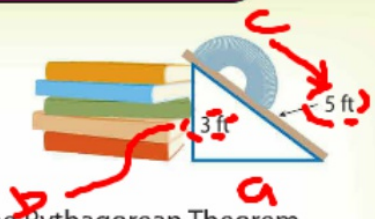
Real-World Link

Physics In an experiment using a coiled spring toy, Zoe and Jack determined they needed to raise one side of a 5-foot board 3 feet for the toy to move.



$a^2+b^2=c^2$

$x^2+3^2=5^2$

$x^2+9=25$

$-9 \quad -9$

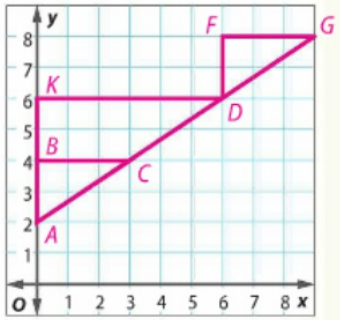
$x^2=16$

$x=4$

1. Find the slope of the board. (*Hint:* Use the Pythagorean Theorem to find how far the end of the board is from the books.) $\frac{3}{4}$ 4

Collaborate

Work with a partner. Use the graph to discover how slope triangles are related.



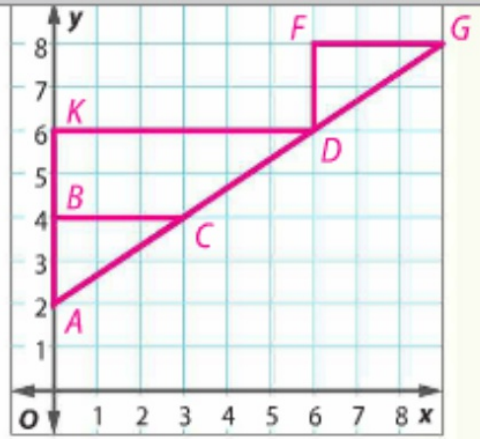
1. Draw the triangle formed by $A(0, 2)$, $B(0, 4)$, and $C(3, 4)$. What kind of triangle did you draw?

right triangle

2. Draw the triangle formed by $D(6, 6)$,

Collaborate

Work with a partner. Use the graph to discover how slope triangles are related.



1. Draw the triangle formed by $A(0, 2)$, $B(0, 4)$, and $C(3, 4)$. What kind of triangle did you draw?

right triangle

2. Draw the triangle formed by $D(6, 6)$, $F(6, 8)$, and $G(9, 8)$. How is $\triangle DFG$ related to $\triangle ABC$?

They are congruent.

3. Draw the triangle formed by $A(0,2)$, $K(0, 6)$, and $D(6, 6)$. How is $\triangle AKD$ related to $\triangle ABC$?

They are similar.

4. What is true about the hypotenuses of the three triangles in Steps 1, 2, and 3?

They all fall on the same line.

$\frac{BC}{DE}$

$\frac{6}{3} = \frac{4}{2}$ $AC = 6, BC = 3, BE = 4, DE = 2$

So, $\frac{AC}{BC} = \frac{BE}{DE}$, or $\frac{6}{3} = \frac{4}{2}$.

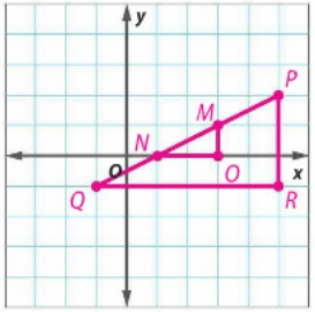
rise / run

Show your work.

Got It? **Do this problem to find out.**

a. $\frac{MO}{NO} = \frac{PR}{QR}$ or $\frac{1}{2}$

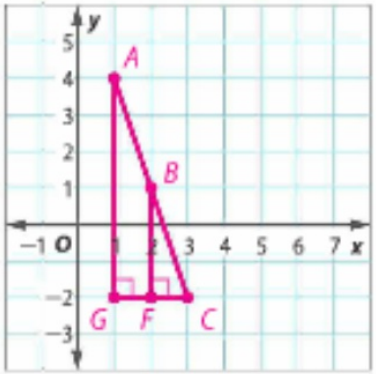
a. Graph $\triangle MNO$ with vertices $M(3, 1)$, $N(1, 0)$, and $O(3, 0)$, and $\triangle PQR$ with vertices $P(5, 2)$, $Q(-1, -1)$, and $R(5, -1)$. Then write a proportion comparing the rise to the run for each of the similar slope triangles and find the numeric value.



