Contents

Standards: 8.EE.B.5

Module 4

Topic B

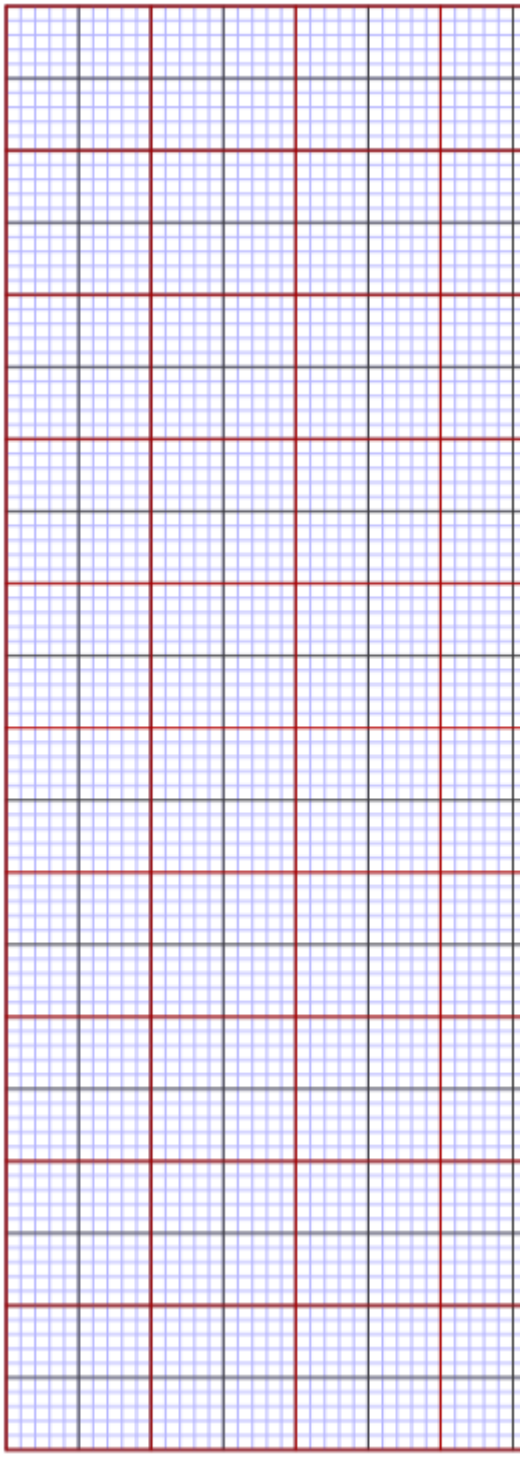
Lesson 10-14

Linear Equations in Two Variables and Their Graphs

“I Can” Do Math (Expressions & Equations)

I can understand the connections between proportional relationships, lines and linear equations.

- 8.EE.B.5 I can graph proportional relationships, interpreting the unit rate as the slope of the graph.
- 8.EE.B.5 I can use a table, an equation or graph to decide the unit rate of a proportional relationship.
- 8.EE.B.5 I can use the unit rate of a graphed proportional unit rate to compare different proportional relationships.



M4 L10 Proportional Relationships

Glue on notebook p.42

Essential Question:

_____

_____

Time (in hours)	Distance (in miles)
3	123
6	246
9	369
12	492
	y

We can write and solve a _____ that contains both x and y or use the table to help us determine the unit rate.

How many miles, y, can be traveled in any number of hours x?

What does the equation $y = 41x$ mean?

It means that the distance traveled, y, is equal to the rate of 41 multiplied by the number of hours x traveled at that rate.

Glue on notebook p.43

M4 L10 Proportional Relationships

Alex skateboards at a constant speed from his house to school 3.8 miles away. It takes him 18 minutes.

a. What fraction represents his constant speed, C?

b. After school, Alex skateboards at the same constant speed to his friend's house. It takes him 10 minutes. Write the fraction that represents constant speed, C, if he travels a distance of y.

c. Write the fractions from parts (a) and (b) as a proportion, and solve to find out how many miles Alex's friend's house is from school. Round your answer to the tenths place.

Classwork 9-27-2018

M4 L10 Proportional Relationships

1. Erek drives from school to soccer practice 1.3 miles away. It takes him 7 minutes.
   a. What fraction represents his constant speed, C?

   b. What fraction represents his constant speed, C, if it takes him x minutes to drive exactly 1 mile?

   c. Write and solve a proportion using the fractions from parts (a) and (b) to determine how much time it takes him to drive exactly 1 mile. Round your answer to the tenths place.

   d. Write a two-variable equation to represent how many miles Erek can drive over any time interval.

2. Noemi drives at a constant speed of 45 miles per hour.
   a. If she drives for y miles and it takes her x hours, write the two-variable equation to represent the number of miles Noemi can drive in x hours.

   b. Noemi plans to drive to the market 14 miles from her house, then to the post office 3 miles from the market, and then return home, which is 15 miles from the post office. Assuming she drives at a constant speed the entire time, how long will it take her to run her errands and get back home? Round your answer to the hundredths place.

M4 L11 Constant Rate

Glue on notebook p.44

8.EE.B.5: Graph proportional relationships interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Learning Target:

[ML1]_____

_____

Example 1

Elias mows a lawn at a constant rate. Suppose he mows a 35-square-foot lawn in 2.5 minutes. What area, in square feet, can he mow in 10 minutes? t minutes?

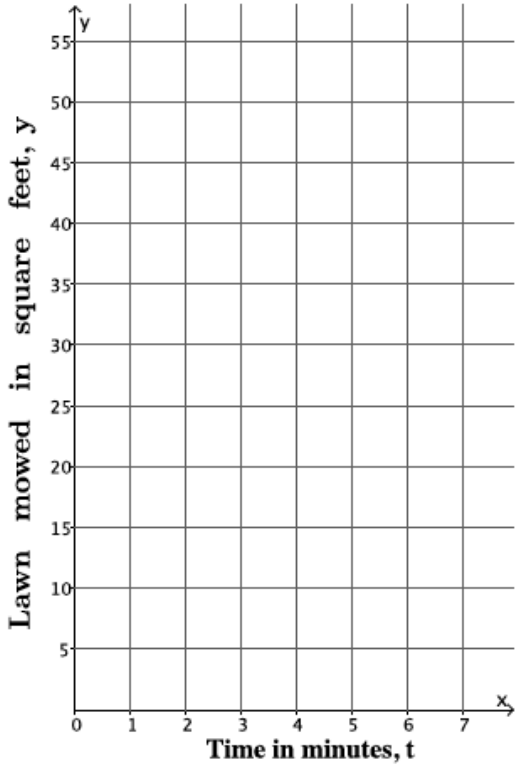
What are the ratio given? Can I write them out in fraction form?

