b = y-intercept

Determine the value of b for the equation $y = 3x + b$ if the line passes through the following points. Then write the equation in slope-intercept form.

129. $R(2,1)$

$y = 3x + b$

$1 = 3(2) + b$

$1 = 6 + b$

$-5 = b$

Therefore:

$y = 3x - 5$

130. $K(-1,4)$

$y = 3x + b$

① substitute (x, y) values.

$(4) = 3(-1) + b$

② Solve for "b"

$4 = -3 + b$

$+3 \quad +3$

$7 = b.$

③ Write in Slope-Int Form

$\therefore y = 3x + 7$

131. $A(3,-2)$

$y = 3x + b$

$-2 = 3(3) + b$

$-2 = 9 + b$

$-9 \quad -9$

$-11 = b$

$\therefore y = 3x - 11$

132. $J(2,1)$

$y = 3x + b$

$1 = 3(2) + b$

$-6 \quad -6$

$-5 = b$

$\therefore y = 3x - 5$

133. $T\left(-2, \frac{1}{2}\right)$

$1/2 = 3(-2) + b$

$+6 \quad +6$

$6\,1/2 = b$

$\therefore y = 3x + \frac{13}{2}$

134. $L\left(\frac{2}{3}, 1\right)$

$1 = 3(2/3) + b$

$1 = 2 + b$

$-2 \quad -2$

$-1 = b$

$\therefore y = 3x - 1$

Determine the value of m for the equation $y = mx + 2$ if the line passes through the following points. Then write the equation in slope-intercept form.

m = slope

135. $R(12,5)$

$y = mx + 2$ sub-in

$5 = m(12) + 2$

$-2 \quad -2$

$\frac{3}{12} = \frac{12m}{12}$

$\frac{1}{4} = m$

$\therefore y = \frac{1}{4}x + 2$

136. $K(1,-3)$

$-3 = m(1) + 2$

$-2 \quad -2$

$-5 = m$

$\therefore y = -5x + 2$

137. $A(-5,1)$

$1 = m(-5) + 2$

$-2 \quad -2$

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

$\frac{1}{5} = m$

$\therefore y = \frac{1}{5}m + 2$

What you just did above is one way that you will be able to find the equation of a line. **IF** you have the slope or the y-int, you can input the coordinates of a point on the line to solve for the unknown part of the equation.

Then you will write the full equation with slope and y-int in place of *m* and *b*.

The following is another method. (see next page)

The Equation of a Line

The three forms

Slope-Intercept Form	Point-Slope Form	General Form
$y = mx + b$	$y - y_1 = m(x - x_1)$	$Ax + By + C = 0$
m is the slope b is the y-intercept	Derived from $m = \frac{y_2 - y_1}{x_2 - x_1}$ Cross multiply to get point-slope form. Need one point and slope	A must be positive. A,B,C are integers.

* no fractions!
* must multiply out fractions to have whole numbers

Write in general form.

138. $y = 3x - 5$

$-y \quad -y$

$\therefore 3x - y - 5 = 0$

139. $y - 5 = x + 7$

$-y+5 \quad -y+5$

$0 = x - y + 12$

140. $5 - 2x = -4y + 2$

$-5 \quad +2x \quad +2x - 5$

$0 = 2x - 4y - 3$

141. $-\frac{1}{3}x - 4y = 2$ $\times 3$

$-1x - 12y = 6$

$+x \quad +12y \quad +x + 12y$

$0 = x + 12y + 6$

142. $y - 5 = \frac{2}{3}x + 7$ $\times 3x$

$3y - 15 = 2x + 21$

$-3y + 15 \quad -3y + 15$

$0 = 2x - 3y + 36$

143. $5 = \frac{2}{3}y + \frac{3}{4}x$ $\times 12$

$60 = \frac{24}{3}y + \frac{36}{4}x$

$60 = 8y + 9x$

$-60 \quad -60$

$9x + 8y - 60 = 0$

144. Challenge #6

Write the equation of the line that passes through A(2,5) and has slope 3. Express your answer in general from and in slope intercept form.

method ①

Slope intercept form:

$y = mx + b$

$(5) = 3(2) + b$

$5 = 6 + b$

$-6 \quad -6$

$-1 = b$

$\therefore y = 3x - 1$

General Form: $3x - y - 1 = 0$

method ②

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$\frac{3}{1} = \frac{y-5}{x-2}$

$3(x-2) = 1(y-5)$ [Point slope Form]

$3x - 6 = y - 5$

$+5 \quad +5$

$3x - 1 = y$

$\therefore y = 3x - 1$ or $0 = 3x - y - 1$

The Equation of a Line

IMPORTANT!!! There is only one line that passes through a given point with a given slope.

