Lesson 7: Comparing Linear Functions and Graphs

Classwork

Exploratory Challenge/Exercises 1–4

Each of Exercises 1–4 provides information about two functions. Use that information given to help you compare the two functions and answer the questions about them.

1. Alan and Margot each drive from City A to City B, a distance of 147 miles. They take the same route and drive at constant speeds. Alan begins driving at 1:40 p.m. and arrives at City B at 4:15 p.m. Margot's trip from City A to City B can be described with the equation $y = 64x$, where y is the distance traveled in miles and x is the time in minutes spent traveling. Who gets from City A to City B faster?

2. You have recently begun researching phone billing plans. Phone Company A charges a flat rate of $75 a month. A flat rate means that your bill will be $75 each month with no additional costs. The billing plan for Phone Company B is a linear function of the number of texts that you send that month. That is, the total cost of the bill changes each month depending on how many texts you send. The table below represents some inputs and the corresponding outputs that the function assigns.

Input (number of texts)	Output (cost of bill in dollars)
50	50
150	60
200	65
500	95

At what number of texts would the bill from each phone plan be the same? At what number of texts is Phone Company A the better choice? At what number of texts is Phone Company B the better choice?

3. The function that gives the volume of water, y, that flows from Faucet A in gallons during x minutes is a linear function with the graph shown. Faucet B's water flow can be described by the equation $y = \frac{5}{6}x$, where y is the volume of water in gallons that flows from the faucet during x minutes. Assume the flow of water from each faucet is constant. Which faucet has a faster rate of flow of water? Each faucet is being used to fill a tub with a volume of 50 gallons. How long will it take each faucet to fill its tub? How do you know?
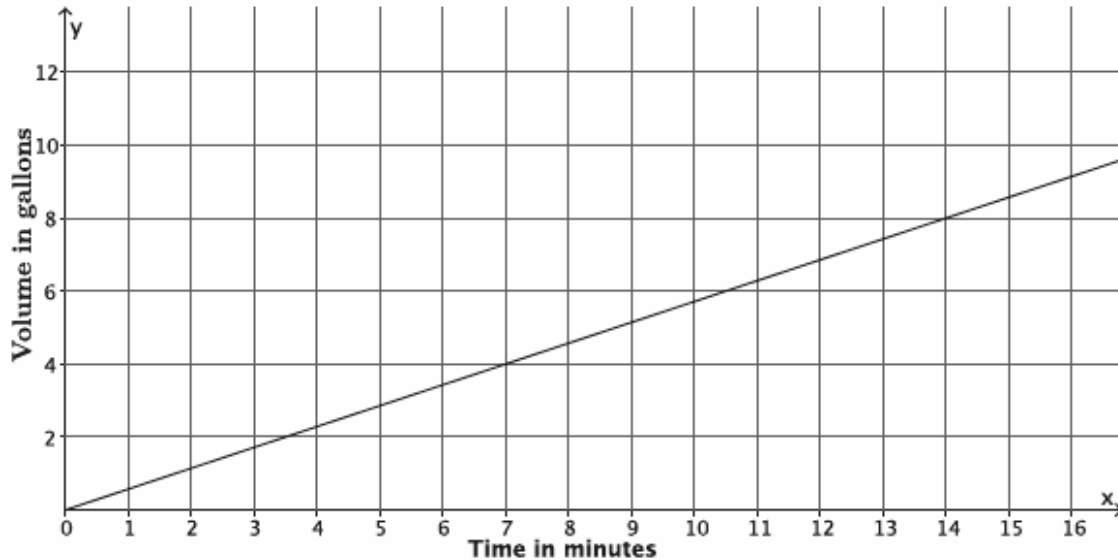
Suppose the tub being filled by Faucet A already had 15 gallons of water in it, and the tub being filled by Faucet B started empty. If now both faucets are turned on at the same time, which faucet will fill its tub fastest?

4. Two people, Adam and Bianca, are competing to see who can save the most money in one month. Use the table and the graph below to determine who will save the most money at the end of the month. State how much money each person had at the start of the competition. (Assume each is following a linear function in his or her saving habit.)
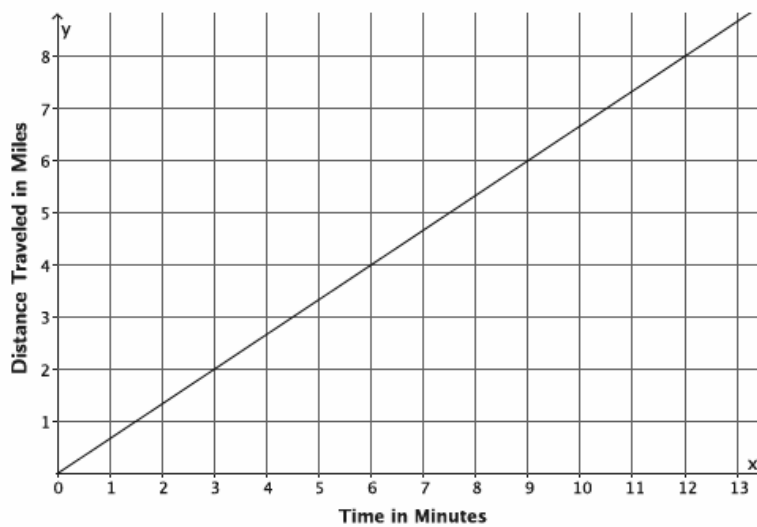
Adam's Savings:
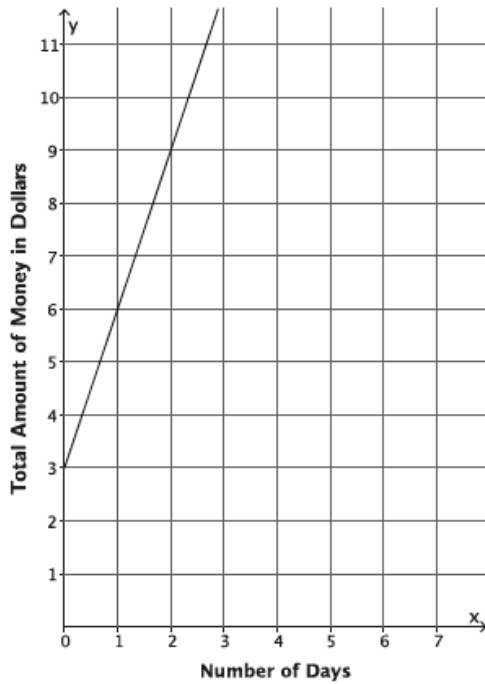
Bianca's Savings:

