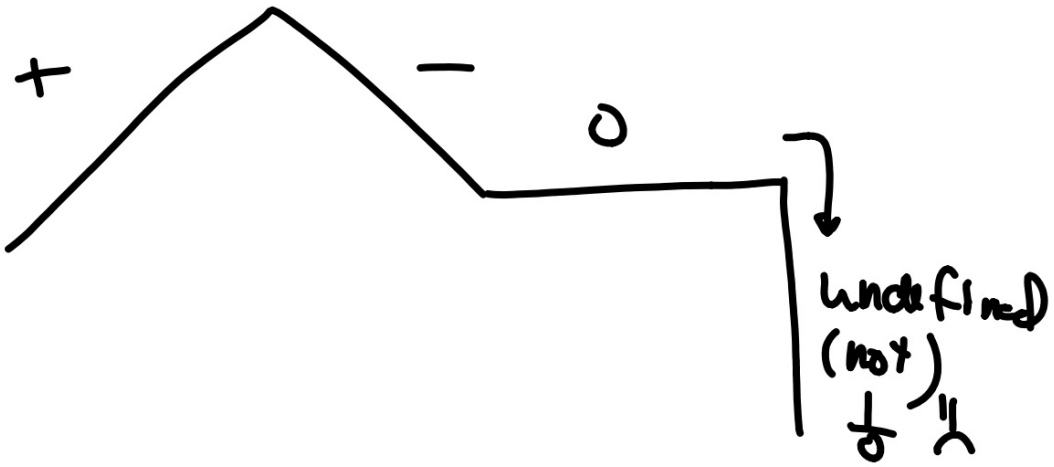
Geometry 3.3
Calculate slopes of lines*
Use slope to identify parallel and perpendicular lines**

slope $m = \frac{\text{vert}}{\text{hor.}} \rightarrow \frac{y\text{'s}}{x\text{'s}}$
rate of change
parallel same slope $\parallel$
perpendicular $\left(\frac{2}{5}\right)\cdot\left(-\frac{5}{2}\right) = -1$ opp + recip.
slope song
whiteboards

*8th grade standard
**Algebra 1 Ch. 5

Quiz 3.1-3.2




+
−
0
undefined
(not)

$\frac{6}{2} = \frac{3}{1}$

Slope Song

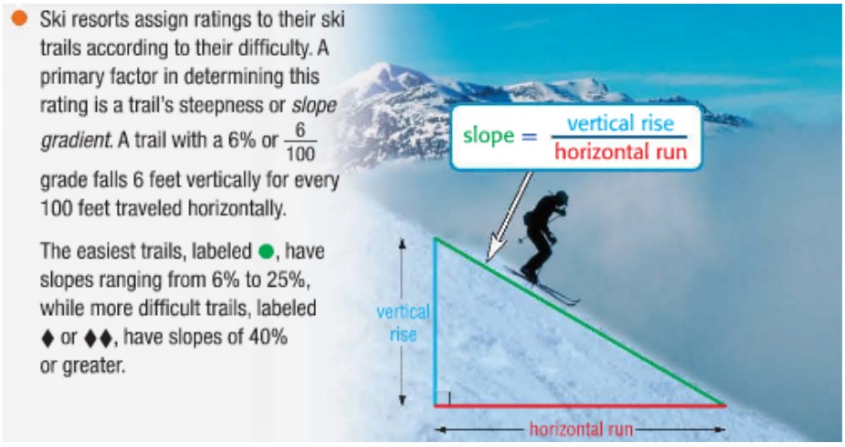
(Turkey in the Straw)

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

Slope is rise over run as we all know.
With the Y's on the top and the X's below.
Subtract the terms to get it right.
Simplify last for a wonderful sight.

$\frac{4}{8} = \frac{1}{2}$

(Chorus)
Rise over run, Y's over X.
Rise over run, Y's over X.
Subtract the terms to get it right.
Simplify last for a wonderful sight!



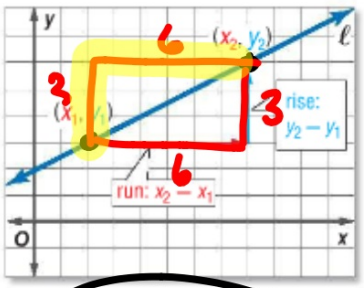
$m = \frac{3}{6} = \frac{1}{2}$

KeyConcept Slope of a Line

In a coordinate plane, the **slope** of a line is the ratio of the change along the *y*-axis to the change along the *x*-axis between any two points on the line.