In 10 mins	In t mins

Complete the table.

t (time in minutes)	Linear Equation:	y (area in square feet)

Graph the data on a coordinate plane.



M4 L11 Constant Rate

Glue on notebook p.45

Example 2

Water flows at a constant rate out of a faucet. Suppose the volume of water that comes out in three minutes is 10.5 gallons. How many gallons of water come out of the faucet in t minutes?

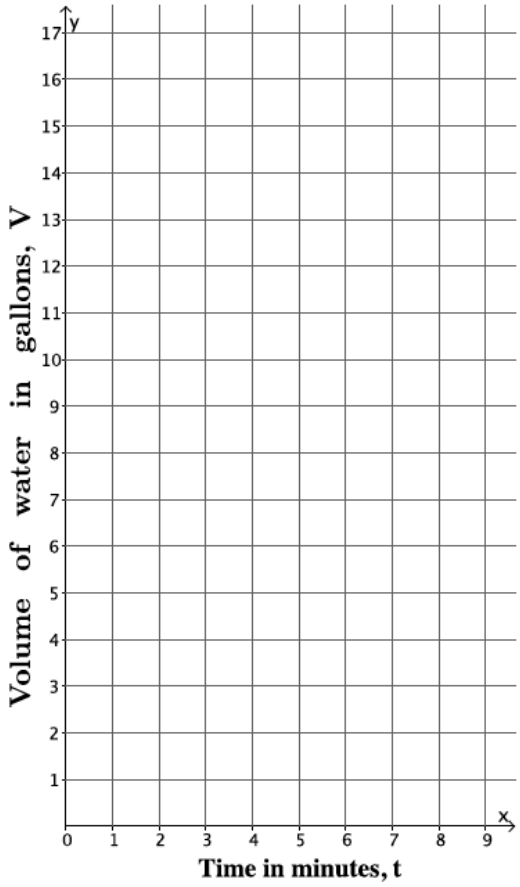
What are the ratio given? Can I write them out in fraction form? How can I use linear equation to represent the constant rate?

In 10 mins	In t mins

Complete the table.

t (time in minutes)	Linear Equation:	V (in gallons)
0		
1		
2		
3		
4		

Graph the data on a coordinate plane.



M4 L11 Constant Rate

Classwork 10-11-2018

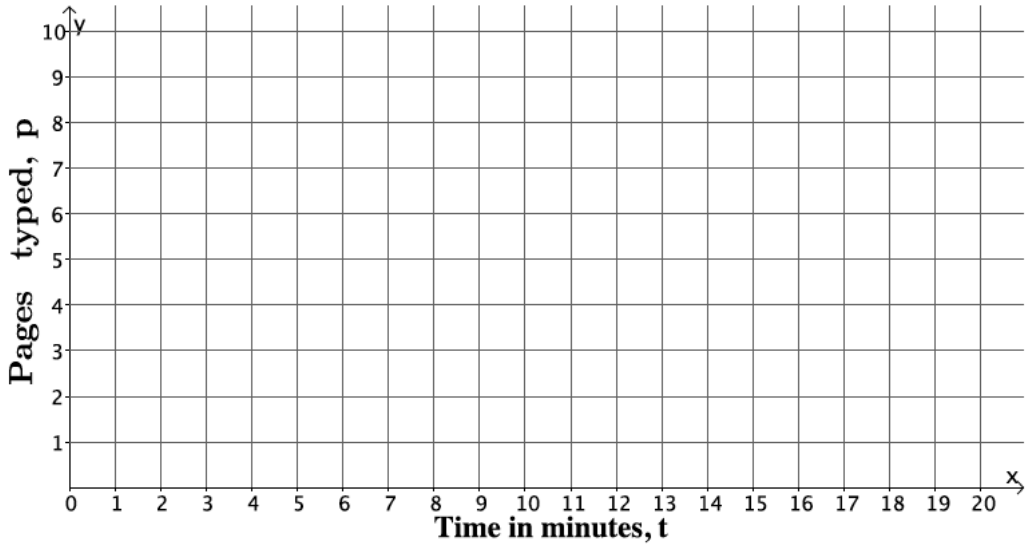
1. Jordan types at a constant rate. He can type a full page of text in $3\frac{1}{2}$ minutes. We want to know how many pages, p, Jordan can type after t minutes.

   a. Write the linear equation in two variables that represents the number of pages Jordan types in any given time interval.

   b. Complete the table below. Use a calculator, and round your answers to the tenths place.

t (time in minutes)	Linear Equation:	p (pages typed)
0		
5		
10		
15		
20		

   c. Graph the data on a coordinate plane.



   d. About how long would it take Juan to type a 5-page paper? Explain.

M4 L11 Constant Rate

Classwork 10-11-2018

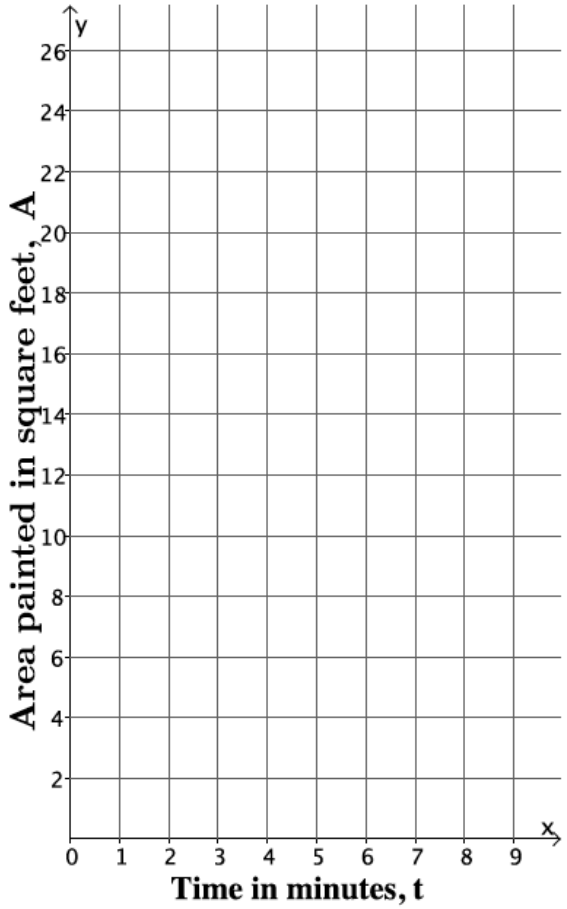
2. Saniah paints at a constant rate. She can paint 32 square feet in 5 minutes. What area, A, in square feet, can she paint in t minutes?

   a. Write the linear equation in two variables that represents the number of square feet Saniah can paint in any given time interval.

   b. Complete the table below. Use a calculator, and round answers to the tenths place.

