Chapter 2.3 Notes
Lines

- Slope $(m) = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$
  - If the slope of a line is (+), then the line slants upward from left to right.
  - If slope of line is (-), then the line slants downward from left to right.
  - When slope is 0, the line is horizontal. $(y = b)$
  - If it is a vertical line, it has an undefined slope. $(x = a)$
- Point-slope form:
  $y - y_1 = m(x - x_1)$
  ↑ slope
- Slope intercept form:
  $y = mx + b$
  ↑ slope, ↑ y-intercept
- General form of line:
  $Ax + By = C$
- Parallel lines: have the same slope, but different y-intercepts
- Perpendicular lines: using the slope of the original line, flip the slope, and change the sign to the opposite.
- Vertical line: $x = a$ (where a is x intercept)
- Horizontal line: $y = b$ (where b is y intercept)

1. Find the slope of the line and interpret the slope.

Points : $(0,0)$ $(3,4)$

$x_1\ y_1$ $(0,0)$ $\quad$ $x_2\ y_2$ $(3,4)$

slope: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{4-0}{3-0} = \dfrac{4}{3}$

Slope = $\boxed{\dfrac{4}{3}}$

* we begin by writing down both ordered pairs, over one pair write X_1, Y_1. Over the other pair write X_2, Y_2
* Then we will use the slope formula.
  * replace each letter with the number that corresponds with it in your ordered pairs.
  * Then solve the problem using calculator if needed.
  * This answer will be your slope.

· For every 3-unit change in x, the change in y is $\boxed{4}$ units.

2. Find the slope of the line and interpret the slope.

Points: $(-2,2)$, $(2,-1)$

$x_1\ y_1$ $(-2,2)$ $\quad$ $x_2\ y_2$ $(2,-1)$

slope $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{-1-2}{2-(-2)} = \dfrac{-3}{4}$

Slope = $\boxed{-\dfrac{3}{4}}$

* we begin by writing down both ordered pairs, over one pair write X_1, Y_1. Over the other pair write X_2, Y_2
* Then we will use the slope formula.
  * replace each letter with the number that corresponds with it in your ordered pairs.
  * Then solve the problem using calculator if needed.
  * This answer will be your slope.

For every 4-unit change in x, the change in y is $\boxed{-3}$ units.

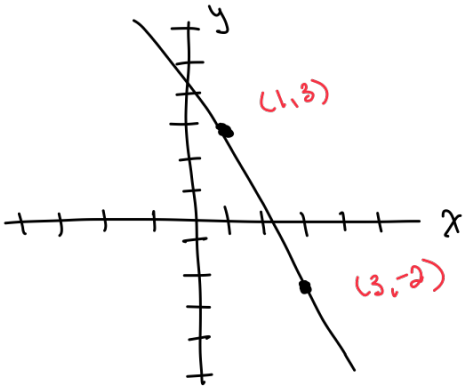
3. Determine the slope of the line containing the given points. Graph the line.

Points: $(1,3)$, $(3,-2)$

x_1 y_1 $(1,3)$ $\quad$ x_2 y_2 $(3,-2)$

slope $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{-2-3}{3-1} = \boxed{\dfrac{-5}{2}}$



To Graph:
- Click on graphing tool.
- Click on [/] (should be in upper right corner)
- Then move point on graph to one of your points + click
- Then move to second point and click
- This should form your line
- Then click save.

