Parallel & Perpendicular Lines
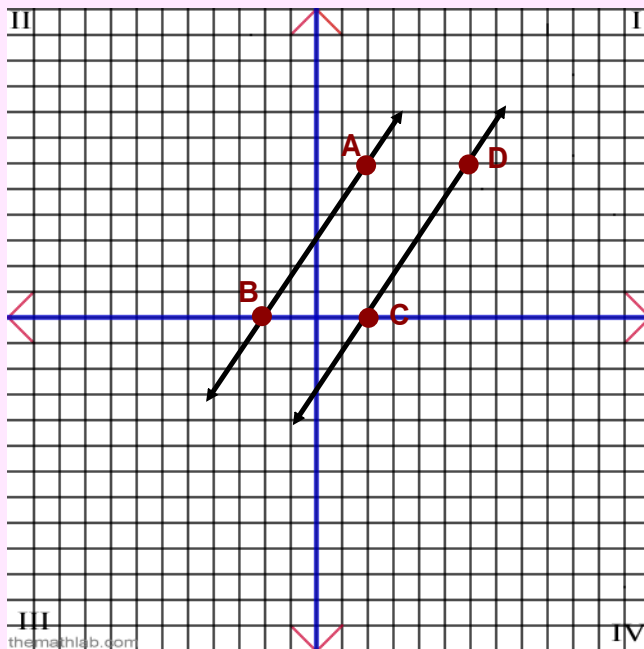
Parallel Lines are two lines that are always the same distance apart, and that never intersect.

