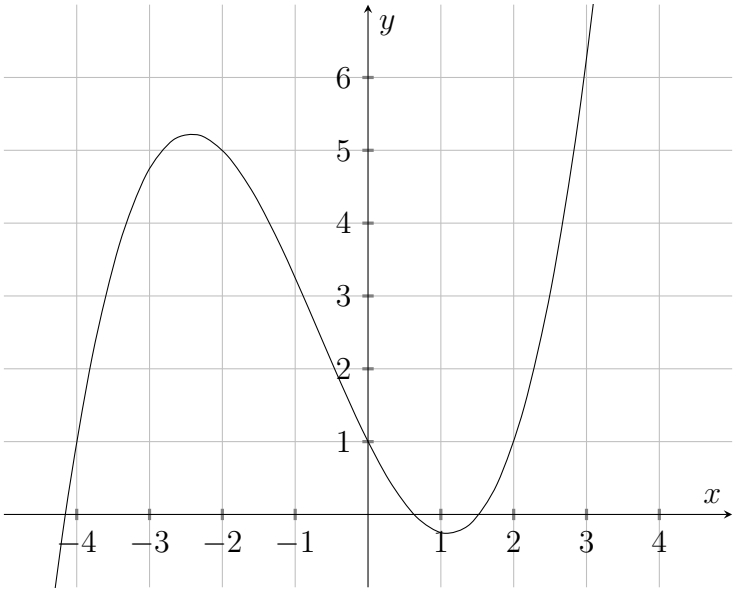
Purpose: In the last class, we explored average rate of change visually and computationally. Today, we will learn and explore how to analyze rates of change.

1. Quick review: Find the average rate of change of the function $f(x) = x^2$ on the interval $[1, 5]$.

2. Consider the graph of the function $f(x)$ below.



   (a) Using your current knowledge, estimate the intervals on which the function is increasing and decreasing.

   (b) Using your current knowledge estimate the intervals on which the function is concave up and concave down.

Definitions:

- A function is **increasing** on an interval if the functions values increase as the inputs increase. That is, a function is increasing on an interval if for any $b > a$ in the interval, we have $f(b) > f(a)$.
- A function is **decreasing** on an interval if the functions values decrease as the inputs increase. That is, a function is decreasing on an interval if for any $b > a$ in the interval, we have $f(b) < f(a)$.

3. With your new information, revisit question 2 part (a) and either confirm your answers or adjust them.

4. Let f be an increasing function on the interval $[A, B]$. Within this interval, is the average rate of change of f positive or negative? How do you know?

5. Let f be a decreasing function on the interval $[A, B]$. Within this interval, is the average rate of change of f positive or negative? How do you know?

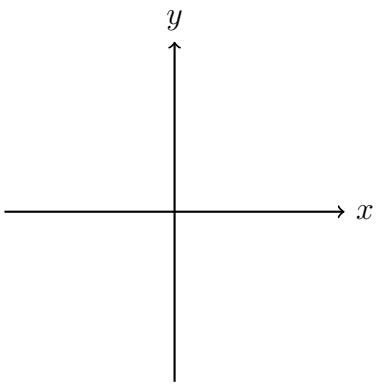
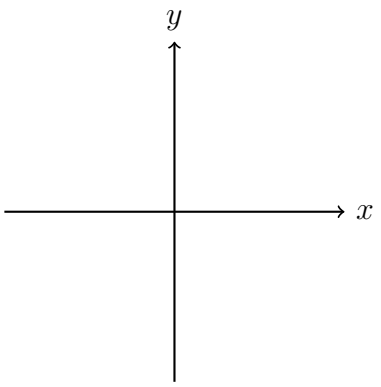
6. In the space below, sketch two graphs: one that is increasing and the rate of change is increasing, and one that is increasing but the rate of change is decreasing. What changes between these graphs?

Definitions:

- A function is **concave up** on an interval if the rate of change is increasing on that interval.
- A function is **concave down** on an interval if the rate of change is decreasing on that interval.
- An **inflection point** is where a function changes concavity (either from concave up to concave down or vice versa).

7. With your new information, revisit question 2 part (b) and either confirm your answers or adjust them. Also, does that function have an inflection point? If so, where?

8. Sketch graphs to fill out the table below.

	Increasing	Decreasing
Concave Down		
Concave Up