***t* (time in minutes)**	**Linear Equation:**	***A* (area painted in square feet)**
0		
1		
2		
3		
4		

   c. Graph the data on a coordinate plane.



   d. About how many square feet can Saniah paint in $2\frac{1}{2}$ minutes? Explain.

M4 L11 Constant Rate Exit Ticket 10-11-2018 Name:_____

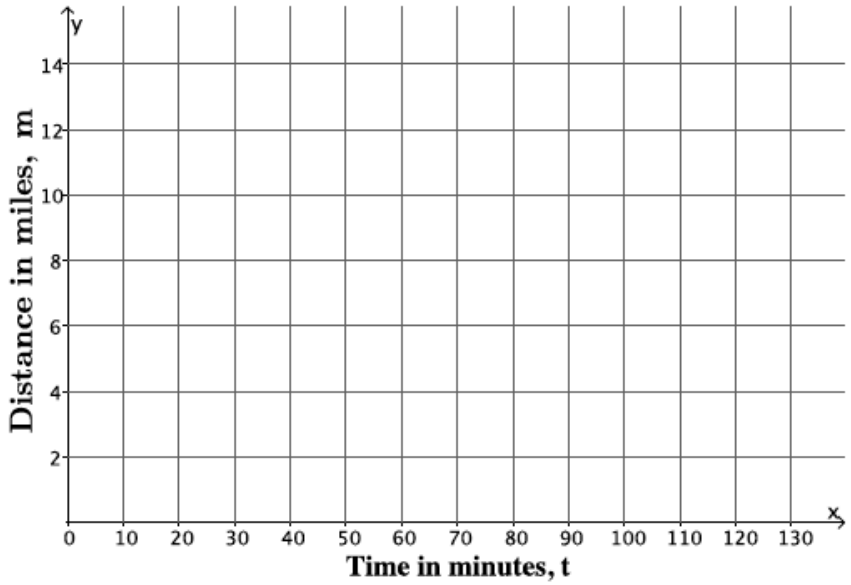
Joseph walks at a constant speed. He walked to a store that is one-half mile away in 6 minutes. How many miles, m, can he walk in t minutes?

Write the linear equation in two variables that represents the number of miles Joseph can walk in any given time interval, t.

Complete the table below. Use a calculator, and round answers to the tenths place.

t (time in minutes)	Linear Equation:	m (distance in miles)
0		
30		
60		
90		
120		

Graph the data on a coordinate plane.



Joseph's friend lives 4 miles away from him. About how long would it take Joseph to walk to his friend's house? Explain.

M4 L12 Linear Equations in Two Variables

Glue on notebook p.46

8.EE.B.5: Graph proportional relationships interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Learning Target:

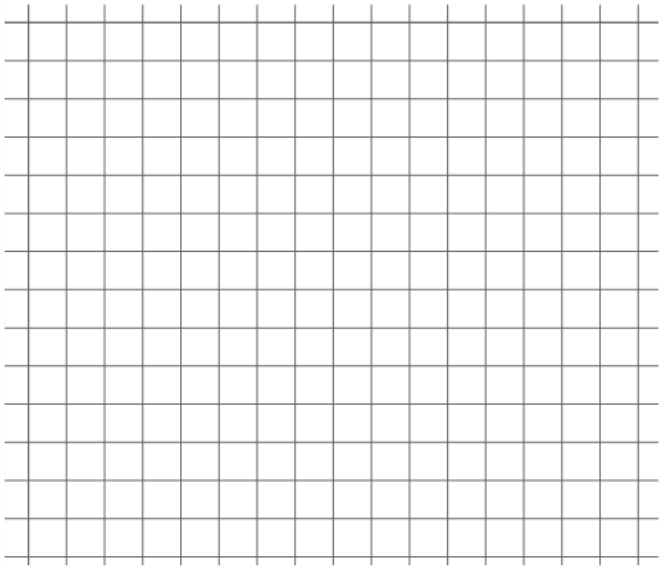
[ML2]_____

_____

1. Find five solutions for the linear equation $x + y = 3$, and plot the solutions as points on a coordinate plane.

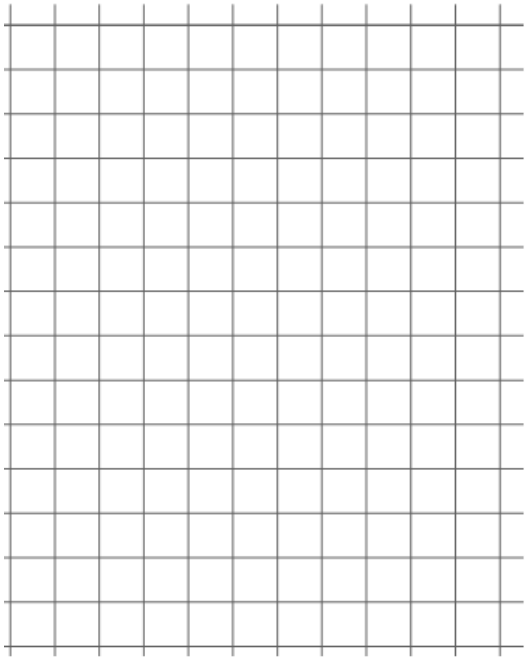
x	Linear Equation: $x + y = 3$	y

Small number would ease the mental math work.



