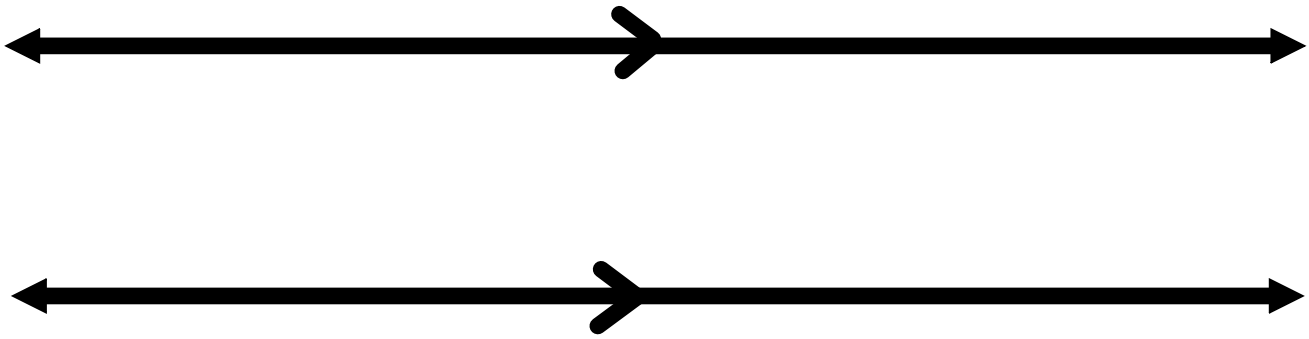
Parallel & Perpendicular

Parallel Lines



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

- Parallel lines have the same slope

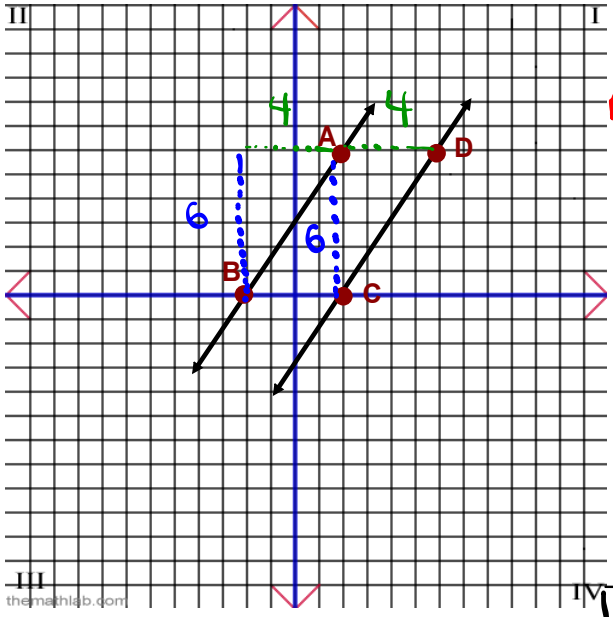
Example $m_{AB} = \frac{1}{2}$

$m_{CD} = \frac{1}{2}$

} Slopes are equal

Parallel Lines

Calculate the slope of segments AB & CD



$m_{AB} = \frac{\text{rise}}{\text{run}}$ | $m_{CD} = \frac{\text{rise}}{\text{run}}$

