Goals: In this activity, we want you and your teammates to review and strengthen your understanding of graphs and the vocabulary we use to describe their shape or behavior. This language will be useful throughout this semester.

Qualitative Descriptions of Graphs:

1. Increasing and Decreasing: Typically, in any graph, the horizontal axis represents the independent or input variable and the vertical axis represents the dependent or output variable. Since the independent variable is the one WE can change, we generally describe the shape or behavior of a graph by saying what happens to the dependent variable as the independent variable increases.

   ![Graph of Retail Price of Air Jordan Shoes]

   Figure 1: Retail Price of Air Jordan Shoes

The retail price of Air Jordan Shoes depends on the number of years since 1985, so we describe the shape of this graph as follows:

"As the years since 1985 increase, the retail price of Air Jordan Shoes increases."

Of course, this graph is also clearly the graph of a line, so we could modify the description to reflect this fact:

"As the years since 1985 increase, the retail price of Air Jordan Shoes increases at a constant rate."

or

"The retail price of Air Jordan Shoes is in a linear relation with the years since 1985; the price increasing at a constant rate."
If the output variable increases as the input variable increases, then we say that the graph is increasing. If the output variable decreases as the input variable increases, then we say that the graph is decreasing. If the output variable doesn’t change as the input variable changes, then the graph is constant.

For each of the graphs below, write a sentence that reflects the behavior of the output variable as the input variable increases. Use the names of the variables in your descriptions. If the graph is obviously a line, include that fact in your description, somehow. Otherwise, just write a sentence describing the increasing or decreasing behavior.

a. [Graph of car value over time]  
   car value over time

b. [Graph of coffee temp over time]  
   coffee temp over time

c. [Graph of # of moons over time]  
   # of moons over time

d. [Graph of population over time]  
   population over time
2. Increasing and Decreasing in the Same Graph: Look at the figure below.

If we want to describe this graph, we could say the following:
"In the first years after 1990, the average first marriage age decreased until it leveled off. After that, the average first marriage age increased again."

Practice describing the increasing/decreasing behavior of the following two graphs.

e. [Graph showing a savings over time with a decrease followed by an increase]

f. [Graph showing a bunnies over time with an increase and peak, then a decrease]
For the following two graphs, the input variable is simply $x$ and the output variable is simply $y$. Practice describing the increasing/decreasing behavior of the following two graphs. Recall the definitions of a graph that is increasing, decreasing and constant:

As the input variable increases, if the output variable is increasing, we say that the graph is INCREASING; if the output variable is decreasing, we say that the graph is DECREASING; and if the output variable doesn’t change, then the graph is CONSTANT.

3. **How fast is it changing?** Look at the three graphs below. In each case, the graph is increasing, but they are doing so in different ways. Come up with your best way of describing the increasing behavior of these graphs so that the three different ways of increasing are distinguished. Again in these examples, the input variable is simply $x$ and the output variable is simply $y$.

![Figure A](image)
![Figure B](image)
![Figure C](image)

Finally, the following three graphs are all decreasing, but in different ways. Come up with your best way of describing the different ways of decreasing represented in each of these graphs.

![Figure D](image)
![Figure E](image)
![Figure F](image)