Parallel Lines

Calculate the slope of segments AB & CD

1st		*2nd*			*1st*		*2nd*	
X_1 Y_1		X_2 Y_2			X_1 Y_1		X_2 Y_2	

A $(-2, 0)$ B $(2, 6)$ | C $(2, 0)$ D $(6, 6)$

$$AB = \frac{y_2 - y_1}{x_2 - x_1}$$

$$CD = \frac{y_2 - y_1}{x_2 - x_1}$$

$$AB = \frac{6 - 0}{2 - (-2)}$$

$$CD = \frac{6 - 0}{6 - 2}$$

$$AB = \frac{6}{4}$$

$$CD = \frac{8}{4}$$

$$AB = \frac{3}{2}$$

$$CD = \frac{3}{2}$$

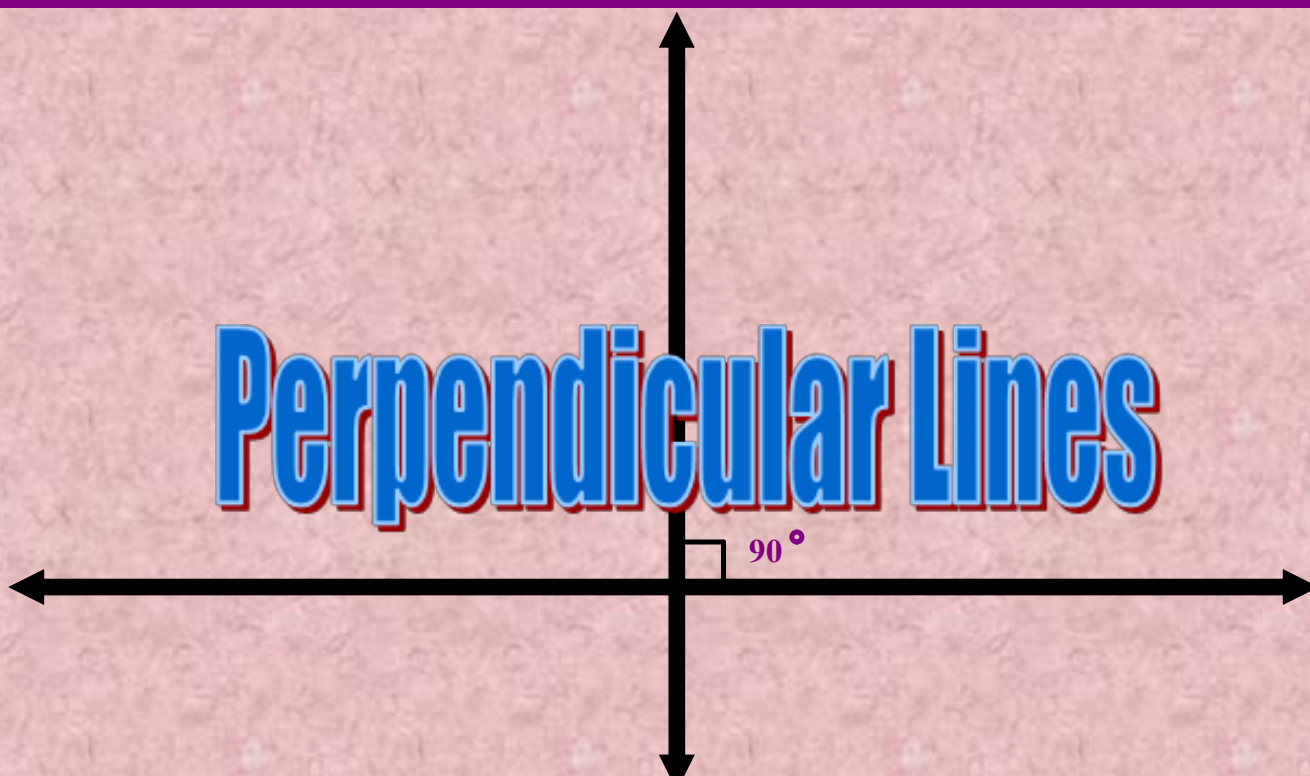They are the same

$$AB \parallel CD$$

What Do You Notice?

Parallel Slopes are Equal

Slope of AB = Slope of CD, therefore

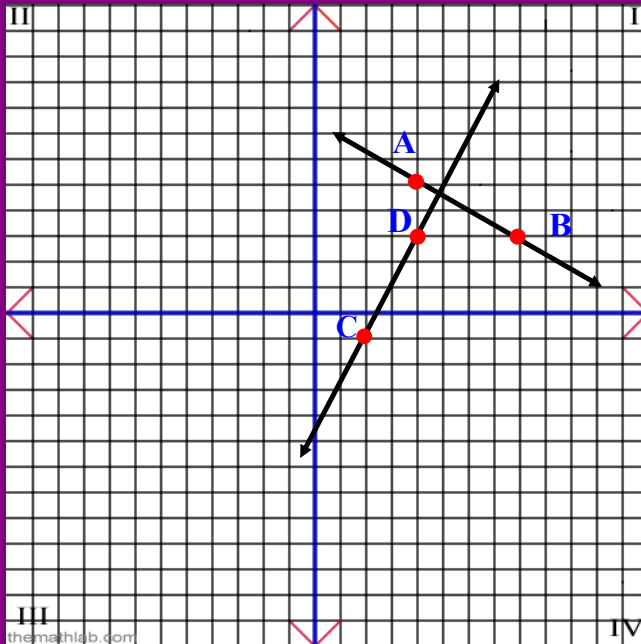$$\overleftrightarrow{AB} \text{ is parallel to } \overleftrightarrow{CD}$$

AB ‖ CD

Perpendicular Lines

90°

Perpendicular Lines are two lines that intersect to form a 90° angle. (Right Angle)

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Perpendicular Lines

Calculate the slope of
AB & DC

(x_1, y_1) (x_2, y_2)

AB   1st $(4, 5)$ 2nd $(8, 3)$

$$AB = \frac{3-5}{8-4} = \frac{-2}{4} = \boxed{\frac{-1}{2}}$$

(x_1, y_1) (x_2, y_2)

CD   1st $(2, -1)$ 2nd $(4, 3)$

$$CD = \frac{3-(-1)}{4-2} = \frac{4}{2} = \boxed{2}$$

Slopes are opposite reciprocals

What Do You Notice?

