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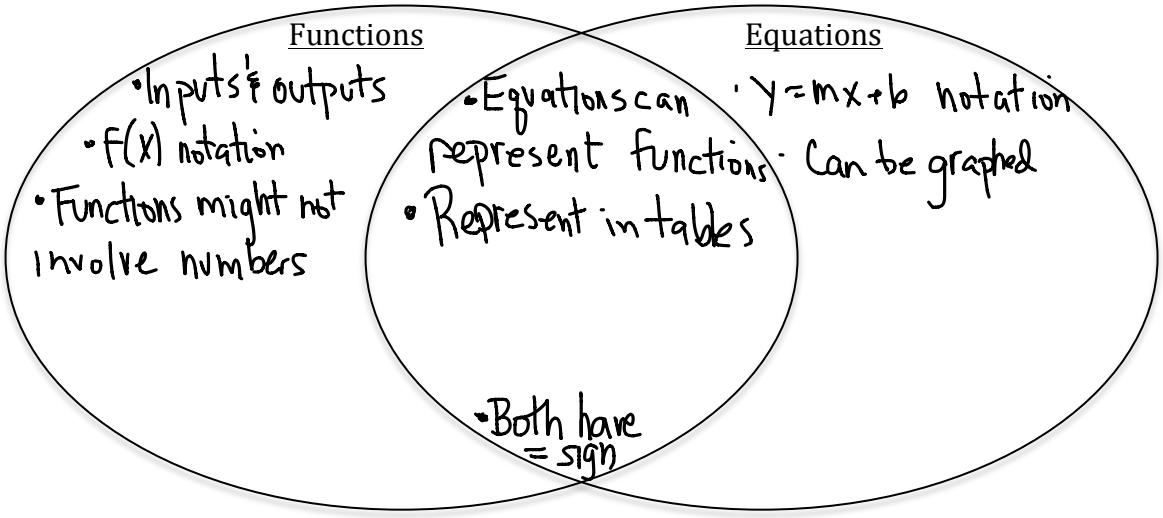
Learning Objective: We will compare the graphs of functions and equations and will determine when a function is a linear function. (G8M5L5)

Concept Development:

Functions: A function is a rule that assigns each input exactly one output.
Stated another way: no *x*-values are repeated.

What is the difference between a function and an equation?



An equation can be used to define a function.
Example: If I begin the school year with 300 markers, and every week, we throw away (or lose) 12 markers, the number of markers I have at any given point is a function of how much time has passed. We can express this function as an equation: $y = 300 - 12x$ where y is the number of markers, and x is the number of weeks that have gone by.

The **graph of a function** is the same as the graph of the equation that describes it. If a function is can be described by the equation $y = mx$, then the ordered pairs of the graph are (x, mx) and the graph of the function is the same as the graph of the equation.

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OUR FOCUS IS ON LINEAR FUNCTIONS

Linear Functions: A function where the rule is specifically a linear equation in the form $y = mx + b$.

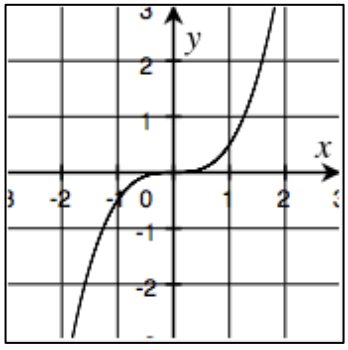
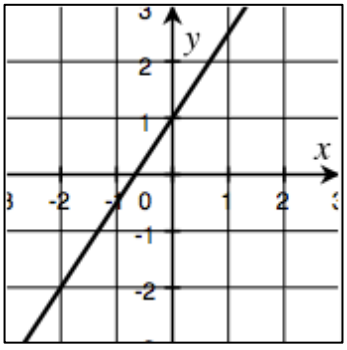
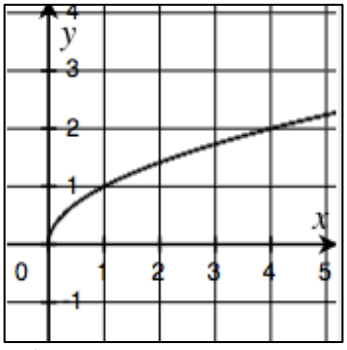
Example: I have $30 loaded on my Starbucks card, and each day I get a medium coffee for $2.00.

This linear function can be represented by the equation: $f(x) = -2x + 30$, where the amount of money I have remaining on my Starbucks card is a function of how many days I've bought a medium coffee.