Help with Challenge #6

Given the slope and a point:

Eg.1. A line passes through A(2,5) and has slope 3. Write the equation of the line.

Use the slope formula :

$m = \frac{y_2 - y_1}{x_2 - x_1}$	**Cross-Multiply.** This creates the Point-Slope form of an equation.
$m(x_2 - x_1) = y_2 - y_1$	Fill in what you know. m = 3. Substitute the given point in for x_1 and y_1.
$3(x - 2) = (y - 5)$	**This is our equation in point-slope form.** We no longer need the subscripts on x and y
$3x - 6 = y - 5$	Expanded.
$3x - y - 1 = 0$	Collecting the terms to the left side is called writing the equation in **general form.**
Or	
$y = 3x - 1$	Isolate for 'y' to get the equation in **slope-intercept form.**

Write the equation of the line that passes through the given point and has the given slope. Express the equation in a) point-slope form b) general form c) slope-intercept form.

145. (-2,3), -2

$y-3=-2(x-$ $-2)$

$y-3=$ $-$

$2(x+2)$ point-slope

$y-3=-2x-4$

$y=-2x-1$ slope-intercept

$2x+y+1=0$ general

a) $y-3=-$

146. (-5,2), 2 ← slope

$m=\frac{y_2-y_1}{x_2-x_1}$

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

$2(x-(-5))=y-2$

$2(x+5)=y-2$
a) point-slope

$2x+10=y-2$
$+2 \quad +2$

$2x+12=y$
b) Slope Intercept Form

$-y \quad -y$

$2x-y+12=0$
c) General Form

a)

147. (-5,-1),-2

$y_2-y_1=m(x_2-x_1)$

$y-(-1)=-2(x-(-5))$

$y+1=-2(x+5)$
a) point slope

$y+1=-2x-10$
$-1 \quad -1$

$y=-2x-11$
b) Slope Intercept

$+2x+11 \quad +2x \quad +N$

$2x+y+11=0$
c) General Form

a)

$2(x+2)$		
b) $2x+y+1=0$	b)	b)
c) $y=-2x-1$	c)	c)
148. $(-3,4), -\frac{1}{3}$	149. $(2,4), \frac{1}{2}$	150. $(0,7), -1$
$y-4=-\frac{1}{3}(x-(-3))$ $y-4=-\frac{1}{3}(x+3)$ a) Point slope $y-4=-\frac{1}{3}x+(-\frac{1}{3})(3)$ $y-4=-\frac{1}{3}x-1$ $+4 \quad +4$ $y=-\frac{1}{3}x+3$ b) Slope intercept $3(y=-\frac{1}{3}x+3)$ $3y=-x+9$ $+x \quad -9$ $x+3y-9=0$ c) General Form	a) $y-4=\frac{1}{2}(x-2)$ $y-4=\frac{1}{2}x-1$ $+4 \quad +4$ b) $y=\frac{1}{2}x+3$ $2(y=\frac{1}{2}x+3)$ $2y=x+6$ $-2y \quad -2y$ c) $0=x-2y+6$	a) $y-7=-1(x-0)$ $y-7=-x$ $+7 \quad +7$ b) $y=-x+7$ $+x-7 \quad +x-7$ c) $x+y-7=0$
a)	a)	a)
b)	b)	b)
c)	c)	c)

Write the equation of the line that passes through the given point and has the given slope. Express the equation in a) point-slope form b) slope-intercept form c) general form.

151. $(3,-6), m = -3$

Start with Point-Slope formula:

$y_2 - y_1 = m(x_2 - x_1)$

$y - -6 = -3(x - 3)$

$y + 6 = -3(x - 3)$

$y + 6 = -3x + 9$

$y = -3x + 3$

$3x + y - 3 = 0$

a) $y + 6 = -3(x - 3)$

b) $y = -3x + 3$

c) $3x + y - 3 =$

152. $(4,6), m = 5$

a) $y - 6 = 5(x - 4)$

$y - 6 = 5x - 20$

$+6 \quad +6$

b) $y = 5x - 14$

$-y \quad -y$

c) $0 = 5x - y - 14$

a)

b)

c)

153. $(-2,-1), m = \frac{1}{2}$

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

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

$-1 \quad -1$

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

b) $y = \frac{1}{2}x$

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

$2y = x$

$-2y \quad -2y$

c) $0 = x - 2y$

a)

b)

c)

