UNIT 6: IRRATIONAL MATH

symbols: ∥ ⊥

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Objectives: I can draw parallel and perpendicular lines using slope.

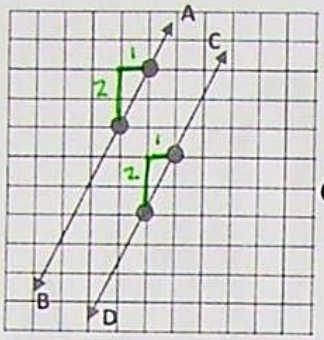
Parallel and Perpendicular Lines

Find the slope of each of the following lines. Indicate whether the lines are parallel, perpendicular or just intersecting.

1) Slope of $\overleftrightarrow{AB}$: $2\left(\frac{2}{1}\right)$

Slope of $\overleftrightarrow{CD}$: $2\left(\frac{2}{1}\right)$

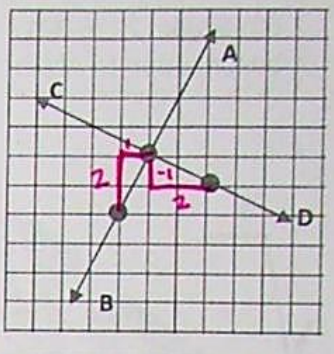
Parallel, Perpendicular or just Intersecting



2) Slope of $\overleftrightarrow{AB}$: $2\left(\frac{2}{1}\right)$

Slope of $\overleftrightarrow{CD}$: $\frac{-1}{2}$

Parallel, **Perpendicular** or just Intersecting

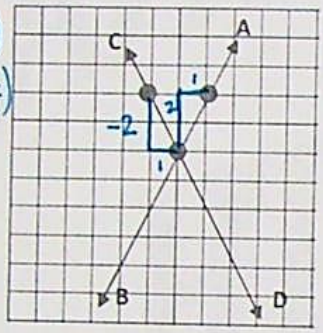


3) Slope of $\overleftrightarrow{AB}$: $2\left(\frac{2}{1}\right)$

Slope of $\overleftrightarrow{CD}$: $-2\left(-\frac{2}{1}\right)$

Parallel, Perpendicular or **just Intersecting**

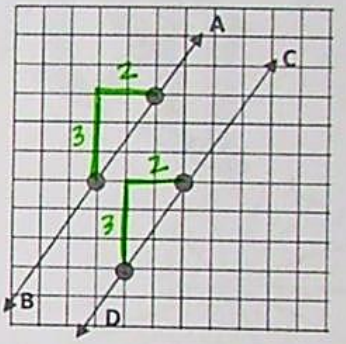
opposite signs, BUT not reciprocals



4) Slope of $\overleftrightarrow{AB}$: $\frac{3}{2}\left(\frac{3}{2}\right)$

Slope of $\overleftrightarrow{CD}$: $\frac{3}{2}\left(\frac{3}{2}\right)$

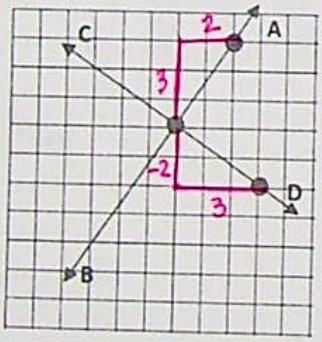
Parallel, Perpendicular or just Intersecting



5) Slope of $\overleftrightarrow{AB}$: $\frac{3}{2}$

Slope of $\overleftrightarrow{CD}$: $\frac{-2}{3}$

Parallel, **Perpendicular** or just Intersecting

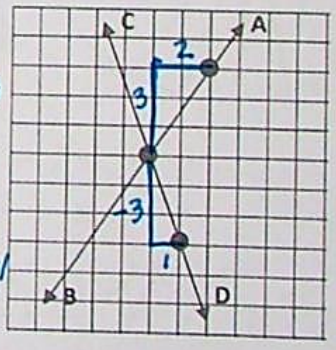


6) Slope of $\overleftrightarrow{AB}$: $\frac{3}{2}$

Slope of $\overleftrightarrow{CD}$: $\frac{-3}{1} = -3$

Parallel, Perpendicular or **just Intersecting**

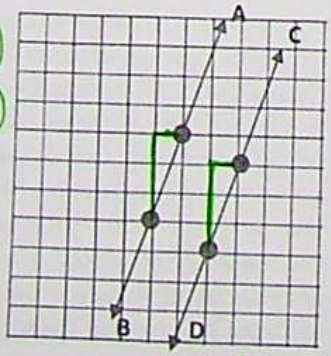
opposite signs, BUT not reciprocals!