Input (Number of Days)	Output (Total amount of money in dollars)
5	17
8	26
12	38
20	62

Problem Set

1. The graph below represents the distance in miles, y, Car A travels in x minutes. The table represents the distance in miles, y, Car B travels in x minutes. It is moving at a constant rate. Which car is traveling at a greater speed? How do you know?

    Car A:

    Car B:

| Time in minutes (x)	Distance in miles (y)
15	12.5
30	25
45	37.5

2. The local park needs to replace an existing fence that is 6 feet high. Fence Company A charges $7,000 for building materials and $200 per foot for the length of the fence. Fence Company B charges are based solely on the length of the fence. That is, the total cost of the six-foot high fence will depend on how long the fence is. The table below represents some inputs and their corresponding outputs that the cost function for Fence Company B assigns. It is a linear function.

Input (length of fence in feet)	Output (cost of bill in dollars)
100	26,000
120	31,200
180	46,800
250	65,000

a. Which company charges a higher rate per foot of fencing? How do you know?

b. At what number of the length of the fence would the cost from each fence company be the same? What will the cost be when the companies charge the same amount? If the fence you need were 190 feet in length, which company would be a better choice?

3. The equation $y = 123x$ describes the function for the number of toys, y, produced at Toys Plus in x minutes of production time. Another company, #1 Toys, has a similar function, also linear, that assigns the values shown in the table below. Which company produces toys at a slower rate? Explain.

Time in minutes (x)	Toys Produced (y)
5	600
11	1,320
13	1,560

4. A train is traveling from City A to City B, a distance of 320 miles. The graph below shows the number of miles, y, the train travels as a function of the number of hours, x, that have passed on its journey. The train travels at a constant speed for the first four hours of its journey and then slows down to a constant speed of 48 miles per hour for the remainder of its journey.
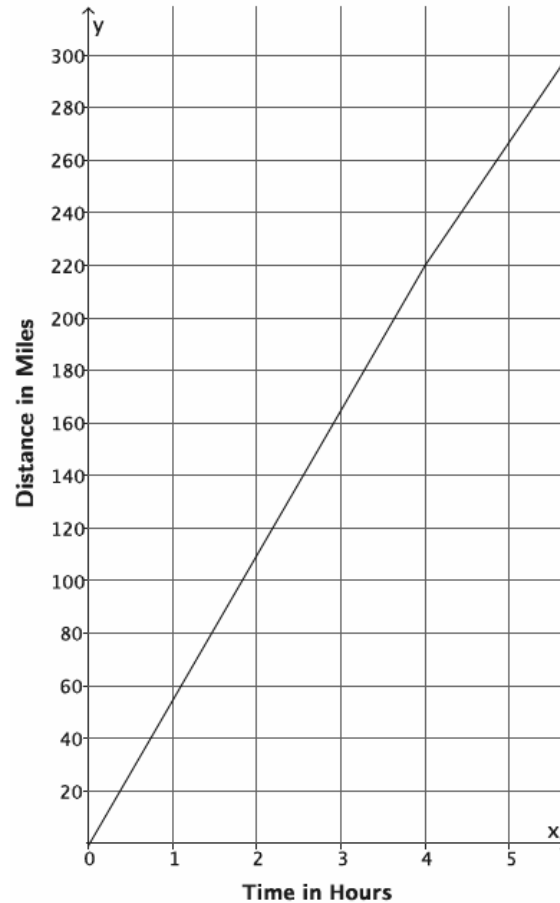
a. How long will it take the train to reach its destination?

b. If the train had not slowed down after 4 hours, how long would it have taken to reach its destination?

c. Suppose after 4 hours, the train increased its constant speed. How fast would the train have to travel to complete the destination in 1.5 hours?

5.

a. A hose is used to fill up a 1,200 gallon water truck. Water flows from the hose at a constant rate. After 10 minutes, there are 65 gallons of water in the truck. After 15 minutes, there are 82 gallons of water in the truck. How long will it take to fill up the water truck? Was the tank initially empty?

b. The driver of the truck realizes that something is wrong with the hose he is using. After 30 minutes, he shuts off the hose and tries a different hose. The second hose flows at a constant rate of 18 gallons per minute. How long now does it take to fill up the truck?