Therefore if the slopes of two lines are

OPPOSITE RECIPROCALS

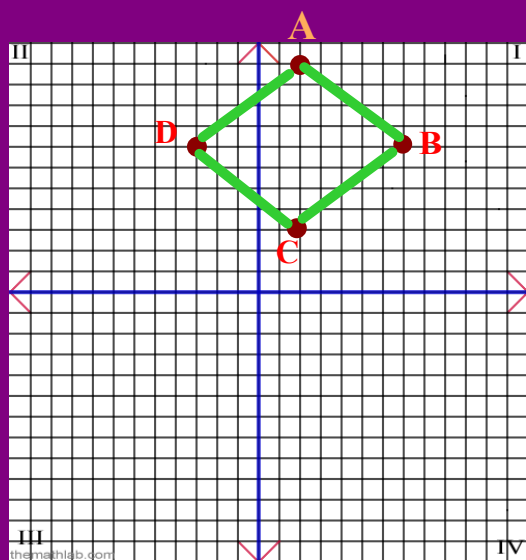we can say the lines are perpendicular

$$m_{AB} = -\frac{1}{2} \qquad\qquad m_{DC} = 2$$
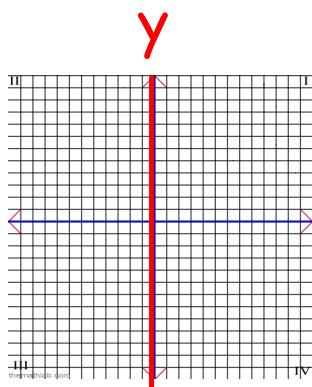
Therefore AB is perpendicular to DC

$$AB \perp DC$$

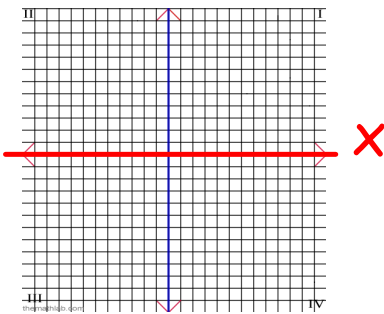## Determine whether or not the following figure is a rectangle.

What is the slope of the y-axis?

vertical

Y
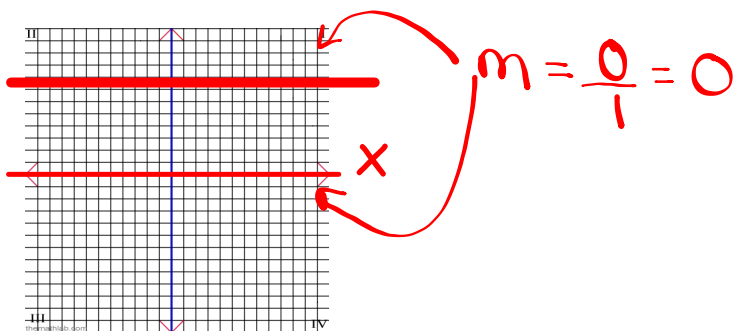
$$m = \frac{1}{0} = undefined$$
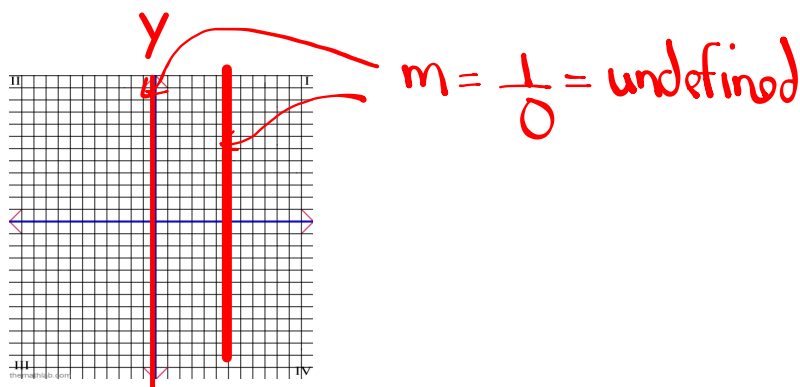
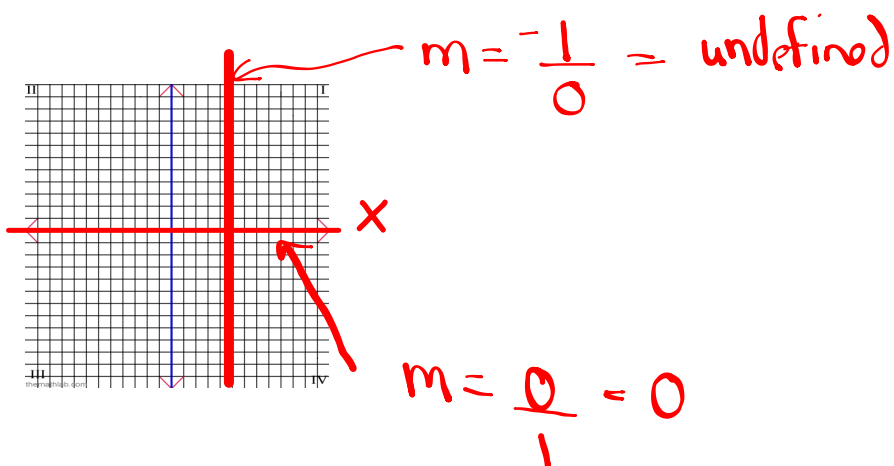What is the slope of the x-axis?