The slope m of a line containing two points with coordinates (x_1, y_1) and (x_2, y_2) is given by the formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}, \text{ where } x_1 \neq x_2.$$



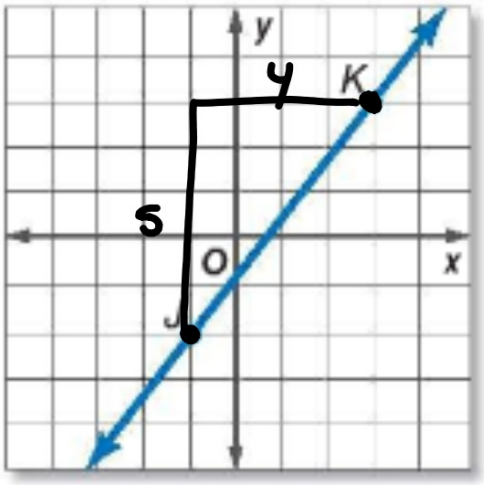
$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

∴

Example 1 Find the Slope of a Line

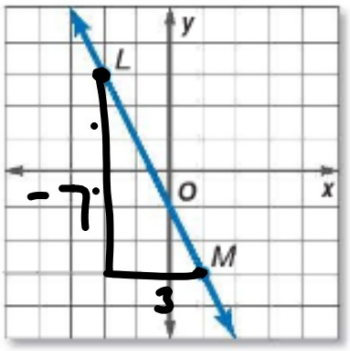
Find the slope of each line.

a.



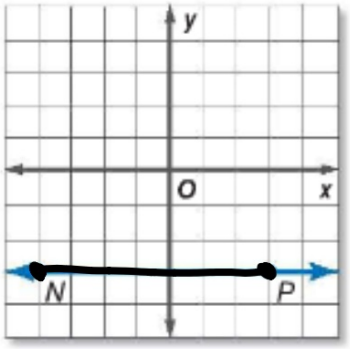
$m = \frac{5}{4}$

b.



$m = \frac{-7}{3}$

c.



$m = \frac{0}{7} = 0$

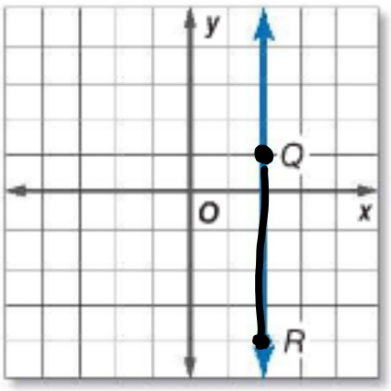
Fact family:
3x2=6
6/3=2
6/2=3
If you multiply the two factors, you get a product.

$\frac{6}{0}$

6/0= ? undef:n
So 0 x ??? = 6

$0 \cdot ? = 6$

d.

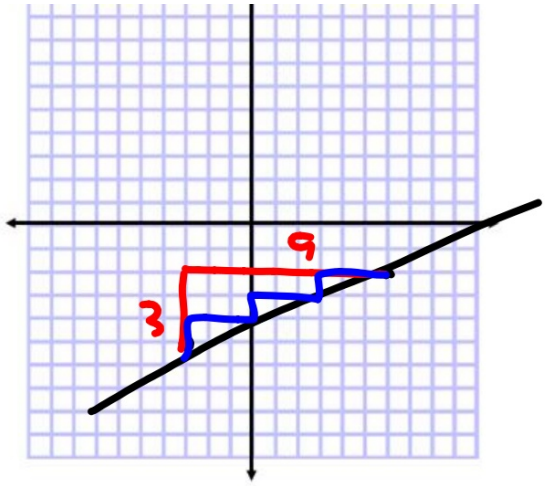


Vertical lines

$\frac{5}{0}$ = undef.

StudyTip

Dividing by 0 The slope $\frac{-5}{0}$ is undefined because there is no number that you can multiply by 0 and get −5. Since this is true for any number, all numbers divided by 0 will have an undefined slope. All vertical lines have undefined slopes.



