LEARNING OBJECTIVE: We will define linear functions and write function rules based on scenarios and tables of values. (G8M5L3)

CONCEPT DEVELOPMENT:

Constant rates and proportional relationships can be described by a **linear function**, where the rule is a linear equation in the form of $y = mx + b$, where m and b are constants. The graph of a linear function is a straight line.

Example: A bathtub has 12 gallons of water already in it, and is filling at a rate of 2 gallons per minute.

$y = 2x + 12$

Table Example:

$$y = 1.25x$$

Bags of candy (x)	1	2	3	4	5	6	7
Cost (y)	$1.25	$2.50	$3.75	$5.00	$6.25	$7.50	$8.75

Why is this a _linear_ function?

constant rate. would graph as straight line.

Function notation: instead of writing $y = 3x - 4$, we can say $f(x) = 3x - 4$.

$f(x)$ is read as "f of x" or "y is a function of x."

F of x

Example: Christine walks 3 miles each hour.

$y = 3x$ *y*   *x*

$f(x) = 3x$

The number of miles you walk is a function of the amount of time you spend walking.

Different ways to say the same thing.

x	y	
independent variable	dependent variable	← *story*
horizontal axis	vertical axis	← *graph*
x	$f(x)$	← *equation*
input	output	← *table*
domain	range	← *possible values*

restrictions possible

Guided Practice:

Steps for Evaluating Functions
1. Read the scenario carefully, and study the table (if values are provided) to verify the function is linear.
2. Create the function rule based on the information provided.
3. Graph your rule.
4. Answer any questions about the rule.

The table below shows the function of time in minutes with respect to mowing an area of lawn in square feet.

Number of minutes (x)	5	20	30	50
Area mowed in square feet (y)	36	144	216	360

What is the **rate** of mowing a lawn in 5 minutes?

$\frac{36}{5} = 7.2$

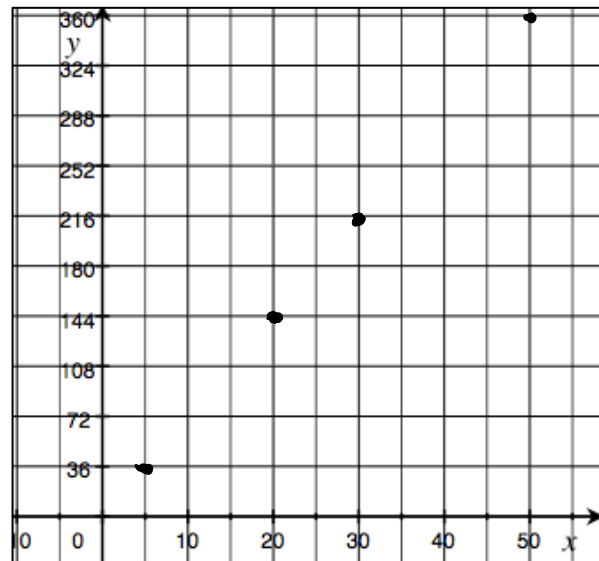What about 20 minutes?

$\frac{144}{20} = 7.2$

30 minutes?

$\frac{216}{30} = 7.2$

50 minutes?

$\frac{360}{50} = 7.2$

Write a function rule that describes the area in square feet *(y)* that can be mowed in *x* minutes.

$f(x) = 7.2x$ or $y = 7.2x$

How long will it take to mow 400 square feet of lawn?

$\rightarrow 400 = 7.2x$ It would take 55-56 minutes

How many square feet can you mow in 24 minutes?

$f(x) = 7.2x$ $f(24) = 7.2(24) = 172.8$ sq. ft.

What are the restrictions on the domain and range?

$x \geq 0$ $y \geq 0$

Water is flowing from a hose, and the amount of water that comes out has been captured at the times indicated in the table below.

| Time in minutes *(x)*	10	25	50	70
Total Volume of Water in gallons *(y)*	44	110	220	308

Describe the function in terms of volume and time.

The amount of water flowing from the hose **is a function of** the time gone by

Write a function rule that describes the volume of water in gallons, *y*, in *x* minutes. Graph the function.

$y = 4.4x$ $f(x) = 4.4x$

What number does the function assign to 250? That is, how many gallons of water flow from the hose in 250 minutes?

$f(250) = 4.4(250) = 1100$
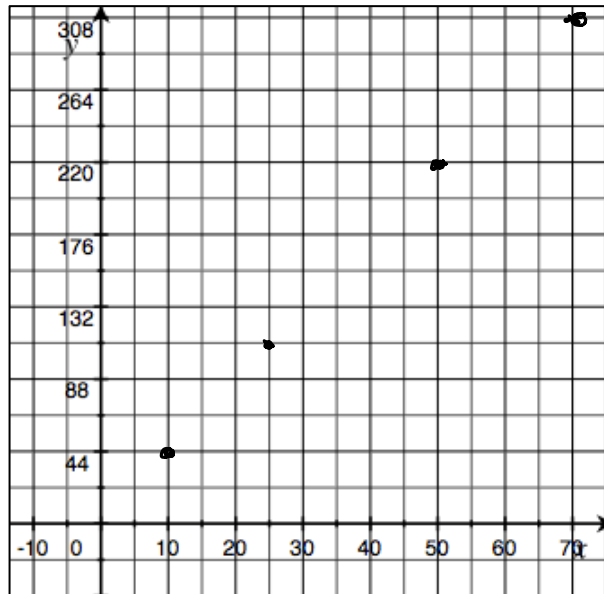
A backyard pool needs 17,300 gallons of water to fill it up. If it already $\frac{1}{4}$ full, write a rule that describes the volume of water flow as a function of the time needed for filling the pool with the hose, including the number of gallons already in the pool.

