Objectives

Find the slope of a line.

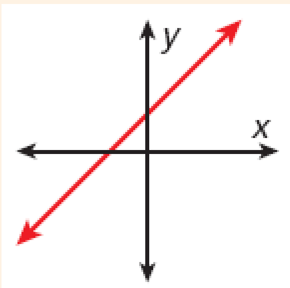
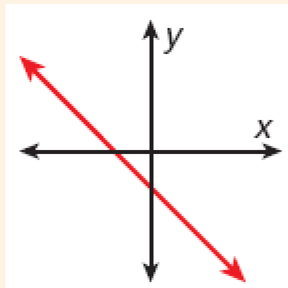
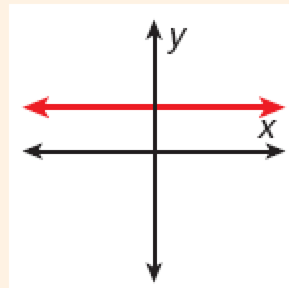
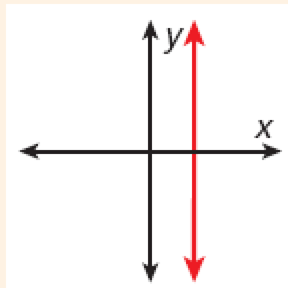
Use slopes to identify parallel and perpendicular lines.

The **slope** is a number that describes the steepness of the line.

Don't forget to watch the video on

Finding Slope

Slope Formula $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Summary: Slope of a Line			
Positive Slope	Negative Slope	Zero Slope	Undefined Slope
			

Remember!

A fraction with zero in the denominator is undefined because it is impossible to divide by zero.

Slope Examples:

1. Use the slope formula to determine the slope of $\overleftrightarrow{JK}$ through $J(3, 1)$ and $K(2, -1)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad = \frac{-1 - 1}{2 - 3} = \frac{2}{1} = 2$$

2. Use the slope formula to determine the slope of $\overleftrightarrow{AB}$ through $A(4, -5)$ and $B(4, -1)$.

Try these on your own

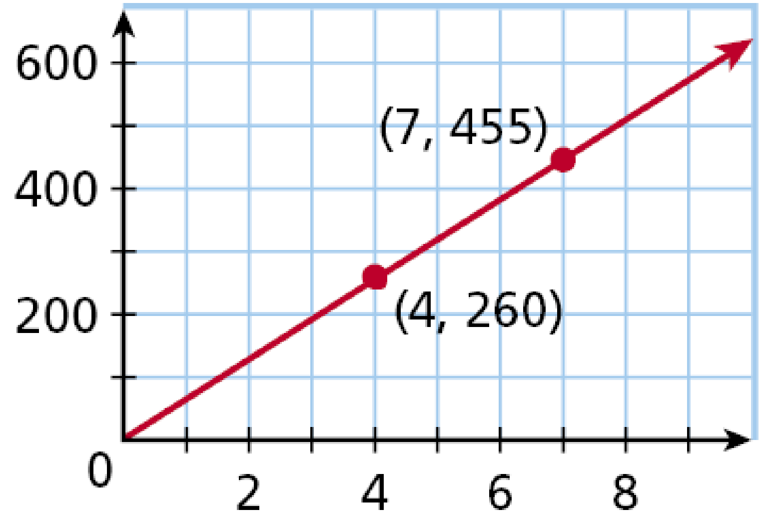
3. Use the slope formula to determine the slope of $\overleftrightarrow{DF}$ through $D(4, -1)$ and $B(-3, -1)$.

Example 2: Transportation Application

Justin is driving to his college dormitory from home. At 4:00 p.m., he is 260 miles from home. At 7:00 p.m., he is 455 miles from home. Find and interpret the slope of the line.

Use the points (4, 260) and (7, 455) to graph the line and find the slope.

$$m = \frac{455 - 260}{7 - 4} = \frac{195}{3} = 65$$



The slope is 65, which means Justin is traveling at an average of 65 miles per hour.

Slopes of Parallel and Perpendicular Lines

3-5-1 Parallel Lines Theorem

In a coordinate plane, two nonvertical lines are parallel if and only if they have the same slope. Any two vertical lines are parallel.

3-5-2 Perpendicular Lines Theorem

In a coordinate plane, two nonvertical lines are perpendicular if and only if the product of their slopes is -1. Vertical and horizontal lines are perpendicular.

Perpendicular lines have slopes that are the opposite reciprocals.

If a line has a slope of $\frac{a}{b}$, then the slope of a perpendicular line is $-\frac{b}{a}$.

Ex. Slope 1 = $-\frac{4}{5}$, Slope 2 = $\frac{5}{4}$

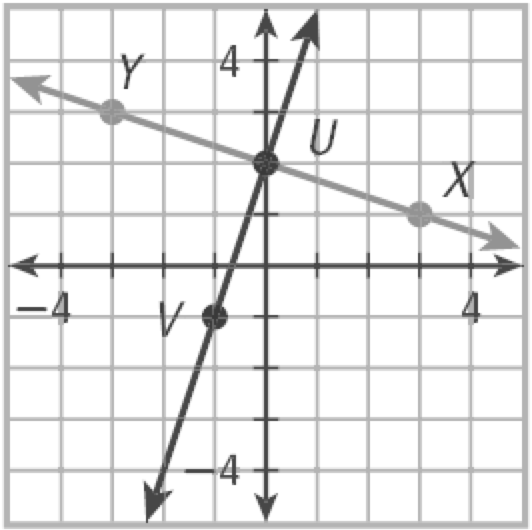
The ratios $\frac{a}{b}$ and $-\frac{b}{a}$ are called *opposite reciprocals*.

change sign and flip fraction.