$m_{AB} = \frac{6}{4}$ | $m_{CD} = \frac{6}{4}$

$m_{AB} = \frac{3}{2}$ | $m_{CD} = \frac{3}{2}$

slopes are equal

AB is parallel to CD

A(2,6) $x_1 = 2, y_1 = 6$

B(-2,0) $x_2 = -2, y_2 = 0$

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

$m_{AB} = \frac{0 - 6}{-2 - 2}$

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

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

C(2,0) $x_1 = 2, y_1 = 0$

D(6,6) $x_2 = 6, y_2 = 6$

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

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

$m_{CD} = \frac{6}{4}$

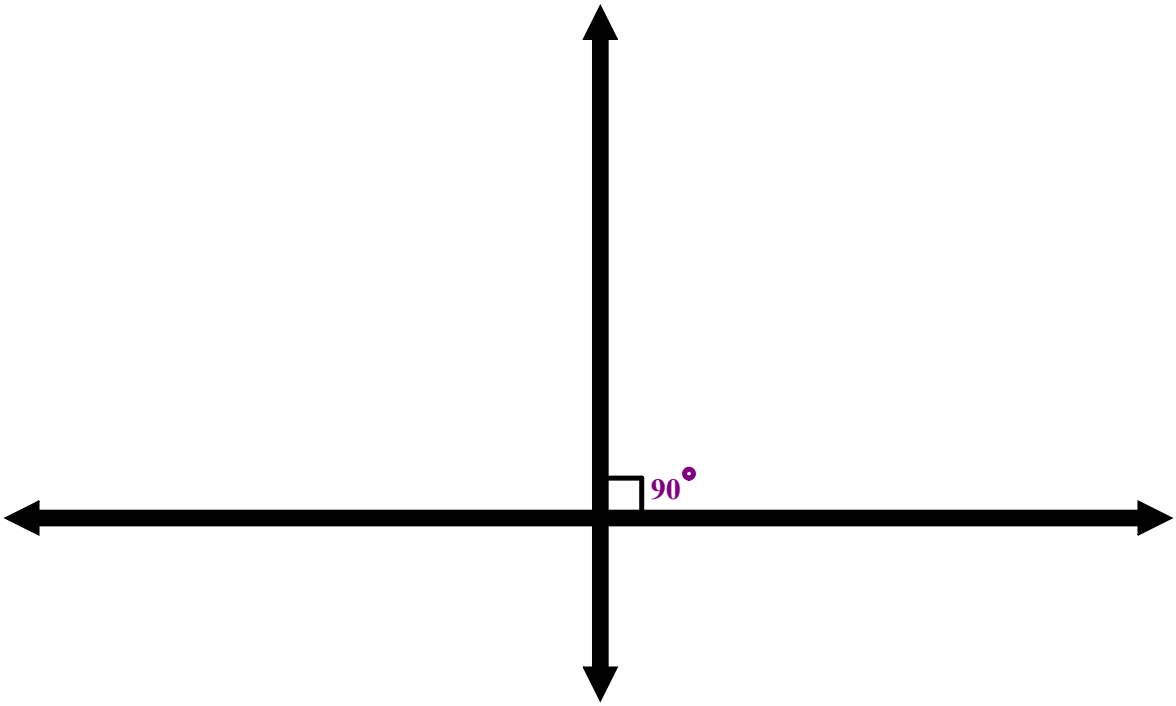
$m_{CD} = \frac{3}{2}$

Slope of AB = Slope of CD, therefore

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

AB ∥ CD

Perpendicular Lines



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

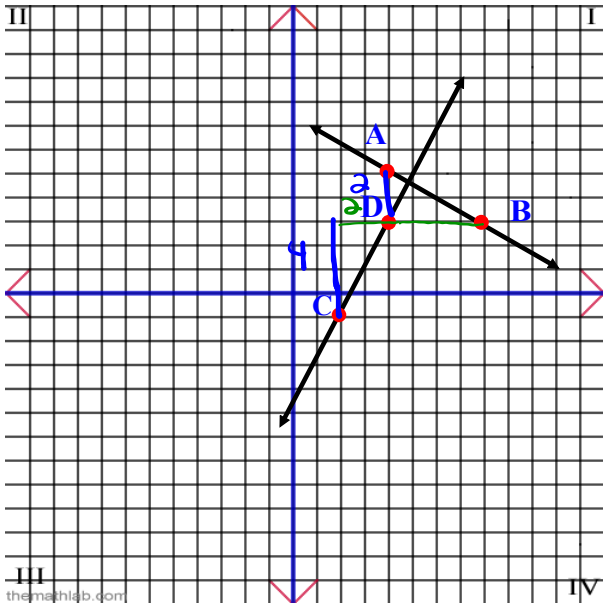
- Perpendicular lines have slopes that are negative (opposite) reciprocals.

Example $m_{AB} = \frac{1}{2}$

$m_{CD} = -\frac{2}{1} = -2$

} Slopes are opposite reciprocals

Perpendicular Lines



Calculate the slope of segments AB & CD

$m_{AB} = \frac{\text{rise}}{\text{run}}$ $m_{CD} = \frac{\text{rise}}{\text{run}}$

