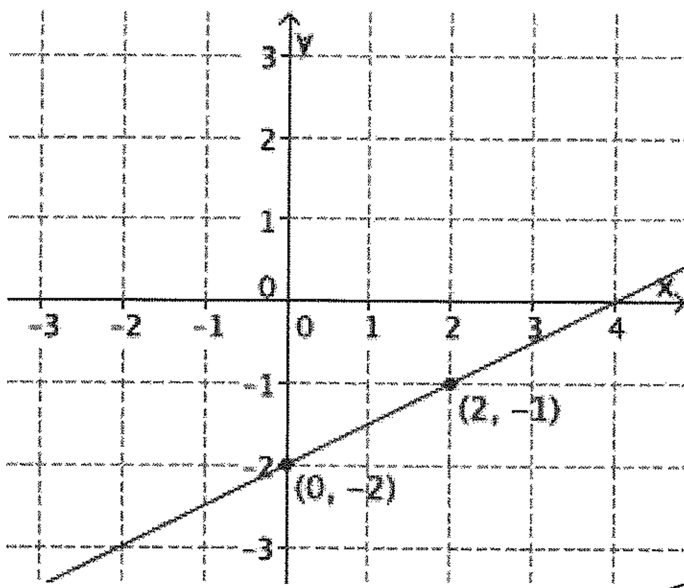
G8-M4-Lesson 19: The Graph of a Linear Equation in Two Variables Is a Line

Students need graph paper to complete the Problem Set.

1. Graph the equation: $y = \frac{1}{2}x - 2$.

> This is a linear equation in slope-intercept form. I will use the slope $m = \frac{1}{2}$ and the y-intercept point $(0, -2)$ to graph the linear equation.



2. Graph the equation: $4x + 8y = 16$.

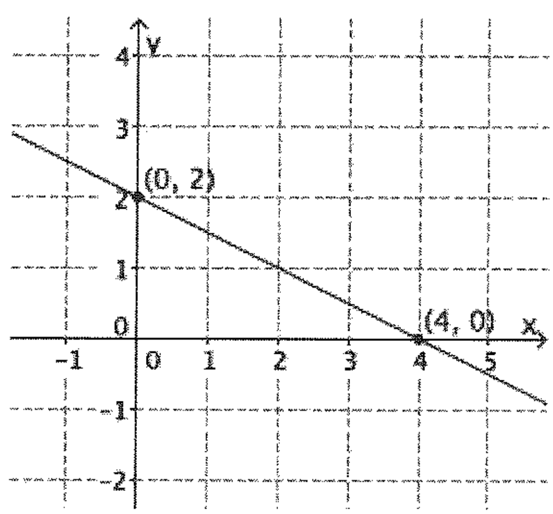
> This is a linear equation in standard form. I will find the y-intercept point by replacing the x with 0. I will find the x-intercept point by replacing the y with 0.

$$4(0) + 8y = 16$$
$$8y = 16$$
$$y = 2$$

The y-intercept point is $(0, 2)$.

$$4x + 8(0) = 16$$
$$4x = 16$$
$$x = 4$$

The x-intercept point is $(4, 0)$.



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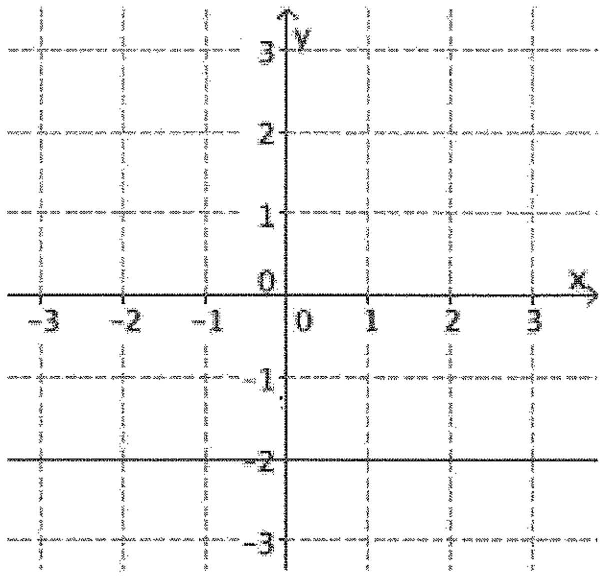
3. Graph the equation: $y = -2$. What is the slope of the graph of this line?



I remember that equations of the form $y = b$ are horizontal lines passing through the point $(0, b)$ where b is a constant.

The slope of this line is zero.

I can calculate the slope by using any two points on the graph of the line.

4. Is the graph of $x^2 - 6y = 11$ a line? Explain.

The graph of the given equation is not a line. The equation $6x^2 - 6y = 11$ is not a linear equation because the expression on the left side of the equal sign is not a linear expression. If this were a linear equation, then I would be sure that it graphs as a line, but because it is not, I am not sure what the graph of this equation would look like.

Linear expressions are constants like -1 or 5. Linear expressions can be a product of constants and an x like $5x$ or $-2x$, or a product of constants and a y like $9y$ or $-11y$.

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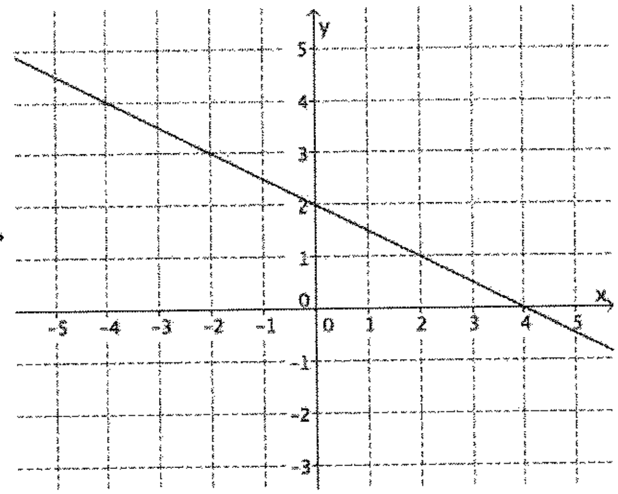
G8-M4-Lesson 20: Every Line Is a Graph of a Linear Equation

