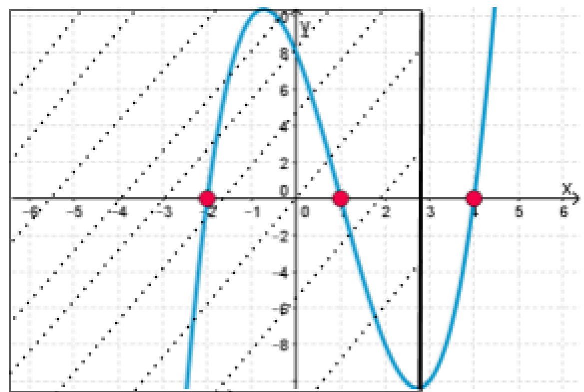
Analyzing Polynomial Graphs Practice Practicing Performer: Date:

Intervals:

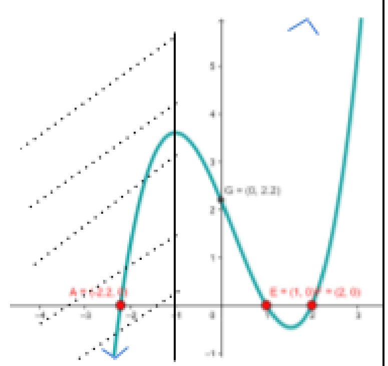
1. When we talk about intervals, we are talking about a section of the graph marked by x-values. Below are examples of how to use intervals and different ways of representing them on graphs. Use the example to help you sort the answer options in the table to show matching representations.

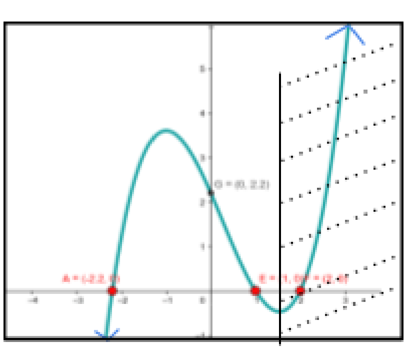
Example: $(-\infty,\ 2.8)$

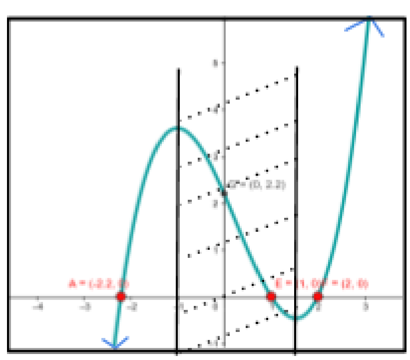
x < 2.8



We look at this portion of the graph.

Inequalities:	-1 < x < 1.5		
Interval Notation:			$(1.5,\ \infty)$
Graphs:			





x > 1.5

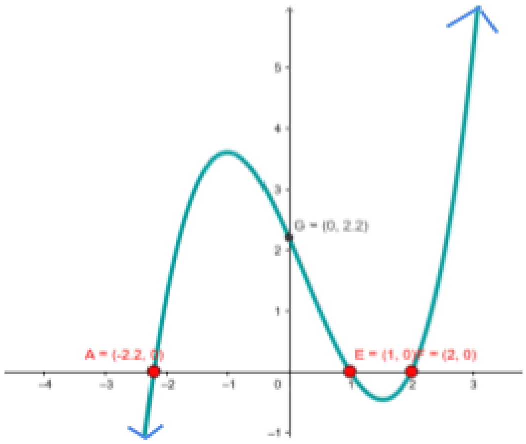
$(-1,\ 1.5)$

$(-\infty,\ -1)$

x < -1

Increasing and Decreasing:

2. Paul and Malaak are talking about the graph below. Paul says "the graph is decreasing over the interval x < -1 because there would be an arrow on the left side at the bottom, meaning it is going down there." Malaak says "the graph is increasing over the interval x < -1 because we read graphs from left to right and it has a positive slope there." If only one of them is correct, who said the right thing?



3. Using the graph above, decide over which intervals is the graph <u>only increasing</u> and <u>only decreasing</u>. Use both the inequality notation and the interval notation. You should not use all of the options.