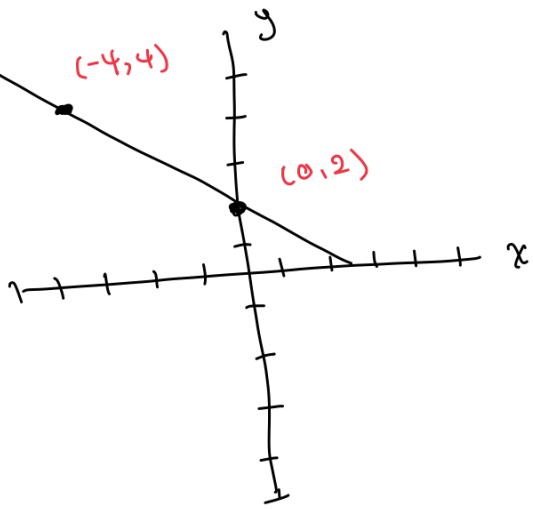
4. Determine the slope of the line containing the given points. Graph the line.

points: $(-4,4)$, $(0,2)$

x_1 y_1 $(-4,4)$ $\quad$ x_2 y_2 $(0,2)$

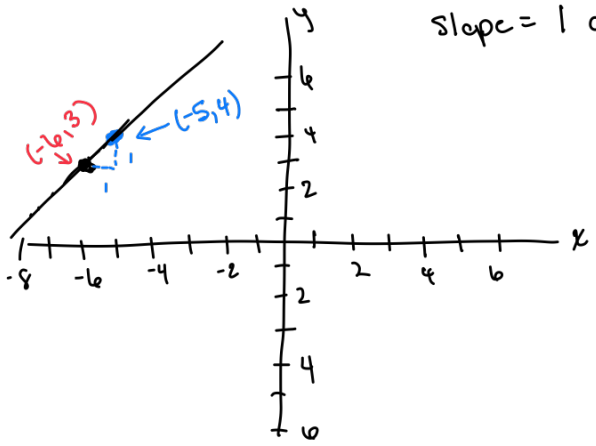
$m = \dfrac{y_2 - y_1}{x_2 - x_1}$

$m = \dfrac{2-4}{0-(-4)} = \dfrac{-2}{4} = \boxed{\dfrac{-1}{2}}$



5. Graph the line containing the point P and having slope m.

P = (-6, 3) m = 1
x y

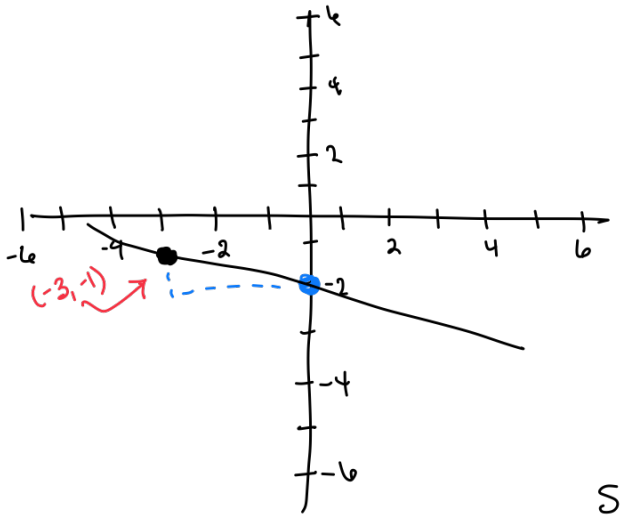


slope = 1 or $\frac{1}{1}$ $\frac{(y)}{(x)}$

* First graph the point given.
* Then we use the slope to graph the next point.
* Always think of the slope as a fraction.
  * The top number tells you how many places to go up (if + number) or down (if negative number)
  * Then the bottom number tells you how many places to to right.
* So you count up or down the top number and then right the bottom number and that is where you place your 2nd point.

6. Graph the line that contains the point (-3,-1) and has a slope of -1/3.

P = (-3, -1) slope = $-\frac{1}{3}$
x y



* First graph the point given.
* Then we use the slope to graph the next point.
* Always think of the slope as a fraction.
  * The top number tells you how many places to go up (if + number) or down (if negative number)
  * Then the bottom number tells you how many places to to right.
* So you count up or down the top number and then right the bottom number and that is where you place your 2nd point.

