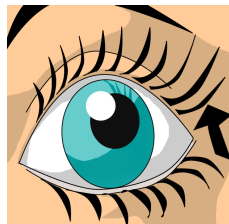


5-3: Linear Equations Slope-Intercept Form



Eye Opener

$$\frac{20}{20} = 1$$

Bamboo can grow very quickly. The graph models the growth of a bamboo plant. Find the point where the line crosses the vertical axis. What does this point tell you about the bamboo plant? Find the slope of the line. What does the slope tell you about the bamboo plant? How do you know?

(0, 20)
plant is 20' tall at start

m = 1
grows 1' per day

Evaluate each expression.

$6a + 3 \text{ for } a = 2$

$12 + 3 = 15$

$-2x - 5 \text{ for } x = 3$

$$\begin{aligned} -2 \cdot 3 - 5 \\ -6 - 5 \\ -11 \end{aligned}$$

$\frac{1}{4}x + 2 \text{ for } x = 16$

$$\begin{aligned} \frac{1}{4} \cdot 16 + 2 \\ 4 + 2 = 6 \end{aligned}$$

$8 - 5n \text{ for } n = 3$

$$\begin{aligned} 8 - 15 \\ -7 \end{aligned}$$

Essential Understanding You can use the slope and y -intercept of a line to write and graph an equation of the line.

Graphs of linear functions may cross the y -axis at any point. A **y -intercept** of a graph is the y -coordinate of a point where the graph crosses the y -axis.



The **slope-intercept form** of a linear equation of a nonvertical line is $y = mx + b$.

↑ ↑

slope y -intercept

Slope-Intercept Form: $y = mx + b$

Using the graphing calculator experiment with one equation, holding everything constant except "m".

What does "m" do in general in $y = mx + b$?

turns line

What does the value or size of "m" tell us?

Positive "m"?



Zero "m"?



Negative "m"?



Values of "m" close to zero?



Values of "m" moving increasingly away from zero?



Slope-Intercept Form: $y = mx + b$

Explore using the graphing calculator holding a linear equation constant except for the value of "**b**".

What in general does changing the value of "**b**" do to the graph of a linear equation?

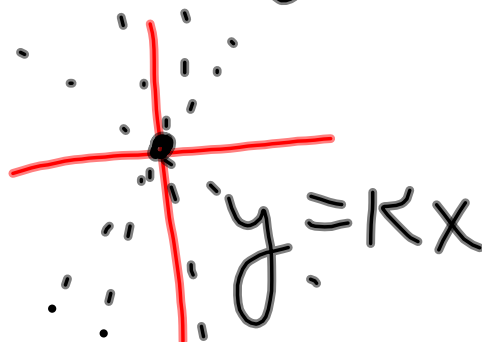
moves up & down y-axis

What do various values of "b" do?

Positive "**b**" \uparrow (0, b)

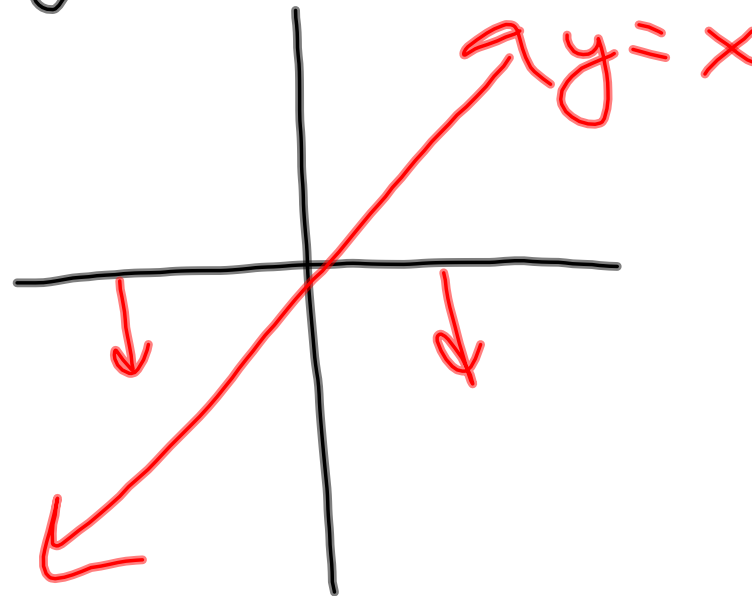
Negative "**b**" \downarrow (0, b)

Zero "**b**" at (0, 0)



$$y = 4x - 7$$

$$y = x$$



Slope-Intercept Form: $y = mx + b$

What do "**x & y**" represent in the equation $y = mx + b$?