2. Find five solutions for the linear equation $2x - y = 10$, and plot the solutions as points on a coordinate plane.

x	Linear Equation: $2x - y = 10$	y



M4 L12 Linear Equations in Two Variables

Glue on notebook p.46

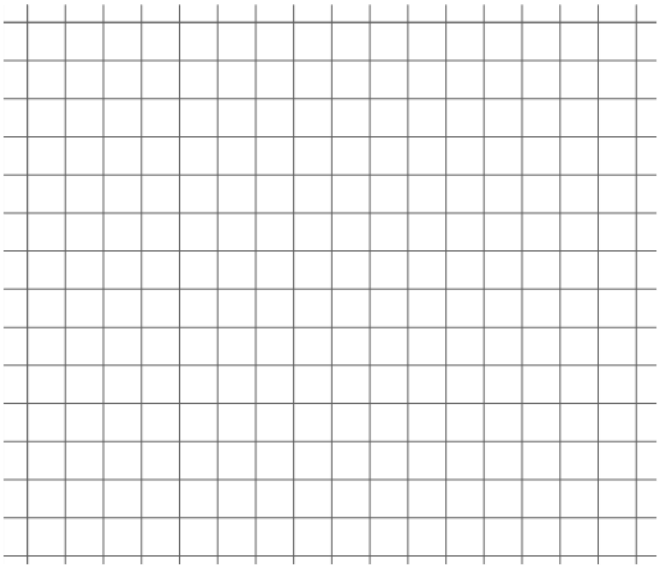
3. Consider the linear equation $\frac{2}{5}x + y = 11$.

   a. Will you choose to fix values for x or y? Explain.

   b. Are there specific numbers that would make your computational work easier? Explain.

   c. Find five solutions to the linear equation $\frac{2}{5}x + y = 11$, and plot the solutions as points on a coordinate plane.

x	**Linear Equation:** $\frac{2}{5}x + y = 11$	y



Lesson Summary

A linear equation in two-variables x and y is in standard form if it is of the form $ax + by = c$ for numbers a, b, and c, where a and b are both not zero. The numbers a, b, and c are called constants.

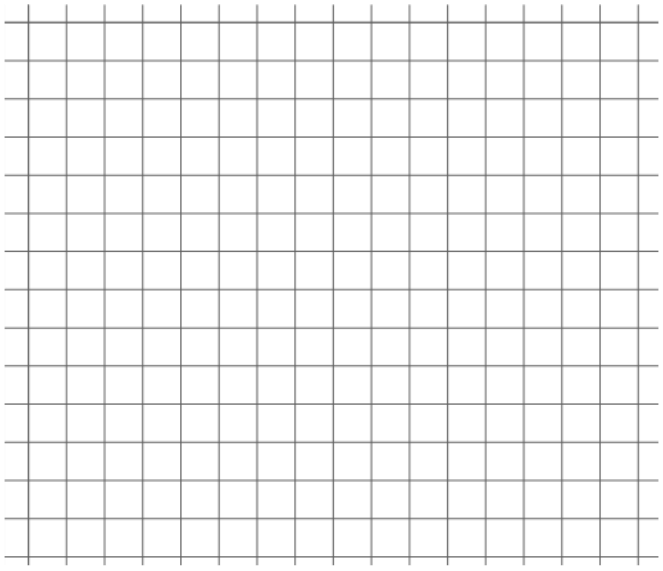
A solution to a linear equation in two variables is the ordered pair (x, y) that makes the given equation true. Solutions can be found by fixing a number for x and solving for y or fixing a number for y and solving for x.

M4 L12 Linear Equations in Two Variables

Classwork 10-12-2018

1. Find five solutions for the linear equation $x + 5y = 21$, and plot the solutions as points on a coordinate plane.

x	**Linear Equation:** $x + 5y = 21$	y



M4 L12 Linear Equations in Two Variables

Classwork 10-12-2018

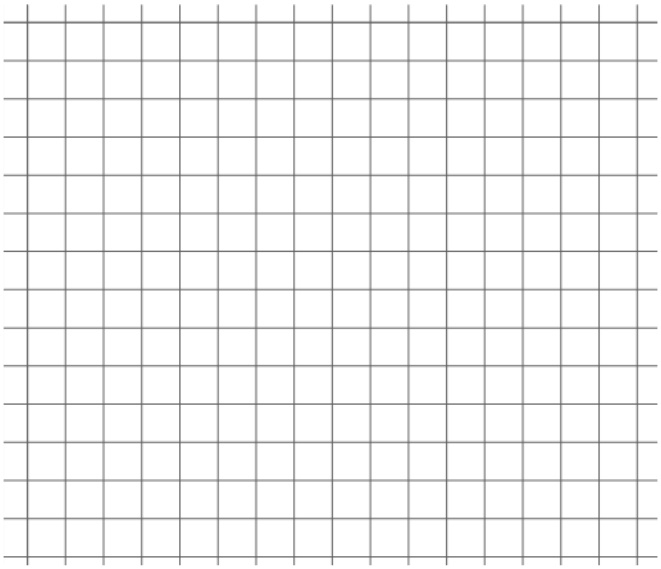
2. Consider the linear equation $x - \frac{3}{2}y = -2$.

   a. Will you choose to fix values for x or y? Explain.

   b. Are there specific numbers that would make your computational work easier? Explain.

   c. Find five solutions to the linear equation $x - \frac{3}{2}y = -2$, and plot the solutions as points on a coordinate plane.