1. Read these stories. Which are linear functions? Why?

a. I begin the year with $500 in my bank account, and each week, I deposit $25. Yes. rate of change (+25) is constant.	b. The number of people who use Twitter has been doubling every year. No! Rate of change Not constant!! (Exponential)	c. I jumped out of an airplane, and I continued to gain speed going down toward the ground until I pulled the parachute cord. No! Parachute makes you slower, gravity makes you faster.

2. Look at these graphs. Which graphs represent linear functions?

 CUBIC -- NOT STRAIGHT	 STRAIGHT LINE!	 SQUARE ROOT NOT STRAIGHT

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3. Look at these equations. Which equations represent linear functions?

$y = -40x + 600$	$y = 3 + \frac{1}{5}x$	$y = x^2 - 1$
Yes! x raised to 1st power!	Yes! X raised to 1st power	No. X raised to 2nd power.

4. Look at these tables. Which tables represent LINEAR functions?

Input	Output
2	5
4 (+2)	7 (+2)
5 (+1)	8 (+1)
8 (+3)	11 (+3)
10	13

Yes. rate of change is constant.

Input	Output
2	4
3	9
4	16
5	25
6	36

No, because rate of change not constant. $\frac{\Delta y}{\Delta x}$

Input	Output
0	−3
1	1
2	6
3	9
4	13

No, because rate of change not constant.

How to tell is a function is a linear function:

Stories: Add or subtract the same amount each time rate of change → constant.

Graphs:

STRAIGHT!

Equations:

X is raised to 1st power

Tables:

Constant rate of change.

When rate of change is constant for pairs of inputs and their corresponding outputs, the function is a linear function.

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Guided Practice:

Determining Linear Functions

1. Read the scenario carefully, study any tables/graphs, and equations.
2. Determine if your function is linear.
3. Answer any additional questions based on your knowledge of functions.

Study the table below.

Input	Output
3	9
9	17
12	21
15	25

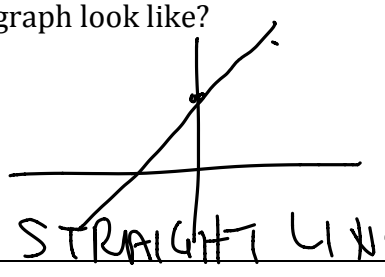
Does this table represent a linear function? Check at least 3 pairs of inputs and their corresponding outputs.

Yes! $\frac{6}{6} = \frac{4}{3} = \frac{4}{3}$

What equation could you use to describe this function?

$y = \frac{4}{3}x + 5$

If you graphed the function, what would the graph look like?



Study the table below.

Input	Output
1	2
2	−1
4	−7
6	−13

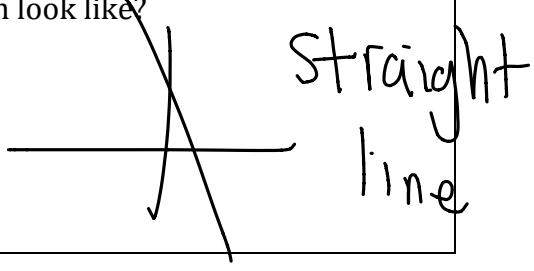
Does this table represent a linear function? Check at least 3 pairs of inputs and their corresponding outputs.

Yes! $\frac{-3}{1} = \frac{-6}{2} = \frac{-6}{2}$

What equation could you use to describe this function?

$y = -3x + 5$

If you graphed the function, what would the graph look like?



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Study the table below.

Input	Output
-1	2
0	0
1	2
2	8
3	18

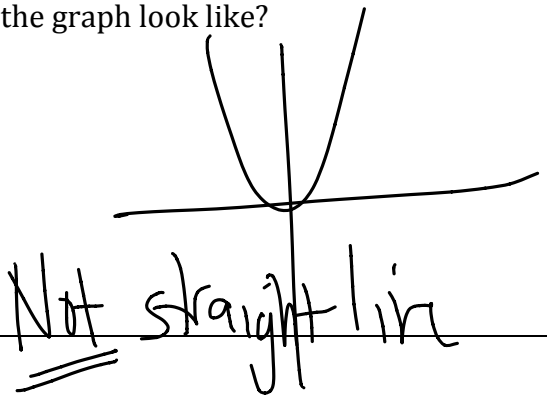
Does this table represent a linear function? Check at least 3 pairs of inputs and their corresponding outputs.

No! $\frac{-2}{1} \neq \frac{2}{1} \neq \frac{10}{1} \neq \frac{6}{1}$

What equation could you use to describe this function?