Slope = $-\frac{1}{3}$ ← tells you to go down (since negative)
← tells you to go right

7. Give the slope and the y-intercept of the line with the given equation. Then, graph the linear equation.

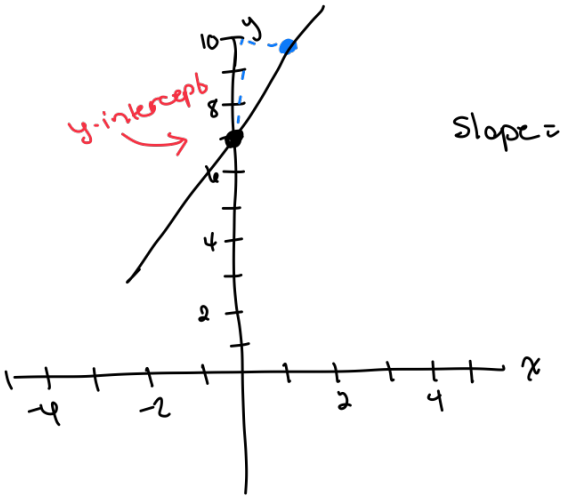
$y = 3x + 7$

Slope = 3

y-intercept = 7

$y = mx + b$ ← y-intercept

↑ slope



$\text{Slope} = \frac{3}{1}$ ← up, ← right

* This is currently in the slope intercept form.
* The slope will just be the number in front of "X".
* The y-intercept will be the number at the end by itself.
* To graph:
  * Draw a point on the y-axis (one going up and down) on the number for y-intercept.
  * If slope is not already in fraction form, make it a fraction my placing a 1 under the number.
  * Then use the slope and go up (if positive number) or down (if negative number) the number of units on the top of the fraction.
  * Then go right the number on the bottom of the fraction. Place a point at this point.

8. Using the given equation, find the intercepts of its graph and graph the equation.

$2x + 3y = 6$

y-intercept: Replace x with 0

$2x+3y=6$

$2(0)+3y=6$

$0+3y=6$

$\frac{3y}{3} = \frac{6}{3}$

$y = 2$

(0, 2) (x, y)

x-intercept: Replace y with 0

$2x+3y=6$

$2x+3(0)=6$

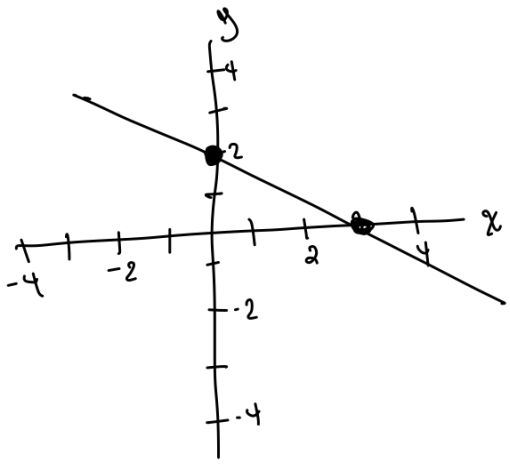
$2x+0=6$

$\frac{2x}{2} = \frac{6}{2}$

$x = 3$

(3, 0) (x, y)

* we will actually write down the equation 2 times.
* The first time replace "X" with 0 and then solve for "Y".
* The second time, replace "Y" with 0 and solve for "X".



9. Find the intercepts of the graph the following equation. Then graph the equation.

$3x + 6y = 9$

y-intercept — Replace x with 0

$3x + 6y = 9$

$3(0) + 6y = 9$

$0 + 6y = 9$

$\frac{6y}{6} = \frac{9}{6}$

$y = \frac{9}{6} = \frac{3}{2}$

$\left(0, \frac{3}{2}\right)$

x-intercept — Replace y with 0

$3x + 6y = 9$

$3x + 6(0) = 9$

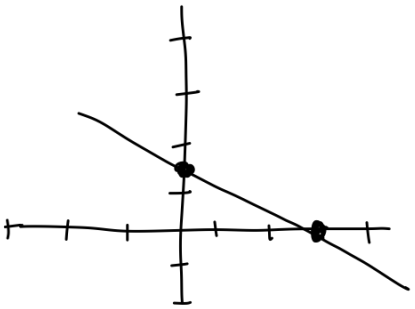
$3x + 0 = 9$

$\frac{3x}{3} = \frac{9}{3}$

$x = 3$

$(3, 0)$

* we will actually write down the equation 2 times.
* The first time replace "X" with 0 and then solve for "Y".
* The second time, replace "Y" with 0 and solve for "X".