1. Write the equation that represents the line shown.

$$y = -\frac{1}{2}x + 2$$



> I identified point P as the y-intercept, which is $(0,2)$. I can use any point on the graph for point R, so I will use $(-4,4)$. Point Q will be $(-4,2)$. This will help me find the slope of $-\frac{2}{4}$, which is equivalent to $-\frac{1}{2}$. I will substitute the information into the slope-intercept form of the equation.

a. Use the properties of equality to change the equation from slope-intercept form, $y = mx + b$, to standard form, $ax + by = c$, where a, b, and c are integers, and a is not negative.

$$y = -\frac{1}{2}x + 2$$

$$\left(y = -\frac{1}{2}x + 2\right)2$$

$$2y = -x + 4$$

$$x + 2y = -x + x + 4$$

$$x + 2y = 4$$

> What number can I multiply the equation by so that $-\frac{1}{2}$ will become an integer?

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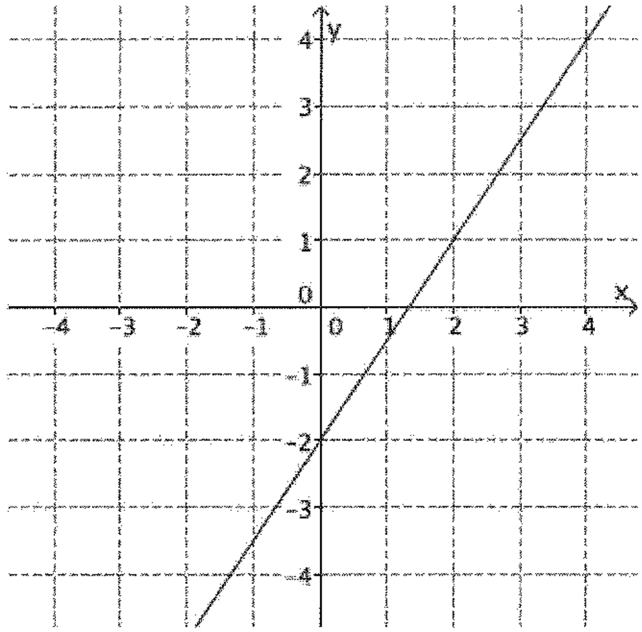
2. Write the equation that represents the line shown.

$$y = \frac{3}{2}x - 2$$



I need to calculate the slope and determine the y-intercept like I did in Problem 1.

a. Use the properties of equality to change the equation from slope-intercept form, $y = mx + b$, to standard form, $ax + by = c$, where a, b, and c are integers, and a is not negative.

$$y = \frac{3}{2}x - 2$$
$$\left(y = \frac{3}{2}x - 2\right)2$$
$$2y = 3x - 4$$
$$-3x + 2y = 3x - 3x - 4$$
$$-3x + 2y = -4$$
$$-1(-3x + 2y = -4)$$
$$3x - 2y = 4$$

I need to multiply each term on both the right and the left sides of the equation by -1 so that a is not negative.

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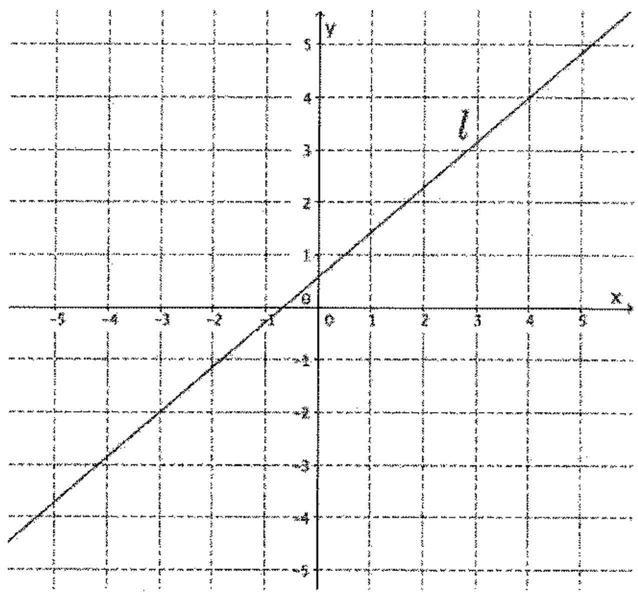
G8-M4-Lesson 21: Some Facts About Graphs of Linear Equations in Two Variables

1. Write the equation for the line l shown in the figure.



> I need to identify two points to find the slope. I will use $(-3, -2)$ and $(4, 4)$ because they have integer coordinates.

Using the points $(-3, -2)$ and $(4, 4)$, the slope of the line is

$$m = \frac{4 - (-2)}{4 - (-3)}$$
$$= \frac{6}{7}$$

The y-intercept point of the line is

$$4 = \frac{6}{7}(4) + b$$
$$4 = \frac{24}{7} + b$$
$$4 - \frac{24}{7} = \frac{24}{7} - \frac{24}{7} + b$$
$$\frac{4}{7} = b$$

> I can see that the line doesn't intersect the y-axis at integer coordinates, so I need to calculate the y-intercept, $(0, b)$. I can use either point to substitute into my equation $y = mx + b$.

The equation of the line is $y = \frac{6}{7}x + \frac{4}{7}$.

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2. Write the equation for the line that goes through point $(11, -8)$ with slope $m = 5$.

$$-8 = 5(11) + b$$
$$-8 = 55 + b$$
$$-63 = b$$

The equation of the line is $y = 5x - 63$.

I know the slope. I only need to calculate the y-intercept.

3. Determine the equation of the line that goes through points $(-7,3)$ and $(5,-6)$.

The slope of the line is

$$m = \frac{-6-3}{5-(-7)}$$
$$= \frac{-9}{12}$$
$$= -\frac{3}{4}$$

This problem is similar to Problem 1, but without a graph.