Options:

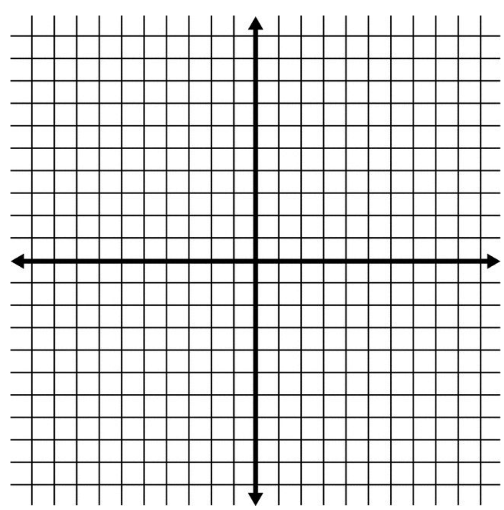
x > 1.5	-1 < x < 1.5	$(-\infty,\ -1)$	$(-0.5,\ 3.75)$
-0.5 < x < 3.75	$(1.5,\ \infty)$	x < -1	$(-1,\ 1.5)$

a. Interval(s) where the graph is increasing:

b. Interval(s) where the graph is decreasing:

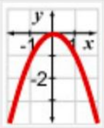
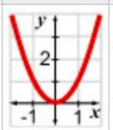
c. Which intervals did you <u>not</u> use and why did you not use them? What made them wrong?

4. Sketch your own cubic function graph and write the intervals (using inequalities OR interval notation) over which your function is increasing and decreasing.



Concavity:

5. Fill in the boxes below with the matching answers.

Graph	Concave up	Concave down	Inflection point
	B	C	D
	F	G	H

$(-\infty,\infty)$

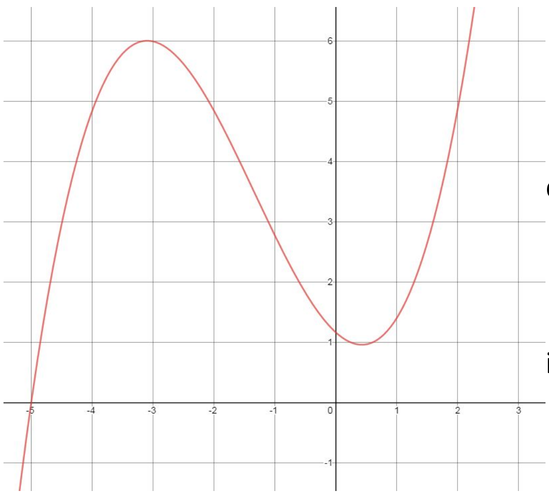
$(0,\infty)$

$(-\infty,0)$

None

(0,0)

6. Mark/highlight the section(s) of this graph that are concave up and concave down in different ways/colors.

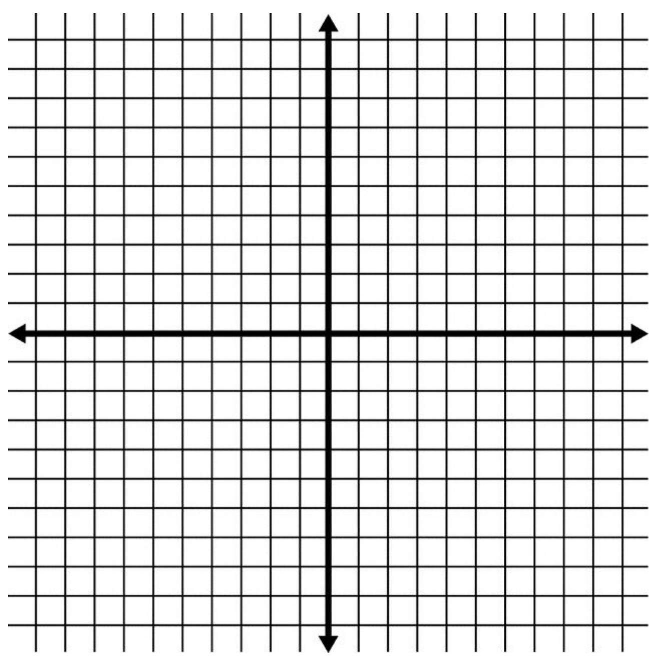


a. Over what interval(s) is the graph concave up?

b. Over what interval(s) is the graph concave down?

c. Estimate the coordinate point where the inflection point is.