0

154. $(5,-6), m = -\frac{3}{4}$

$y-(-6)=\frac{-3}{4}(x-5)$

a) $y+6=\frac{-3}{4}(x-5)$

$y+6=\frac{-3}{4}x+\frac{15}{4}$

$y+\frac{24}{4}=\frac{-3}{4}x+\frac{15}{4}$

$-\frac{24}{4}$ $-\frac{24}{4}$

a)
b) $y=\frac{-3}{4}x+\frac{15-24}{4}$

b) $y=\frac{-3}{4}x-\frac{9}{4}$

$4\times\left(y=\frac{-3}{4}x-\frac{9}{4}\right)$

$4y=-3x-9$

$+3x+9$ $+3x+9$

c) $3x+4y+9=0$

155. $\left(\frac{1}{2},6\right), m=\frac{4}{3}$

a) $y-6=\frac{4}{3}\left(x-\frac{1}{2}\right)$

$+6$ $+6$

$y=\frac{4}{3}x-\frac{4}{6}+\frac{6}{1}$

common denominators

$y=\frac{4}{3}x-\frac{2}{3}+\frac{18}{3}$

b) $y=\frac{4}{3}x+\frac{16}{3}$

a)
b) $3\times\left(y=\frac{4}{3}x+\frac{16}{3}\right)$

$3y=4x+16$

$-3y$ $-3y$

c) $0=4x-3y+16$

156. $(-2,1), m=1.5=\frac{3}{2}$

a) $y-1=\frac{3}{2}(x+2)$

$+1$ $+1$

$y=\frac{3}{2}x+3+1$

b) $y=\frac{3}{2}x+4$

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

a)
b)
$2y=3x+8$

$-2y$ $-2y$

c) $0=3x-2y+8$

157. Challenge #7:

Write the equation of a line in general form given that the line passes through (3,4) and (4,6).

slope?

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{6-4}{4-3} = \frac{2}{1} = 2$$

$$y - 4 = 2(x - 3)$$

$$y - 4 = 2x - 6$$

$$-y + 4 \qquad -y + 4$$

$$\therefore \boxed{0 = 2x - y - 2}$$

Given two points:

When given two points we must first find the slope of the line. Then we will follow the same process as above.

Write the equation of the line that passes through (3,4) and (4,6).

Help with #7 Challenge ▷

$m = \frac{y_2 - y_1}{x_2 - x_1}$	Find the slope.
$m = \frac{6-4}{4-3} = \frac{2}{1} = 2$	The slope is 2.
$2 = \frac{y-4}{x-3}$	Substitute slope and ONE of the points.
$2(x-3) = y-4$	Cross-multiply. **Point-slope form**
$2x - 6 = y - 4$	Expand and simplify.
$2x - y - 2 = 0$	Write in general form.
$y = 2x - 2$	And in slope-intercept form if necessary.

Write the equation of the line that passes through the following two points in general form.

158. (3,4) and (4,6) Explain your reasoning

$m = \frac{y_2 - y_1}{x_2 - x_1}$ ① Find the slope

$m = \frac{6-4}{4-3} = \frac{2}{1} = 2$

$y - 4 = 2(x-3)$ ② Substitute + put in Point Slope Form

Use ONE of the points given (3,4) or (4,6) not both.

$y - 4 = 2x - 6$ ③ Expand.

$-y + 4 \quad -y + 4$

$0 = 2x - y - 2$. ④ Convert to General Form.

159. (-2, -4) and (0, 6)

$m = \frac{-4-6}{-2-0} = \frac{-10}{-2} = 5$

$y-(-4) = 5(x-(-2))$

$y+4 = 5(x+2)$

$y+4 = 5x+10$ $-y-4$

$-y-4$

$\therefore 5x - y + 6 = 0$

Explain your reasoning

① Find slope

② use 1 ordered pair (-2, -4) to put in Point Slope form.

③ Convert to general form by expanding.

Write the equation of the line that passes through the following two points in general form.

160. (-5, -8) and (-7, -9)

$m = \frac{-9-(-8)}{-7-(-5)} = \frac{-1}{-2} = \frac{1}{2}$

$y-(-8) = \frac{1}{2}(x-(-5))$

$y+8 = \frac{1}{2}(x+5)$

$2x\left(y+8 = \frac{1}{2}x + \frac{5}{2}\right)$

$2y+16 = x+5$

$0 = x-2y-11$

161. (-1, -2) and (3, 0)

$m = \frac{-2-0}{-1-3} = \frac{-2}{-4} = \frac{1}{2}$

$y-0 = \frac{1}{2}(x-3)$

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

$2y = x-3$

$x-2y-3 = 0$

162. (0, 4) and (5, 0)

