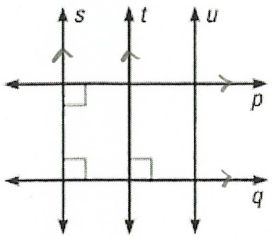
Example #5: Determine which lines, if any, must be parallel in the diagram. Explain your reasoning.

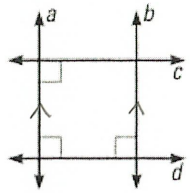


$p \parallel q$ (Thm 3.12)

$t \parallel s$ (Thm 3.12)

{Change for next year?

Example #6: Is $b \parallel a$? Is $b \perp c$? Explain your reasoning.



$b \parallel a$; Thm 3.12

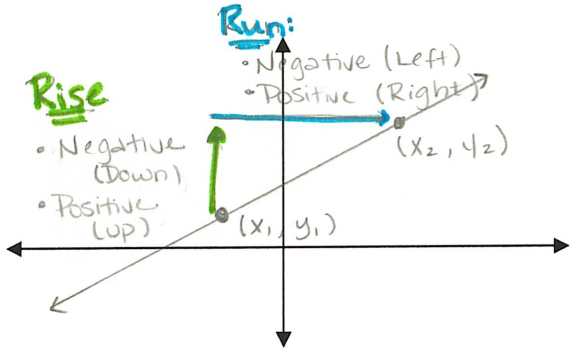
$b \perp c$; Thm 3.11

Chapter 3.4: Find and Use Slopes of Lines

Objective: I can find slopes given a graph or two ordered pair.
I can identify parallel and perpendicular slopes.

Slope:

The Slope of a non-vertical line is the ratio of vertical (rise) to horizontal change (run) between any two points on the line.

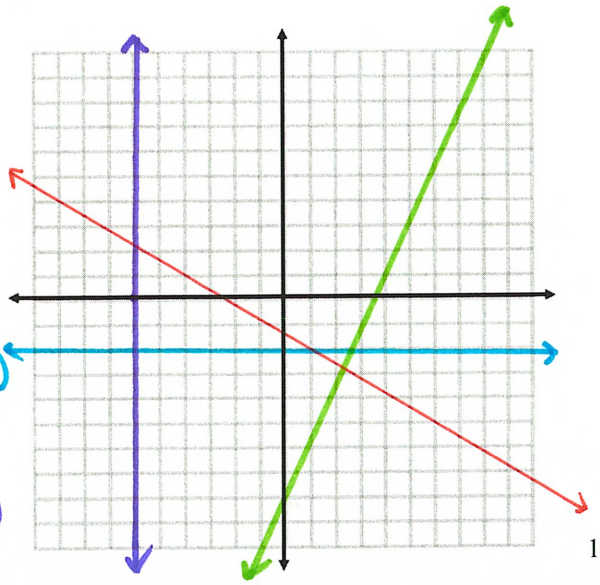


If a line in the coordinate plane passes through points (x_1, y_1) and (x_2, y_2) then the slope m is

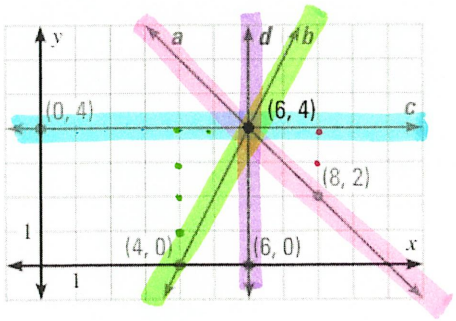
$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} \Rightarrow m = \frac{y_2 - y_1}{x_2 - x_1}$$ { Slope Formula

Slope of Lines in the Coordinate Plane:

1. Negative Slope: falls from left to right
2. Positive Slope: rises from left to right
3. Zero Slope: Horizontal Line
   $m = \frac{0}{\#}$; $y = -2$ (Never crosses x-axis)
4. Undefined Slope: Vertical Line
   $m = \frac{\#}{0}$; $x = -4$ (Never crosses y-axis)



Example #1: Find the slope of lines *a, b, c* and *d.*



a: $m = \frac{2}{-2}$ or $m = \frac{-2}{2} \Rightarrow m = -1$

b: $m = \frac{4}{2}$ or $m = \frac{-4}{-2} \Rightarrow m = 2$

c: $m = \frac{0}{6} \Rightarrow m = 0$

d: $m = \frac{4}{0} \Rightarrow$ No Slope/Undefined

Example #2: Determine the slope of the line that passes through the given points

a.) (5, -3) and (10, 4)
x_1, y_1 x_2, y_2

$m = \frac{4-(-3)}{10-5}$

$m = \frac{4+3}{5}$

$m = \frac{7}{5}$

b.) (-4, 3) and (-4, -5)
x_1, y_1 x_2, y_2

$m = \frac{-5-3}{-4-(-4)}$

$m = \frac{-8}{-4+4}$

$m = \frac{-8}{0}$

No Slope / Undefined

c.) (6, 3) and (3, 3)
x_1, y_1 x_2, y_2

$m = \frac{3-3}{3-6}$

$m = \frac{0}{-3}$

$m = 0$

Slopes of Parallel Lines (Postulate 17):

In a coordinate plane, two non-vertical lines are parallel iff they have the EXACT same Slope.