The y*-intercept point of the line is*

$$-6 = -\frac{3}{4}(5) + b$$
$$-6 = -\frac{15}{4} + b$$
$$-\frac{9}{4} = b$$

The equation of the line is $y = -\frac{3}{4}x - \frac{9}{4}$.

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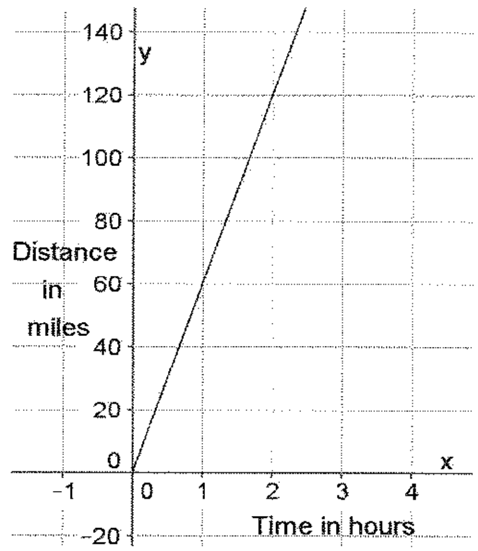
G8-M4-Lesson 22: Constant Rates Revisited

1. Train A can travel a distance of 450 miles in 7 hours.

   a. Assuming the train travels at a constant rate, write the linear equation that represents the situation.

   Let y represent the total number of miles Train A travels in x hours. We can write $\frac{y}{x} = \frac{450}{7}$ and $y = \frac{450}{7}x$.

   b. The figure represents the constant rate of travel for Train B. Which train is faster? Explain.



   To see which train is faster, I need to compare the slopes or rates of change.

   Train A is faster than Train B. The slope, or rate, for Train A is $\frac{450}{7}$, and the slope of the line for Train B is $\frac{60}{1}$. When you compare the slopes, you see that $\frac{450}{7} > 60$.

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2. Norton and Sylvia read the same book. Norton can read 33 pages in 8 minutes.

   a. Assuming he reads at a constant rate, write the linear equation that represents the situation.

   Let y represent the total number of pages Norton can read in x minutes. We can write $\frac{y}{x} = \frac{33}{8}$ and $y = \frac{33}{8}x$.

   b. The table of values below represents the number of pages read by Sylvia for a few selected time intervals. Assume Sylvia is reading at a constant rate. Who reads faster? Explain.

Minutes (x)	Pages Read (y)
3	11
5	$\frac{55}{3}$
6	22
8	$\frac{88}{3}$

Since Sylvia is reading at a constant rate, I can use any two points to calculate the slope or rate of change.

Norton reads faster. Using the table of values, I can find the slope that represents Sylvia's constant rate of reading: $\frac{11}{3}$. The slope or rate for Norton is $\frac{33}{8}$. When you compare the slopes, you see that $\frac{33}{8} > \frac{11}{3}$.

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G8-M4-Lesson 23: The Defining Equation of a Line

1. Do the equations $3x - 5y = 8$ and $6x - 10y = 16$ define the same line? Explain.

They define the same line when $\frac{a'}{a} = \frac{b'}{b} = \frac{c'}{c}$ is true. In $3x - 5y = 8$, $a = 3, b = -5$, and $c = 8$. In $6x - 10y = 16$, $a' = 6, b' = -10$, and $c' = 16$.

Yes, these equations define the same line. When you compare the constants from each equation, you get

$\frac{a'}{a} = \frac{6}{3} = 2, \frac{b'}{b} = \frac{-10}{-5} = 2,$ *and* $\frac{c'}{c} = \frac{16}{8} = 2.$

When I multiply the first equation by 2, I get the second equation.

$$(3x - 5y = 8)2$$
$$6x - 10y = 16$$

Therefore, these equations define the same line.

2. Do the equations $y = -\frac{7}{5}x - 4$ and $14x + 10y = -40$ define the same line? Explain.

I need to rewrite the first equation in standard form before I can determine if they define the same line.

Yes, these equations define the same line. When you rewrite the first equation in standard form:

$$y = -\frac{7}{5}x - 4$$
$$\left(y = -\frac{7}{5}x - 4\right)5$$
$$5y = -7x - 20$$
$$7x + 5y = -20.$$

When you compare the constants from each equation:

$$\frac{a'}{a} = \frac{14}{7} = 2, \frac{b'}{b} = \frac{10}{5} = 2, \textit{ and } \frac{c'}{c} = \frac{-40}{-20} = 2.$$

When I multiply the first equation by 2, I get the second equation.

$$(7x + 5y = -20)2$$
$$14x + 10y = -40$$

Therefore, these equations define the same line.

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3. Write an equation that would define the same line as $9x - 12y = 15$.

Answers will vary. When you multiply the equation by 2:

$$(9x - 12y = 15)2$$
$$18x - 24y = 30.$$

When you compare the constants from each equation:

$$\frac{a'}{a} = \frac{18}{9} = 2, \frac{b'}{b} = \frac{-24}{-12} = 2, \text{ and } \frac{c'}{c} = \frac{30}{15} = 2.$$

Therefore, these equations define the same line.

I can multiply the equation by any number other than zero and then make sure that $\frac{a'}{a}$, $\frac{b'}{b}$, $\frac{c'}{c}$ are all equal to the same number.

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 nonzero number s so that $a' = sa$, $b' = sb$, and $c' = sc$.

When $b = 0$, then $b' = 0$, and the equations are $ax = c$ and $a'x = c'$.

I need to write the equations when $b = 0$. Since the problem said they were the same line, I will solve for x in both equations so that I can use substitution.

We can rewrite the equations as $x = \frac{c}{a}$ and $x = \frac{c'}{a'}$. Because the equations graph as the same line, then we know that

$$\frac{c}{a} = \frac{c'}{a'}$$

and we can rewrite those fractions as

$$\frac{a'}{a} = \frac{c'}{c}.$$

I can use properties of equality to rewrite in the form I need.

These fractions are equal to the same number. Let that number be s. Then $\frac{a'}{a} = s$ and $\frac{c'}{c} = s$. Therefore, $a' = sa$ and $c' = sc$.

