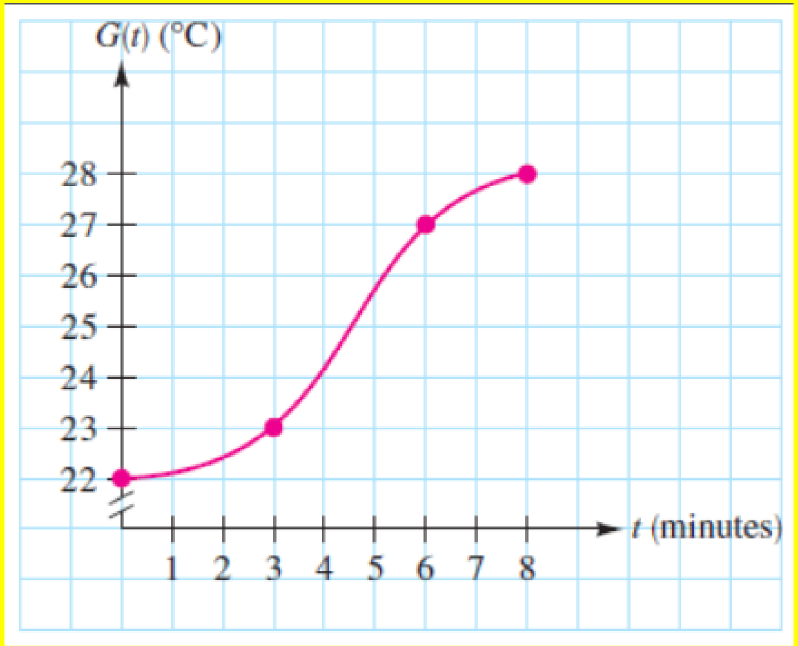
avg. rate of change = 1

$$\frac{-1 - -4}{3 - 0} = \frac{-1 + 4}{3 - 0} = \frac{3}{3} = 1$$

Average Rate of Change

G(t) represents the temperature measured in Celsius over a period of time measured in minutes.

Find the average rate of change between the following sets of points:

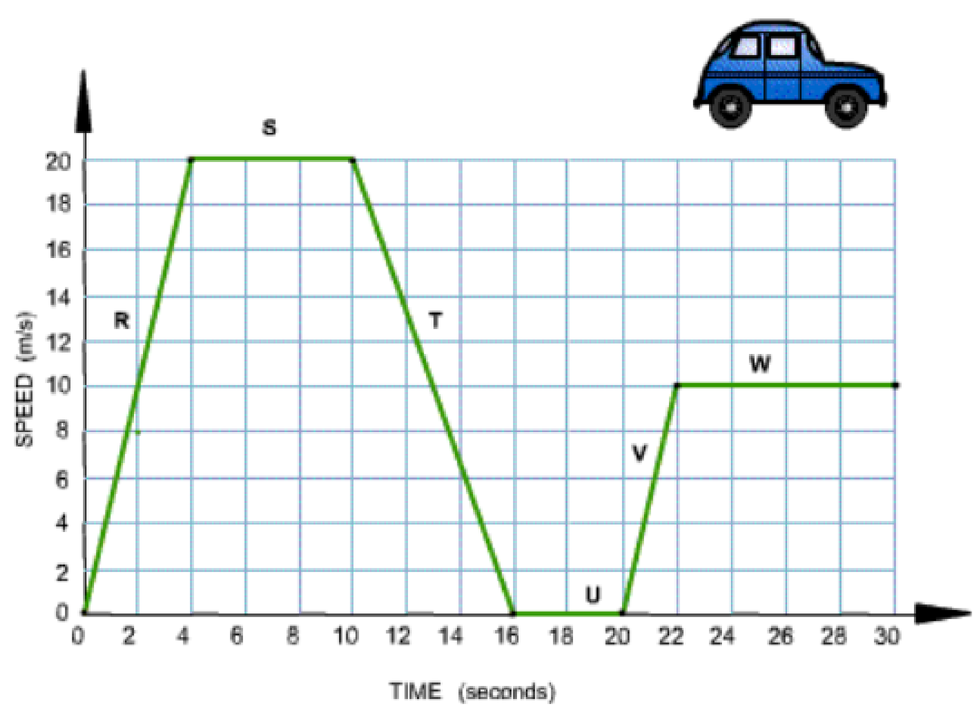


#1) (0,22) and (3,23)

#2) (3,22) and (8,28)

#3) (0,22) and (6,27)

Identify all of the key features of this graph below



x - intercept

y - intercept

increasing

decreasing

positive

negative

maximum

minimum

avg. rate of change from x = 0 to x = 30

HW #10

Key Features of Graphs