

## 1.2.3 What do they have in common?

### The Family of Linear Functions



In Lesson 1.2.2, your team investigated functions of the form  $f(x) = \frac{1}{x-h}$ , where  $h$  could be any number. You learned that as you changed  $h$ , the graph changed, but the basic shape stayed the same. In this lesson, you will think about functions of the form  $f(x) = mx + b$ .

**1-98.** Consider functions of the form  $y = mx + b$ .

- What do  $x$  and  $y$  represent in this function? What do  $m$  and  $b$  represent? Which ones can you change?
- With the rest of the class, explore the effects of  $m$  and  $b$  on the function  $y = mx + b$ . What effect does  $m$  have on the graph? What effect does  $b$  have on the graph?
- For this function,  $m$  and  $b$  are called **parameters** (as  $h$  was for  $f(x) = \frac{1}{x-h}$ ), whereas  $x$  and  $y$  are called **variables**. With your team, explain the difference between a parameter and a variable.
- What do all of the functions of the form  $y = mx + b$  have in common? Since they all have the same basic relationship between  $x$  and  $y$ , they can be called a **family of functions**.

**1-99.** With your team, examine each of group of equations below and discuss what you would see if you drew the graphs of the four equations on one set of axes. Write a description of what you imagine you would see. (You do not actually have to draw them.)

a.  $x + 2y = 10$   
 $y = -\frac{1}{2}x + 3$   
 $-4y = 2x + 8$   
 $y = -\frac{1}{2}x$

b.  $5x + y = -3$   
 $y = -\frac{1}{2}x - 3$   
 $3x - 4y = 12$   
 $5y - 2x = -15$

**1-100.** Parts, (a) through (f) below are six representations of a relationship between an input and an output. With your team, decide whether each relationship is linear and write a clear summary statement justifying your decision. If the relationship is linear, graph it and find its equation. If it is not linear, describe the growth. [Desmos](#)

a.

Pieces of Bread	Grams of Fiber
0	0
1	5
2	10
3	15
4	20

b.

*Killer Fried Chickens charges \$7.00 for a basic bucket of chicken and \$0.50 for each additional piece. The input is the number of extra pieces of chicken ordered, and the output is the total cost of the order.*

c.

x	y
10	0
5	5
3	7
2	8
1	9
0	10

d.

x	y
10	1
5	2
4	2.5
2	5
1	10
0.5	20

e.

*James planted a bush in his yard. The year he planted it, the bush produced 17 flowers. Each year, the branches of the bush split, so the number of flowers doubles. The input is the year after planting, and the output is the number of flowers.*

f.

x	y
0	-7
2	-2
4	3
6	8
8	13

**1-101.** Work with your team to create one new table and one new situation that display linear relationships. Be sure to justify how you can tell that your table and situation are linear.

**1-102.** Without using a graph, decide whether the relationship shown in the table below at right. Write a clear summary statement justifying your ideas. Be prepared to share your ideas with the class.

x	y
1	0.5
4	-7
10	-22
15	-34.5

### 1-103. LEARNING LOG

In your Learning Log, explain how you can recognize a linear relationship in a table or the description of a situation. Be sure to include examples. Title this entry "Recognizing Linear Relationships" and label it with today's date.



**1-104.** Find the slope and intercepts of  $3x + 4y = 12$ . Sketch a graph. [Help \(Html5\)](#)  $\Leftrightarrow$  [Help \(Java\)](#)

**1-105.** Write an equation for the line that passes through the points  $(2, 0)$  and  $(0, -3)$ . Remember that drawing a diagram (in this case, drawing the graph) can be very helpful. [Help \(Html5\)](#)  $\Leftrightarrow$  [Help \(Java\)](#)

**1-106.** Solve each equation below. Give solutions in both radical and decimal form. [Help \(Html5\)](#)  $\Leftrightarrow$  [Help \(Java\)](#)

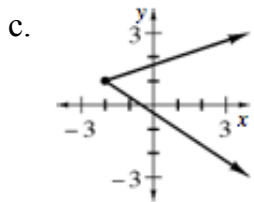
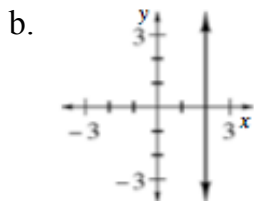
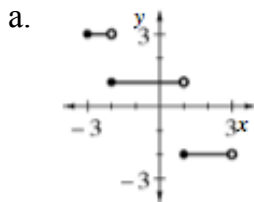
a.  $x^2 + 3x - 3 = 0$

b.  $3x^2 - 7x = 12$

**1-107.** Jason loves to download music. *Downloads R Us* sells songs only in packages of three, and it charges \$2.00 for each package of three songs. Jason's favorite group just released their *Greatest Hits* CD, which has 17 songs on it. Jason wants to buy all 17 songs from *Downloads R Us*. How much should Jason expect to pay? [Help \(Html5\)](#)  $\Leftrightarrow$  [Help \(Java\)](#)

**1-108.** Make a sketch of a graph showing the relationship between the number of people on your school's campus and the time of day. [Help \(Html5\)](#)  $\Leftrightarrow$  [Help \(Java\)](#)

**1-109.** For each graph below, what are the domain and range? [Help \(Html5\)](#)  $\Leftrightarrow$  [Help \(Java\)](#)



**1-110.** Uyregor has a collection of six-sided number cubes. He takes one out to roll it. [Help \(Html5\)](#)  $\Leftrightarrow$  [Help \(Java\)](#)

- What are all possible outcomes that can come up?
- What is the probability that a 4 comes up?
- What is the probability that the number that comes up is less than 5?