x	**Linear Equation:** $x - \frac{3}{2}y = -2$	y

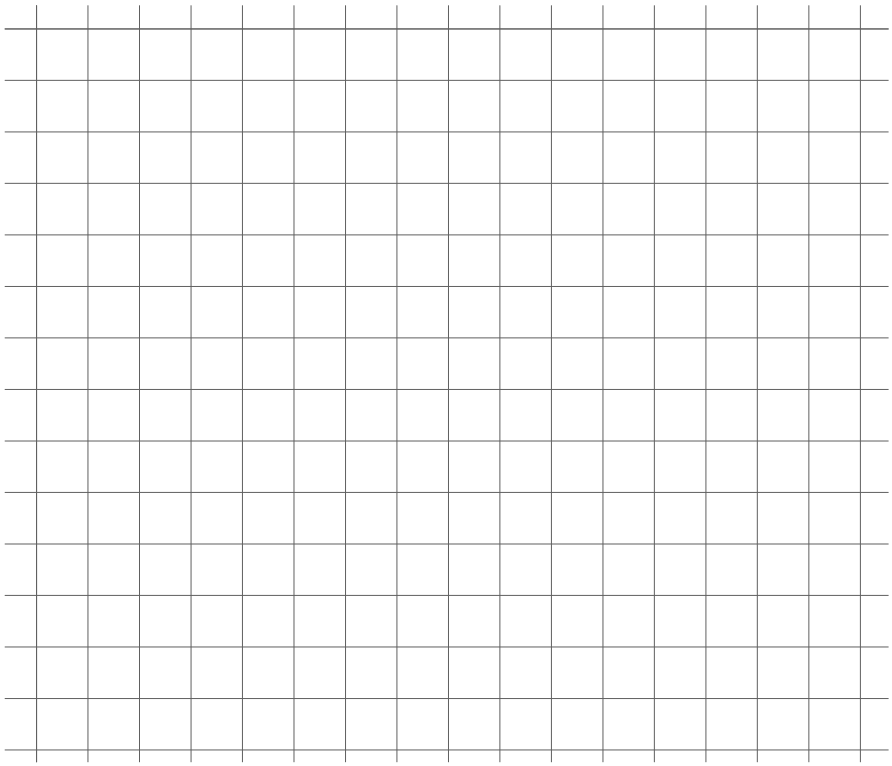


M4 L12 Linear Equations in Two Variables Exit Ticket 10-12-2018

Name:_____ Cohort:_____

1. Find three solutions for the linear equation $4x - 3y = 1$, and plot the solutions as points on a coordinate plane.

x	**Linear Equation:** $4x - 3y = 1$	y



M4 L13 The Graph of Linear Equations

Glue on notebook p.48

8.EE.B.5: Graph proportional relationships interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Learning Target:

[ML3]_____

_____

In the last lesson, we saw that the _____[ML4] of a linear equation in two variables can be plotted on a coordinate plane as points. The collection of all points (x, y) in the coordinate plane so that each (x, y) is a solution of $ax + by = c$ is called the graph of $ax + by = c$.

Do you think it is possible to plot all of the solutions of a linear equation on a coordinate plane?

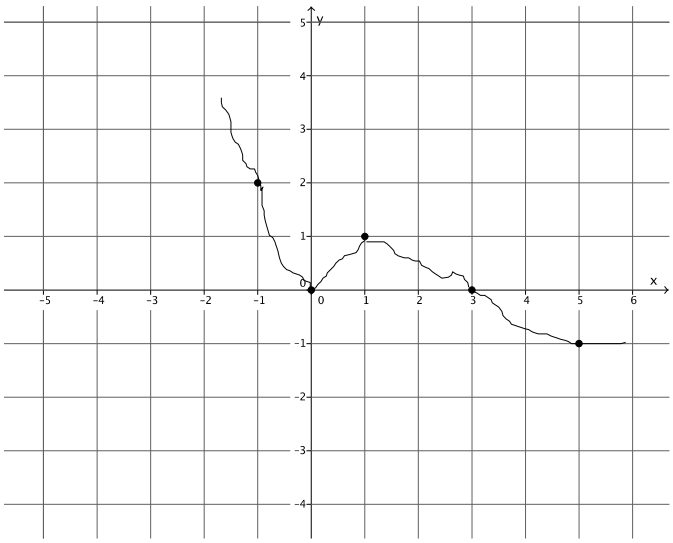
_____[ML5]_____

_____

___

♣ For that reason, we _____[ML6] draw the graph of a linear equation. What we can do is _____[ML7] of an equation and make _____[ML8] about what the graph should look like.

1. Julius predicts that the graph of $-x + 2y = 3$ will look like the graph shown below. Do you agree? Explain why or why not.

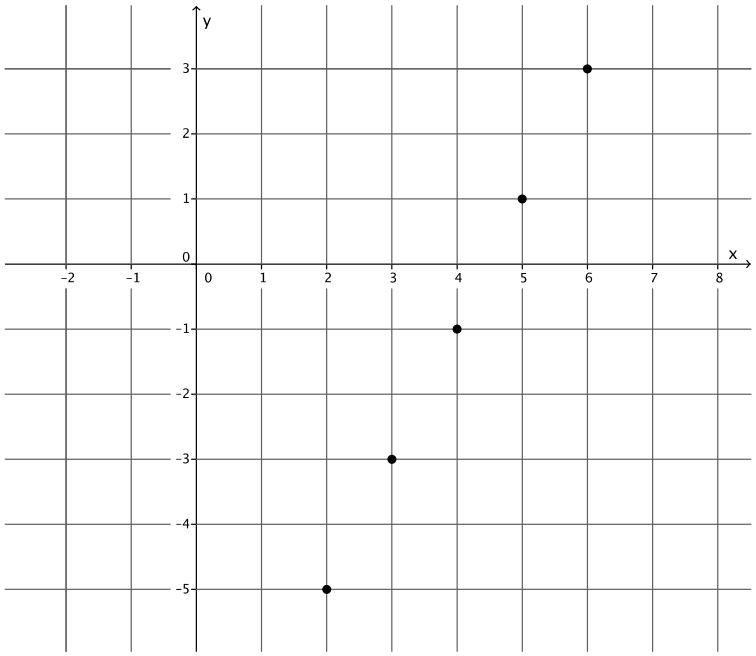


2. We have looked at some equations that appear to be lines. Can you write an equation that has solutions that do not form a line?

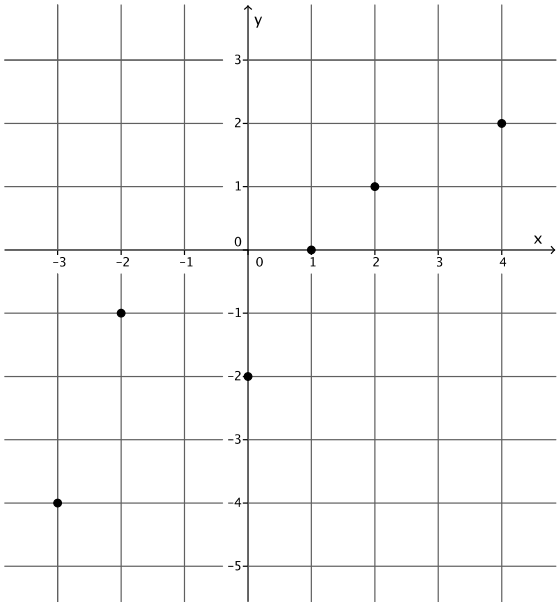
M4 L13 The Graph of Linear Equations

Glue on notebook p.49

3. Can the following points be on the graph of the equation $2x - y = 9$? Explain.



4. Can the following points be on the graph of the equation $x - y = 1$? Explain.



Lesson Summary

One way to determine if a given point is on the graph of a linear equation is by **checking to see if it is a solution to the equation**. Note that all graphs of linear