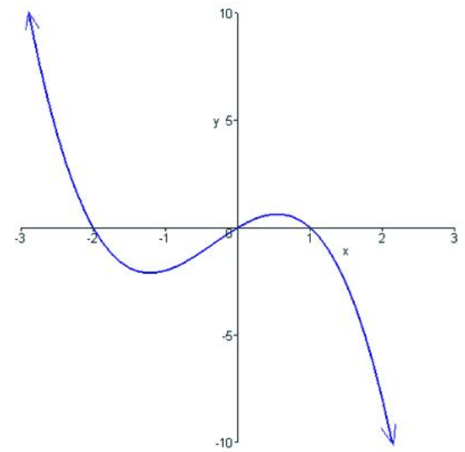
7. Draw a graph of a cubic function that (a) decreases and is concave up on $(-\infty, \ -4)$, (b) increases and is concave up on $(-4, \ -1)$, (c) increases and is concave down on $(-1, 5)$, and (d) decreases and is concave down on $(5, \ \infty)$.



<u>End Behavior:</u> Increasing or decreasing was all about reading graphs from left to right and seeing if they go up or down, end behavior is more about where the graph is <u>pointing</u> when x becomes larger in the positive side, $x \to \infty$, or when x becomes larger in the negative side, $x \to -\infty$.

8. Note the end behavior of the graphs below.

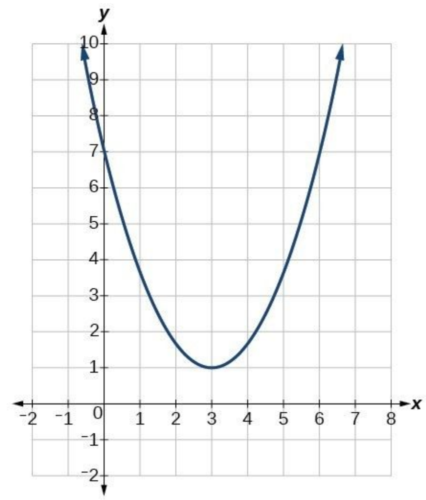
a.



As $x \to -\infty, \quad f(x) \to \infty$

As $x \to$ _____, __________

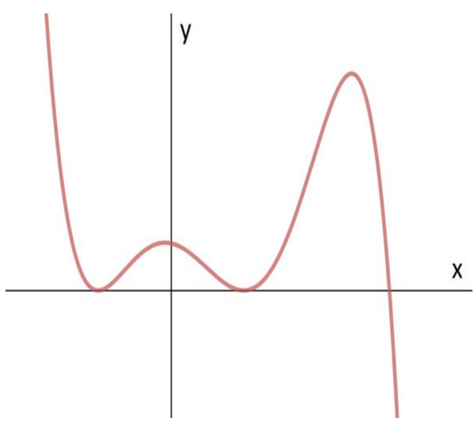
b.



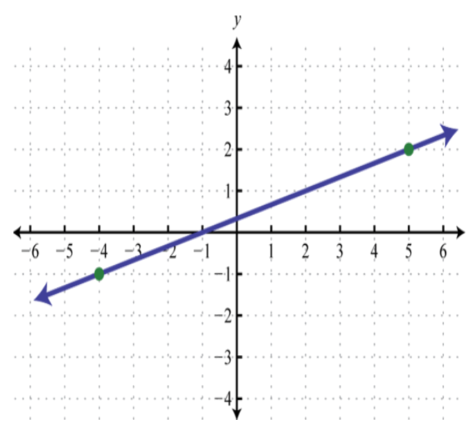
As $x \to$ _____, __________

As $x \to$ _____, __________

c.

