0.7 What do they have in common?

The Family of Linear Functions

In Lesson 0.6 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. Consider functions of the form f(x) = mx + b.
   a. What do x and y represent in this function? What do m and b represent? Which ones can you change?
   b. With the rest of the class, explore the effects of m and b on the function f(x) = mx + b. What effect does m have on the graph? What effect does b have on the graph?
   c. 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.
   d. What do all of the functions of the form f(x) = 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**.

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

3. 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.

   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

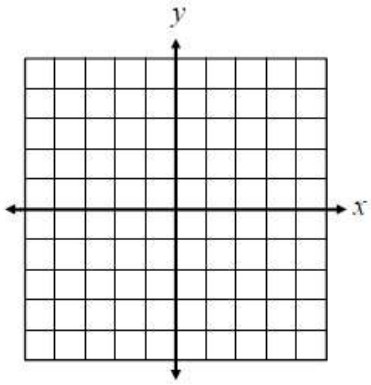
   d.

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

Main Ideas/Questions	Notes/Examples
ABSOLUTE VALUE FUNCTIONS	• The **absolute value function** is written as _____ • Complete the table below to graph the function. Give the domain and range. | x | | $\|x\|$ | -3 -2 -1 0 1 2 3  D = _____ R = _____ • The **graph** looks like a _____; The **turning point** is called the _____.
GRAPHING {by Table}	To create a table of values, it's best to place the vertex in the middle, then include values on both sides. ① Find the **x-value of the vertex.** Set the expression from the inside of the absolute value bars equal to 0 and solve. ② **PLACE THIS VALUE IN THE MIDDLE ROW OF YOUR TABLE.** Number up and down, then complete the table. ③ **GRAPH!**

Main Ideas/Questions	Notes	
WARM-UP	**1.** If $\|x\| = 7$, what are the possible values of x?	**2.** If $\|x\| = -4$, what are the possible values of x?
STEPS TO SOLVE Absolute Value Equations	① **ISOLATE** the absolute value expression. ② **CREATE TWO CASES.** Set the "inside" equal to both the positive and negative value of the number on the opposite side of the equal sign. ③ **SOLVE** both equations. ④ **CHECK** for extraneous solutions.	