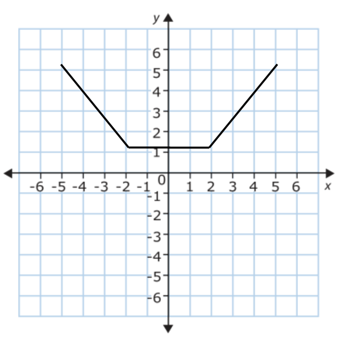
NOTES: SECONDARY 2 HONORS

IDENTIFY INTERVALS AND END BEHAVIOR (2.6) and CALCULATE RATE OF CHANGE (2.10)

Vocabulary

- An **interval** is a set of numbers between two x-values
  - An **open interval** does not include the end values
    - In *interval notation*, open intervals are represented with ___________________________
    - In *inequality notation*, open intervals are represented with _________________________
    - On *number lines*, open intervals are represented with _____________________________
  - A **closed interval** does include the end values
    - In *interval notation*, closed intervals are represented with _________________________
    - In *inequality notation*, closed intervals are represented with ______________________
    - On *number lines*, closed intervals are represented with ___________________________
  - When an interval extends indefinitely in one direction, we use the special symbol:
    - In interval notation, "**infinity**" is always accompanied by an ___________ parenthesis
- **Interval Notation** is used:
  - to describe the domain and range of functions
  - to describe where functions are __________________, ___________________, or **constant**
  - to describe where functions have __________________ or _________________ y-values

Example #1:



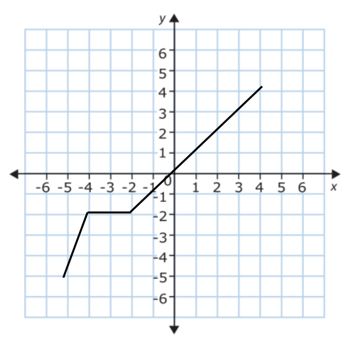
The function is **increasing** on the interval:

The function is **decreasing** on the interval:

The function is **constant** on the interval:

The function is **positive** on the interval:

Example #2:



The function is **increasing** on the interval(s):

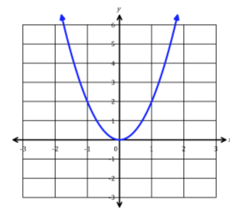
The function is **constant** on the interval:

The function is **positive** on the interval:

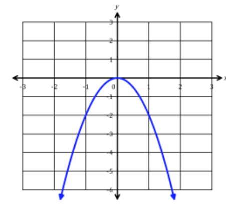
The function is **negative** on the interval:

Vocabulary:

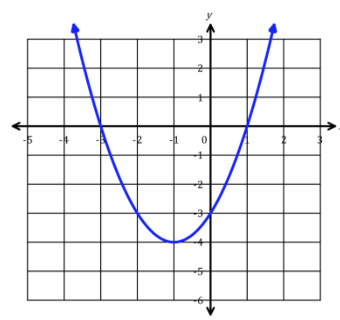
- **End behavior** describes the y-values of a graph as the x-values approach -∞ and ∞
  - If the leading coefficient of a quadratic function is positive, the end behavior is described as:
    - Left End Behavior:
    - Right End Behavior:



  - If the leading coefficient of a quadratic function is negative, the end behavior is described as:
    - Left End Behavior:
    - Right End Behavior:



Example #3: Given the graph of $f(x) = x^2 + 2x - 3$, find the intervals where the function is:



a) Increasing

b) Decreasing

c) Constant

d) Positive

e) Negative

f) Determine the end behavior of the graph.

Example #4: Given the quadratic function shown in the table, find the intervals where the function is:

a) Increasing

b) Decreasing

c) Constant

d) Positive

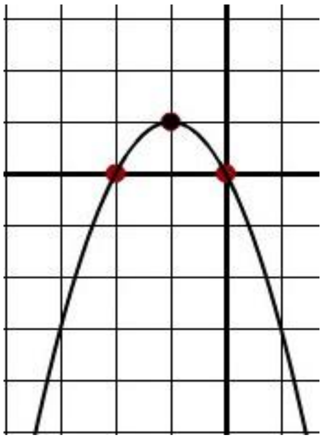
e) Negative

f) Determine the end behavior of the function.

x	***y***
-2	-12
-1	-5
0	0
1	3
2	4
3	3
4	0

More Practice:

a)



x-intercept(s):
y-intercept:

maximum or minimum:

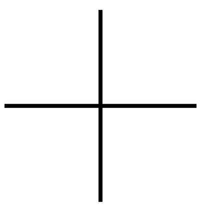
increasing interval:
decreasing interval:

positive interval(s):
negative interval(s):

left end behavior:
right end behavior:

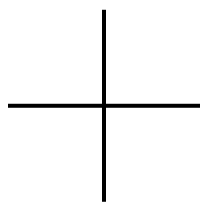
Graph each function using a graphing calculator. Find the x- and y-intercept(s), máximum or minimum (vertex), increasing, decreasing, positive and negative intervals, and end behavior. Label your graph.

b) $f(x) = x^2 - 4$



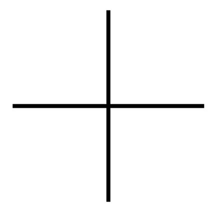
x-intercept(s):
y-intercept:
max/min:
increasing:
decreasing:
positive:
negative:
left end behavior:
as $x \to -\infty$, $y \to$
right end behavior:
as $x \to \infty$, $y \to$

c) $h(x) = -x^2 + 9$



x-intercept(s):
y-intercept:
max/min:
increasing:
decreasing:
positive:
negative:
left end behavior:
as $x \to -\infty$, $y \to$
right end behavior:
as $x \to \infty$, $y \to$

d) $y = (x + 2)^2$



x-intercept(s):
y-intercept:
max/min:
increasing:
decreasing:
positive:
negative:
left end behavior:
as $x \to -\infty$, $y \to$
right end behavior:
as $x \to \infty$, $y \to$

e)

x	*y*
-5	0
-4	-3
-3	-4
-2	-3
-1	0
0	5

x-intercept(s):
y-intercept:
max/min:
increasing:
decreasing:
positive:
negative:
left end behavior:
as $x \to -\infty$, $y \to$
right end behavior:
as $x \to \infty$, $y \to$

f)

x	*y*
-2	0
-1	-1
0	0
1	3
2	8
3	15
4	24
5	35

x-intercept(s):
y-intercept:
max/min:
increasing:
decreasing:
positive:
negative:
left end behavior:
as $x \to -\infty$, $y \to$
right end behavior:
as $x \to \infty$, $y \to$

Vocabulary:

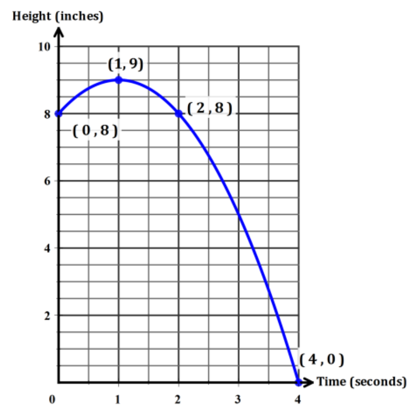
- The **rate of change** describes the rate at which one quantity is changing with respect to another quantity.
- The **average rate of change** is a rate of change (or slope) over an interval.
  - The formula for calculating the **average rate of change** is:

- The line passing through the two endpoints of the interval is referred to as the **secant line**

Example #1: $h(t)$ represents the height of an object, in *inches*, tossed up in the air. Find the average rate of change of the height of the object on the given time intervals.

$h(t) = -t^2 + 2t + 8$

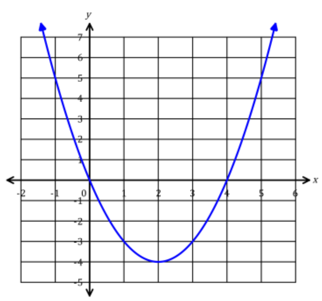
[0, 1], [1, 2], [2, 4], and [0, 2]



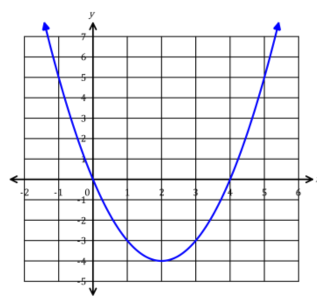
Example #2: For each of the following, draw the **secant line** that connects the two end points. Write the coordinates of the two end points, and then calculate the **average rate of change** on the specified interval.

$g(x) = x^2 - 4x$

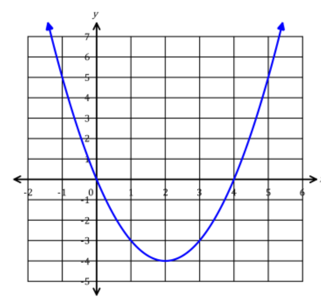
a) $g(x)$ on [0, 5]



b) $g(x)$ on [1, 5]



c) $g(x)$ on [-1, 4]



Example #3: The per capita consumption of ready-to-eat and ready-to-cook breakfast cereal is shown below. Find the average rate of change from 1992 to 1995 and interpret its meaning.

Years since 1990	0	1	2	3	4	5	6	7	8	9
Cereal Consumption (pounds)	15.4	16.1	16.6	17.3	17.4	17.1	16.6	16.3	15.6	15.3