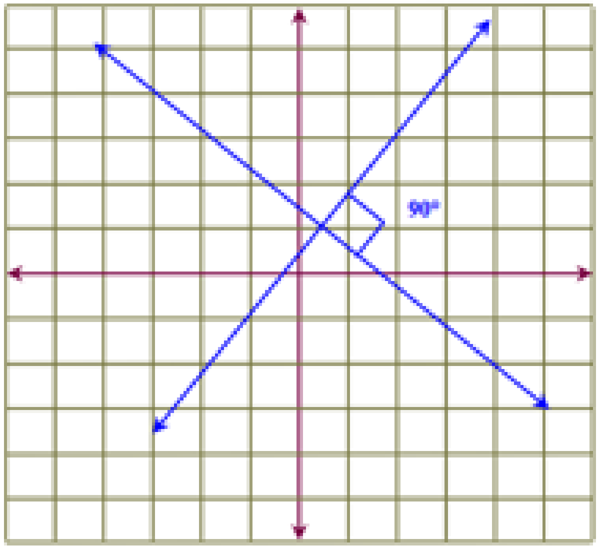
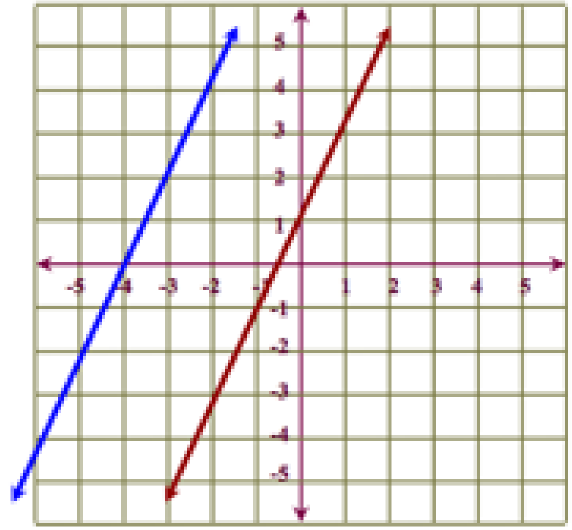
4.9 Slope of Perpendicular & Parallel Lines





The **slope** of two **perpendicular** lines are **opposite & reciprocal**

(Flip #)

Ex) $y = \boxed{-\frac{2}{3}} x + 7$ ← m

$y = \boxed{\frac{3}{2}} x + 2$ ← m

We don't care about the y-int !!

The **slope** of two **parallel** lines are the **same**

$y = \boxed{-4} x + 1$ — m

$y = \boxed{-4} x + 2$ — m

Ex1) Identify which 2 lines are *PARALLEL*:

a) $y=\frac{3}{4}x+8$ b) $-3x+4y=44$ c) $y=-4$ d) $y-3=4$

$\boxed{m=\frac{3}{4}}$

Same

$4y=3x+44$

$y=\frac{3}{4}x+\frac{44}{4}$

$\boxed{m=\frac{3}{4}}$

(a) & (b) are parallel.

$\boxed{m=0}$ Same

Horizontal

$y=7$

$\boxed{m=0}$

(c) & (d) are parallel.

opposite & Reciprocal

Ex2) Identify which 2 lines are *PERPENDICULAR*:

a) $y=-3$ b) $y-6=5(x+4)$ c) $x=4$ d) $x+5y=10$

Horizontal Line

$m=0$

$m=5$

vertical Line

undefined slope

$5y=-x+10$

$y=\boxed{-\frac{1}{5}}x+\frac{10}{5}$

$m=-\frac{1}{5}$

(a) & (c) are perpendicular.

(b) & (d) are perpendicular

Ex3) Write the equation of the line in slope-intercept form.

a) Passing through $(-2, -7)$ and **PARALLEL** to the line $y = \boxed{-5}x + 4$.

Step 1: Use the given point & slope from the parallel line. same slope $m = -5$

pt: $(-2, -7)$; $m = -5$
$x_1 \quad y_1$

Step 2: Put the point and slope in point-slope form.

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

$$y + 7 = -5(x + 2)$$

Step 3: Distribute & get y alone for slope-intercept form.

$$y + 7 = -5x - 10$$
$$-7 \qquad\qquad -7$$

$$\boxed{y = -5x - 17}$$

b) Passing through (2, −4) and **PARALLEL** to the line $y = \frac{1}{2}x + 1$

Step 1: Use the given point & slope from the parallel line.

$$\text{pt}: (\underset{x_1}{2}, \underset{y_1}{-4}) \; ; \; m = \frac{1}{2}$$

Step 2: Put the point and slope in point-slope form.