4325 gallons in the pool already.

$f(x) = 4.4x + 4325$

How many hours will it take to finish filling up the pool?

$17,300 = 4.4x + 4325$ $4.4x = 12975$

$x \approx 2948.6$

What are the restrictions on the domain and range? $\dfrac{x \approx 2948.6}{60}$

$x \geq 0$ $y \geq 4325$

$x \approx 49$ hours

You can buy a reusable mug for $9.00 at the theatre, and refill your soda for $2.00 each time.

Complete the table below.

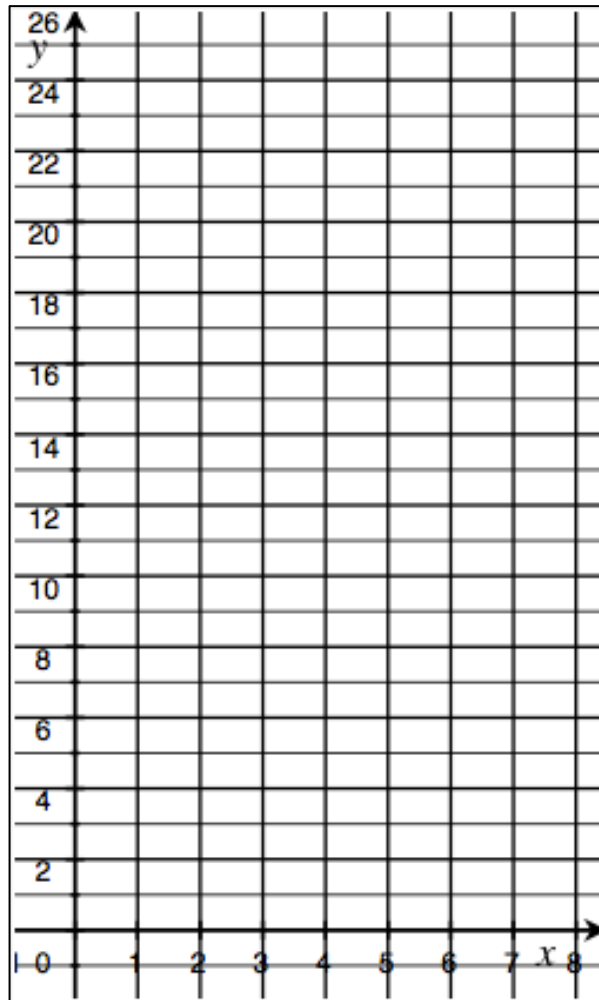| Number of sodas purchased (x)	0		4	5	
Amount paid (y)	9	13			21

Describe the function in terms of sodas purchased and money spent.

Write a function rule that describes the amount of money paid, y, for x sodas. Graph the function.

How much money would you need to 8 sodas?

If you had $31, how many sodas would you be able to drink?

What are the restrictions on the domain and range?

Logan has a certain amount in her bank account when she decides she's going to make recurring weekly deposits (she puts the **same** amount in each week). Below is a partial table of values.

Number of weeks (x)	0	1	3		10	
Amount in Logan's bank account (y)		95		195	275	315

How much money does Logan have when she decides she's going to start to deposit the same amount?

How much does Logan deposit each week?

Write a function rule that describes the amount of money Logan has in her account, *y*, after *x* weeks. Graph the function.

If Logan needs $500 to go on tour, how long will it take her to save that amount?
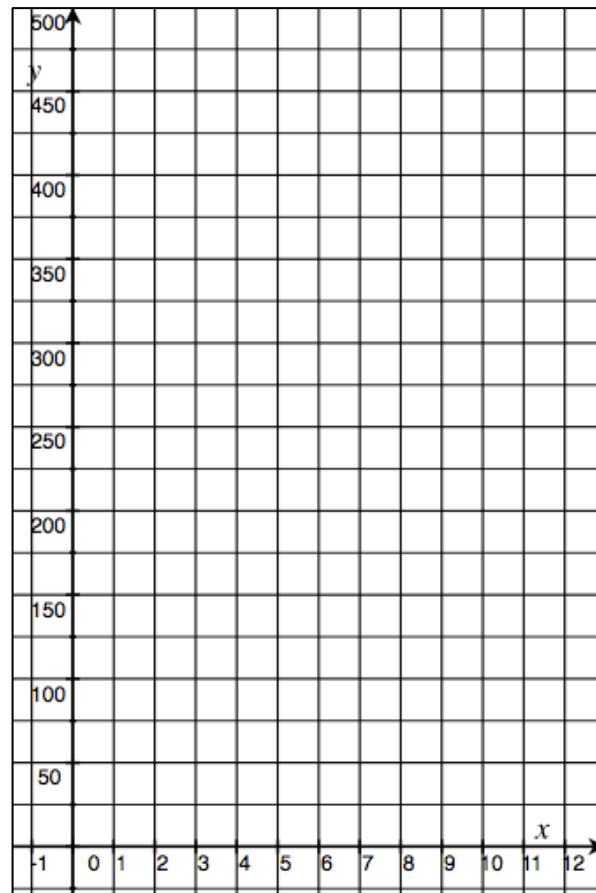
What are the restrictions on the domain and range?

Independent Practice:

Battery charging activity from Illustrative Math can be independent practice.

Activating Prior Knowledge:

We can write linear equations based on a table of values.

Write the equation based on the following table of values:	Write the equation based on the following table of values:

<table>
<tr><td>

x	y
0	5
1	8
2	11
3	14

Equation:

</td><td>

x	y
0	-4
2	-6
4	-8
6	-10

Equation:

</td></tr>
</table>

Closure:

Teacher Notes: