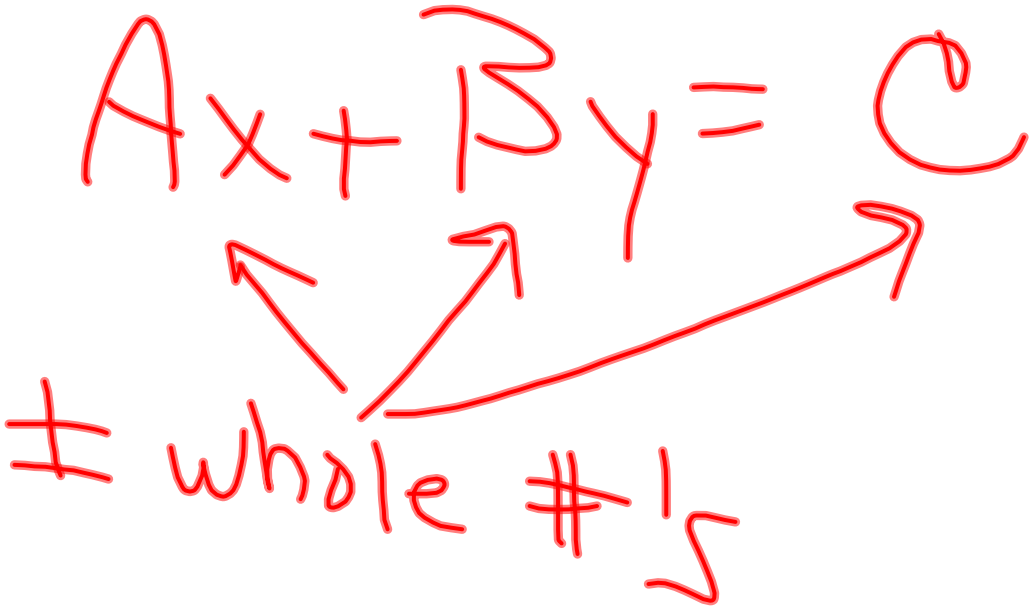
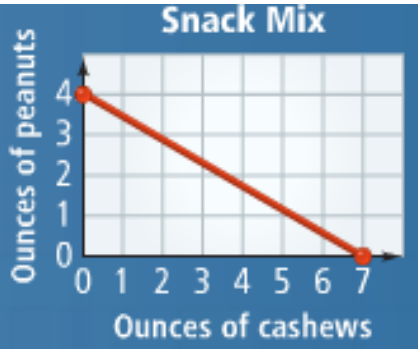
5-5: Linear Equations
Standard Form



An athlete wants to make a snack mix of peanuts and cashews that will contain a certain amount of protein. Cashews have 4 g of protein per ounce, and peanuts have 7 g of protein per ounce. How many grams of protein will the athlete's mix contain? What do the points (7, 0) and (0, 4) represent? Explain.



Solve each equation for *y*.

$7xy = z$

$ay - 3 = 7b$

$6(x - y) = c$

Eye Opener

Essential Understanding One form of a linear equation, called *standard form*, allows you to find intercepts quickly. You can use the intercepts to draw the graph.

In this lesson, you will learn to use intercepts to graph a line. Recall that a y-intercept is the y-coordinate of a point where a graph crosses the y-axis. The **x-intercept** is the x-coordinate of a point where a graph crosses the x-axis.

The standard form of a linear equation is:
Ax + By = C where **A, B, and C are integers**

Examples: 2x + 3y = 12 OR 5x - 7y = -70

Standard form help in identifying the x and y-intercepts

The **y-intercept** is the point at which the line crosses y-axis and is represented by (0,y)
[Remember in SI format, y = mx + b, the y-intercept is (0,b)]

Similarly, the x-intercept is the point at which the line crosses the x-axis and is represented (x , 0)

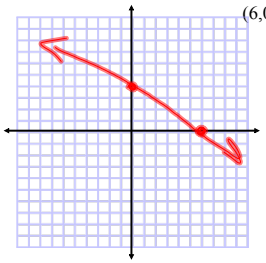
Since two points determine a line, we can use the x & y-intercepts as the two points needed to graph our line.

For instance:

Graph: 2x + 3y = 12

Substitute x = 0 and y = 0 one at a time into the equation and solve for the remaining variable to find the x & y-intercepts

2(0) + 3y = 12	AND	2x + 3(0) = 12
0 + 3y = 12		2x + 0 = 12
3y = 12		2x = 12
3y/3 = 12/3		2x/2 = 12/2
y = 4		x = 6
(0,4)		(6,0)

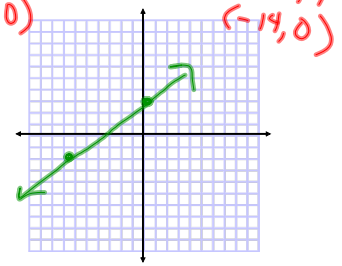


Graph 5x - 7y = -70

5(0) - 7y = -70 AND 5x - 7(0) = -70

-7y = -70
y = 10
(0,10)

5x = -70
x = -14
(-14,0)



Since two points determine a line, we can use the x & y-intercepts as the two points needed to graph our line.

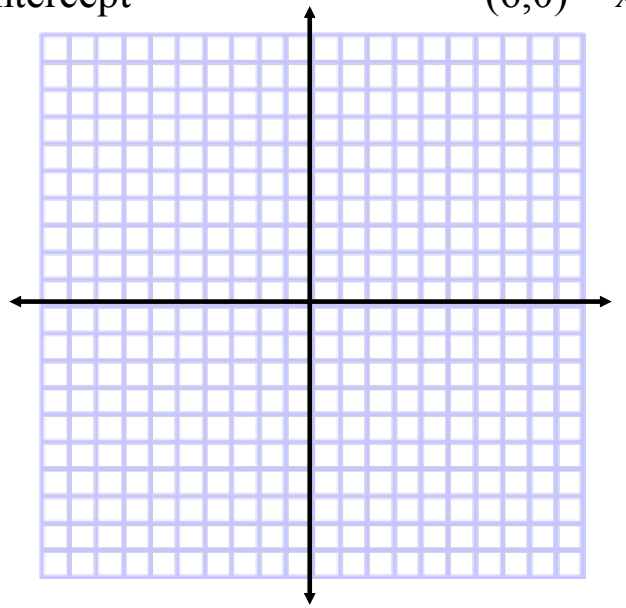
Graph: $2x + 3y = 12$

Substitute $x = 0$ and $y = 0$ one at a time into the equation and solve for the remaining variable to find the x & y-intercepts

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

AND

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



Graph and connect the points.

Identify the x & y-intercepts of the following lines:

- $2x + 4y = 8$

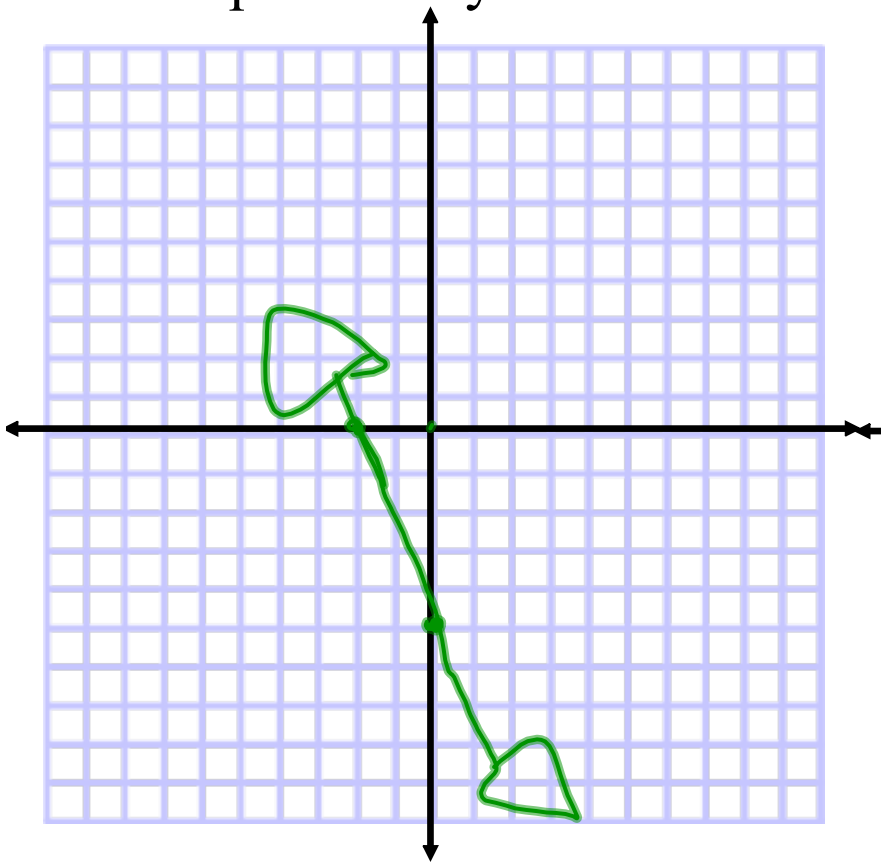
(0, 2) (4, 0)

- $4x - 9y = -12$

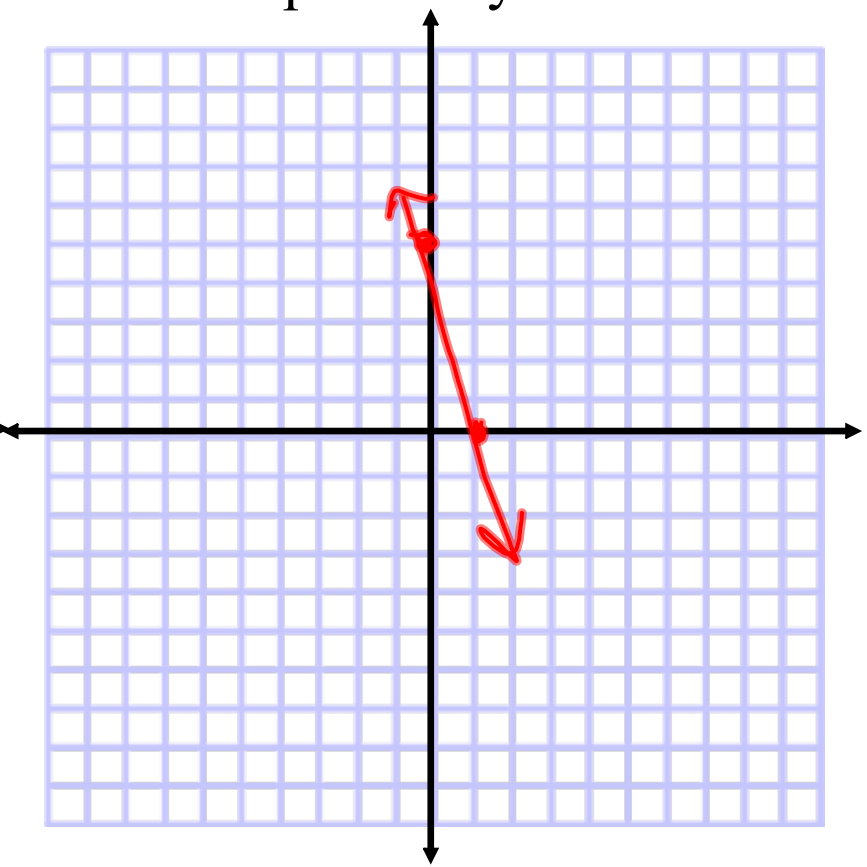
$\frac{-9y}{-9} = \frac{-12}{-9}$

(0, 4/3) (-3, 0)

Graph 5x + 2y = -10



Graph 3x + y = 5



Graph 5x + ~~2y~~ = -10

(0, -5) (2, 0)

Graph 3x + y = 5

y = 5 (0, 5)

x = 5/3 (5/3, 0)

Any linear equation can be translated into standard form, by eliminating all fractions (multiply both sides of equation by the least common denominator) THEN moving Ax & By & C into the form Ax + By = C using the addition and subtraction properties of equality

For instance:

- Translate y = 2/3x - 5 into standard form

y = 2/3x - 5	multiply both sides by LCD of 3
y(3) = (2/3x -5)(3)	distribute
3y = 2/3x(3) -5(3)	simplify
3y = 2x - 15	put in standard form
3y - 2x = -15	subtract 2x from both sides

-2x + 3y = -15

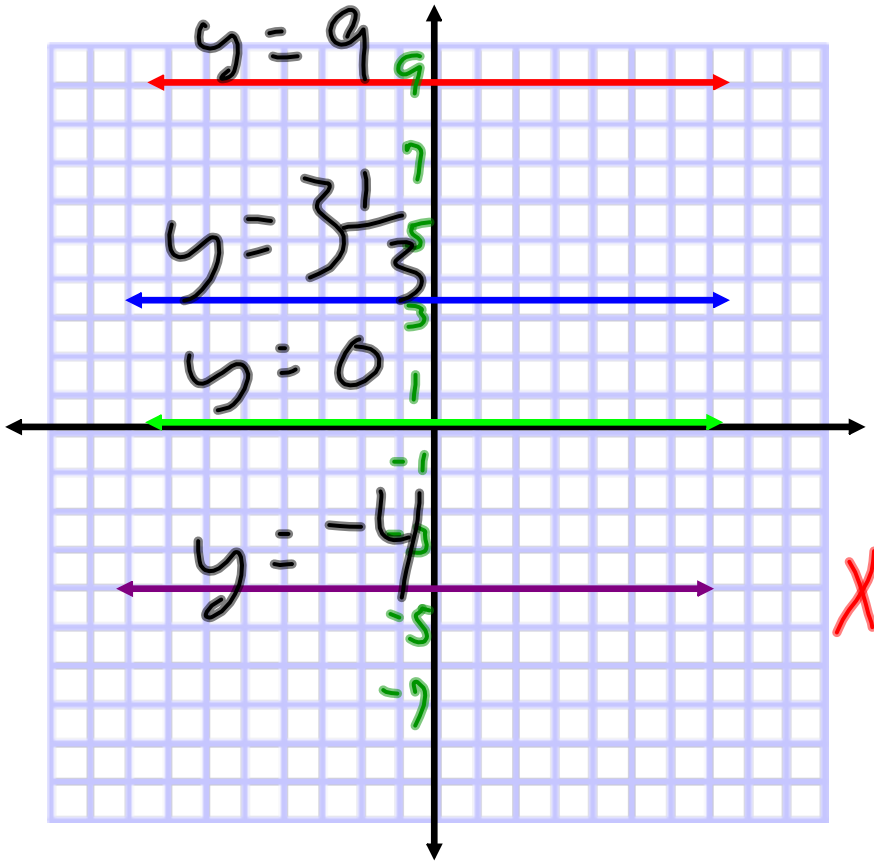
2x-3y=15

- Translate 3/5 x -12 = 2/3 y into standard form

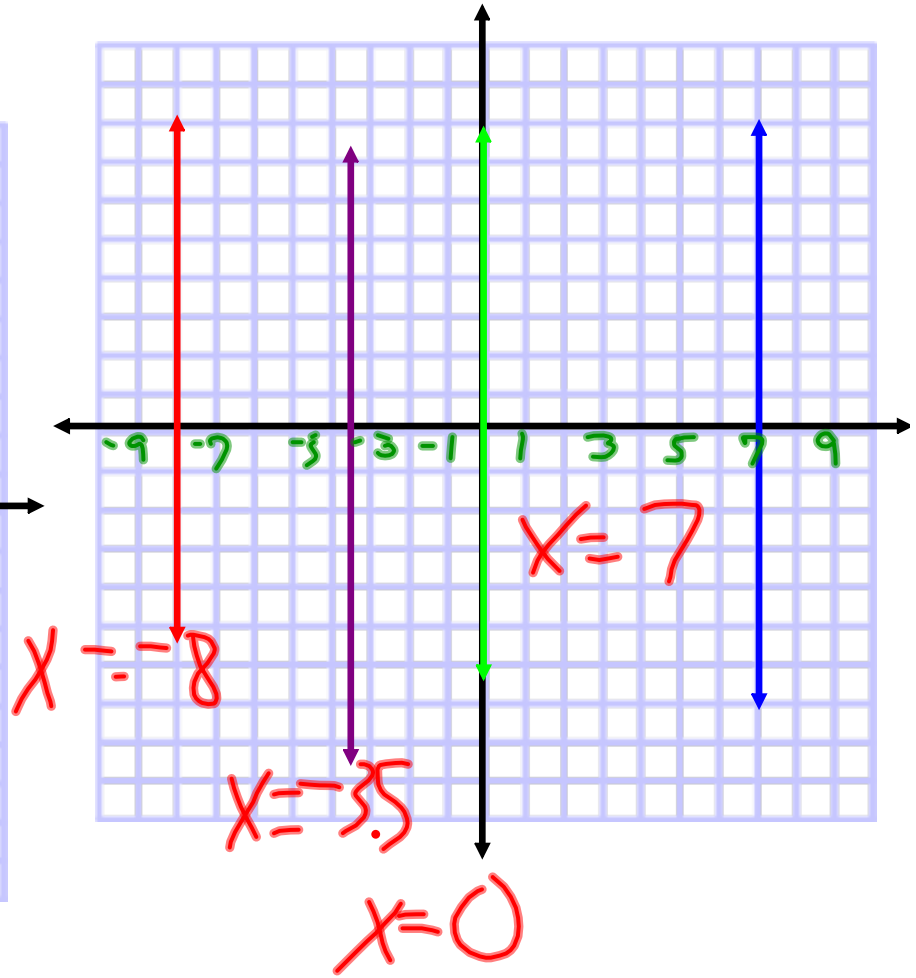
3/5 x - 12 = 2/3 y

If $A = 0$ in the standard form $Ax + By = C$, then you can write the equation in the form $y = b$, where b is a constant. If $B = 0$, you can write the equation in the form $x = a$, where a is a constant. The graph of $y = b$ is a horizontal line, and the graph of $x = a$ is a vertical line.