7) Slope of $\overleftrightarrow{AB}$: $3\left(\frac{3}{1}\right)$

Slope of $\overleftrightarrow{CD}$: $3\left(\frac{3}{1}\right)$

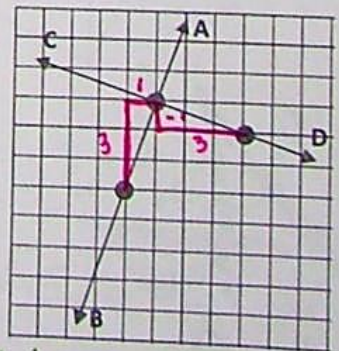
Parallel, Perpendicular or just Intersecting



8) Slope of $\overleftrightarrow{AB}$: $3\ \frac{3}{1}$

Slope of $\overleftrightarrow{CD}$: $-\frac{1}{3}$

Parallel, **Perpendicular** or just Intersecting



Make a conjecture about the **slopes of parallel lines**: The slopes of parallel lines are the same!

Make a conjecture about the **slopes of perpendicular lines**: The slopes of perpendicular lines are opposite reciprocals!

② $(2)(-\frac{1}{2})$ ⑤ $(\frac{3}{2})(-\frac{2}{3})$ ⑧ $(3)(-\frac{1}{3})$

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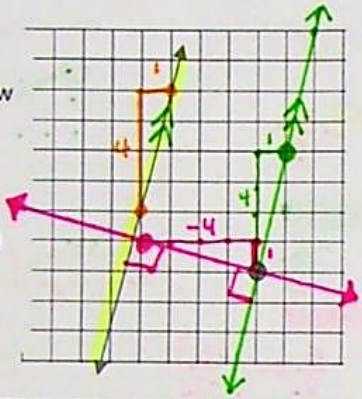
Test your conjecture....

1. What do you think the slope of a line parallel to a line with a slope of 4 will be? same → 4
2. What do you think the slope of a line parallel to a line with a slope of $\frac{2}{5}$ will be? same → $\frac{2}{5}$
3. What do you think the slope of a line perpendicular to a line with a slope of 4 will be? opposite reciprocal → $-\frac{1}{4}$
4. What do you think the slope of a line perpendicular to a line with a slope of $\frac{2}{5}$ will be? opposite reciprocal → $-\frac{5}{2}$

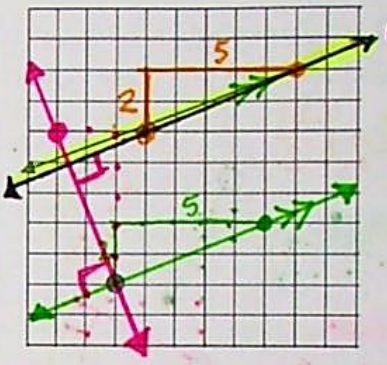
The line has a slope of 4. Draw a line through the point with the slope you wrote in #1 and then #3.

$-\frac{1}{4}$ ... $\frac{1}{-4}$



The line has a slope of $\frac{2}{5}$. Draw a line through the point with the slope you wrote in #2 and then #4.

$-\frac{5}{2}$ ... $\frac{5}{-2}$



ooo was off a little bit!

Parallel lines have the **same slope** and will never intersect. Parallel lines continue, literally, forever without touching (assuming that these lines are on the same plane.)

Perpendicular lines have the **opposite and reciprocal slope** of each other. A pair of these lines intersects at 90 degrees.

Example of parallel lines.

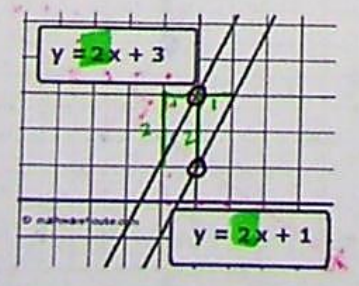
As you can see from the diagram below, these lines

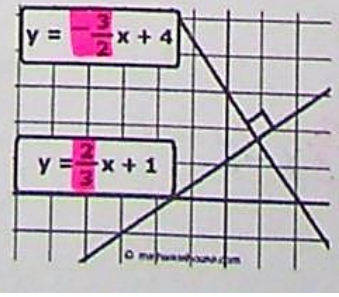
- have the same slope
  - 2
- are never going to intersect

Example of perpendicular lines.

As you can see from the picture below:

- the slope of these lines are negative reciprocals
  - $\frac{2}{3}$ and $-\frac{3}{2}$ are ~~negative~~ opposite reciprocals
- these lines are perpendicular and intersect at 90 degrees





Note: You know two slopes are opposite reciprocals if their product equals -1!