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G8-M4-Lesson 24: Introduction to Simultaneous Equations

1. Allen and Regina walk at constant speeds. Allen can walk 1 mile in 60 minutes, and Regina can walk 2 miles in 90 minutes. Regina started walking 10 minutes after Allen. Assuming they walk the same path, when will Regina catch up to Allen?

   a. Write the linear equation that represents Regina's constant speed.

   Regina's rate is $\frac{2}{90}$ miles per minute, which is the same as $\frac{1}{45}$ miles per minute. If Regina continues walking y miles in x minutes at a constant speed, then $y = \frac{1}{45}x$.

   Since they are walking at constant speeds, I can write equations using average speed like I did in Lesson 10.

   I need to define my variables for the equations to make sense.

   b. Write the linear equation that represents Allen's constant speed. Make sure to include in your equation the extra time that Allen was able to walk.

   Allen's rate is $\frac{1}{60}$ miles per minute. If Allen continues walking y miles in x minutes at a constant speed, then $y = \frac{1}{60}x$. To account for the extra time that Allen gets to walk, we write the equation

   To account for the extra time, I need to add 10 minutes to Allen's time of x minutes.

   $$y = \frac{1}{60}(x + 10)$$
   $$y = \frac{1}{60}x + \frac{1}{6}$$

   When I distribute $\frac{1}{60}$ to 10, I can write it as $\frac{10}{60}$, or $\frac{1}{6}$.

   c. Write the system of linear equations that represents this situation.

   Writing a system means to write both of the equations with the bracket in front.

   $$\begin{cases} y = \frac{1}{45}x \\ y = \frac{1}{60}x + \frac{1}{6} \end{cases}$$

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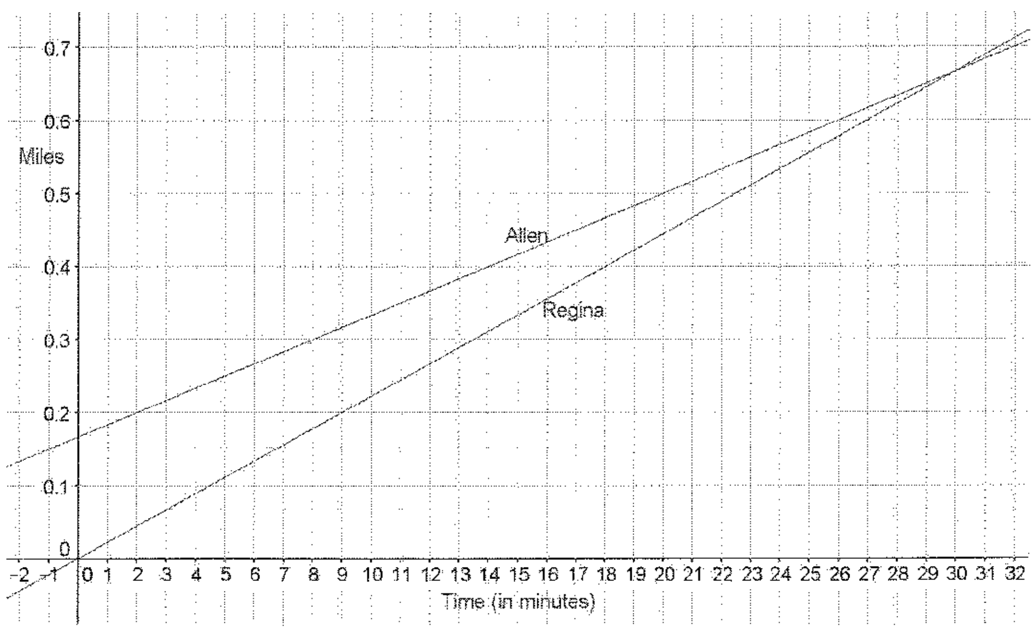
d. Sketch the graphs of the two equations.

I put information about Regina's walk in a table to help me graph.

Number of Minutes (x)	Miles Walked (y)
0	0
9	0.2
18	0.4

I can do the same with information about Allen's walk.

I will label the axis according to how I defined my variables. I need to label the graph of each line.



e. Will Regina ever catch up to Allen? If so, approximately when?

Yes, Regina will catch up to Allen after about 30 *minutes or about* 0.65 *miles.*

f. At approximately what point do the graphs of the lines intersect?

The lines intersect at approximately $(30, 0.65)$.

I can use the graph to see at what point the graphs of the lines intersect. This will tell me when Regina will catch up to Allen.

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G8-M4-Lesson 25: Geometric Interpretation of the Solutions of a Linear System

1. Sketch the graphs of the linear system on a coordinate plane: $\begin{cases} y = -\frac{1}{9}x - 3 \\ -2x + 3y = 12 \end{cases}$

> I will use the slope and y-intercept to help me graph the equation of this line.

For the equation $y = -\frac{1}{9}x - 3$*:*

The slope is $-\frac{1}{9}$*, and the* y*-intercept is* $(0, -3)$.

> Since this equation is in standard form, I will fix $x = 0$ to find y (the y-intercept) and fix $y = 0$ to find x (the x-intercept) to help me graph the line of this equation.

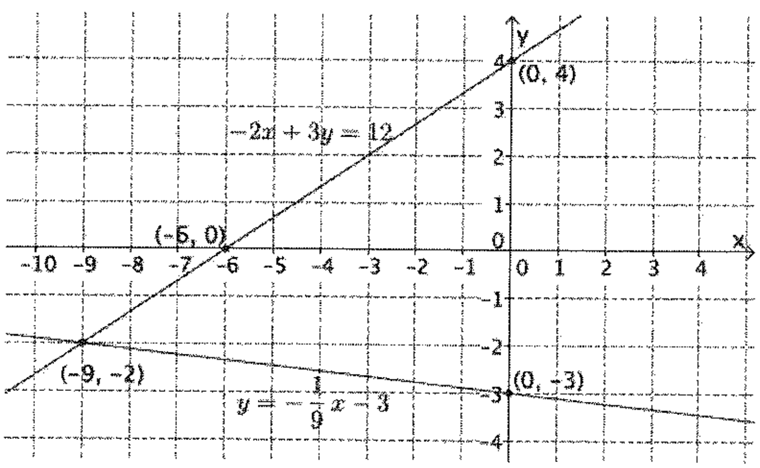
For the equation $-2x + 3y = 12$*:*

$$-2(0) + 3y = 12$$
$$3y = 12$$
$$y = 4$$

The y*-intercept is* $(0, 4)$.

$$-2x + 3(0) = 12$$
$$-2x = 12$$
$$x = -6$$

The x*-intercept is* $(-6, 0)$.