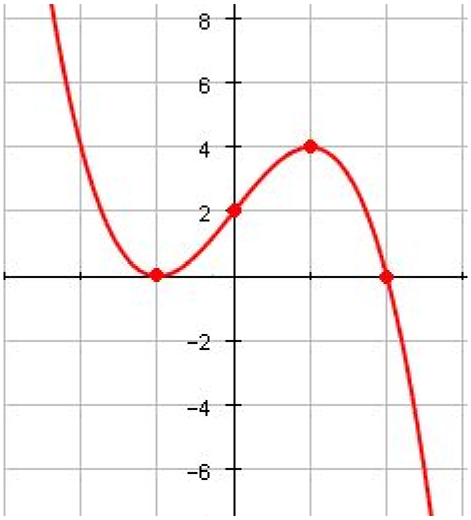


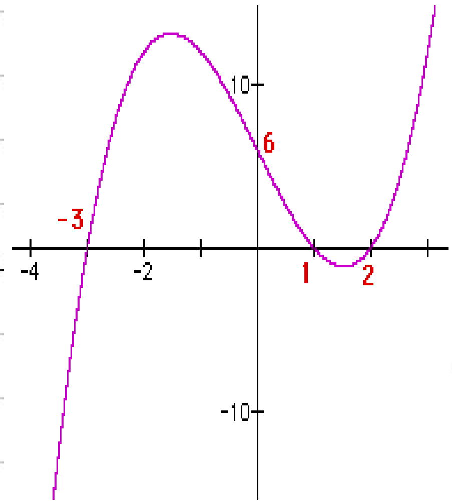
d.

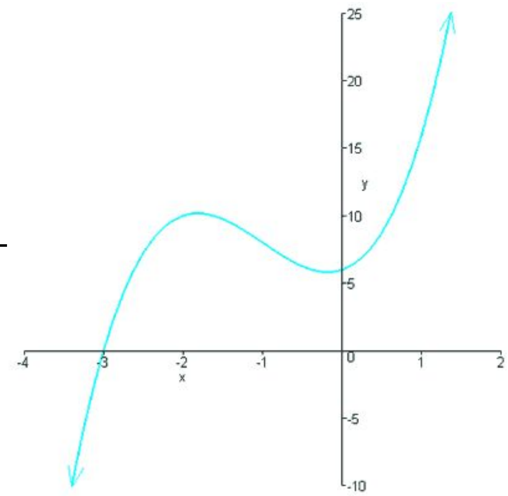


Roots/Zeros:

9. The following graphs are all cubic functions.



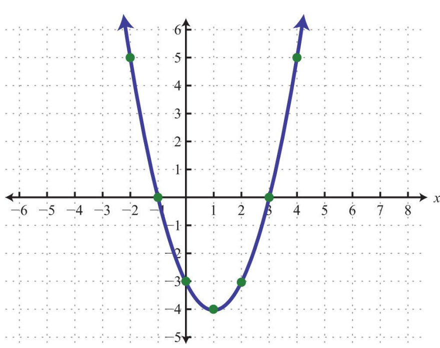


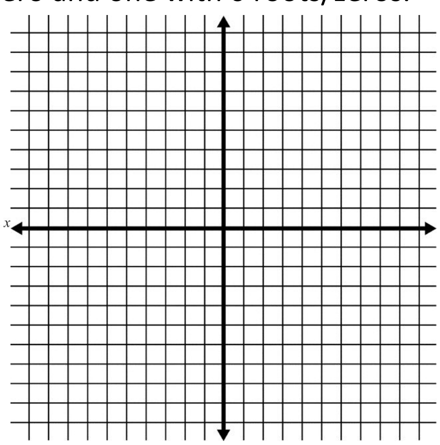


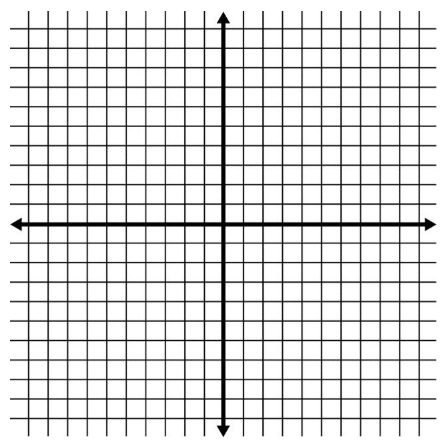
a. What are all the possible amounts of roots/zeros a cubic function could have?

b. Could a cubic function ever have 0 roots/zeros? Explain your reasoning.

10. Below is an example of a quadratic graph with 2 roots/zeros. Draw an example of a quadratic graph with 1 root/zero and one with 0 roots/zeros.







