Section B.1: Linear Functions

Linear model and linear function

If the graph of a model is a straight line, the model is called *linear* and the function is called *linear function*. A linear function has a constant rate of change and a straight line graph. For all linear functions the rate of change is equal to the slope of the graph which is defined as the amount that the graph rises vertically for a given distance that it runs horizontally:

$$\text{rate of change} = \text{slope} = \frac{\text{change in dependent variable}}{\text{change in independent variable}}$$

The greater the rate of change, the steeper the slope.

Ex.1
You hike a 3-mile trail, starting at an elevation of 8000 feet. Along the way, the trail gains elevation at a rate of 650 feet per mile. What is the domain for the elevation function? From the given data, draw a graph of a linear function that could represent a model for your elevation as you hike along the trail. Does this model seem realistic?

This model assumes that elevation increases at a constant rate along the entire 3-mile trail. While an elevation change of 650 feet per mile seems reasonable as an average, the actual rate of change probably varies from point to point along the trail. Thus, the model's predictions are likely to be reasonable estimates, rather than exact values, of your elevation at different points along the trail.

Ex.2
A small stores sells fresh pineapples. Based on data for pineapple prices between \$2 and \$5, the storeowners created a model in which a linear function is used to describe how the demand (number of pineapples sold per day) varies with the price. The points (\$2, 80 pineapples) and (\$5, 50 pineapples) are in the graph. Draw the graph. What is the rate of change for this function? Discuss the validity of this model.

This model seems reasonable within the domain for which the storeowners gathered data. Outside this domain, the model's predictions probably are not true. For example, the model predicts that the store could sell one pineapple per day at a price of \$9.90, but could never sell a pineapple at a price of \$10. On the other hand, the model predicts that the store could sell only 100 pineapples if they were free. This model is useful only in a limited domain.