> To locate where the graphs of the lines intersect, I will use graph paper so that I can be as accurate as possible.

a. Name the ordered pair where the graphs of the two linear equations intersect.

$(-9, -2)$

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b. Verify that the ordered pair named in part (a) is a solution to $y = -\frac{1}{9}x - 3$.

$$-2 = -\frac{1}{9}(-9) - 3$$
$$-2 = 1 - 3$$
$$-2 = -2$$

The left and right sides of the equation are equal.

If the solutions I found on the graph of the lines satisfies both equations, then I have found an ordered pair of the system.

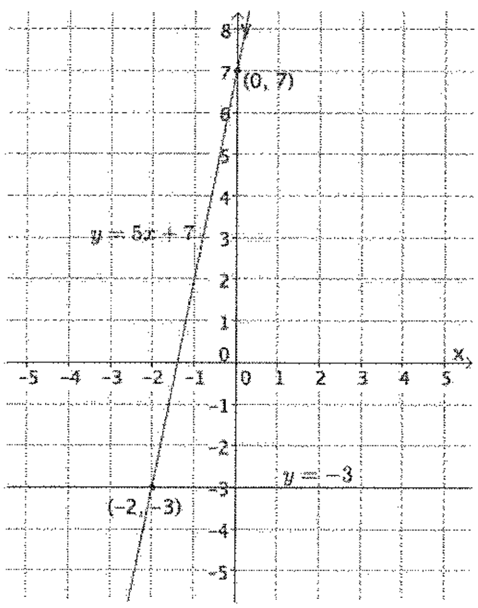
c. Verify that the ordered pair named in part (a) is a solution to $-2x + 3y = 12$.

$$-2(-9) + 3(-2) = 12$$
$$18 - 6 = 12$$
$$12 = 12$$

The left and right sides of the equation are equal.

2. Sketch the graphs of the linear system on a coordinate plane: $\begin{cases} y = 5x + 7 \\ y = -3 \end{cases}$

The equation of the form $y = c$, where c is a constant, is a horizontal line passing though the point $(0, c)$. I know that -3 will be the y-coordinate of my intersection point.



I can write the slope of 5 with the denominator of 1 as the fraction $\frac{5}{1}$.

For the equation $y = 5x + 7$:

The slope is $\frac{5}{1}$, and the y-intercept is $(0, 7)$.

I need to verify that the ordered pair is a solution to both of the equations.

Name the ordered pair where the graphs of the two linear equations intersect.

$(-2, -3)$

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G8-M4-Lesson 26: Characterization of Parallel Lines

I need to determine if the graphs of the lines are parallel. Parallel lines do not intersect, which means parallel lines have no solution.

Answer Problems 1–2 without graphing the equations.

1. Does the system of linear equations shown below have a solution? Explain.

$$\begin{cases} 2x + 5y = 9 \\ -4x - 10y = 4 \end{cases}$$

Standard form is $ax + by = c$, where a, b, c are constants and a and b are not both zero.

I learned from Lesson 23 that when equations are written in standard form, I know the slope is $m = -\frac{a}{b}$, and the y-intercept is $\frac{c}{b}$.

No, this system does not have a solution. The slope of the first equation is $-\frac{2}{5}$, and the slope of the second equation is $-\frac{4}{10}$, which is equivalent to $-\frac{2}{5}$. Since the slopes are the same and the lines are distinct, these equations will graph as parallel lines. Parallel lines never intersect, which means this system has no solution.

2. Does the system of linear equations shown below have a solution? Explain.

$$\begin{cases} \frac{7}{4}x + 2 = y \\ x + 2y = 4 \end{cases}$$

If the slopes are different, these equations will graph as non-parallel lines and intersect at some point. That means they will have a solution.

The first equation is written in slope-intercept form. The slope is $\frac{7}{4}$.

Yes, this system does have a solution. The slope of the first equation is $\frac{7}{4}$, and the slope of the second equation is $-\frac{1}{2}$. Since the slopes are different, these equations will graph as non-parallel lines, which means they will intersect at some point.

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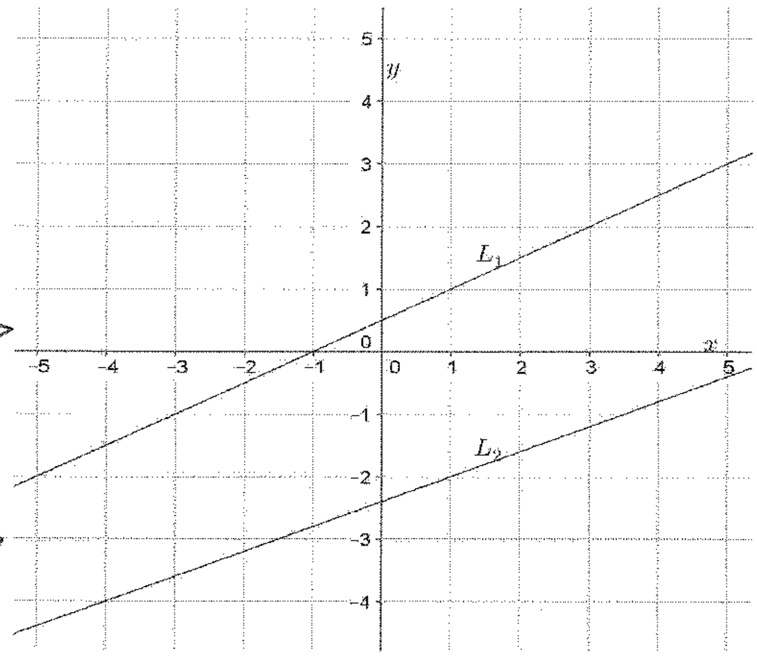
3. Given the graphs of a system of linear equations below, is there a solution to the system that we cannot see on this portion of the coordinate plane? That is, will the lines intersect somewhere on the plane not represented in the picture? Explain.

