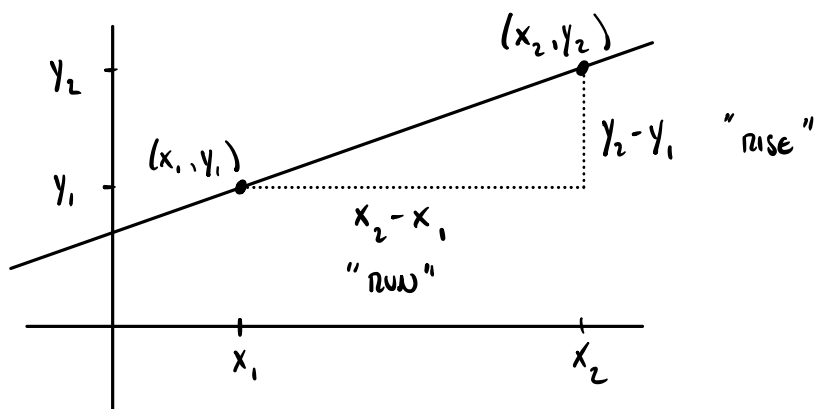


§ 1.3 LINES

A LINE IN THE xy -PLANE IS DETERMINED BY ITS ^{DIRECTION} SLOPE & ITS ^{STARTING POINT} POSITION

Def: THE SLOPE OF A (NONVERTICAL) LINE IS $m = \frac{y_2 - y_1}{x_2 - x_1} \left(= \frac{y_1 - y_2}{x_1 - x_2} \right)$,

WHERE (x_1, y_1) & (x_2, y_2) ARE ANY 2 POINTS ON THE LINE.



$$\text{SLOPE} = \frac{\text{RISE}}{\text{RUN}}$$

Q: WHAT IS THE SLOPE OF A HORIZONTAL LINE?
VERTICAL LINE?

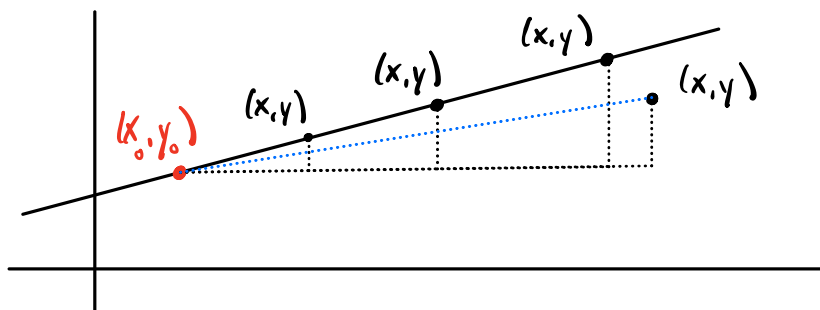
ex. FIND THE SLOPE OF THE LINE THROUGH $(-3, -4)$ & $(1, -2)$?

ex. FIND SLOPE OF LINE WITH x -INT 5 & y -INT 3.

POINT-SLOPE EQUATION

GIVEN A LINE WITH SLOPE m THAT PASSES THROUGH THE POINT (x_0, y_0) ,

ANY OTHER POINT (x, y) ON THE LINE MUST SATISFY $m = \frac{y - y_0}{x - x_0}$.



POINTS NOT ON THE LINE WILL NOT SATISFY THE EQUATION.

∴ This is the equation whose graph is the line with slope m through (x_0, y_0) .

$$m = \frac{y - y_0}{x - x_0}$$

Point-Slope Formula

$$y - y_0 = m(x - x_0)$$

$$y = mx + (y_0 - mx_0)$$

Slope-Intercept Formula

$$y = mx + b$$

y-int.

General Eq. of a line: $Ax + By + C = 0$

ex. What is slope of $2x - 7y + 8 = 0$?

ex. (a) Give an eq. for line through $(-3, 2)$ & $(1, 4)$.

(b) Put it in slope-int. form.

(c) What are x & y ints?

Note:

Horizontal lines $\Rightarrow m = 0 \Rightarrow y = y_0$

Vertical lines $\Rightarrow m$ undefined $\Rightarrow x = x_0$

ex. Give eq's for (a) hor. & (b) vert. lines through $(5, -4)$.

Def: Parallel lines $\parallel$ have same slopes

Perpendicular lines $\perp$ have negative-reciprocal slopes.

ex. Find an equation of the line through the point $(5, 2)$ that is parallel to the line $4x + 6y + 5 = 0$.

ex. $\uparrow$ Perpendicular?