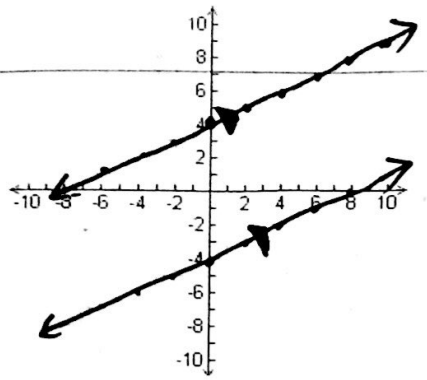
Parallel and Perpendicular Lines in the Coordinate Plane NOTES

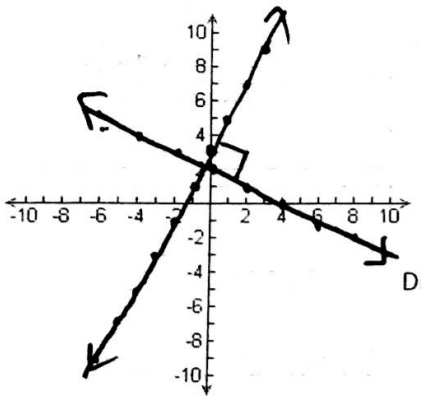


Parallel lines have the same slope.

Draw an example of parallel lines. Give an equation for each of your lines.

$y = +\frac{1}{2}x + 4$

$y = +\frac{1}{2}x - 4$



Perpendicular lines have opposite reciprocal slope.

What does this mean?

one is +, one is −, they are reciprocals

*Note: The product of perpendicular line slopes is -1

Draw an example of perpendicular lines. Give an equation for each of your lines.

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

For each slope given, identify what slope the parallel and perpendicular line would have.

slope	parallel	perpendicular
$\frac{4}{3}$	$\frac{4}{3}$	$-\frac{3}{4}$
$-\frac{2}{5}$	$-\frac{2}{5}$	$\frac{5}{2}$
5	5	$-\frac{1}{5}$
-1	-1	1
0	0	undefined
$\frac{a}{b}$	$\frac{a}{b}$	$-\frac{b}{a}$

Are the following lines parallel perpendicular or neither? How do you know?

1. $y = 3x + 5$, $y = -3x + 1$

Neither

2. $y = -\frac{2}{3}x + 5$, $y = \frac{3}{2}x - 8$

Perp

3. $y = -x + 1$, $y = x + 2$

Perp

4. $y = 5x$, $y = 4 + 5x$

Parallel

What would lines that are neither parallel nor perpendicular look like?

Write the equation of a line that is parallel AND a line that is perpendicular to a given line through the given point.

Method 1: Use point-slope form

$y = -2x - 5$, (-1, 4)

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

$m = -2$

$y - 4 = -2(x+1)$

$y - 4 = -2x - 2$

$+4 \quad +4$

$y = -2x + 2$

PARALLEL

$m = \frac{1}{2}$

$y - 4 = \frac{1}{2}(x+1)$

$y - 4 = \frac{1}{2}x + \frac{1}{2}$

$+4 \quad +4$

$y = \frac{1}{2}x + 4\frac{1}{2}$

PERPENDICULAR

Method 2: Plug in to $y = mx + b$

$y = -2x - 5$, (-1, 4)

$y = mx + b$

$4 = -2(-1) + b$

$4 = 2 + b$

$-2 \quad -2$

$2 = b$

$y = -2x + 2$

PARALLEL

$y = mx + b$

$4 = \frac{1}{2}(-1) + b$

$4 = -\frac{1}{2} + b$

$+\frac{1}{2} \quad +\frac{1}{2}$

$4\frac{1}{2} = b$

$y = \frac{1}{2}x + 4\frac{1}{2}$

PERPENDICULAR

Choose which method you like best and do the next four problems. Find the equation of a line that is parallel AND one that is perpendicular.

1. $y = \frac{3}{4}x - 2$, (0, 5) — y-intercept!

PAR: $y = \frac{3}{4}x + 5$

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

2. $y = -10x + 8$, $\left(\frac{1}{2}, \frac{1}{2}\right)$

PAR: $y = -10x + 5\frac{1}{2}$

PERP: $y = \frac{1}{10}x + \frac{9}{20}$

3. $\frac{7y}{7} = \frac{4x}{7} + \frac{1}{7}$, (28, 2)

$y = \frac{4}{7}x + \frac{1}{7}$

$y = mx + b$

$2 = \frac{4}{7}(28) + b$

$2 = 16 + b$

$-14 = b$

PAR: $y = \frac{4}{7}x - 14$

$y = mx + b$

$2 = -\frac{7}{4}(28) + b$

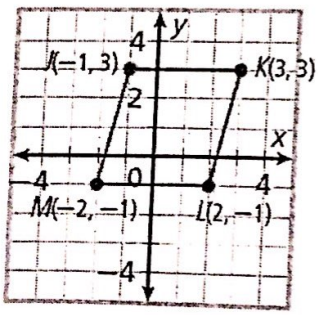
$2 = -49 + b$

$51 = b$

PERP: $y = -\frac{7}{4}x + 51$

How can you show that JKLM is a parallelogram?

For a parallelogram, opposite sides are parallel.



slope of MJ and KL

both 4

slope of JK + ML

both 0

4. $6y + x = 120$, (18, 24)

$-x \quad -x$

$\frac{6y}{6} = \frac{-x}{6} + \frac{120}{6}$

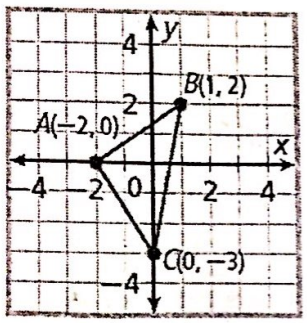
$y = -\frac{1}{6}x + 20$

PAR: $y = -\frac{1}{6}x + 27$

PERP: $y = 6x - 84$

How can you show this triangle is a right triangle?

Right triangles are triangles that are never wrong. ☺



slope of AB: $\frac{2}{3}$

slope of AC: $-\frac{3}{2}$

AB and AC are perpendicular!