10. Find the equation for the line with the given properties. Express your answer using either the general form or the slope-intercept form of the equation of a line.

Slope = 3 containing point (3,4)

Point slope form → $y - y_1 = m(x - x_1)$

x_1 y_1

$(3, 4)$

m = slope

3

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

$y - 4 = 3x - 9$

$+4 \quad +4$

$y = 3x - 5$

* First, we have a point and a slope, so we will use the point slope form.
* Then we write down our points and place X Y over them.
* Then using our formula, we replace each letter with the number that corresponds to it.
* The "m" is replaced with the slope.
* Then to get rid of the parenthesis on the right side, use the FOIL method.
* Then we want just "Y" on the left, so we move the number on the left to the right by doing the opposite.
* Now we are in the slope-intercept form.

II. Find the equation for the line with the given properties. Express your answer using the general form or the slope-intercept form of that equation of the line.

Slope = $\frac{2}{3}$ point = $(3, -3)$

Point-slope form → $y - y_1 = m(x - x_1)$

x_1 y_1

$(3, -3)$

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

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

$-3 \quad -3$

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

m = slope $= \frac{2}{3}$

* First, we have a point and a slope, so we will use the point slope form.
* Then we write down our points and place X Y over them.
* Then using our formula, we replace each letter with the number that corresponds to it.
* The "m" is replaced with the slope.
* Then to get rid of the parenthesis on the right side, use the FOIL method.
* Then we want just "Y" on the left, so we move the number on the left to the right by doing the opposite.
* Now we are in the slope-intercept form.

12. Find an equation for the line with the given properties. Express your answer using the general form or the slope-intercept form of the equation of a line.

Slope = -7 , y-intercept = 9

Slope intercept form → $y = mx + b$

$y = -7x + 9$

* Using the slope intercept form, replace the "m" with the slope, and replace the "b" with the y-intercept.

13. Find an equation for the line with the given properties. Express your answer using either the general form or the slope-intercept form of the equation of a line.

containing points $(3, -6)$ and $(5, -5)$

x_1 y_1 $(3, -6)$ $\quad$ x_2 y_2 $(5, -5)$

Slope formula → $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-6)}{5 - 3} = \frac{1}{2}$ ← slope

Point-slope form → $y - y_1 = m(x - x_1)$

$y - (-6) = \frac{1}{2}(x - 3)$

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

$-6 \quad -6$

$y = \frac{1}{2}x - \frac{15}{2}$

* First we write down both sets of point and write $X_1 Y_1$ Over one set, and $X_2 Y_2$ over the other.
* Then we must find the slope. Using the slope formula, replace the letters with the numbers that corresponds with them, and then solve for the slope.
* Nest, since we know the slope and at least one point, we will use the point slope form.
* Replace the Y_1 , m, and the X_1 With the numbers you have. (remember m stands for the slope.)
* Now use the distributive property to get rid of the parenthesis.
* Lastly, move the number on the right to the left by doing the opposite.

14, Find an equation for the line with the given properties. Express your answer using the general form or the slope-intercept form of the equation of the line.

x-intercept = 3 y-intercept = -2

x-intercept = 3
so ordered pair is
(3, 0)
x_1 y_1

y-intercept = -2
so ordered pair is
(0, -2)
x_2 y_2

Find slope:

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2-0}{0-3} = \frac{2}{3}$$ ← slope

Slope intercept form

$y = mx + b$

m ↑ slope, b ↑ y-intercept

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

* First we make 2 ordered pairs; one for the X-intercept and one for the Y-intercept.
* Then we use those ordered pairs to find the slope.
* Then we will use the slope-intercept form to write our equation.
* Replace the "m" with your slope number, and replace the b with the y-intercept you were give in the problem.

