

# Intro to College Math: Chapter 3.5

## Equations of a Line

\* Slope-intercept Form:  $y = mx + b$

*↑ slope*      *↑ y-intercept*

\* Point-slope Form:  $y - y_1 = m(x - x_1)$

\* use this formula if you know a point and the slope.

\* Parallel Lines: have the same slope, but different y-intercepts.

ex.)  $y = \frac{1}{3}x + 2$     $y = \frac{1}{3}x + 5$   
 same ... so parallel

\* Perpendicular Lines: their slopes are flipped and opposite sign.

ex.)  $y = \frac{1}{2}x + 2$        $y = -3x + 5$

↑ flip & opposite sign ..... so perpendicular

1. Give the equation of the line with the given slope and y-intercept.

$$m = -2, b = 2$$

$y = mx + b$  ← Slope-intercept form

$$y = -2x + 2$$

- \* Just replace the "m" and "b" in the slope-intercept form with your numbers.

2. Give the equation of the line with the given slope and y-intercept.

$$m = \frac{1}{5}, b = -5$$

$y = mx + b$  ← slope intercept form

$$y = \frac{1}{5}x - 5$$

- \* Just replace the "m" and "b" in the slope-intercept form with your numbers.

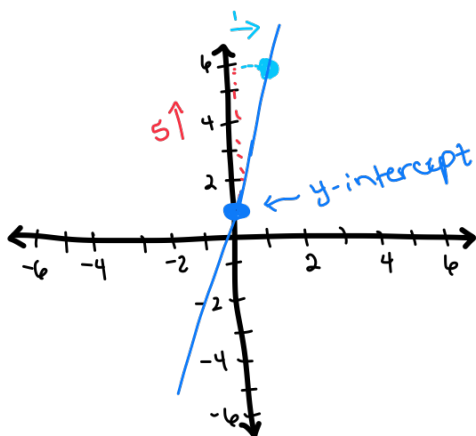
3. Find the slope and y-intercept for the following equations by writing it in the form  $y = mx + b$ . Then, graph the equation.  $-5x + y = 1$

$$\begin{array}{r} -5x + y = 1 \\ +5x \quad +5x \\ \hline y = 5x + 1 \end{array}$$

↑ slope
↑ y-intercept

$m = \text{slope} = \frac{5}{1}$  ← go up 5  
← go right 1

y-intercept = 1



\* First solve the equation for y. This means get y by itself on the left and everything else on the right.

\* On the right side of the equation, make sure that you put the x first and then the number by itself.

\* The number in front of x will be the slope.

\* The number by itself is the y-intercept.

\* If the slope is not a fraction, make it a fraction by putting 1 under it.

To Graph:

\* Place a point for the y-intercept on the y axis.

\* Then using your slope, go up (if positive) or down (if negative) the top number on the fraction. And go right the bottom number of the fraction.

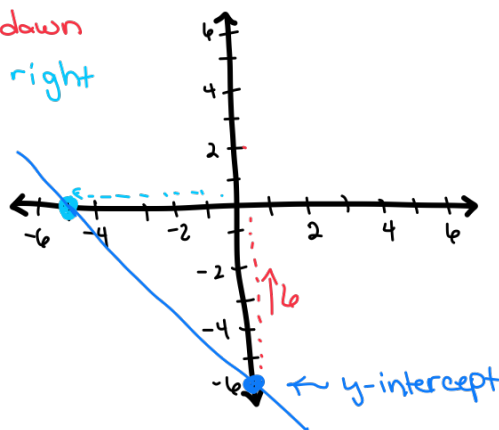
4. Find the slope and y-intercept for the following equations by writing it in the form  $y = mx + b$ . Then, graph the equation.  $-6x - 5y = 30$

$$\begin{array}{r} -6x - 5y = 30 \\ +6x \quad +6x \\ \hline -5y = 6x + 30 \\ \frac{-5y}{-5} = \frac{6x}{-5} + \frac{30}{-5} \\ y = -\frac{6}{5}x - 6 \end{array}$$

↑ slope
↑ y-intercept

$m = \text{slope} = -\frac{6}{5}$  ← go down 6  
← go right 5

y-intercept = -6



\* First solve the equation for y. This means get y by itself on the left and everything else on the right.

\* On the right side of the equation, make sure that you put the x first and then the number by itself.

\* The number in front of x will be the slope.

\* The number by itself is the y-intercept.

\* Since we can't go down on this graph, we have to change how to graph the next point

\* Put the (-) with the bottom number.

$\frac{6}{-5}$  ← go up 6  
← go left 5

5. For the following problem, the slope and one point on a line is given. Use the point-slope form to find the equation of that line. (Write your answer in slope-intercept form.)

$$(-3, -4) \quad m = -\frac{1}{3}$$

$$y - y_1 = m(x - x_1) \quad \leftarrow \text{point-slope formula}$$

$$y - (-4) = -\frac{1}{3}(x - (-3))$$

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

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

$$y = -\frac{1}{3}x - 5$$

Use point-slope formula

\* Replace  $x_1$ ,  $y_1$ , +  $m$  with the numbers given.

\* If 2 negatives beside each other they make a (+)

\* on the right side, use distributive Property to get rid of ( ).

\* Then move number on left to right by adding or subtracting.