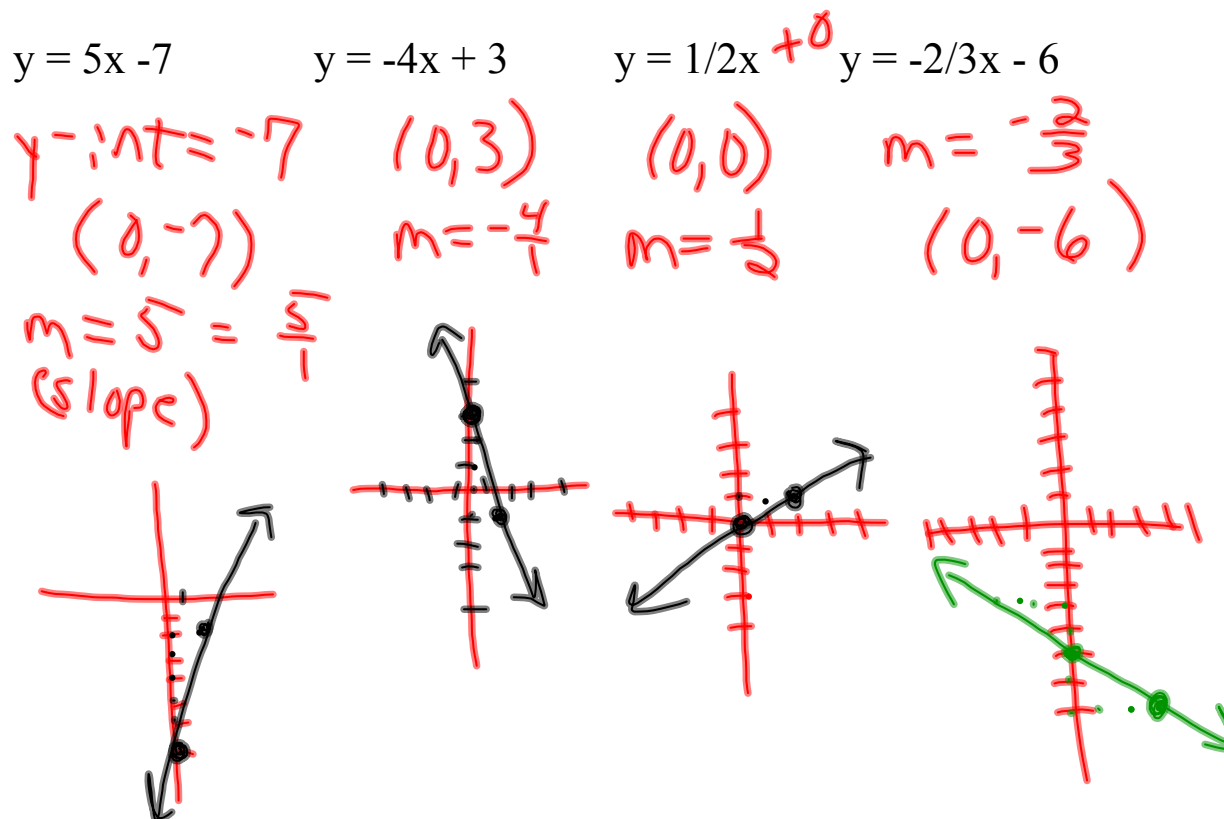
(x, y)
ordered pairs
on that line

So, given any equation $y = mx + b$:

- m = slope of the line (+, -, 0, no slope/ undefined)
- x & y represent all the ordered pairs (x,y) on the line
- b identifies the point at which the line crosses the y -axis; $(0,b)$