Name the lines below:



Name the lines below:

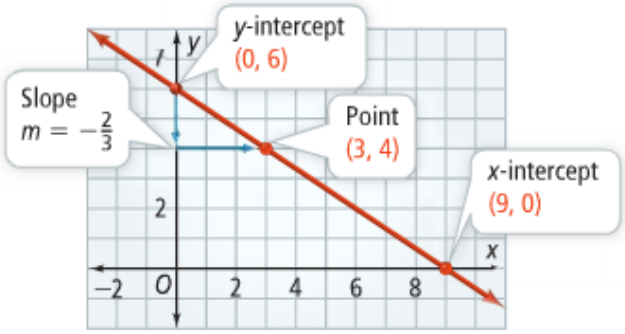


take note

Concept Summary Linear Equations

You can describe any line using one or more of these forms of a linear equation. Any two equations for the same line are equivalent.

Graph



Forms

Slope-Intercept Form

$y = mx + b$

$y = -\frac{2}{3}x + 6$

Point-Slope Form

$y - y_1 = m(x - x_1)$

$y - 4 = -\frac{2}{3}(x - 3)$

Standard Form

$Ax + By = C$

$2x + 3y = 18$

You should be able to convert from one format to another.

$2x + 3y = 18$

$-2x \quad\quad -2x$

$\frac{3y}{3} = \frac{-2x}{3} + \frac{18}{3}$

$y = -\frac{2}{3}x + 6$

(0, 6)

$y = mx + b$

$y - y_1 = m(x - x_1)$

(0, −5)

$y = 3x - 5$

$y + 5 = 3(x - 0)$

40. Think About a Plan You are preparing a fruit salad. You want the total carbohydrates from pineapple and watermelon to equal 24 g. Pineapple has 3 g of carbohydrates per ounce and watermelon has 2 g of carbohydrates per ounce. What is a graph that shows all possible combinations of ounces of pineapple and ounces of watermelon?

- Can you write an equation to model the situation?
- What domain and range are reasonable for the graph?

x = pineapple y = watermelon

$3x + 2y = 24$

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

$x \leq 8$ $y \leq 12$

36. $y + 2 = \frac{2}{3}(x + 4)$

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

$3y + 6 = 2x + 8$

$-2x - 6 \quad -2x - 6$

$+2x + 3y = 2$

4. What is $y = \frac{1}{2}x + 3$ written in standard form using integers?

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

$2y = 1x + 6$

$-x \quad -x$

$-x + 2y = 6$

$Ax + By = C$

$$2(3+5)$$

$$2(3)+2(5)$$

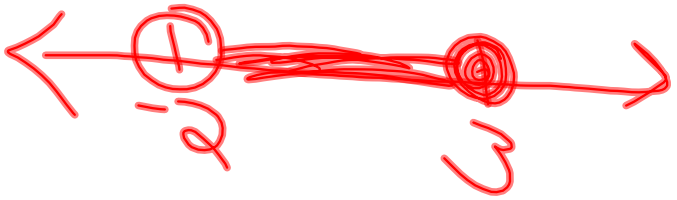
Solve each compound inequality. Graph your solution.

See Lesson 3-6.

74. $-6 < 3t \leq 9$ **75.** $-9.5 < 3 - y \leq 1.3$ **76.** $3x + 1 > 10$ or $5x + 3 \leq -2$

$\frac{-6}{3} < \frac{3t}{3}$ and $\frac{3t}{3} \leq \frac{9}{3}$

$-2 < t$ & $t \leq 3$



$\frac{-6}{3} < \frac{3t}{3} \leq \frac{9}{3}$

$-2 < t \leq 3$

56. $(-7, 6), (-4, 11)$

Eq of Line ⟶ Stand Form

↓

Pt-Slope

+3 (	-7	6
	-4	11

) +5

$m = 5/3$

$3(y - 6) = 5/3 \cdot (x + 7) \cdot 3$

$3y - 18 = 5x + 35$

$-5x + 18 \quad -5x + 18$

$-5x + 3y = 53$