$m = \frac{3}{9} = \frac{1}{3}$

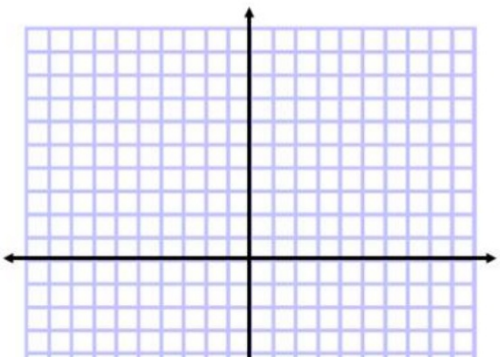
GuidedPractice

1A. the line containing (6, −2) and (−3, −5)

1B. the line containing (8, −3) and (−6, −2)

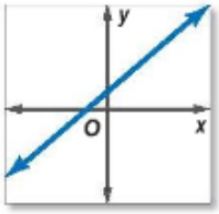
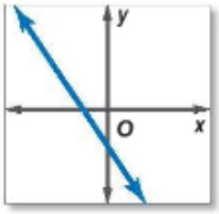
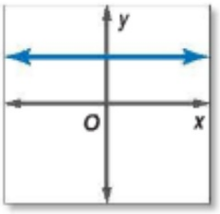
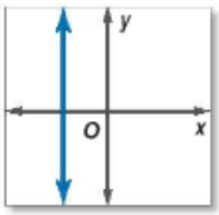
1C. the line containing (4, 2) and (4, −3)

1D. the line containing (−3, 3) and (4, 3)



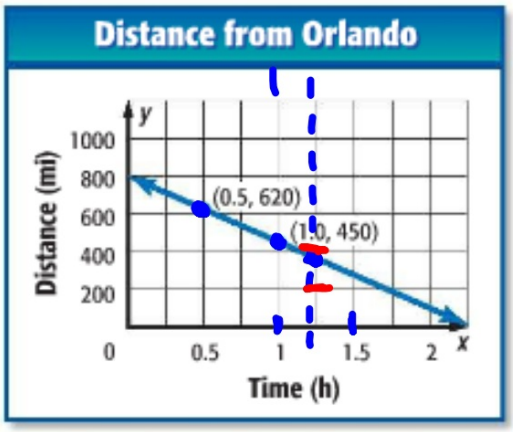
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ConceptSummary Classifying Slopes

Positive Slope	Negative Slope	Zero Slope	Undefined Slope
			

Real-World Example 2 Use Slope as Rate of Change

TRAVEL A pilot flies a plane from Columbus, Ohio, to Orlando, Florida. After 0.5 hour, the plane reaches its cruising altitude and is 620 miles from Orlando. Half an hour later, the plane is 450 miles from Orlando. How far was the plane from Orlando 1.25 hours after takeoff?



$\frac{1}{2}$ hr = 170 mi

$\frac{1}{4}$ = 85

450 − 85

365 mi

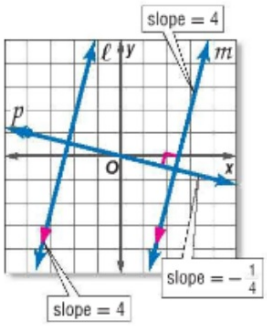
Postulates Parallel and Perpendicular Lines

3.2 Slopes of Parallel Lines Two nonvertical lines have the same slope if and only if they are parallel. All vertical lines are parallel.

Example Parallel lines ℓ and m have the same slope, 4.

3.3 Slopes of Perpendicular Lines Two nonvertical lines are perpendicular if and only if the product of their slopes is -1. Vertical and horizontal lines are perpendicular.

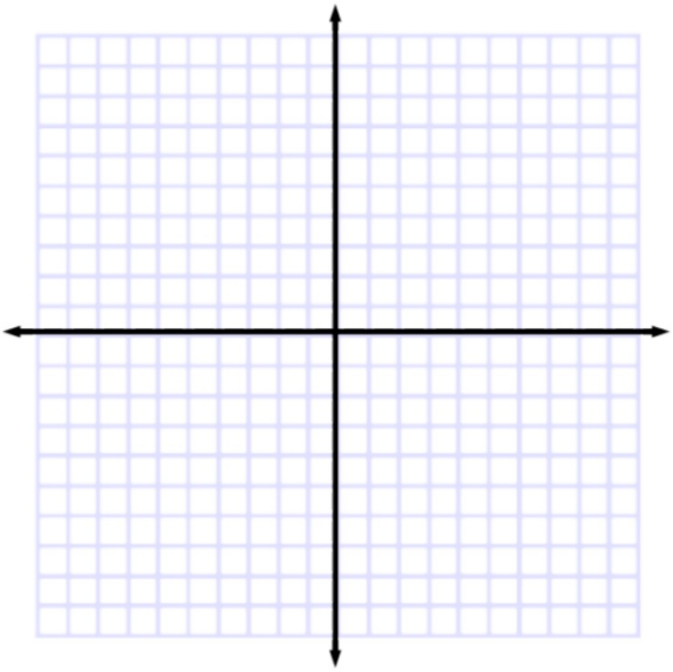
Example line $m \perp$ line p
product of slopes $= 4 \cdot -\frac{1}{4}$ or -1



