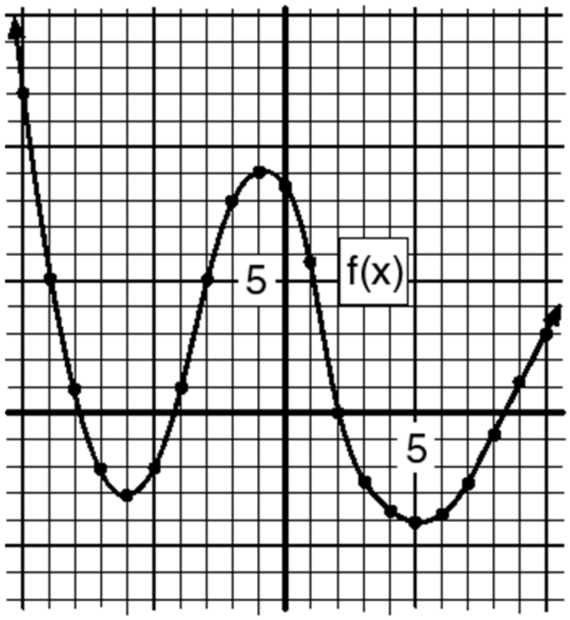
Increasing and decreasing functions Solutions **NAME:**

The function *f*(*x*) is shown below. Complete the table by finding the *f*(*x*) values for the given values of *x*. The points are plotted to help you. Round to the nearest integer.



x	***f*(*x*)**		***x***	***f*(*x*)**
-10	*12*		**0**	*9 (rounded)*
-9	*5*		**1**	*6 (rounded)*
-8	*1*		**2**	*0*
-7	*-2*		**3**	*-3 (rounded)*
-6	*-3*		**4**	*-4 (rounded)*
-5	*-2*		**5**	*-4*
-4	*1*		**6**	*-4 (rounded)*
-3	*5*		**7**	*-3 (rounded)*
-2	*8*		**8**	*-1*
-1	*9*		**9**	*1*

2. Notice how the y values in the table decrease as x goes from –10 to –6, then the y values start to increase. At what x value do the y values stop increasing?

Looking at the graph from left to right, we see the y values decrease from the far left of the graph to the x value of -6. Then the y values start increasing until about the x value of -1. You can also see this by looking at the table of values.

3. Let's analyze the whole graph. Going from left to right, determine the intervals of x where the graph is increasing or decreasing. Write your answers in interval notation.

(Hint: Since the graph is assumed to go on forever at the left and right ends, we say the graph decreases on the interval $(-\infty,-6)$ and also increases on the interval $(5,\infty)$. Notice we use the symbols for negative and positive infinity. Include these intervals in your answer.)

Increasing: *(-6, -1) and (5, ∞)*

Decreasing: *(-∞, -6) and (-1, 5)*

Notice we use open parentheses as opposed to brackets in our interval notation. We always use parentheses when describing where a graph is increasing or decreasing. The reason is because ***at*** *-6, for instance, the graph is neither decreasing nor increasing.*

I figure this by looking at the graph from left to right. It also helps to see the graph as four pieces. The first piece goes from the far left to the x value of -6 where a local minimum occurs. The y values are getting smaller as you go left to right along this piece. So we have (-∞, -6) under decreasing.

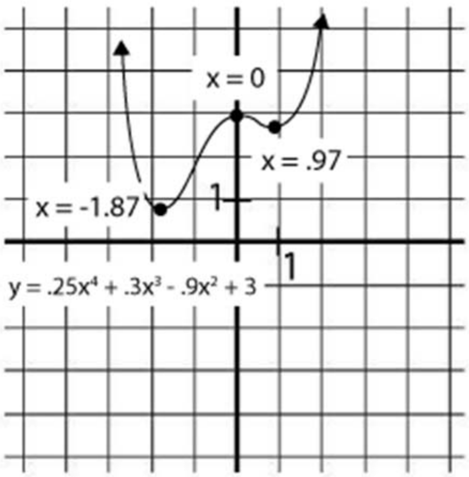
The second piece is from that x value to -1 where the graph has a local maximum. The y values along this piece are increasing as you go left to right. So we have (-6, -1) under increasing.

The third piece goes from here to the local minimum at 5. The graph's y values are decreasing along this piece. So we have (-1, 5) under decreasing.

The fourth and last piece is from there to the right end of the graph, where the graph is again increasing. That leaves the interval (5, ∞) to go under increasing.

Remember we are looking for where the ***y values*** *are increasing or decreasing. But we phrase our answers in terms of the* ***x values*** *that produce those parts of the graph.*

4. Use your grapher to graph $y = .25x^4 + .3x^3 - .9x^2 + 3$. Use the same window as the graph paper below represents so it will be easier to sketch. Use the calculator's Max and Min functions to find the x values of the maximum and minimum points on the graph (the humps; you should see three). Label the x values of these points on your graph. Round to two decimal places.



I used the Maximum and Minimum calculator functions to find the x values of the humps. Notice we only need the x values since the intervals we list below are in terms of x.

5. Now write (in interval notation) the intervals of x values where the graph is increasing or decreasing. I usually start at the far left and go towards the right. Round your numbers to two decimal places.

> *Like I said, I go from the far left to the far right of the graph. Follow the numbered boxes below to see how I think through this.*

Increasing: *(-1.87, 0) and (.97, ∞)*

2. From the x value of -1.87 to 0, the y values are getting bigger (increasing).

4. From .97 to the far right of the graph (positive ∞), the y values are increasing.

Decreasing: *(-∞, -1.87) and (0, .97)*

1. From the far left of the graph (x value of -∞) until the x value of -1.87, the y values are getting smaller (decreasing).

3. From the x value of 0 to .97, the y values are decreasing.