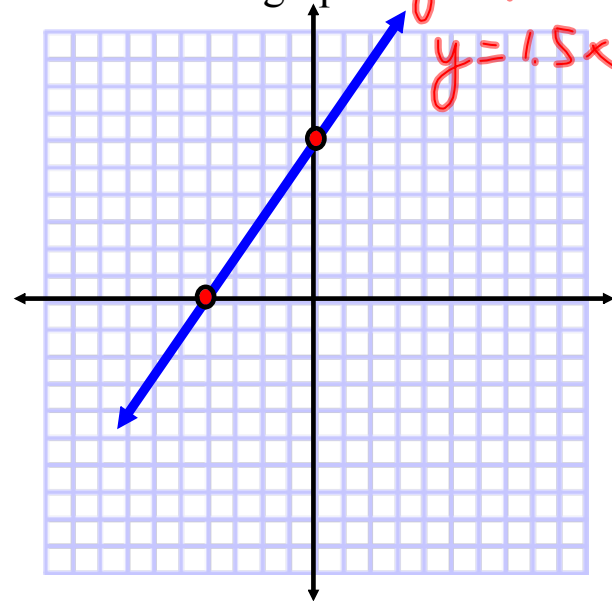
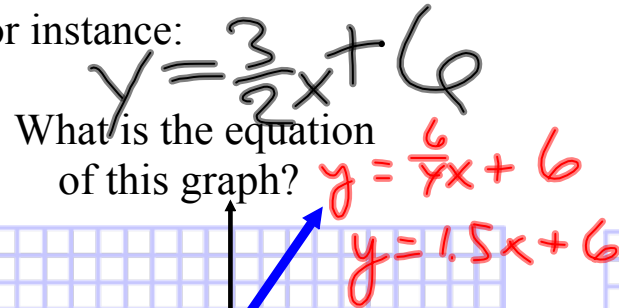
The point $(0,b)$ at which the line crosses the y -axis is called the **y-intercept**

What do we know about the lines:



We want to be able to graph lines given equations of lines or identify the linear equation for a graph of a line.

For instance:



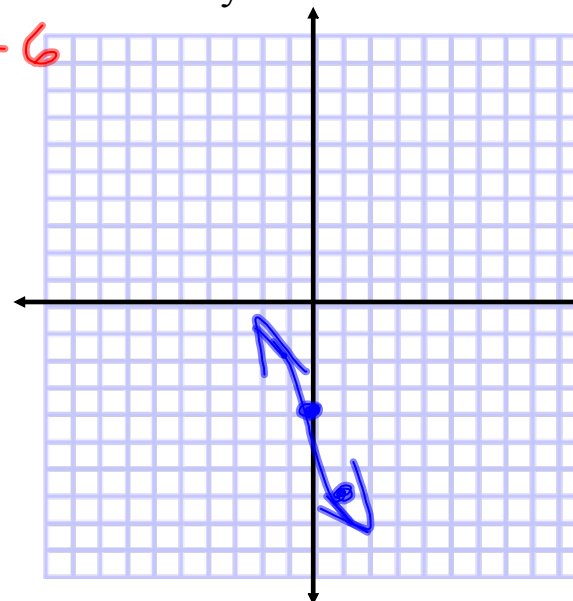
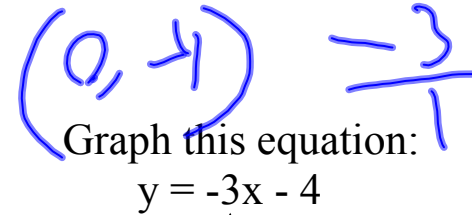
What is the y-intercept of this line?

$$(0, 6)$$

What is the slope of this line?

$$6/4 = 3/2 = 1.5$$

What is the equation of this line?



What is the y-intercept of this line?

$$(0, -4)$$

What is the slope of this line?

$$-3$$

What is the graph of this line?

What is the slope and y-intercept of:

• $y = -2x + 1$ $m = \underline{-2}$ $b = \underline{1}$

• $y = 7/6x - 3/4$ $m = \underline{7/6}$ $b = \underline{-3/4}$

• $y = -4/5x$ $m = \underline{-4/5}$ $b = \underline{0}$

• $y = 7$ $m = \underline{0}$ $b = \underline{7}$

What is the equation of a line with:

• slope = $3/8$ and y-intercept = -6 $y = \underline{3/8x - 6}$

• slope = -3 and y-intercept = 4 $y = \underline{-3x + 4}$

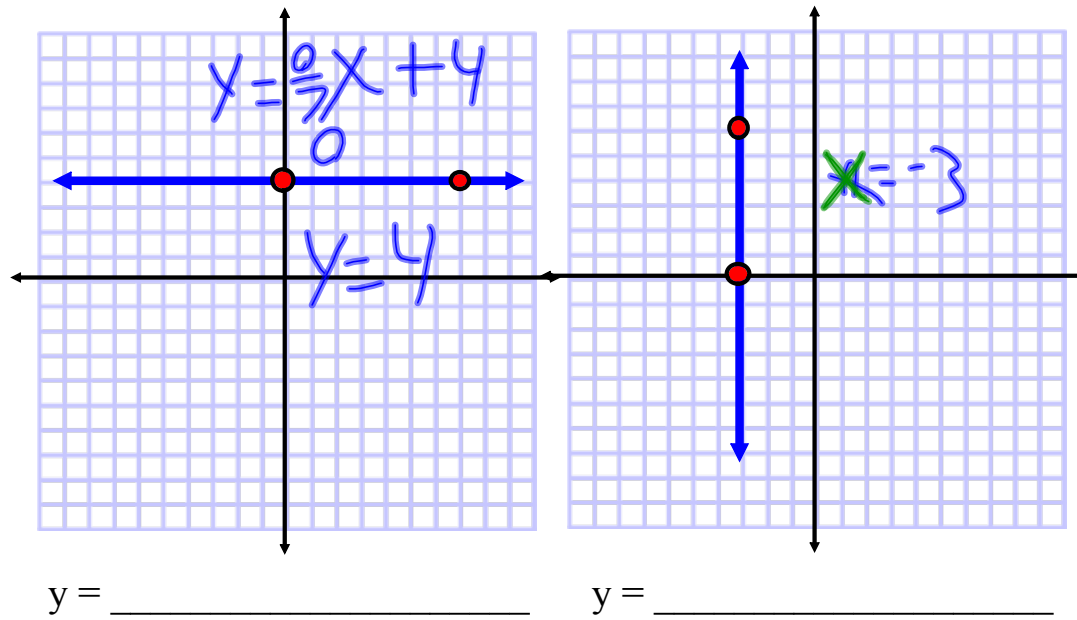
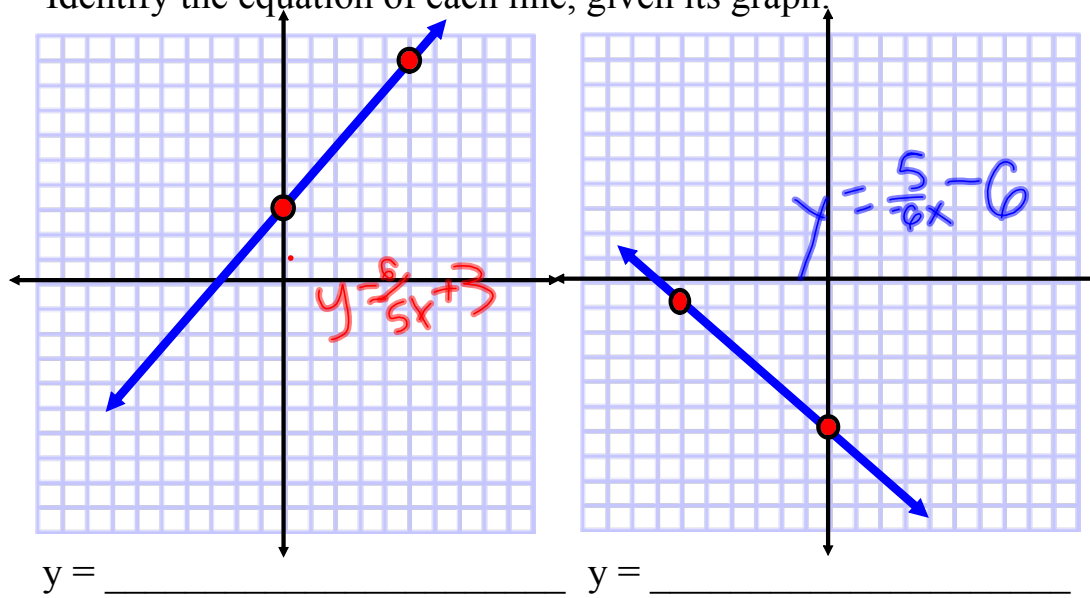
• slope = 0 and y-intercept = -7 $y = \underline{-7}$

