Geometry Body of Knowledge

Standard 1: Points, Lines, Angles, and Planes

- MA.912.G.1.4
  Use coordinate geometry to find slopes, parallel lines,
  perpendicular lines, and equations of lines.

Parallel and Perpendicular Lines

When two lines are on the same coordinate plane, there are two
possibilities. Either the two lines are **parallel (∥)** to each other or they
**intersect** each other.

If two lines are *parallel* to each other, we can say that the lines are always
the same distance apart and will never *intersect*. This happens when the
two lines have the same *slant*. In other words, two **parallel lines** have
equal slopes.

For example, the two lines, $y = 5x + 13$ and $y = 5x - 6$ are parallel because
in each line, m has a value of **5**.

If two lines intersect, they cross each other at some point. You may not see
that point where they cross on the particular picture, but remember that
lines extend forever and their slopes may be such that they will eventually
cross. If the two lines intersect at a **right angle** or at 90 **degrees (°)**, they are
perpendicular (⊥). Keep in mind that when this happens, their slopes will
be negative **reciprocals** of each other.

A line whose equation is $y = \frac{3}{2} x - 5$ is *perpendicular* to a line whose
equation is $y = -\frac{2}{3} x + 6$. Notice that their slopes are $\frac{3}{2}$ and $-\frac{2}{3}$.

Note: If you multiply the slopes of two **perpendicular lines**, the **product**
will be -1, unless one of the lines was vertical.
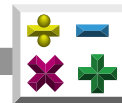
Practice

Use the slope formula below to find the **slopes** *of* $\overleftrightarrow{AB}$ *and* $\overleftrightarrow{CD}$. *Then* **multiply the slopes** *to determine if they are* **parallel, perpendicular,** *or* **neither. Show all your work.** *Write the answer on the line provided.* **The first one has been done for you.**

$$\boxed{\begin{array}{c} \textbf{slope formula} \\[6pt] m = \dfrac{y_2 - y_1}{x_2 - x_1} \end{array}}$$

Remember:

- If slopes are **equal**, the lines are **parallel**.

- If slopes are **negative reciprocals**, the lines are **perpendicular**.

_____parallel_____ 1. *A* (3, 2), *B* (-5, 6), *C* (-4, 1), *D* (-2, 0)

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

$$\frac{6 - 2}{\text{-}5 - 3} = \qquad\qquad\qquad \frac{0 - 1}{\text{-}2 - \text{-}4} =$$

$$\frac{6 + \text{-}2}{\text{-}5 + \text{-}3} = \qquad\qquad\qquad \frac{0 + \text{-}1}{\text{-}2 + {}^{+}4} =$$

$$\frac{4}{\text{-}8} = \qquad\qquad\qquad\qquad \text{-}\frac{1}{2}$$

$$\text{-}\frac{1}{2} =$$

The slopes are equal; therefore, the lines are *parallel.*