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

Step 3: Distribute & get y alone.

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

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

$$\boxed{y = \frac{1}{2}x - 5}$$

Try) Passing through (3, −8) and **PARALLEL** to the line $y = 2x + 4$.

$(3, -8)$; $m = 2$

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

$$y + 8 = 2(x - 3)$$

$$y + 8 = 2x - 6$$

$$\boxed{y = 2x - 14}$$

Ex4) Write the equation of the line in slope-intercept form and general form.

a) Passing through (5, −9) and **PERPENDICULAR** to the line $y = 2x + 5$. $m = 2$

Step 1: Use the given point & slope from the perpendicular line. (must make the slope opposite & reciprocal) $(5, -9)$; $m = -\frac{1}{2}$

Step 2: Put the point and slope in point-slope form. $y - y_1 = m(x - x_1)$

$$y + 9 = -\frac{1}{2}(x - 5)$$

Step 3: Distribute & get y alone.

$$\frac{5}{2} - 9$$

$$= \frac{5}{2} - \frac{18}{2} = \frac{-13}{2}$$

$$y + 9 = -\frac{1}{2}x + \frac{5}{2}$$

$$-9 \qquad -9$$

$$\boxed{y = -\frac{1}{2}x - \frac{13}{2}}$$

b) Passing through (5, −9) and **PERPENDICULAR** to the line

$$y = \boxed{-\frac{2}{7}}x + 1$$

Step 1: Use the given point & slope from the perpendicular line. (must make the slope opposite & reciprocal)

$(5, -9)\ ;\ m = \frac{7}{2}$

Step 2: Put the point and slope in point-slope form.

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

Step 3: Distribute & get y alone.

$y + 9 = \frac{7}{2}(x - 5)$

$y + 9 = \frac{7}{2}x - \frac{35}{2}$

$\quad -9 \qquad\qquad -9$

$$\boxed{y = \frac{7}{2}x - \frac{53}{2}}$$

$-\frac{35}{2} - 9$

$= \frac{-35}{2} - \frac{18}{2} = \frac{-53}{2}$

Try) Passing through (4, 3) and **PERPENDICULAR** to the line $y = 4x - 5$.

opposite & reciprocal

make the slope opposite & reciprocal

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

$$y - 3 = -\frac{1}{4}(x - 4)$$

$$y - 3 = -\frac{1}{4}x + 1$$

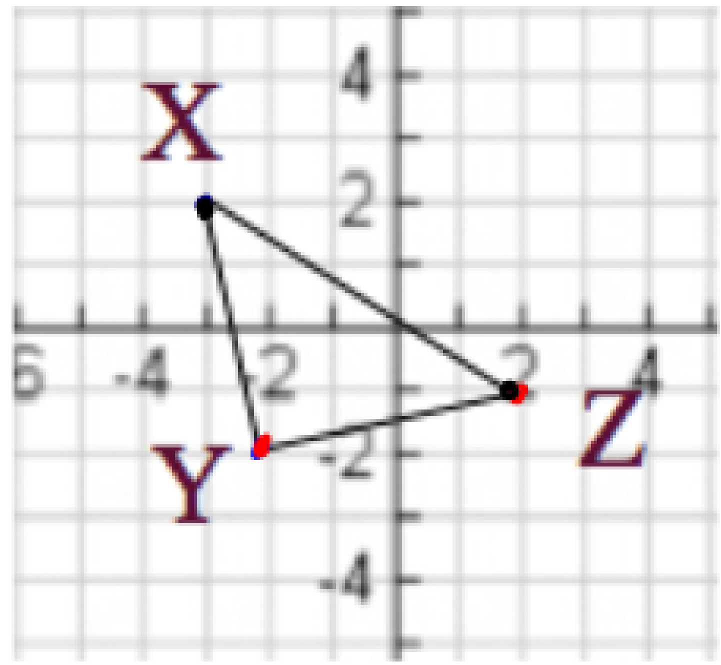
$$\boxed{y = -\frac{1}{4}x + 4}$$

Ex5) Find the slope of each side of the triangle.

Slope of XY: -4

Slope of YZ: $\frac{1}{4}$

Slope of XZ: $-\frac{3}{5}$



Explain why XYZ is a right triangle.

Because the slope of XY & YZ are opposite and reciprocal, so, they are perpendicular.