• slope = $2/3$ and y-intercept = 0 $y = \underline{2/3x}$

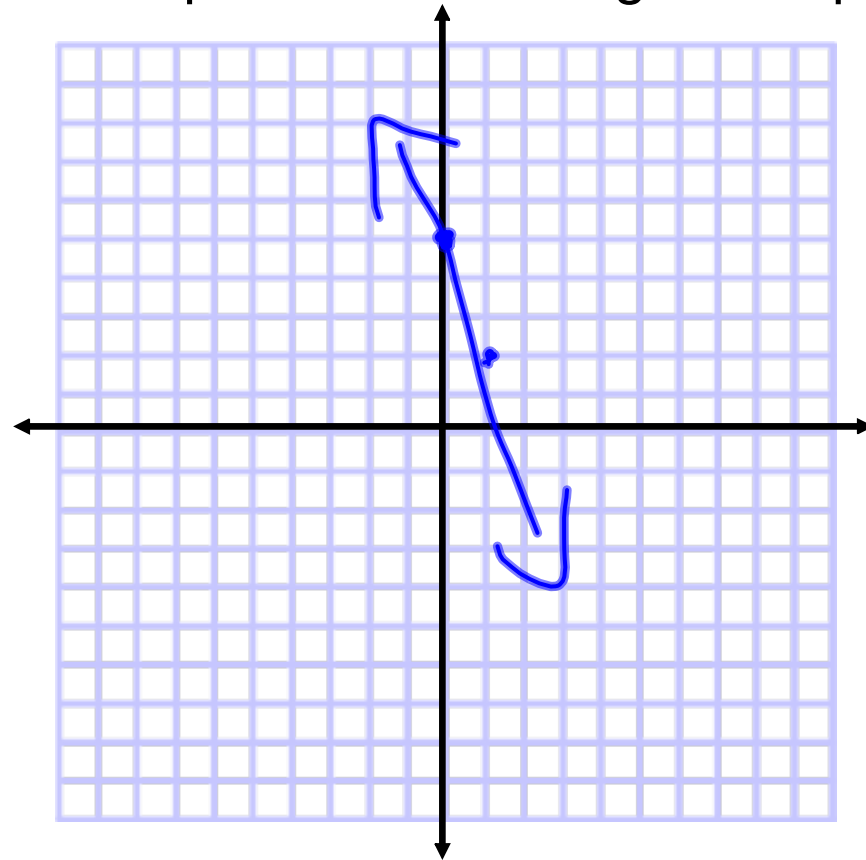
• no slope and no y-intercept

$\underline{x = \text{anything but } 0}$

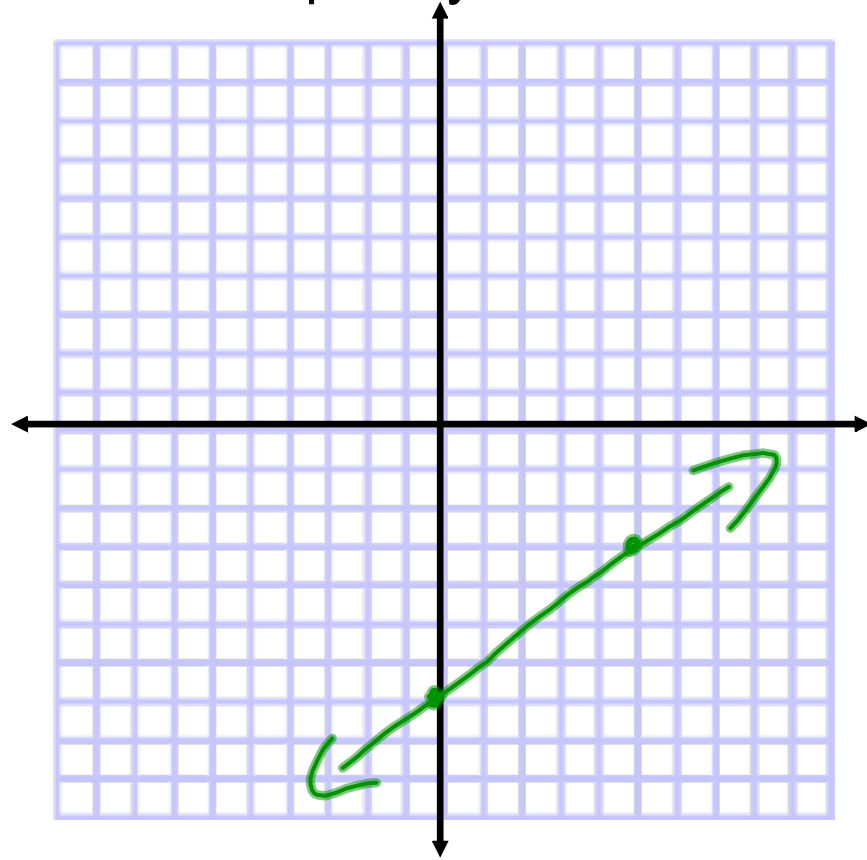
Identify the equation of each line, given its graph:



Graph each line using the slope and intercept only.



$$y = -3x + 5$$



$$y = 4/5 x - 7$$

How do you graph or identify the graph of a line whose slope and y-intercept are not obvious?