6. For the following problem, the slope and one point on a line is given. Use the point-slope form to find the equation of that line. (Write your answer in slope-intercept form.)

$$(-1, 1) \quad m = -3$$

$$y - y_1 = m(x - x_1) \quad \leftarrow \text{point-slope formula}$$

$$y - 1 = -3(x - (-1))$$

$$y - 1 = -3(x + 1)$$

$$y - 1 = -3x - 3$$

$$y = -3x - 2$$

Use point-slope formula

\* Replace  $x_1$ ,  $y_1$ , +  $m$  with the numbers given.

\* If 2 negatives beside each other they make a (+)

\* on the right side, use distributive Property to get rid of ( ).

\* Then move number on left to right by adding or subtracting.

7. Find the equation of the line with x-intercept (2,0) and y-intercept (0,1).

$(2, 0)$   $(0, 1)$   
 $x_1 \ y_1$   $x_2 \ y_2$  y-intercept

slope formula  $\rightarrow m = \frac{y_2 - y_1}{x_2 - x_1}$   
 $m = \frac{1 - 0}{0 - 2} = -\frac{1}{2}$

slope-intercept form  $\rightarrow y = mx + b$   
 $y = -\frac{1}{2}x + 1$

- \* First, find the slope of the 2 points.
  - label 1 point  $x_1, y_1$
  - label 2<sup>nd</sup> point  $x_2, y_2$
  - Use slope formula + replace each letter with its corresponding number.
- \* Then use slope-intercept formula.
  - Replace "m" with the number you just found.
  - Replace "b" with your y-intercept.

8. Find the equation of the line with x-intercept (-4,0) and y-intercept (0,-1).

$(-4, 0)$   $(0, -1)$   
 $x_1 \ y_1$   $x_2 \ y_2$  y-intercept

slope formula  $\rightarrow m = \frac{y_2 - y_1}{x_2 - x_1}$   
 $m = \frac{-1 - 0}{0 - (-4)} = -\frac{1}{4}$

slope-intercept form  $\rightarrow y = mx + b$   
 $y = -\frac{1}{4}x - 1$

- \* First, find the slope of the 2 points.
  - label 1 point  $x_1, y_1$
  - label 2<sup>nd</sup> point  $x_2, y_2$
  - Use slope formula + replace each letter with its corresponding number.
- \* Then use slope-intercept formula.
  - Replace "m" with the number you just found.
  - Replace "b" with your y-intercept.

9. Line  $l$  is parallel to the graph of the equation  $5x + 4y = -40$  and contains the point  $(-5, 3)$ . Find the equation for  $l$ .

$$\begin{array}{r}
 5x + 4y = -40 \\
 \underline{-5x} \qquad \qquad \underline{-5x} \\
 4y = -5x - 40 \\
 \underline{4} \qquad \qquad \underline{4} \qquad \underline{4} \\
 y = -\frac{5}{4}x - 10
 \end{array}$$

↑ slope

\* First, solve for  $y$ . (Get  $y$  by itself on the left)

\* Then the number in front of  $x$  will be your slope.

Point-slope formula →

$$\begin{aligned}
 &(-5, 3) \quad m = -\frac{5}{4} \\
 &y - y_1 = m(x - x_1) \\
 &y - 3 = -\frac{5}{4}(x - (-5)) \\
 &y - 3 = -\frac{5}{4}(x + 5) \\
 &y - 3 = -\frac{5}{4}x - \frac{25}{4} \\
 &\underline{+3} \qquad \qquad \qquad \underline{+3} \\
 &\boxed{y = -\frac{5}{4}x - \frac{13}{4}}
 \end{aligned}$$

\* Now use point-slope formula.\*

\* Since it is parallel, the slope is the exact same as the one you just found.

\* Replace the " $m$ " with the slope, and the " $x_1$ " + " $y_1$ " with the numbers from your point.

\* Then solve for  $y$ .

• If 2 negatives are together, they make a  $(+)$ .

• Use distributive property to get rid of parenthesis.

• Move number from left to right, by add or subtract.

10. Line  $l$  is perpendicular to the graph of the equation  $2x + 5y = -10$  and contains the point  $(-2, -1)$ . Find the equation for  $l$ .

$$\begin{array}{r} 2x + 5y = -10 \\ -2x \qquad -2x \\ \hline 5y = -2x - 10 \\ \frac{5y}{5} = \frac{-2x}{5} - \frac{10}{5} \\ y = -\frac{2}{5}x - 2 \end{array}$$

↑  
slope

\* First, solve for  $y$ . (Get  $y$  by itself on the left)

\* Then the number in front of  $x$  will be your slope.

want perpendicular line so...

$$m = -\frac{2}{5} \rightarrow \frac{-5}{2} \rightarrow \frac{5}{2}$$

↑  
flip

↑  
change sign

New slope

\* To find slope for perpendicular

- Flip original slope
- Change sign to opposite

Point-slope formula

$(-2, -1)$   $m = \frac{5}{2}$

$x_1$   $y_1$

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

$$y - (-1) = \frac{5}{2}(x - (-2))$$

$$y + 1 = \frac{5}{2}(x + 2)$$

$$y + 1 = \frac{5}{2}x + 5$$

$$y = \frac{5}{2}x + 4$$

\* Now use point-slope formula.\*

\* Replace the "m" with the new slope and the " $x_1$ " + " $y_1$ " with the numbers from your point.

\* Then solve for  $y$ .

- If 2 negatives are together, they make a (+).
- Use distributive property to get rid of parenthesis.
- Move number from left to right, by add or subtract.