Example 4:

Graph each pair of lines. Use their slopes to determine whether they are parallel, perpendicular, or neither.

$\overleftrightarrow{UV}$ and $\overleftrightarrow{XY}$ for $U(0, 2)$, $V(–1, –1)$, $X(3, 1)$, and $Y(–3, 3)$



$$\text{slope of } \overleftrightarrow{UV} = \frac{-1-2}{-1-0} = \frac{-3}{-1} = 3$$

$$\text{slope of } \overleftrightarrow{XY} = \frac{3-1}{-3-3} = \frac{2}{-6} = -\frac{1}{3}$$

The products of the slopes is –1, so the lines are perpendicular.

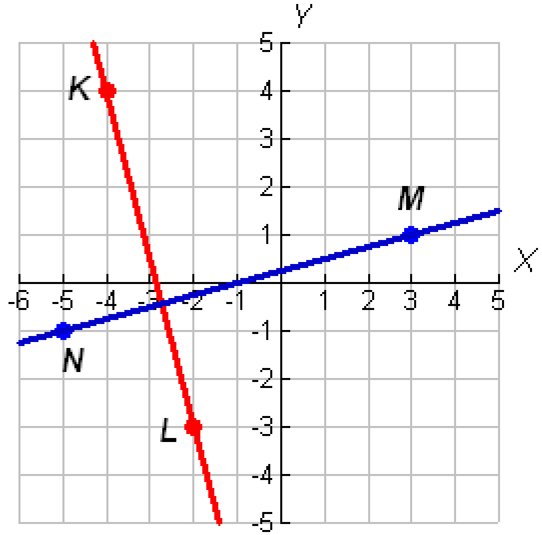
Example 5

Use slopes to determine whether the lines are parallel, perpendicular, or neither.

$\overleftrightarrow{KL}$ and $\overleftrightarrow{MN}$ for $K(-4, 4)$, $L(-2, -3)$, $M(3, 1)$, and $N(-5, -1)$

$$\text{slope of } \overleftrightarrow{KL} = \frac{-3-4}{-2-(-4)} = \frac{-7}{2}$$

$$\text{slope of } \overleftrightarrow{MN} = \frac{-1-1}{-5-3} = \frac{-2}{-8} = \frac{1}{4}$$

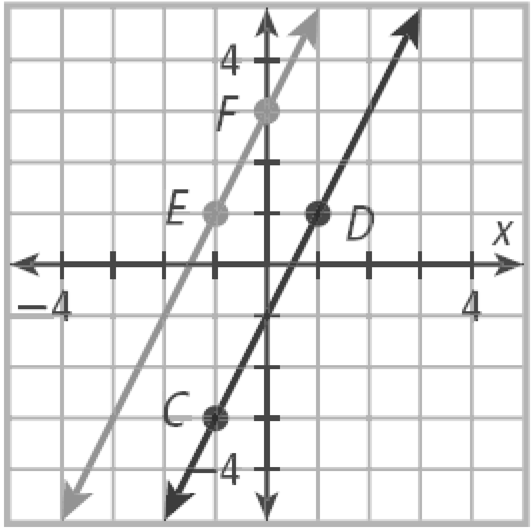


The slopes are not the same and the product of the slopes is not −1, so the lines are not perpendicular.

Example 6

Graph each pair of lines. Use their slopes to determine whether they are parallel, perpendicular, or neither.

$\overleftrightarrow{CD}$ and $\overleftrightarrow{EF}$ for $C(-1, -3)$, $D(1, 1)$, $E(-1, 1)$, and $F(0, 3)$



$$\text{slope of } \overleftrightarrow{CD} = \frac{1-(-3)}{1-(-1)} = \frac{4}{2} = 2$$

$$\text{slope of } \overleftrightarrow{EF} = \frac{3-1}{0-(-1)} = \frac{2}{1} = 2$$

The lines have the same slope, so they are parallel.

Lesson Quiz: Answer the following on a google doc and submit them to show that you are done with lesson.

1. Use the slope formula to determine the slope of the line that passes through $M(3, 7)$ and $N(-3, 1)$.

Graph each pair of lines. Use slopes to determine whether they are parallel, perpendicular, or neither.

2. $\overleftrightarrow{AB}$ and $\overleftrightarrow{XY}$ for
$A(-2, 5)$, $B(-3, 1)$,
$X(0, -2)$, and $Y(1, 2)$

3. $\overleftrightarrow{MN}$ and $\overleftrightarrow{ST}$ for
$M(0, -2)$, $N(4, -4)$,
$S(4, 1)$, and $T(1, -5)$