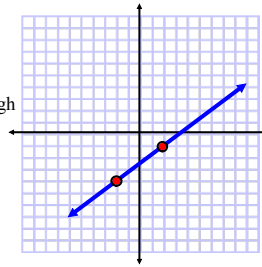
For instance:

~~$2x + 3y = 12$~~ OR

The line that passes through (3,5) and (9,12)

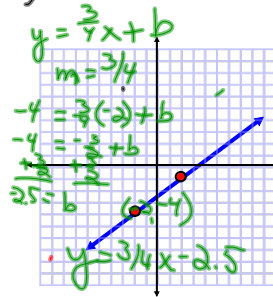
OR

The graph to the right



1. How do you identify the slope and y-intercept of a line like:

~~$2x + 3y = 12$~~
 $y = 4 - \frac{2}{3}x$



2. How do you identify the equation of this line when the y-intercept is not clear? (Remember 2 points determine a line)

$y = \frac{3}{4}x + ?$
 $-1 = \frac{3}{4} + ?$
 $-1 - \frac{3}{4} = ?$
 $-\frac{7}{4} = ?$
 $-\frac{7}{4} = -\frac{3}{4} + ?$
 $-\frac{7}{4} + \frac{3}{4} = ?$
 $-\frac{4}{4} = ?$
 $-1 = ?$

3. How do you find the equation of the line that passes through (3,5) and (9,12)?

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{12 - 5}{9 - 3} = \frac{7}{6}$
 $y = mx + b$
 $y = \frac{7}{6}x + b$
 $5 = \frac{7}{6}(3) + b$
 $5 = \frac{7}{2} + b$
 $5 - \frac{7}{2} = b$
 $\frac{10}{2} - \frac{7}{2} = b$
 $\frac{3}{2} = b$
 $1.5 = b$

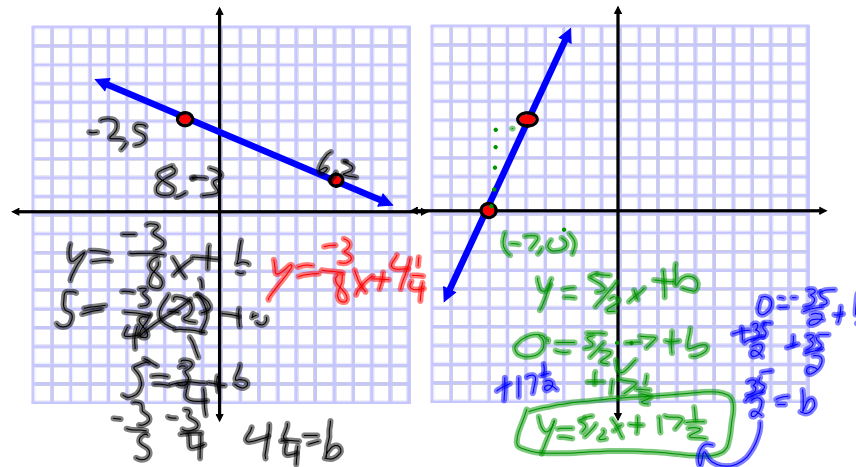
What is the slope and y-intercept of these lines?

• $3x - 4y = 8$
 $\frac{-3x - 4y = 8}{-4} \Rightarrow y = \frac{3}{4}x - 2$

• $2x = -5y + 10$
 $\frac{2x - 10 = -5y}{-5} \Rightarrow \frac{2}{-5}x + 2 = y$

• $7y - 14 = 21x$
 $\frac{7y - 14 = 21x}{7} \Rightarrow y = 3x + 2$

What is the equation of the lines illustrated below?



What is the equation of the line that passes through:

• $(8, -2)$ and $(-3, -5)$

• $(6, 10)$ and $(12, 16)$