15. Find the equation for the one with the given properties. Express your answer using either the general form or the slope-intercept form of the equation of the line.

Parallel to the line $x - 2y = -1$; containing the point (0,0)

$x - 2y = -1$

$-x \quad -x$

$-2y = -x - 1$

$\frac{-2y}{-2} = \frac{-x}{-2} - \frac{1}{-2}$ ← rearrange into y-intercept form

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

slope ↓

$y - y_1 = m(x - x_1)$ ← use point-slope formula

(0,0)
x_1 y_1

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

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

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

* First, we arrange the equation we are given into the y-intercept form. This means getting "y" on the left by itself and everything else on the right.
* Once you do this, you know the slope is the number in front of "X".
* Now we use the point-slope formula to find the equation of the parallel line.
* Since it is a parallel line, they have the same slope, so you will replace the "m" with your slope.
* Then you replace y_1 And X_1 With the numbers from the ordered pair.
* Then you simplify the equation, making sure the you have "y" by itself on the left side.

* parallel lines have the same slope!

16. Find an equation of the line with the given properties. Express your answer using the general form or the slope-intercept form of the equation of a line.

Parallel to the line $3x-y=-6$; containing the point $(0,0)$

$3x-y=-6$ ← rearrange into y-intercept form

$-3x \quad -3x$

$-y = -3x-6$

$-1 \quad -1 \quad -1$

$y = 3x+6$

slope: 3

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

$(0,0)$ → x_1, y_1

$y-0 = 3(x-0)$ ← use point-slope formula

$y = 3x-0$

$y = 3x$

* First, we arrange the equation we are given into the y-intercept form. This means getting "y" on the left by itself and everything else on the right.
* Once you do this, you know the slope is the number in front of "X".
* Now we use the point-slope formula to find the equation of the parallel line.
* Since it is a parallel line, they have the same slope, so you will replace the "m" with your slope.
* Then you replace y_1 And X_1 With the numbers from the ordered pair.
* Then you simplify the equation, making sure the you have "y" by itself on the left side.

17. Find an equation of the line with the given properties. Express your answer using either the general form or the slope-intercept form of the equation of the line.