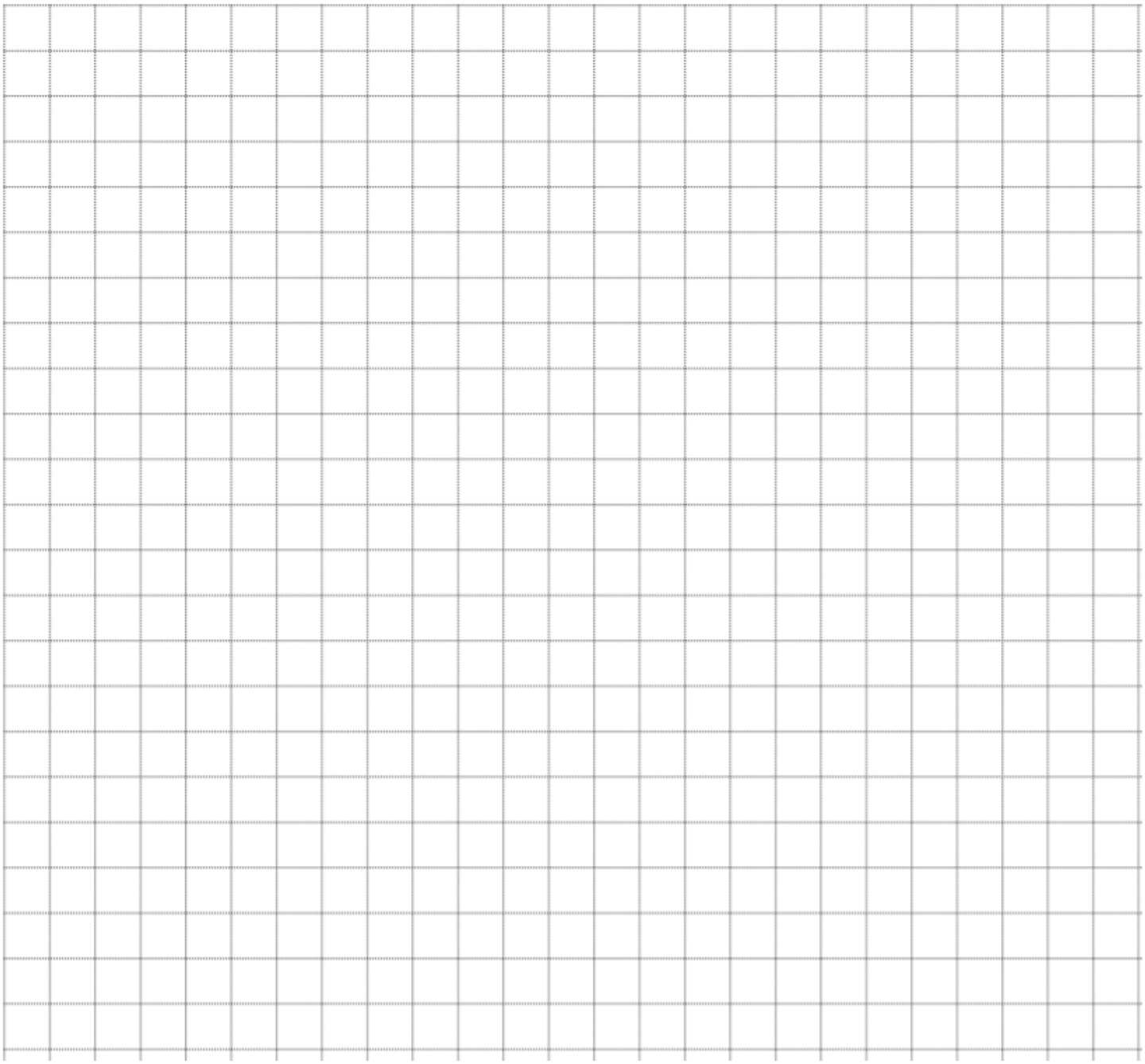
equations appear to be lines.

M4 L13 The Graph of Linear Equations

Classwork 10-15-2018

1. Find at least ten solutions to the linear equation $3x + y = -8$, and plot the points on a coordinate plane.

x	**Linear Equation:** $3x + y = -8$	y

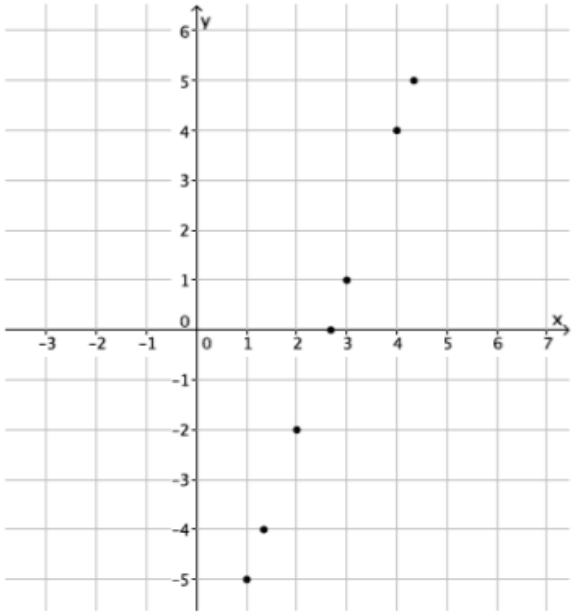


What shape is the graph of the linear equation taking?