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

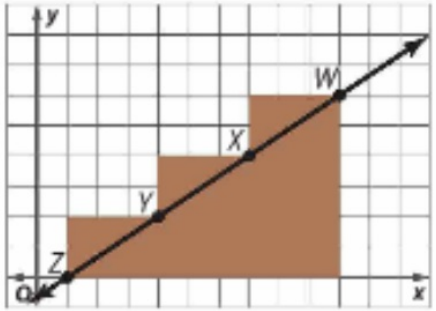
1. Graph $\triangle ACG$ with vertices $A(1, 4)$, $C(3, -2)$, and $G(1, -2)$, and $\triangle BCF$ with vertices $B(2, 1)$, $C(3, -2)$, and $F(2, -2)$. Then write a proportion comparing the rise to the run for each of the similar slope triangles and find the numeric value. (Example 1)

$\frac{GA}{GC} = \frac{FB}{FC}$, or $-\frac{3}{1}$ or -3



2. The plans for a set of stairs are shown below. Using points X and Z, find the slope of the line down the stairs. Then verify that the slope is the same at a different location by choosing a different set of points. (Example 2)

$m = \frac{2}{3}$; See students' work for other slope. The other slope should equal $\frac{2}{3}$.



3. **Building on the Essential Question** How is the slope of a line related to the similar slope triangles formed by the line?

Sample answer: The ratio of the vertical leg to the horizontal leg of each similar slope triangle formed by the line is equivalent to the absolute value of the slope.

Rate Yourself!

How confident are you about slope and similar triangles? Check the box that applies.

Independent Practice

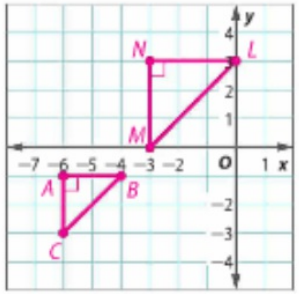
Go online for Step-by-Step Solutions

Graph each pair of similar triangles. Then write a proportion comparing the rise to the run for each of the similar slope triangles and find the numeric value. (Example 1)

1 $\triangle ABC$ with vertices $A(-6, -1)$, $B(-4, -1)$, and $C(-6, -3)$; $\triangle NLM$ with vertices $N(-3, 3)$, $L(0, 3)$, and $M(-3, 0)$

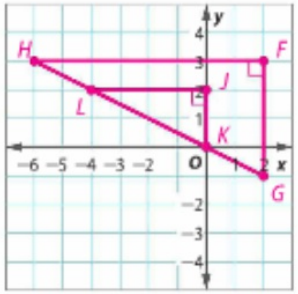
Show your work.

$\frac{AC}{AB} = \frac{NM}{NL}$, or $\frac{1}{1}$

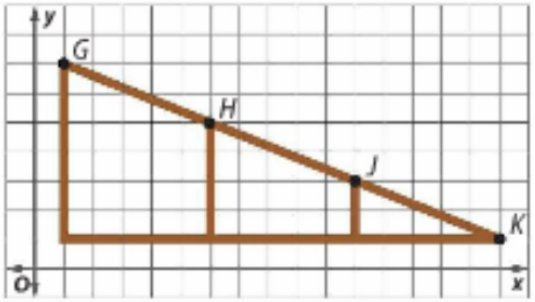


2. $\triangle FGH$ with vertices $F(2, 3)$, $G(2, -1)$, and $H(-6, 3)$; $\triangle JKL$ with vertices $J(0, 2)$, $K(0, 0)$, and $L(-4, 2)$

$\frac{GF}{FH} = \frac{KJ}{JL}$, or $-\frac{1}{2}$

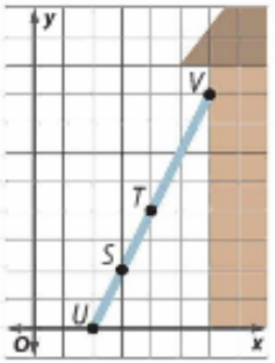


3 The plans for a skateboard ramp are shown. Use two points to find the slope of the ramp. Then verify that the slope is the same at a different location by choosing a different set of points. (Example 2)



$m = -\frac{2}{5}$; See students' work for other slope. The other slope should equal $-\frac{2}{5}$.