$m_{AB} = \frac{-2}{4}$ $m_{CD} = \frac{4}{2}$

$m_{AB} = -\frac{1}{2}$ $m_{CD} = 2$

opposite reciprocals

AB is perpendicular to CD

$A(4,5)$ $x_1 = 4, y_1 = 5$

$B(8,3)$ $x_2 = 8, y_2 = 3$

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

$m_{AB} = \frac{3-5}{8-4}$

$m_{AB} = -\frac{2}{4}$

$m_{CD} = -\frac{1}{2}$

$C(2,-1)$ $x_1 = 2$ $y_1 = -1$

$D(4,3)$ $x_2 = 4$ $y_2 = 3$

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

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

$m_{CD} = \frac{4}{2}$

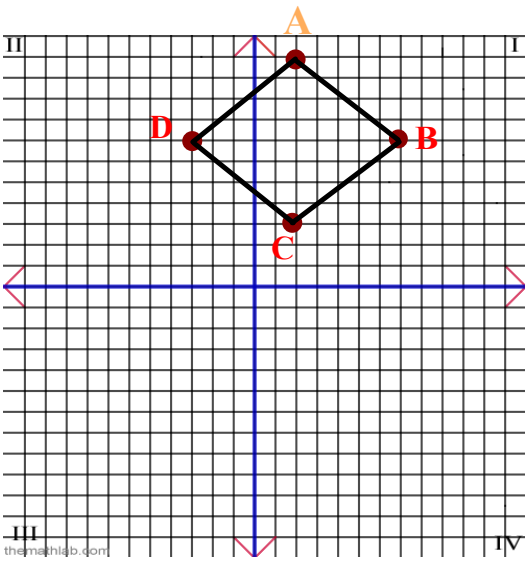
$m_{CD} = 2$

Slope of AB is the negative (opposite) recriprocal of the slope of CD, therefore

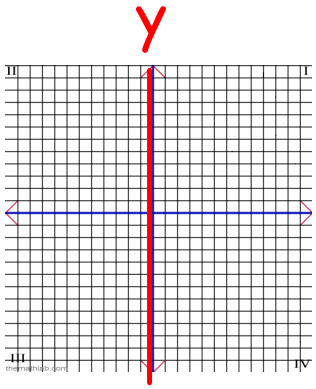
$\overleftrightarrow{AB}$ is perpendicular to $\overleftrightarrow{CD}$

$AB \perp CD$

Determine whether the following is a rectangle:



What is the slope of the y-axis?

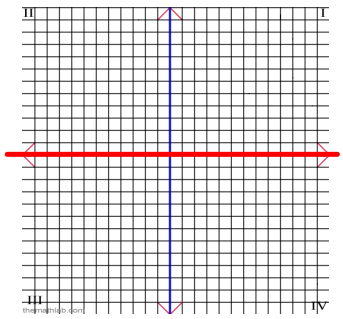


vertical line

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

↑ denominator is 0

What is the slope of the x-axis?



horizontal line:

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

numerator is 0

What is the slope parallel to the x -axis?

0 or $\frac{0}{1}$

What is the slope parallel to the y-axis?

undefined or $\frac{1}{0}$

What is the slope perpendicular to the x -axis?

$-\frac{1}{0}$ or undefined

What is the slope perpendicular to the y-axis?

$\frac{0}{-1}$ or 0

Homework

Solution to Q5:

In what follows, m1 is the slope of line L1 and m2 is the slope of line L2.

a. Find the slope m1 of line L1 and the slope m2 of line L1
m1 = (1 - 2) / (3 - 1) = -1 / 2
m2 = (0 - (-1)) / (2 - 0) = 1/2
The two slopes m1 and m2 are not equal and their products is not equal to -1. Hence the two lines are neither parallel nor perpendicular.

b. m1 = (1 - 3) / (3 - 0) = -2 / 3
m2 = (-5 - 4) / (-7 - (-1)) = -9 / -6 = 3/2
The product of the two slopes m1*m2 = (-2 / 3)(3 / 2) = -1, the two lines are perpendicular.

c. m1 = (-7 - (-1)) / (5 - 2) = -6 / 3 = -2
m2 = (2 - 0) / (-1 - 0) = -2
The two slopes are equal, the two lines are parallel.

d. m1 = (0 - 0) / (2 - 1) = 0 / 1 = 0
m2 = (-5 - (-5)) / (-10 - 5) = 0 / -15 = 0
The two slopes are equal , the two lines are parallel. Also the two lines are horizontal

e. m1 = (7 - 5) / (-2 - (-2))
m2 = (13 - 1) / (5 - 5)
The two slopes are both undefined since the denominators in both m1 and m2 are equal to zero. The two lines are vertical lines and therefore parallel.

Solution to Q6:

No. If both slopes are negative, their product can never be equal to -1.

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

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

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

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

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