$y = 2x^2$

If you graphed the function, what would the graph look like?



Not straight line

Study the table below.

Input	Output
-2	4
3	9
4	16
4.5	20.25
5	25

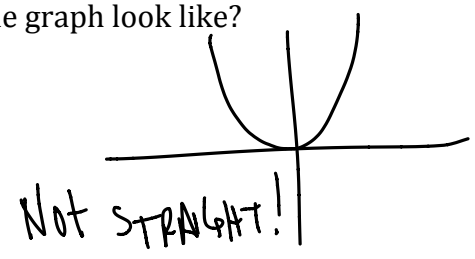
Does this table represent a linear function? Check at least 3 pairs of inputs and their corresponding outputs.

No! $\frac{5}{5} \neq \frac{7}{1}$

What equation could you use to describe this function?

$y = x^2$

If you graphed the function, what would the graph look like?



Not straight!

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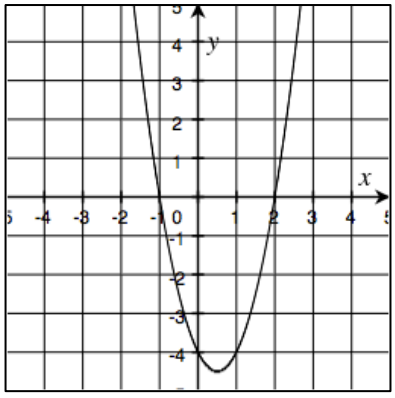
Is the following a graph of a linear function?

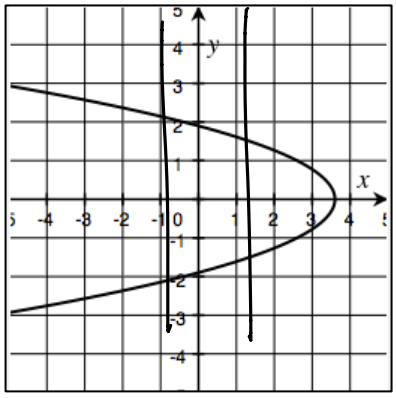


Nut

Can you determine the equation for this function?

$y=2(x+1)(x-2)$

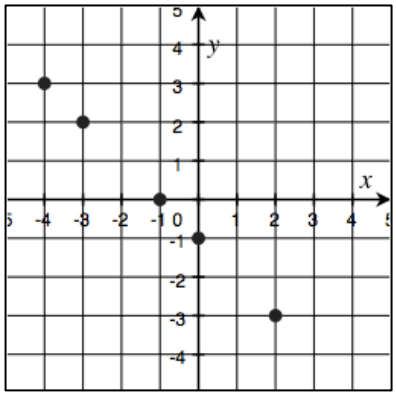
Is the following a graph of a linear function? No! Not function



Can you determine the equation for this function?

$x=-y^2+\frac{7}{2}$

Is the following a graph of a linear function?



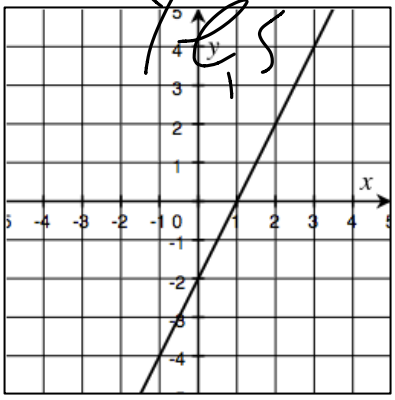
Yes.

Can you determine the equation for this function?

$-x-1$

x is integer.

Is the following a graph of a linear function? Yes



Can you determine the equation for this function?

$y=2x-2$

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Independent Practice:

Question 3, 4, and 6 from the problem set can be independent practice.

Activating Prior Knowledge:

$3x + 2 = 5x + 6$	$6 - 4x = 10x + 9$	$5x + 2 = 9x - 18$
$4(5x + 6) = 4(3x + 2)$	$-2(-4x + 6) = -2(10x + 9)$	$8x + 2 - 3x = 7x - 18 + 2x$
$\frac{3x + 2}{6} = \frac{5x + 6}{6}$	$\frac{10x + 9}{5} = \frac{6 - 4x}{5}$	$\frac{2 + 5x}{3} = \frac{7x - 18 + 2x}{3}$

Closure:

Exit ticket Lesson 6 for closure.

Teacher Notes:

Map to Lesson 7, Mod 5.