Ex: $\left(\frac{2}{3}\right)\left(-\frac{3}{2}\right) = -\frac{6}{6} = -1$

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Practice with Parallel and Perpendicular Lines

Symbol ∥ Symbol ⊥

$y = mx + b$

m = slope

b = y-intercept

Problems 3 & 4

Examples:

m ≠

(∥) same (⊥) opposite reciprocal

① For the given slopes of lines, write the parallel and the perpendicular slopes.

a) $m = 3$ ∥ m = 3 ⊥ m = $-\frac{1}{3}$

b) $m = -5$ ∥ m = -5 ⊥ m = $\frac{1}{5}$

c) $m = \frac{1}{4}$ ∥ m = $\frac{1}{4}$ ⊥ m = -4

d) $m = -\frac{2}{3}$ ∥ m = $-\frac{2}{3}$ ⊥ m = $\frac{3}{2}$

② Find the slope of the given segment. Write the parallel and perpendicular slope. Draw line segments through the given point with these slopes.

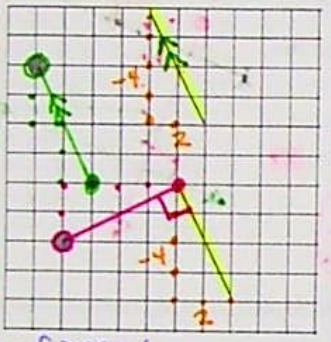
a) Slope: -2 $\left(\frac{-4}{2}\right)$

Same

Parallel slope: -2 $\left(\frac{-4}{2}\right)$

opposite reciprocal

Perpendicular slope: $\frac{1}{2}$ $\left(\frac{2}{4}\right)$

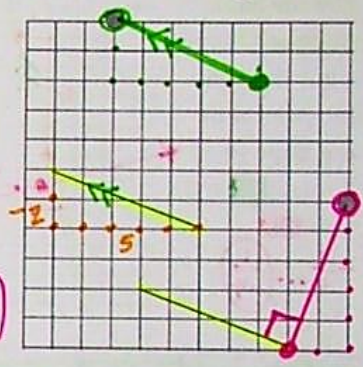


b) Slope: $-\frac{2}{5}$

Same

Parallel slope: $-\frac{2}{5}$

Perpendicular slope: $\frac{5}{2}$ or $\left(\frac{-5}{-2}\right)$



* See box at top of page!

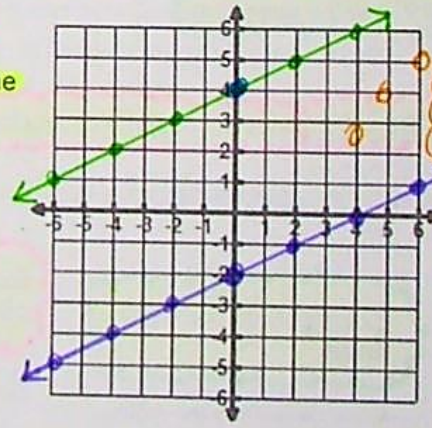
③ Write an equation of a line with a y-intercept of 4 that is parallel to $y = \frac{1}{2}x - 2$. Graph both lines on the coordinate grid.

(same)

Parallel Slope: $\frac{1}{2}$

New y-intercept: 4

Equation of new line: $y = \frac{1}{2}x + 4$



∥ lines have same slope so they never intersect!

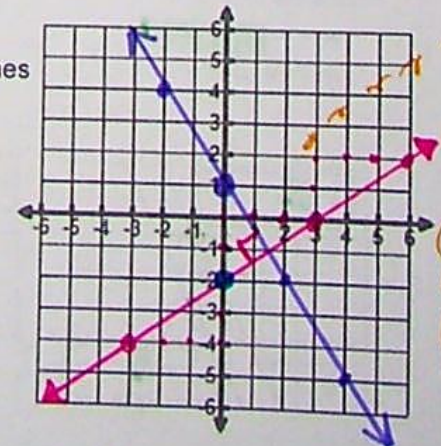
④ Write an equation of a line with a y-intercept of -2 that is perpendicular to $y = -\frac{3}{2}x + 1$. Graph both lines on the coordinate grid.

opposite reciprocal of $\frac{2}{3}$

Perpendicular Slope: $\frac{2}{3}$

New y-intercept: -2

Equation of new line: $y = \frac{2}{3}x - 2$



⊥ lines have opposite reciprocal slopes so they form right angles when they intersect!