For L_1, I used $(3,2)$ and $(-1,0)$ to find the slope because they are distinct points with integer coordinates that will make my calculation easier.



Although the lines of the graphs may look parallel, I have to check the slopes of each line to be sure.

The slope of L_1 is $\frac{1}{2}$, and the slope of L_2 is $\frac{2}{5}$. Since the slopes are different, these lines are nonparallel lines, which means they will intersect at some point. Therefore, the system of linear equations whose graphs are the given lines will have a solution.

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G8-M4-Lesson 27: Nature of Solutions of a System of Linear Equations

Determine the nature of the solution to each system of linear equations. If the system has a solution, find it algebraically, and then verify that your solution is correct by graphing.

1. $\begin{cases} y = -\frac{4}{5}x + 9 \\ 4x + 5y = 9 \end{cases}$

If the equations have the same slope and different y-intercepts, then the equations graph as parallel lines, which means the system doesn't have a solution.

The slopes of these two equations are the same, and the y-intercepts are different, which means they graph as parallel lines. Therefore, this system will have no solutions.

2. $\begin{cases} 2x - 3y = 12 \\ y = \frac{2}{3}x - 4 \end{cases}$

I notice that if I multiply the second equation by 3, the result is $3y = 2x - 12$. When I use my properties of equality, I see the second equation is the same as the first. This means that I have the same line; therefore, I have infinitely many solutions.

These equations define the same line. Therefore, this system will have infinitely many solutions.

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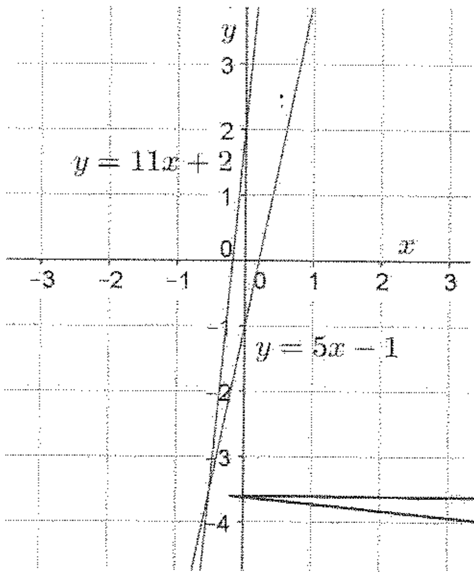
3. $\begin{cases} y = 5x - 1 \\ y = 11x + 2 \end{cases}$

Since the equations are both equal to y, I can use substitution, and write the equations equal to each other and solve for x.

$$5x - 1 = 11x + 2$$
$$-3 = 6x$$
$$-\frac{1}{2} = x$$

Once I solve for x, then I can use substitution again in either equation and solve for y.



$$y = 5\left(-\frac{1}{2}\right) - 1$$
$$y = -\frac{5}{2} - 1$$
$$y = -\frac{7}{2}$$

The solution is $\left(-\frac{1}{2}, -\frac{7}{2}\right)$.

I see that the graphs of the lines intersect at $\left(-\frac{1}{2}, -\frac{7}{2}\right)$.

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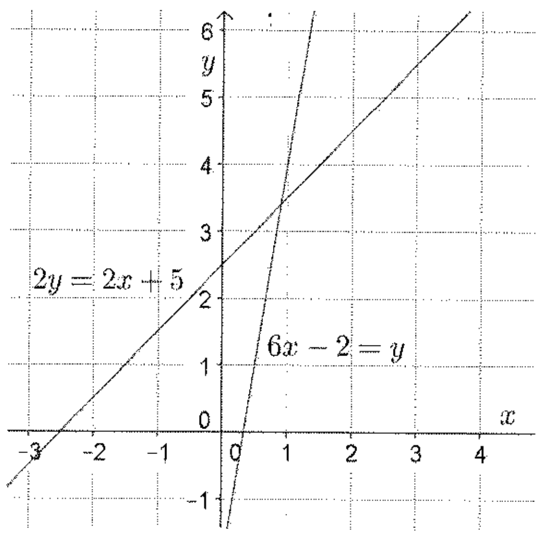
4. $\begin{cases} 6x - 2 = y \\ 2y = 2x + 5 \end{cases}$

I can multiply the first equation by 2 to produce an equivalent equation, namely $12x - 4 = 2y$. Now that both equations are equal to $2y$, the expressions $12x - 4$ and $2x + 5$ can be written equal to one another.

$$(6x - 2 = y)2$$
$$12x - 4 = 2y$$

I can write the system as $\begin{cases} 12x - 4 = 2y \\ 2y = 2x + 5. \end{cases}$

$$\begin{cases} 12x - 4 = 2y \\ 2y = 2x + 5 \end{cases}$$
$$12x - 4 = 2x + 5$$
$$10x = 9$$
$$x = \frac{9}{10}$$



$$6\left(\frac{9}{10}\right) - 2 = y$$
$$\frac{54}{10} - 2 = y$$
$$\frac{17}{5} = y$$

The solution is $\left(\frac{9}{10}, \frac{17}{5}\right)$.

