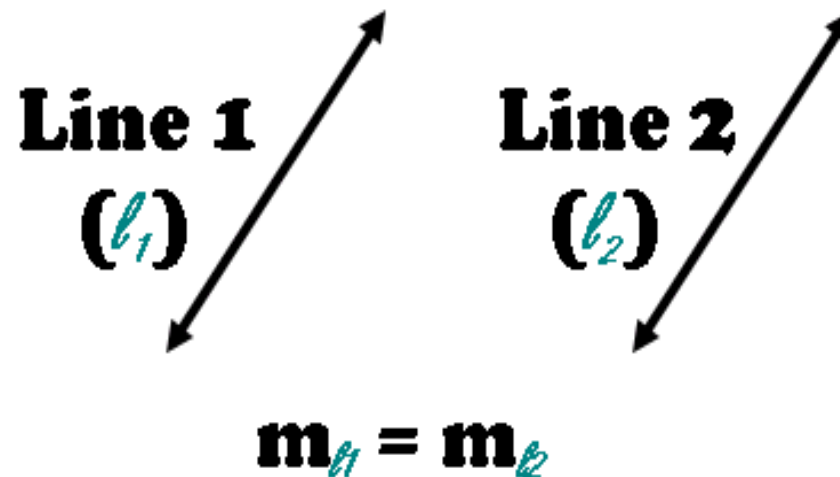


# Parallel & Perpendicular Lines

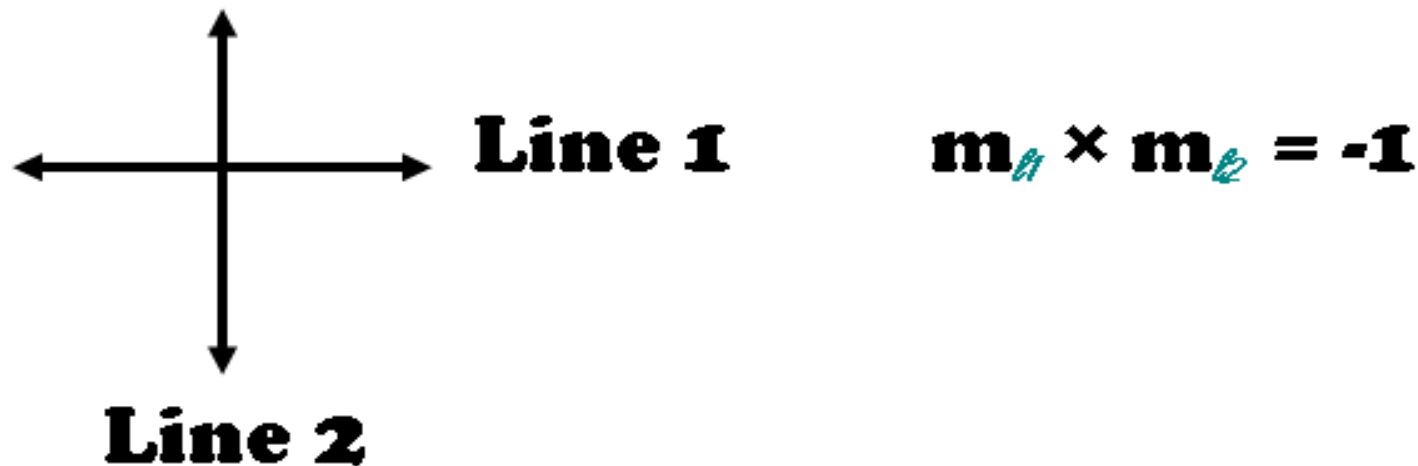
## Parallel Lines

**Two lines are parallel if they have the same slope.**



## Perpendicular Lines

**Two lines are perpendicular if the product of their slopes is -1. In other words, the slopes of the lines are negative reciprocals of each other.**



## Example 1

**Show that the line through  $A(0, 3)$  and  $B(1, 5)$  is parallel to the line through  $C(1, 4)$  and  $D(2, 6)$ .**

## Solution:

**Find the slope of each pair of points.**

$$\begin{aligned} m_{AB} &= \frac{y_2 - y_1}{x_2 - x_1} & m_{CD} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{5 - 3}{1 - 0} & &= \frac{6 - 4}{2 - 1} \\ &= \underline{2} & &= \underline{2} \\ &= \underline{2} & &= \underline{2} \\ &= \underline{2} & &= \underline{2} \end{aligned}$$

**$m_{AB} = m_{CD}$ , therefore these two lines are parallel.**

## Example 2

**Show that the line through  $A(-1, -2)$  and  $B(-3, -5)$  is perpendicular to the line through  $C(1, 0)$  and  $D(4, -2)$ .**

## Solution:

$$\begin{aligned}m_{AB} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{-5 - -2}{-3 - -1} \\ &= \frac{-3}{-2} \\ &= \underline{\underline{\frac{3}{2}}}\end{aligned}$$

$$\begin{aligned}m_{CD} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{-2 - 0}{4 - 1} \\ &= \frac{-2}{3}\end{aligned}$$

**$m_{AB}$  is the negative reciprocal of  $m_{CD}$ , therefore the two lines are perpendicular.**

### Example 3

**The vertices of  $\triangle ABC$  are  $A(-3, 2)$ ,  $B(2, 3)$  and  $C(3, -2)$ . Determine whether  $\triangle ABC$  is a right triangle.**

## Solution

**Calculate the slope of each side of  $\triangle ABC$ .**

$$\begin{aligned} m_{AB} &= \frac{y_2 - y_1}{x_2 - x_1} & m_{BC} &= \frac{y_2 - y_1}{x_2 - x_1} & m_{AC} &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{3 - 2}{2 - -3} & &= \frac{-2 - 3}{3 - 2} & &= \frac{-2 - 2}{3 - -3} \\ &= \frac{1}{5} & &= \frac{-5}{1} & &= \frac{-4}{6} \\ & & &= -5 & &= \frac{-2}{3} \end{aligned}$$



**Since  $m_{AB}$  is the negative reciprocal of  $m_{BC}$ , we know that  $AB$  and  $BC$  are perpendicular to each other.**

**△  $ABC$  is therefore a right triangle.**