horizontal

$$m = \frac{0}{1} = 0$$

X

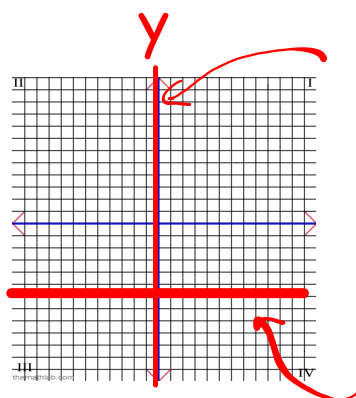What is the slope <u>parallel</u> to the x -axis?

same slope　　　horizontal

$$m = \frac{0}{1} = 0$$

X

What is the slope <u>parallel</u> to the y-axis?
same slope   vertical

y

$m = \dfrac{1}{0} = $ undefined

What is the slope <u>perpendicular</u> to the x -axis?

opposite reciprocals

$$m = \frac{-1}{0} = \text{undefined}$$

x

$$m = \frac{0}{1} = 0$$

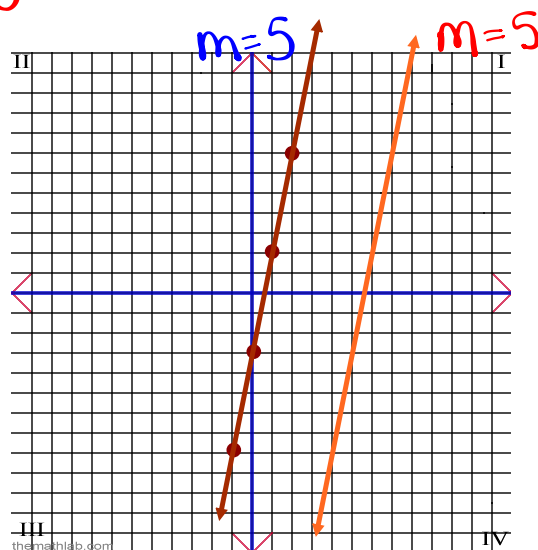What is the slope <u>perpendicular</u> to the y-axis?

opposite reciprocal

$$m = \frac{1}{0} = \text{undefined}$$

$$m = -\frac{0}{1} = 0$$

State the slope parallel to y = 5x -3.

same slope   m=5

$y = mx + b$

slope   y-intercept

m=5   m=5

$$y = \underline{m}x + b$$

State the slope perpendicular to $y = 4/5x - 3$

opposite reciprocal $y = \dfrac{4}{5}x - 3$

$m = \dfrac{4}{5}$

$m\perp = -\dfrac{5}{4}$

State the slope parallel to $y = -8x + 7$

(same) $m = -8$

parallel $m|| = {-8}$

perpendicular $m\perp = \dfrac{1}{8}$

State the slope perpendicular to y =-2/3x - 4

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

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

perpendicular $m \perp = \frac{3}{2}$

State the slope perpendicular to $y = -2x + 8$