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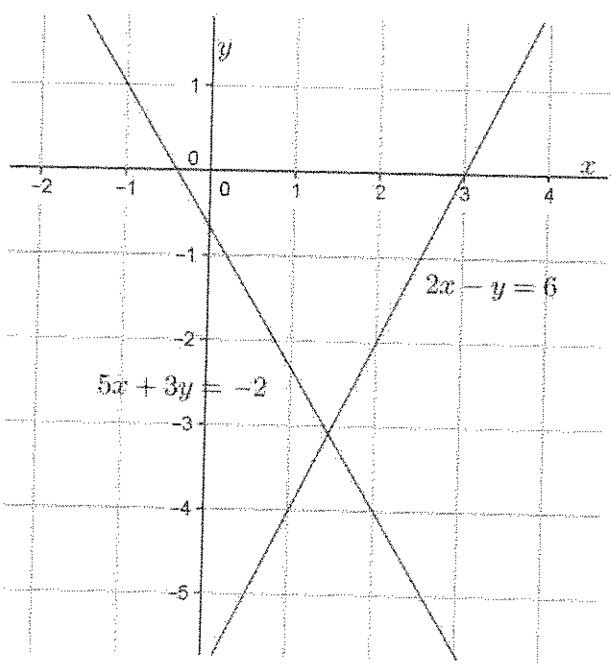
G8-M4-Lesson 28: Another Computational Method of Solving a Linear System

I can determine if the solutions exist by checking the slope and the y-intercepts like I did in the previous lesson's Problem Set.

Determine the solution, if it exists, for each system of linear equations. Verify your solution on the coordinate plane.

1. $\begin{cases} 5x + 3y = -2 \\ 2x - y = 6 \end{cases}$

If I multiply the second equation by 3, then I will eliminate x and be able to solve for y.



$$3(2x - y = 6)$$
$$6x - 3y = 18$$
$$\begin{cases} 5x + 3y = -2 \\ 6x - 3y = 18 \end{cases}$$
$$5x + 3y + 6x - 3y = -2 + 18$$
$$11x = 16$$
$$x = \frac{16}{11}$$

$$2\left(\frac{16}{11}\right) - y = 6$$
$$-y = \frac{34}{11}$$
$$y = -\frac{34}{11}$$

The solution is $\left(\frac{16}{11}, -\frac{34}{11}\right)$.

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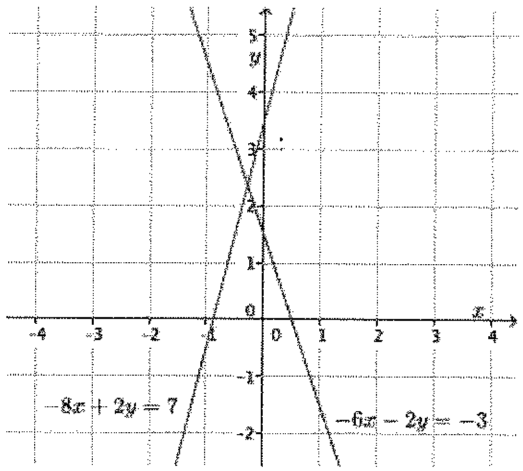
2. $\begin{cases} -6x - 2y = -3 \\ -8x + 2y = 7 \end{cases}$

I notice that since the first equation has $-2y$ and the second equation has $+2y$, when I add the equations together, y will be eliminated, and I can solve for x first.

$$-6x - 2y - 8x + 2y = -3 + 7$$
$$-14x = 4$$
$$x = -\frac{4}{14}$$

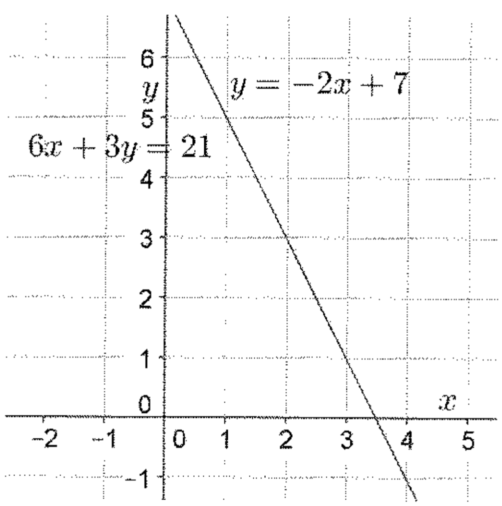


$$-6\left(-\frac{4}{14}\right) - 2y = -3$$
$$\frac{12}{7} - 2y = -3$$
$$-2y = -\frac{33}{7}$$
$$y = \frac{33}{14}$$

The solution is $\left(-\frac{4}{14}, \frac{33}{14}\right)$.

3. $\begin{cases} y = -2x + 7 \\ 6x + 3y = 21 \end{cases}$

When I substituted for y with the first equation into the second equation, $6x + 3(-2x + 7) = 21$, it resulted in an identity, namely $21 = 21$. This means the two equations will graph the same line.



These equations define the same line. Therefore, this system will have infinitely many solutions.

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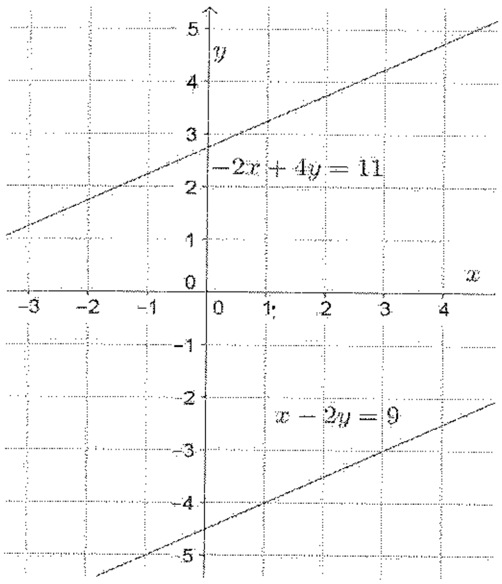
4. $\begin{cases} -2x + 4y = 11 \\ x - 2y = 9 \end{cases}$

When I multiplied the second equation by 2, I eliminated both x and y. The result was an untrue statement, namely $0 \neq 29$. I should check the slopes and y-intercepts.



The equations graph as distinct lines. The slopes of these two equations are the same, and the y-intercepts are different, which means they graph as parallel lines. Therefore, this system will have no solution.