Desmos

Example 3 Determine Line Relationships

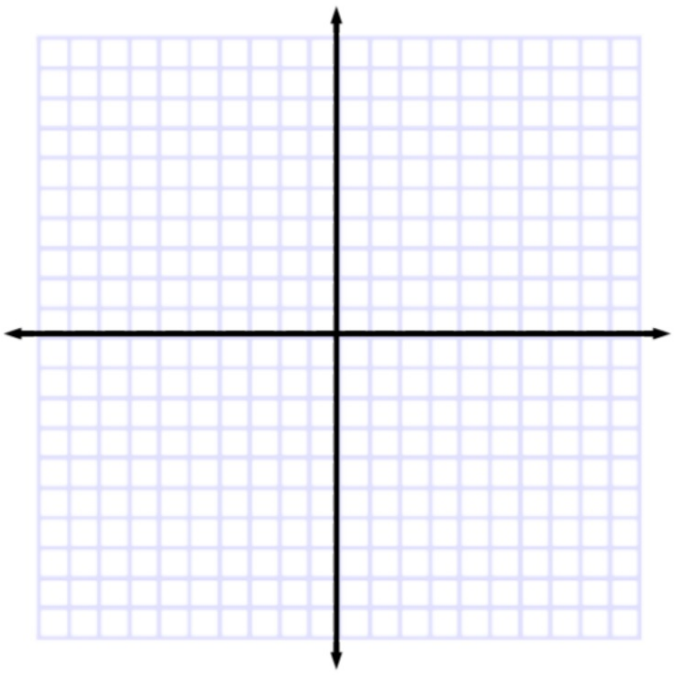
Determine whether $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are *parallel, perpendicular,* or *neither* for $A(1, 1)$, $B(-1, -5)$, $C(3, 2)$, and $D(6, 1)$. Graph each line to verify your answer.



Determine whether $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are *parallel, perpendicular,* or *neither.* Graph each line to verify your answer.

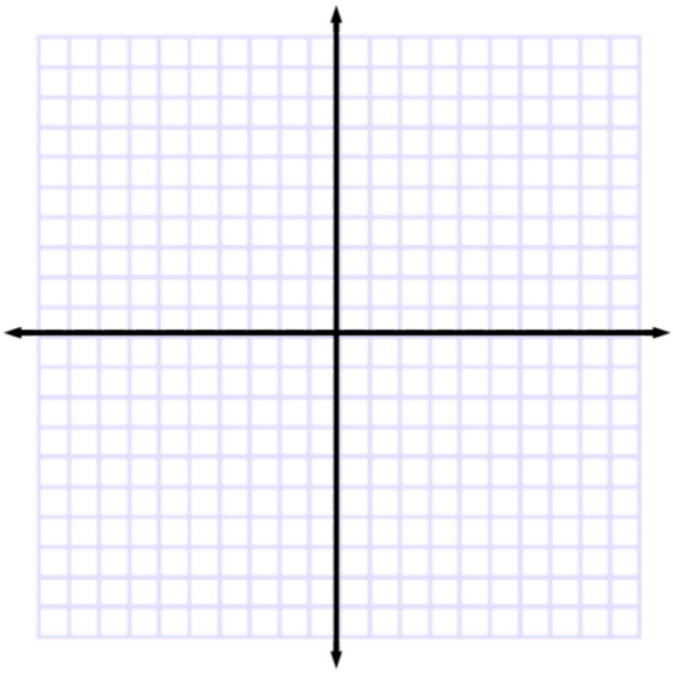
3A. $A(14, 13)$, $B(-11, 0)$, $C(-3, 7)$, $D(-4, -5)$

3B. $A(3, 6)$, $B(-9, 2)$, $C(5, 4)$, $D(2, 3)$



Example 4 Use Slope to Graph a Line

Graph the line that contains $A(-3, 0)$ and is perpendicular to $\overleftrightarrow{CD}$ with $C(-2, -3)$ and $D(2, 0)$.



4. Graph the line that contains $P(0, 1)$ and is perpendicular to $\overleftrightarrow{QR}$ with $Q(-6, -2)$ and $R(0, -6)$.