Perpendicular to the line $y = -\frac{1}{3}x-4$; containing the point $(2,6)$

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

slope: $-\frac{1}{3}$

$-\frac{1}{3} = \frac{3}{1} = 3$ ← flip the slope and change sign to opposite

new slope: 3

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

x_1, y_1 → $(2,6)$

$y-6 = 3(x-2)$ ← use point-slope formula

$y-6 = 3x-6$

$+6 \quad +6$

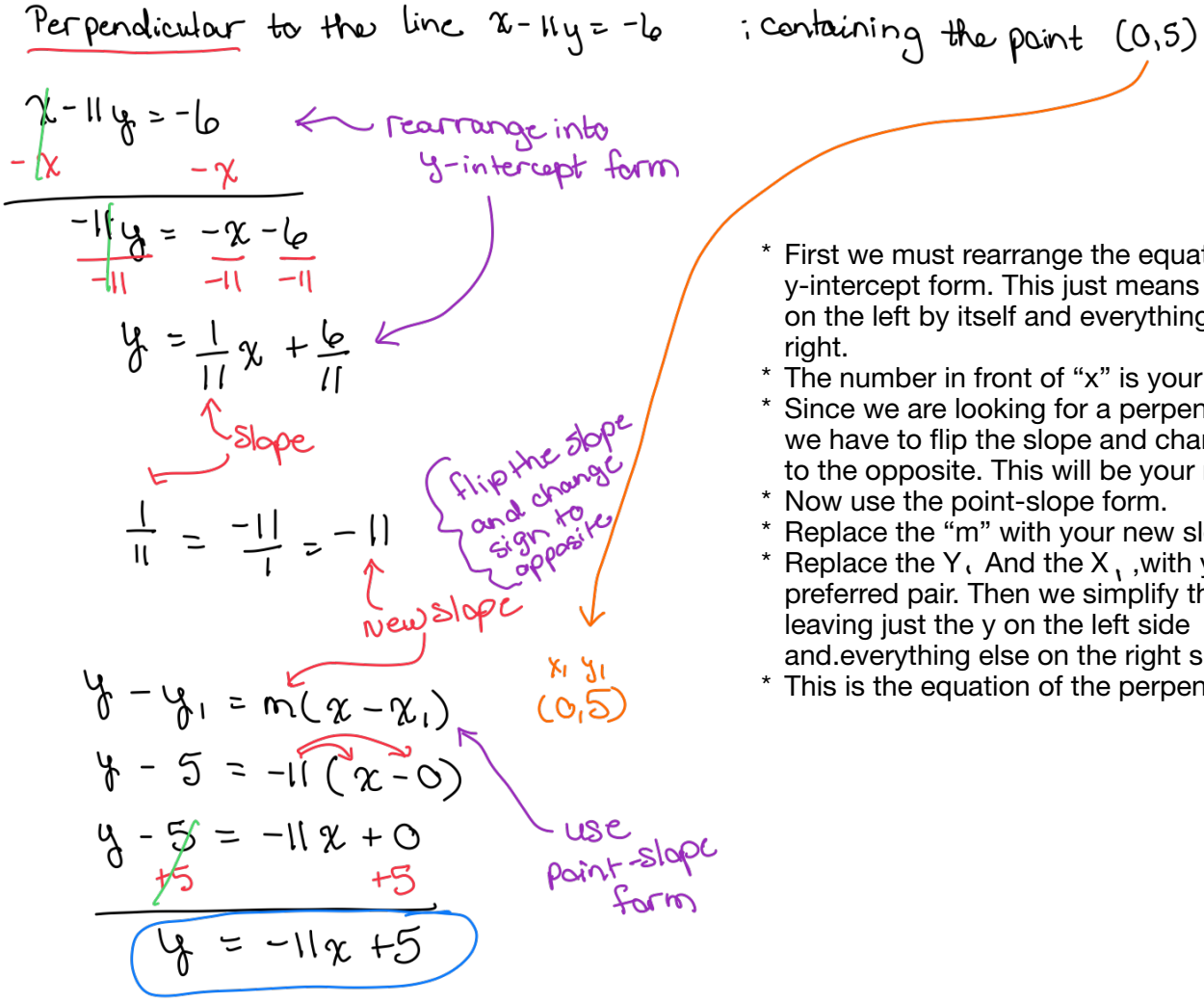
$y = 3x+0$

$y = 3x$

* The equation is already in the slope-intercept form, so we do not have to rearrange it.
* The number in front of "x" is your slope.
* Since we are looking for a perpendicular line, we have to flip the slope and change the sign to the opposite. This will be your new slope.
* Now use the point-slope form.
* Replace the "m" with your new slope.
* Replace the Y_1 And the X_1 ,with your preferred pair. Then we simplify the equation leaving just the y on the left side and.everything else on the right side.
* This is the equation of the perpendicular line.

* perpendicular lines:
  flip slope + then change sign to opposite.

18. Find the equation for the line with the given properties. Express your answer using either the general form of the slope-intercept form of the equation of a line.



* First we must rearrange the equation into the y-intercept form. This just means getting "y" on the left by itself and everything Elsa on the right.
* The number in front of "x" is your slope.
* Since we are looking for a perpendicular line, we have to flip the slope and change the sign to the opposite. This will be your new slope.
* Now use the point-slope form.
* Replace the "m" with your new slope.
* Replace the Y_1 And the X_1 ,with your preferred pair. Then we simplify the equation leaving just the y on the left side and.everything else on the right side.
* This is the equation of the perpendicular line.