Unit 4 – Lesson 23 **Name:** ______________________________________

The Equation of a Line **Date:** _______________ **Period:** _____________

Focus Standards:	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.*
	8.EE.B.6	Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation for a line through the origin and the equation for a line intercepting the vertical axis at .

Student Outcomes

- Students know that two equations in the form of $ax + by = c$ and $a'x + b'y = c'$ graph as the same line when $\frac{a'}{a} = \frac{b'}{b} = \frac{c'}{c}$ and at least one of a or b is nonzero.
- Students know that the graph of a linear equation $ax + by = c$, where a, b, and c are constants and at least one of a or b is nonzero, is the line defined by the equation $ax + by = c$.

Classwork

Exploratory Challenge/Exercises 1–3

1. Sketch the graph of the equation $9x + 3y = 18$ using intercepts.

a. Sketch the graph of the equation $y = -3x + 6$ on the same coordinate plane.

b. What do you notice about the graphs of $9x + 3y = 18$ and $y = -3x + 6$? Why do you think this is so?

c. Rewrite $y = -3x + 6$ in standard form.

d. Identify the constants a, b, and c of the equation in standard form from part (c).

e. Identify the constants of the equation $9x + 3y = 18$. Note them as a', b', and c'.

f. What do you notice about $\frac{a'}{a}$, $\frac{b'}{b}$, and $\frac{c'}{c}$?

2. Sketch the graph of the equation $y = \frac{1}{2}x + 3$ using the y-intercept and the slope.

a. Sketch the graph of the equation $4x - 8y = -24$ using intercepts on the same coordinate plane.

b. What do you notice about the graphs of $y = \frac{1}{2}x + 3$ and $4x - 8y = -24$? Why do you think this is so?

c. Rewrite $y = \frac{1}{2}x + 3$ in standard form.

d. Identify the constants a, b, and c of the equation in standard form from part (c).

e. Identify the constants of the equation $4x - 8y = -24$. Note them as a', b', and c'.

f. What do you notice about $\frac{a'}{a}$, $\frac{b'}{b}$, and $\frac{c'}{c}$?

3. The graphs of the equations $y = \frac{2}{3}x - 4$ and $6x - 9y = 36$ are the same line.

a. Rewrite $y = \frac{2}{3}x - 4$ in standard form.

b. Identify the constants a, b, and c of the equation in standard form from part (a).

c. Identify the constants of the equation $6x - 9y = 36$. Note them as a', b', and c'.

d. What do you notice about $\frac{a'}{a}$, $\frac{b'}{b}$, and $\frac{c'}{c}$?

e. You should have noticed that each fraction was equal to the same constant. Multiply that constant by the standard form of the equation from part (a). What do you notice?

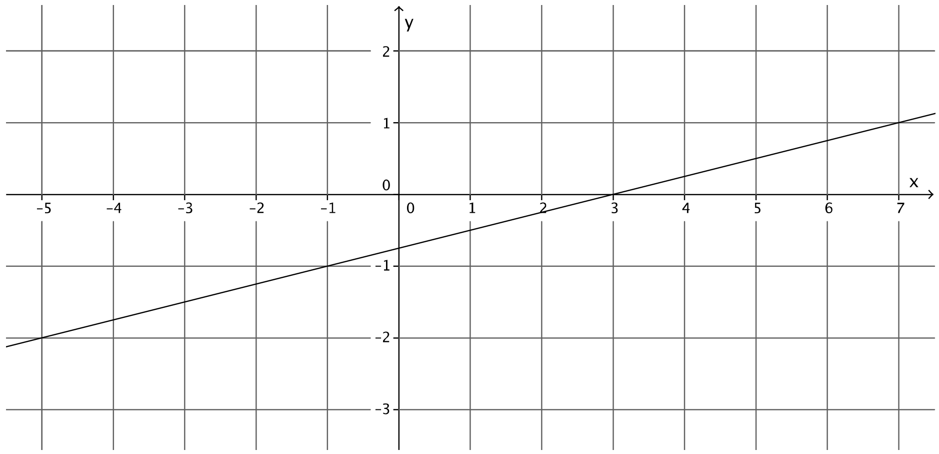
Exercises 4–8

4. Write three equations whose graphs are the same line as the equation $3x + 2y = 7$.

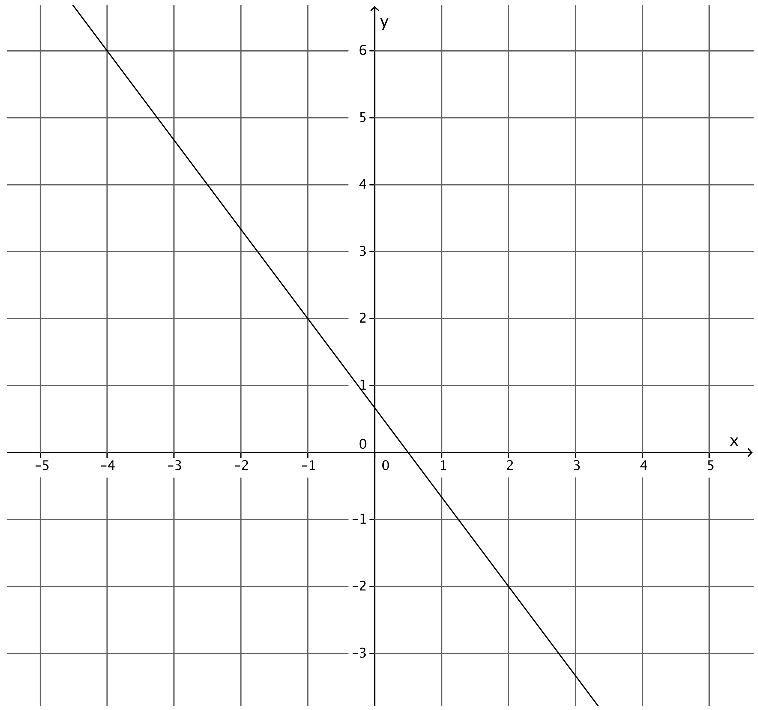
5. Write three equations whose graphs are the same line as the equation $x - 9y = \frac{3}{4}$.

6. Write three equations whose graphs are the same line as the equation $-9x + 5y = -4$.

7. Write at least two equations in the form $ax + by = c$ whose graphs are the line shown below.



8. Write at least two equations in the form $ax + by = c$ whose graphs are the line shown below.



Problem Set

1. Do the equations $x + y = -2$ and $3x + 3y = -6$ define the same line? Explain.

2. Do the equations $y = -\frac{5}{4}x + 2$ and $10x + 8y = 16$ define the same line? Explain.

3. Write an equation that would define the same line as $7x - 2y = 5$.

4. Challenge: Show that if the two lines given by $ax + by = c$ and $a'x + b'y = c'$ are the same when $b = 0$ (vertical lines), then there exists a non-zero number s, so that $a' = sa$, $b' = sb$, and $c' = sc$.

5. Challenge: Show that if the two lines given by $ax + by = c$ and $a'x + b'y = c'$ are the same when $a = 0$ (horizontal lines), then there exists a non-zero number s, so that $a' = sa$, $b' = sb$, and $c' = sc$.