Example: $y = \frac{1}{2}x + 6$, $y = \frac{1}{2}x - 3$ OR $y = \frac{-2}{3}x + 3$, $y = \frac{2}{-3}x - 3$, $y = -\frac{2}{3}x + 2$

Slopes of Perpendicular Lines (Postulate 18):

In a coordinate plane, two non-vertical lines are perpendicular iff their slopes are opposite (signs +/-) reciprocals (flipped fraction).

Example: $y = \frac{2}{5}x - 7$, $y = -\frac{5}{2}x + 4$ OR $y = x + 2$, $y = -x + 2$

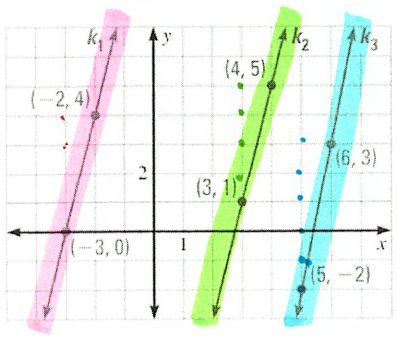
Example #3: Given the line $y = -\frac{2}{3}x + 5$

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

What is the slope of a line that is perpendicular to this line? $\perp m = \frac{3}{2}$ ← Reciprocal, opposite

What is the slope of a line that is parallel to this line? $\parallel m = -\frac{2}{3}$ Exactly the Same.

Example #4: Find the slope of each line. Which lines are parallel?



K_1: $m = \frac{4}{1} \Rightarrow m = 4$

K_2: $m = \frac{4}{1} \Rightarrow m = 4$

K_3: $m = \frac{5}{1} \Rightarrow m = 5$

$K_1 \parallel K_2$ because their slopes are the same

Example #5: Line *c* passes through (2, -2) and (5, 7). Linde *d* passes through (-3, 4) and (1, -8). $c \parallel d$? Explain how you know.

$x_1\ y_1 \quad x_2\ y_2$

c: $m = \frac{7-(-2)}{5-2}$

$m = \frac{7+2}{3}$

$m = \frac{9}{3} \Rightarrow m = 3$

$x_1\ y_1 \quad x_2\ y_2$

d: $m = \frac{-8-4}{1-(-3)}$

$m = \frac{-12}{1+3}$

$m = -\frac{12}{4} \Rightarrow m = -3$

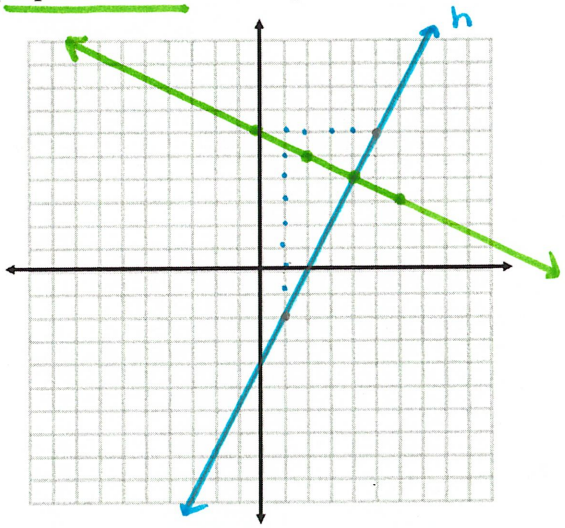
$c \not\parallel d$ because they do not have the same slope.

Example #4: Line *h* passes through (1, -2) and (5, 6). Graph the line perpendicular to *h* that passes through the point (2, 5).

h: $m = \frac{8}{4} \Rightarrow m = 2$

ℓ: $\perp m = -\frac{1}{2}$ $P(2,5)$

↑ graph 1st



Example #5: Line *n* passes through (1, 6) and (8, 4). Line *m* passes through (0, 5) and (2, 12). Is $n \perp m$? Explain.

$x_1\ y_1 \quad x_2\ y_2$

n: $m = \frac{4-6}{8-1}$

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

$x_1\ y_1 \quad x_2\ y_2$

m: $m = \frac{12-5}{2-0}$

$m = \frac{7}{2}$

$n \perp m$ because their slopes are opposite reciprocals