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G8-M4-Lesson 29: Word Problems

1. Two numbers have a sum of 853 and a difference of 229. What are the two numbers?

Let x represent one number and y represent the other number.

$$\begin{cases} x+y=853 \\ x-y=229 \end{cases}$$

$$x+y+x-y=853+229$$

$$2x=1082$$

$$x=541$$

$$541+y=853$$

$$y=312$$

I can check my answer mentally.

Sum means I add the two numbers together, and difference means I subtract one number from the other. Since I don't know either number, I need to define my variables with two different letters.

The solution is $(541, 312)$. *The two numbers are* 541 *and* 312.

2. The sum of the ages of two sisters is 36. The younger sister is 6 more than a fifth of the older sister's age. How old is each sister?

Let x represent the age of the younger sister and y represent the age of the older sister.

A fifth of the older sister's age means to multiply $\frac{1}{5}$ times y, the age of the older sister.

$$\begin{cases} x+y=36 \\ x=6+\frac{1}{5}y \end{cases}$$

I will use the substitution method since x is isolated. I will replace x with $6+\frac{1}{5}y$ in the first equation.

$$6+\frac{1}{5}y+y=36$$

$$6+\frac{6}{5}y=36$$

$$\frac{6}{5}y=30$$

$$y=25$$

$$x+25=36$$

$$x=11$$

If I let x represent the age of the older sister and y represent the age of the younger sister, the second equation would be $y=6+\frac{1}{5}x$. I would use the same method to solve.

Check:

$$11=6+\frac{1}{5}(25)$$

$$11=6+5$$

$$11=11$$

The solution is $(11, 25)$. *The older sister is* 25 *years old, and the younger sister is* 11 *years old.*

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3. Some friends went to the local movie theater and bought three buckets of large popcorn and four boxes of candy. The total for the snacks was $30.50. The last time you were at the theater, you bought a large popcorn and two boxes of candy, and the total was $12.50. How much would 2 large buckets of popcorn and 3 boxes of candy cost?

Let x represent the cost of a large bucket of popcorn and y represent the cost of a box of candy.

> I have choices. I could eliminate x by multiplying the second equation by -3 or eliminate y by multiplying the second equation by -2.

$$\begin{cases} 3x + 4y = 30.50 \\ x + 2y = 12.50 \end{cases}$$

$$-2(x + 2y = 12.50)$$

$$-2x - 4y = -25$$

$$\begin{cases} 3x + 4y = 30.50 \\ -2x - 4y = -25 \end{cases}$$

$$3x + 4y - 2x - 4y = 30.50 - 25$$

$$3x - 2x = 5.50$$

$$x = 5.50$$

> The question is asking about the *cost* of items, not the number of items. I need to define my variables as the *cost* of each item.

$$5.50 + 2y = 12.50$$

$$2y = 7$$

$$y = 3.50$$

The solution is $(5.50, 3.50)$.

Check:

$$3(5.50) + 4(3.50) = 30.50$$

$$16.50 + 14 = 30.50$$

$$30.50 = 30.50$$

> Once I find out the cost of each item, I can determine the cost for 2 large popcorns and 3 boxes of candy.

Since a large bucket of popcorn costs $5.50 *and a box of candy costs* $3.50, *then the equation to find the cost of two large buckets of popcorn and three boxes of candy is* $2(5.50) + 3(3.50) = 11 + 10.50$, *which is equal to* 21.50. *Therefore, the cost of two large buckets of popcorn and three boxes of candy is* $21.50.

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G8-M4-Lesson 30: Conversion Between Celsius and Fahrenheit

1. Does the equation $t°\text{C} = (32 + 1.8t)°\text{F}$ work for any rational number t? Check that it does with $t = 12\frac{1}{5}$ and $t = -12\frac{1}{5}$.

I will use substitution with $t = 12\frac{1}{5}$ and $t = -12\frac{1}{5}$.

$$\left(12\frac{1}{5}\right)°\text{C} = \left(32 + 1.8 \times 12\frac{1}{5}\right)°\text{F} = (32 + 21.96)°\text{F} = 53.96°\text{F}$$

This means that $12\frac{1}{5}°\text{C}$ is the same as $53.96°\text{F}$.

$$\left(-12\frac{1}{5}\right)°\text{C} = \left(32 + 1.8 \times \left(-12\frac{1}{5}\right)\right)°\text{F} = (32 - 21.96)°\text{F} = 10.04°\text{F}$$

2. Knowing that $t°\text{C} = \left(32 + \frac{9}{5}t\right)°\text{F}$ for any rational number t, show that for any rational number d, $d°\text{F} = \left(\frac{5}{9}(d - 32)\right)°\text{C}$.

I will write down everything I know from the problem and lesson.

From the lesson, I know that $d°\text{F} = \left(32 + \frac{9}{5}t\right)°\text{F}$.

That implies that $d = \left(32 + \frac{9}{5}t\right)$.

From the problem, I know that $t°\text{C} = \left(32 + \frac{9}{5}t\right)°\text{F}$.

From the lesson, I know that $t°\text{C} = d°\text{F}$.

I will use these equations to help me show that $d°\text{F} = \left(\frac{5}{9}(d - 32)\right)°\text{C}$.

I will start by solving for t.

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Since d°F can be found by $\left(32+\frac{9}{5}t\right)$*, then* $d=\left(32+\frac{9}{5}t\right)$*, and* d°F $= t$°C*. Substituting* $d=\left(32+\frac{9}{5}t\right)$ *into* d°F *we get*

$$d\text{°F}=\left(32+\frac{9}{5}t\right)\text{°F}$$
$$d=32+\frac{9}{5}t$$
$$d-32=\frac{9}{5}t$$
$$\frac{5}{9}(d-32)=t$$

Now that we know $t=\frac{5}{9}(d-32)$*, then* $d\text{°F}=\left(\frac{5}{9}(d-32)\right)\text{°C}$.

Once I know t, I can substitute into $t\text{°C}=d\text{°F}$ to show that for any rational number d, $d\text{°F}=\left(\frac{5}{9}(d-32)\right)\text{°C}$.

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