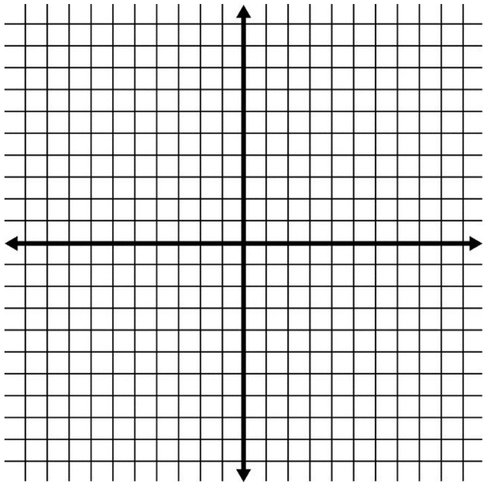
11. What is the maximum number of roots/zeros a quadratic graph could have?

12. Take a guess: what is the maximum number of roots/zeros a 4th-degree polynomial could have?

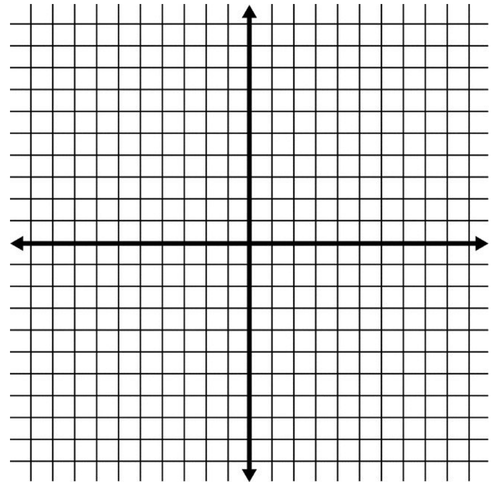
Extension:

13. Draw 2 cubic graphs with roots at x = -5, x = -1, and x = 2. Draw (a) so that it is concave up from $(-\infty,\ -2)$ and concave down from $(-2,\ \infty)$ and draw (b) so that it is concave down from $(-\infty,\ -2)$ and concave up from $(-2,\ \infty)$.

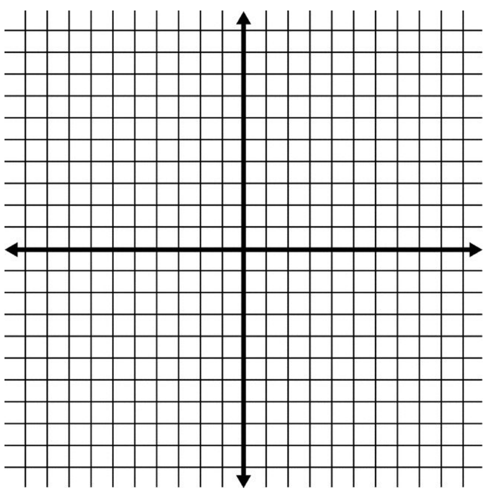
a.

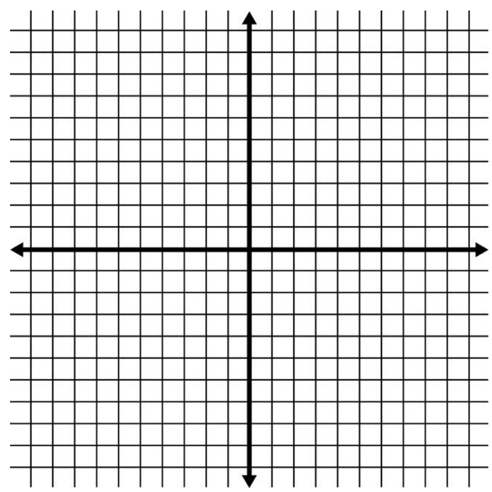


b.



14. On a graphing calculator, or a website like Desmos.com or Wolframalpha.com, graph the functions $y=(x+1)(x-5)(3-x)$ and $y=(x+1)^2(x-5)^2(3-x)^2$. Sketch graphs of them below.





a. What are the coordinate points for the roots/zeros of each graph?

b. What is different about the roots/zeros in graph (a) when compared to graph (b)?

c. What can we say about a root/zero in a function when the graph crosses through the x-axis at its roots/zeros and when the graph bounces off the x-axis at those points?