2.3 - Lines

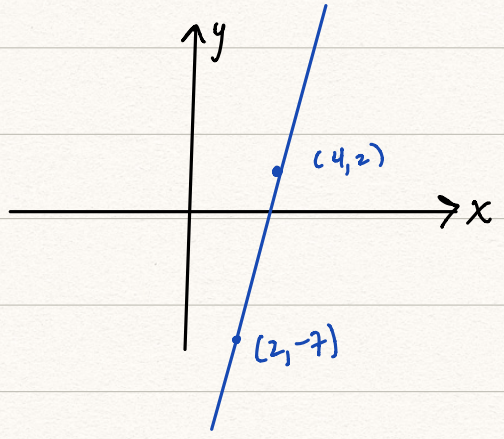
- The <u>slope</u> of a line passing through points (x_1, y_1) & (x_2, y_2) is denoted by m and is defined by

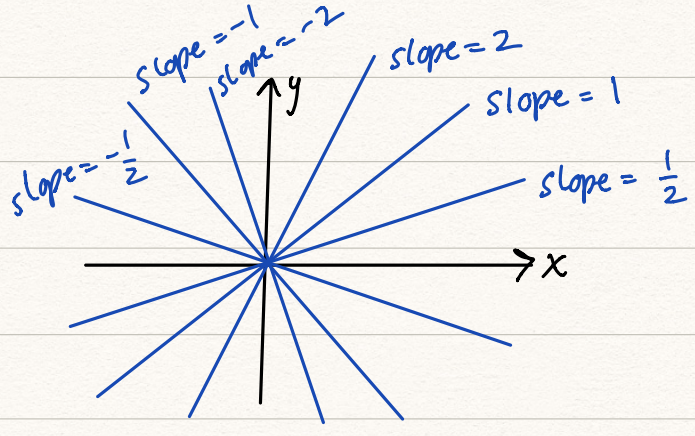
$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

<u>Ex</u>: Slope of line passing through $(2, -7)$ & $(4, 2)$

$$m = \frac{2 - (-7)}{4 - 2} = \frac{9}{2}$$

$$m = \frac{-7 - 2}{2 - 4} = \frac{-9}{-2} = \frac{9}{2}$$





<u>Point-Slope form of the equation of a line</u>

- Line w/ slope m passing through (x_1, y_1)

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

Ex: Eqn of line w/ slope $-\frac{2}{3}$, passing through $(-2,-3)$.

$$y-(-3)=-\frac{2}{3}(x-(-2))$$
$$y+3=-\frac{2}{3}(x+2)$$
$$y+3=-\frac{2}{3}x-\frac{4}{3}$$
$$y=-\frac{2}{3}x-\frac{13}{3}$$

Slope-Intercept

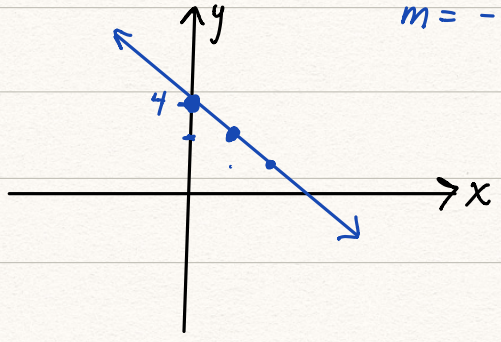
- Eqn of a line w/ slope m & y-intercept b is

$$y=mx+b.$$

Ex: Eqn of line w/ slope -1 & containing $(0,4)$.

$$y=-x+4$$

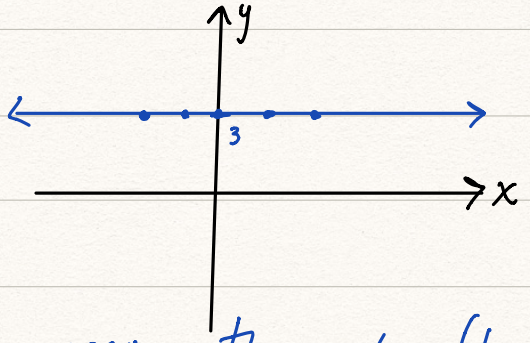
$$m=-1=\frac{-1}{1}=\frac{\text{rise}}{\text{run}}$$



Equations of Horizontal & Vertical lines

- Horizontal line passing through (h,k) has equation $y=k$.

Ex $y=3$



x	y
-2	3
-1	3
0	3
1	3
2	3

- Vertical line passing through (h,k) has equation $x=h$.

General Form of the Equation of a line

$$ax + by + c = 0 \quad , \quad a \neq 0, b \neq 0, c = \text{any real number.}$$

Ex: $3x + 4y = 24$

$$4y = 24 - 3x$$

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

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

Parallel & Perpendicular Lines

- Parallel lines have the <u>same</u> slope.
- Perpendicular lines have slopes which are opposite reciprocals.
  → Line 1 has slope a, then Line 2 is perpendicular to Line 1 if it has slope $-\frac{1}{a}$.

Ex: ① Give eqn of line that passes through $(-1, 2)$, and is $\perp$ to a line with slope $-\frac{1}{2}$.

- $m = 2$
- point $(-1, 2)$

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

$$y = 2x + 4$$

② Eqn of a line that passes through $(-2, 5)$, and is parallel to a line that contains the points $(2, 3), (5, 7)$.

- m = slope of "other line" $= \frac{7-3}{5-2} = \frac{4}{3}$

= slope of "our line".

So $y - 5 = \frac{4}{3}(x + 2)$

$y - 5 = \frac{4}{3}x + \frac{8}{3}$

$y = \frac{4}{3}x + \frac{23}{3}$