$m = \frac{0-4}{5-0} = \frac{-4}{5}$

$y-0 = \frac{-4}{5}(x-5)$

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

$5y = -4x+20$

$4x+5y-20 = 0$

class example

163. (8, -7) and (-6, -7)

$m = \frac{-7-(-7)}{-6-8} = \frac{0}{14} = 0$

$y-(-7) = 0(x-8)$

$\therefore y+7 = 0$

164. $\left(\frac{2}{3}, \frac{1}{4}\right)$ and $\left(\frac{1}{3}, \frac{1}{3}\right)$

$m = \frac{\frac{1}{3}-\frac{1}{4}}{\frac{1}{3}-\frac{2}{3}} = \frac{\frac{4}{12}-\frac{3}{12}}{\frac{-1}{3}} = \frac{\frac{1}{12}}{\frac{-1}{3}}$

$m = \frac{1}{12} \div \left(\frac{-1}{3}\right)$ reciprocal

$= \frac{1}{12} \times \frac{-3}{1} = \frac{-3}{12} = \frac{-1}{4}$

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

$12x\left(y-\frac{1}{3} = \frac{-1}{4}x + \frac{1}{12}\right)$

$12y-\frac{12}{3} = \frac{-12}{4}x+1$

$12y-4 = -3x+1$

$3x+12y-5 = 0$

165. (0.3, 0.4) and (0.5, 0.7)

$m = \frac{0.7-0.4}{0.5-0.3} = \frac{0.3}{0.2} = \frac{\frac{3}{10}}{\frac{2}{10}}$

$m = \frac{3}{10} \div \left(\frac{2}{10}\right) = \frac{3}{10} \times \frac{10}{2} = \frac{30}{20} = \frac{3}{2}$

$y-\frac{4}{10} = \frac{3}{2}(x-\frac{3}{10})$

$\left(y-\frac{4}{10} = \frac{3}{2}x - \frac{9}{20}\right) \times 20$

$20y-\frac{80}{10} = \frac{60}{2}x-9$

$20y-8 = 30x-9$

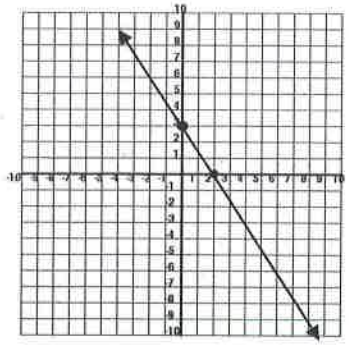
$30x-20y-1 = 0$

Working With Linear Equations:

- Be able to convert equations between general form and slope-intercept form.
- Be able to graph equations given to you in either form.
- Be able to make comparisons based on parallel and perpendicular lines.

Eg.1. Graph the line $3x + 2y - 6 = 0$.

Your Options:
1) use intercepts
2) make a table of values — ✗ time consuming
3) convert to slope-intercept form — ✓ useful; but more steps.



I chose **option 1** because this equation allows for easy calculations to find both intercepts.

$3(0) + 2y - 6 = 0 \qquad 2y - 6 = 0 \qquad 2y = 6 \qquad y = 3$

The y-intercept is 3.

$3x + 2(0) - 6 = 0 \qquad 3x - 6 = 0 \qquad 3x = 6 \qquad x = 2$

The x-intercept is 2.

Plot the two points & draw the line through them.

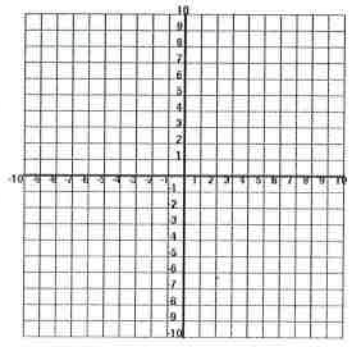
My second choice would have been option 3, conversion to slope-intercept form.

$3x + 2y - 6 = 0 \qquad 2y = -3x + 6 \qquad y = \frac{-3}{2}x + 3$

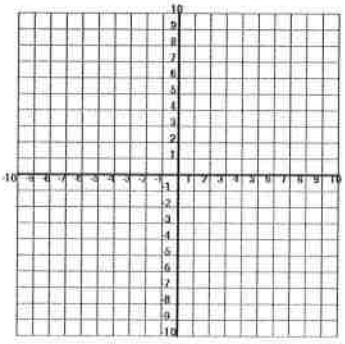
Plot the y-intercept then use the slope to plot another point, draw a line through the two points.

Graph the lines represented by each of the following equations. Use any method.

166. $3x + 2y + 6 = 0$



167. $5x + 2y - 10 = 0$



168. $x - y = 10$