Name:_____

Perpendicular Lines

- Perpendicular lines cross each other at 90° (a right angle).
- They will have a unique solution (they cross only once, so ONE solution).
- Their slopes are the NEGATIVE RECIPROCAL of each other $\left(m \rightarrow -\frac{1}{m}\right)$
- If you multiply their slopes, you get -1.

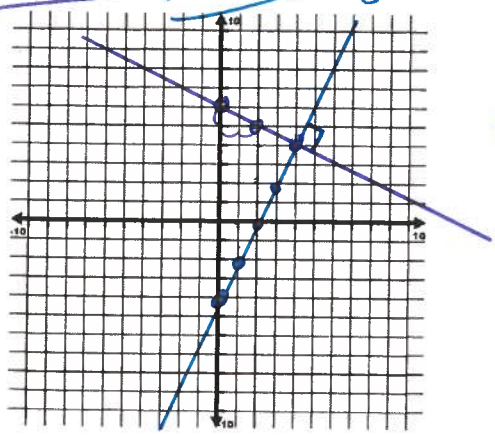
Ex 1. Draw the lines $y = \frac{-x}{2} + 6$ and $y = 2x - 4$

a b

b

a = 2

b = -4



Cross at (4, 4) (the "solution")

Ex 2. Practice finding the negative reciprocal.

a) $\frac{1}{3} \rightarrow \frac{-3}{1}$ b) $-\frac{2}{5} \rightarrow \frac{5}{2}$ c) $4 \rightarrow \frac{-1}{4}$ d) $-2 \rightarrow \frac{1}{2}$

Ex 3. Find the equation of the line that is perpendicular to y = -3x + 2, and that passes through A(-4, 14).

Negative reciprocal * have to write this

Slope:

a $\frac{-3}{1}$ neg rec. $\rightarrow \frac{1}{3}$

New b: $y = ax + b$ with $(\overset{x}{-4}, \overset{y}{14})$

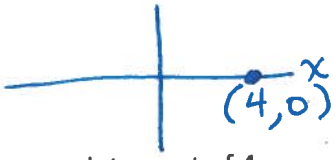
$14 = \frac{1}{3}(-4) + b$

$14 = -1.33 + b$

$14 + 1.33 = b$

$15.33 = b$

$y = \frac{1}{3}x + 15.33$



Ex 4. Find the equation of the line that is perpendicular to $0 = 2x - 3y + 5$ and that has an x-intercept of 4.

$0 = 2x - 3y + 5$

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

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

Negative reciprocal

$a: \frac{2}{3} \rightarrow \frac{-3}{2}$

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

New b: $y = ax + b$

$0 = \frac{-3}{2}(4) + b$

$0 = -6 + b$

$6 = b$

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

Ex 5. Find the slope of a line perpendicular to the line that passes through the points (5, 2) and (8, -1).

1st line $a = \frac{y_2 - y_1}{x_2 - x_1}$

$a = \frac{-1-2}{8-5}$

$a = \frac{-3}{3}$ $a = -1$

→ Neg. rec.

New line $\frac{-1}{1} \rightarrow \frac{1}{1}$ $a = 1$

Ex 6. Which of the following is an equation of a line perpendicular to $y = x - 1$?

$a = 1$ Neg. rec. $= -1$

A. $y + 3 = x$ $y = x - 3$

B. $2y - 3 = x$ $\frac{2y}{2} = \frac{x}{2} + \frac{3}{2}$ $y = \frac{1}{2}x + 1.5$

C. $-x + y = 3$ $y = x + 3$

D. $x + y = -3$ $y = -x - 3$

Ex 7. Line *j* goes through the point (-7, 5) and is perpendicular to $2x - 3y = -18$. Find the equation of line *j*.

$2x - 3y = -18$

$\frac{-3y}{-3} = \frac{-2x}{-3} - \frac{18}{-3}$

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

Neg. rec.

$a = \frac{2}{3} \rightarrow \frac{-3}{2}$

New b: $y = ax + b$ (x, y) $(-7, 5)$

$5 = \frac{-3}{2}(-7) + b$

$5 = 10.5 + b$

$5 - 10.5 = b$

$-5.5 = b$

$y = \frac{-3}{2}x - 5.5$

Ex 8. Which lines are perpendicular?

A. $y = \frac{1}{2}x + 6$, $y = -\frac{1}{2}x + 1$ Didn't flip

B. $y = 3x + 1$, $y = 3x - 1$ No

C. $y = 2x$, $y = \frac{1}{2}x$ No sign change

D. $y = \frac{2}{3}x + 3$, $y = -\frac{3}{2}x - 1$ ✓ Negative reciprocal slopes

Ex 9. Which of the following statements are true about lines *w*, *n*, *p*, and *z*?

$w: y = \frac{3}{2}x + 2$ $n: y = \frac{2}{3}x + 6$ $p: y = -\frac{3}{2}x - 3$ $z: y = \frac{2}{3}x + 1$

I. $w \perp p$ II. $n \parallel z$ ✓ same slope III. $z \perp p$ ✓ Neg rec.

A. I only B. II only C. III only D. I and II E. II and III