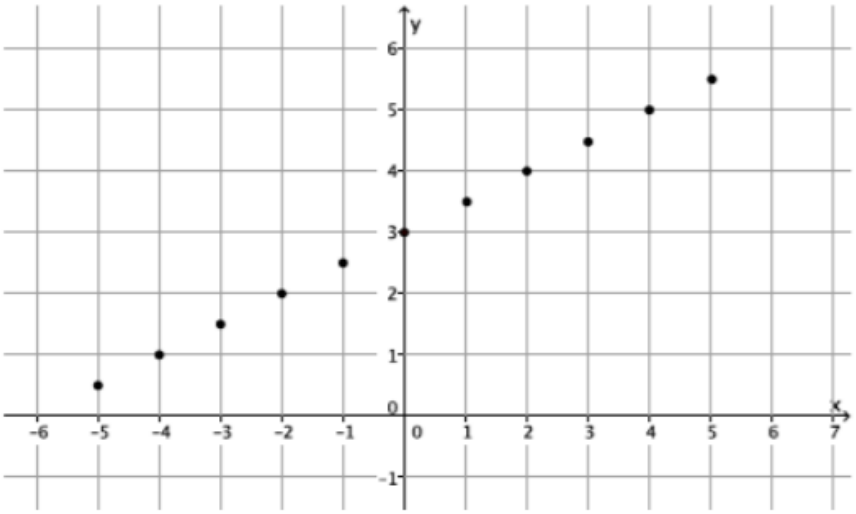
M4 L13 The Graph of Linear Equation Exit Ticket 10-15-2018

Name:_____ Cohort: _____

1. Ethan found solutions to the linear equation $3x - y = 8$ and graphed them. What shape is the graph of the linear equation taking?



2. Could the following points be on the graph of $-x + 2y = 5$?



M4 L14 Horizontal and Vertical Lines

Glue on notebook p.50

8.EE.B.5: Graph proportional relationships interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

Learning Target:

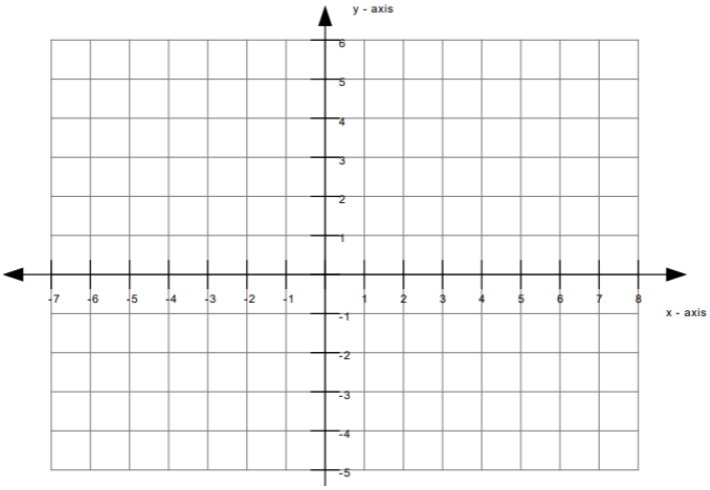
[ML9]_____

_____

1. Find at least four solutions to graph the linear equation $1x + 2y = 5$.

2. Find at least four solutions to graph the linear equation $1x + 0y = 5$.

3. What was different about the equations in Exercises 1 and 2? What effect did this change have on the graph?



From Lesson 13, we can say that the graph of a linear equation in two variables looks like a line. We want to be able to prove that the graph is a line, not just predict. For that reason, we will begin with two special cases of linear equations in two variables.

$$1 \cdot x + 0 \cdot y = 5.$$

How have we found solutions in prior lessons?

We find solutions _____ and then solve for the other variable. The numbers (x, y) are a solution to the equation.

What happens if we pick 7 for x? Explain

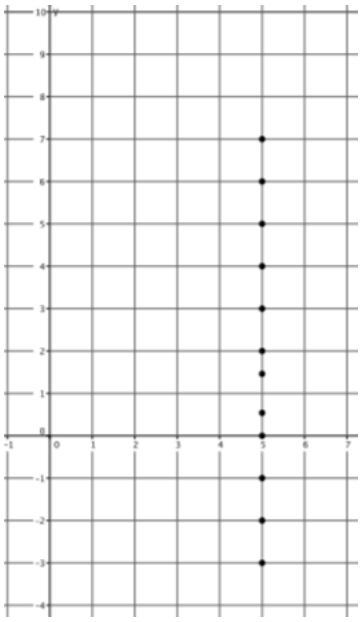
What happens if we pick 7 for y? Explain.

What happens if we pick −3 for y? Explain.

What happens if we pick 1/2 for y? Explain.

M4 L14 Horizontal and Vertical Lines

Glue on notebook p.51



What do you notice about the x-value each time we pick a number for y?

Look at the equation again. Can we show that x must always be equal to 5?

What does that mean for our y-values? Which number will produce a solution where $x = 5$?

$0 \cdot x + 1 \cdot y = 2$

What happens if we pick 7 for y?

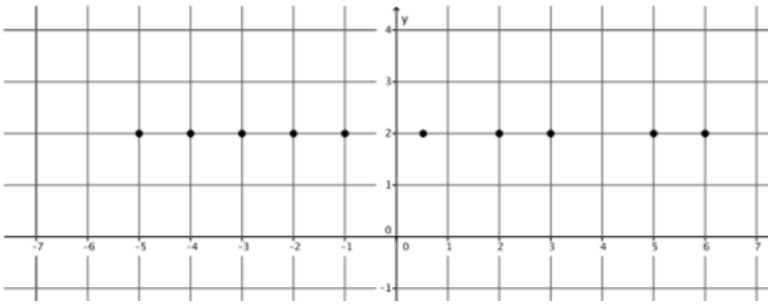
If $x = 5$, what value does y have?

If $x = -5$, what value does y have?

If $x = 1\ 2$, what value does y have?

Do you see a similar pattern emerging for this linear equation? Explain.

What do you think the graph of $y = 2$ will look like?



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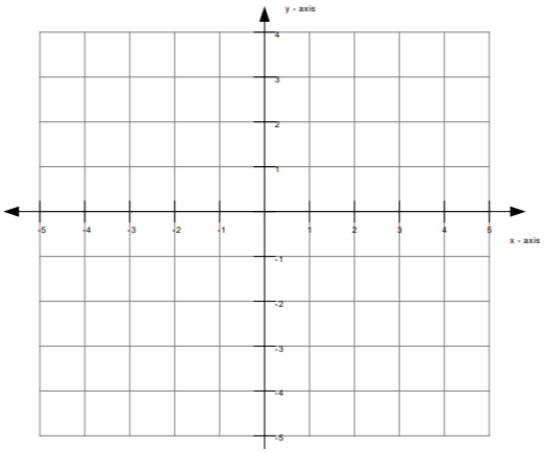
M4 L14 Horizontal and Vertical Lines

Classwork 10/16/2018

4. Graph the linear equation $x = -2$.

5. Graph the linear equation $x = 3$.

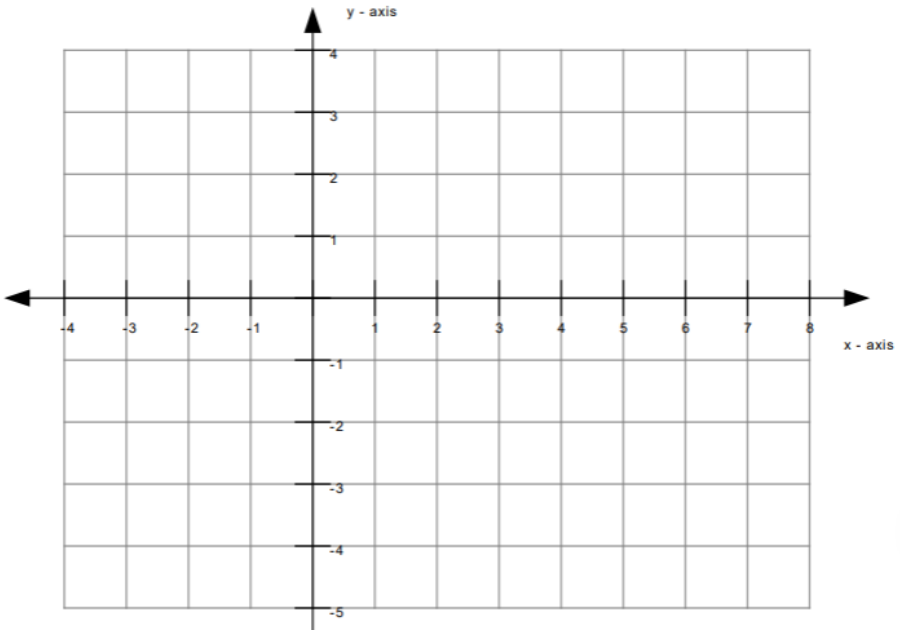
6. What will the graph of $x = 0$ look like?



7. Find at least four solutions to graph the linear equation $2x + 1y = 2$.

8. Find at least four solutions to graph the linear equation $0x + 1y = 2$.

9. What was different about the equations in Exercises 7 and 8? What effect did this change have on the graph?

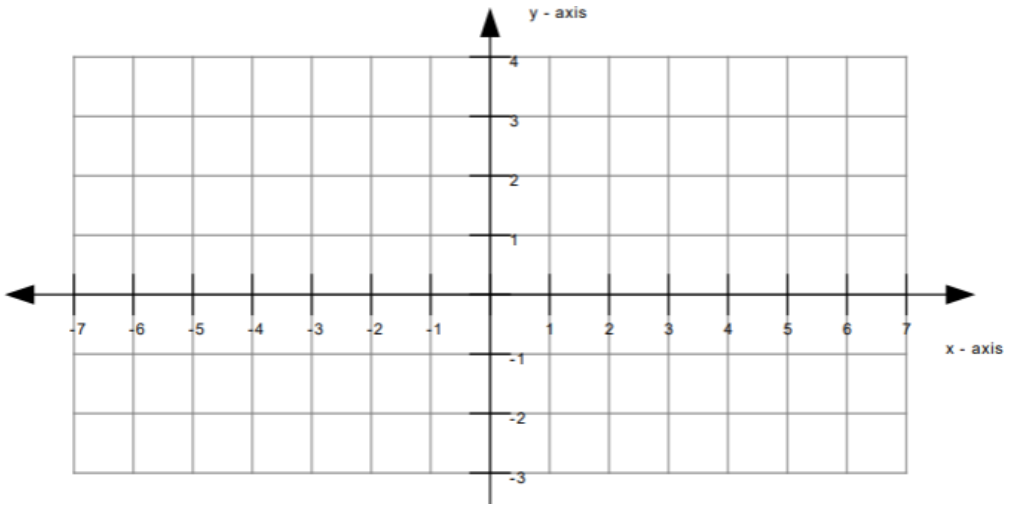


M4 L14 Horizontal and Vertical Lines Classwork 10/16/2018

10. Graph the linear equation $y = -2$.

11. Graph the linear equation $y = 3$.

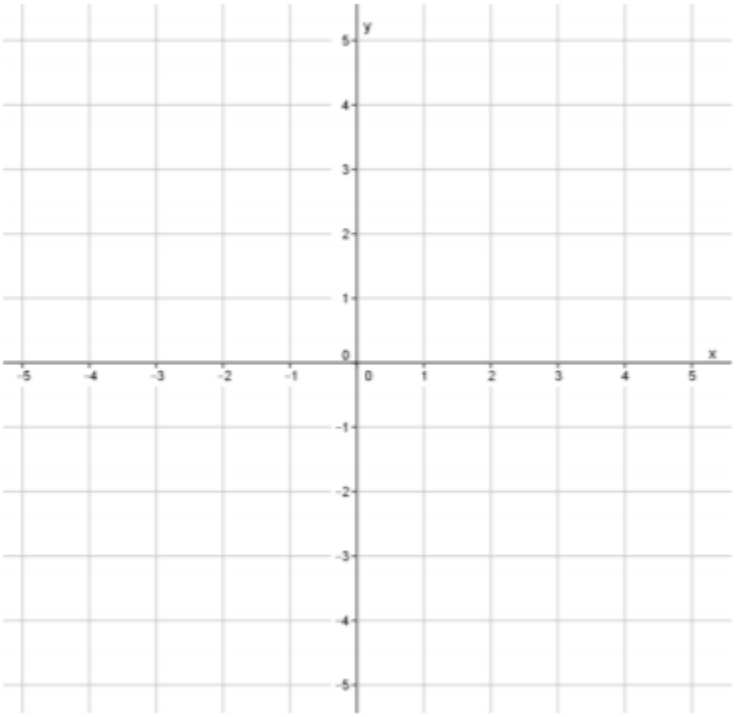
12. What will the graph of $y = 0$ look like?



M4 L14 Horizontal and Vertical Lines Exit Ticket 10-16-2018

Name:_____ Cohort: _____

1. Graph the linear equation $ax + by = c$, where $a = 0$, $b = 1$, and $c = 1.5$.



2. Graph the linear equation $ax + by = c$, where $a = 1$, $b = 0$, and $c = -\frac{5}{2}$.