4. A ladder is leaning up against the side of a house. Use two points to find the slope of the ladder. Then verify that the slope is the same at a different location by choosing a different set of points. (Example 2)

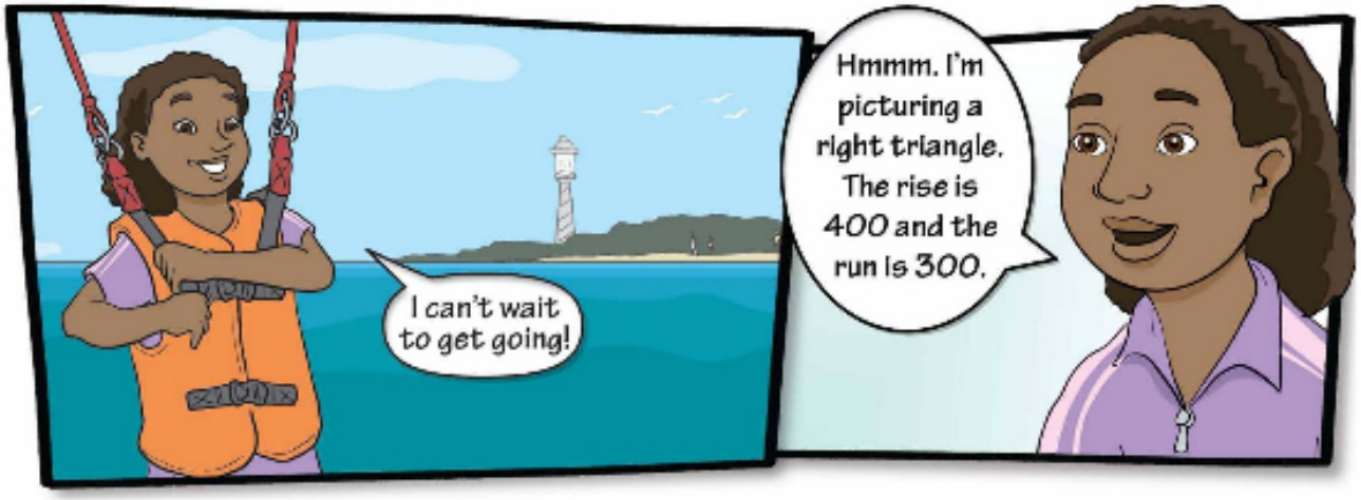


$m = 2$; See students' work for other slope. The other slope should equal 2.

5. CCSS **Reason Abstractly** Triangle XYZ has vertices $X(0, 0)$, $Y(10, 0)$, and $Z(0, 6)$. Triangle MYP has vertices $M(5, 0)$, $Y(10, 0)$, and $P(x, y)$. Find the missing coordinates for P if $\triangle MYP \sim \triangle XYZ$.

$P(5, 3)$

6. **Model with Mathematics** Refer to the graphic novel frame below. On the beach, a cable is attached to the pier. The line formed by the cable has a slope of $\frac{3}{5}$. Is the triangle formed by the pier, the beach, and the cable similar to the triangle formed by the boat, the parasailer, and the rope? Explain. **No; the slope of the triangle formed by the boat, parasailer and rope is $\frac{400}{300}$ or $\frac{4}{3}$. Since the slopes are not the same, the triangles are not similar.**



H.O.T. Problems Higher Order Thinking

7. **Model with Mathematics** On a separate piece of grid paper, draw the graph of a line with a positive slope. Draw two slope triangles formed by the line. Demonstrate that the simplified ratio of the rise to the run of each triangle is equivalent to the slope. **See students' work.**

8. **Persevere with Problems** The slope of a line is −3.5. Find two possible measurements for the legs of similar slope triangles. Explain your reasoning. **Sample answer: 3.5 and 1; 7 and 2; Since the slope is the ratio of the two legs of a slope triangle, look for values that simplify to $|-3.5|$. $\frac{3.5}{1}$ and $\frac{7}{2}$ both simplify to 3.5.**

9. **Reason Inductively** Triangle JKL has vertices $J(0, 0)$, $K(1, 0)$, and $L(1, 2)$. Determine if each triangle is similar to and/or a slope triangle with $\triangle JKL$.

   a. $\triangle ABC$: $A(1, 2)$, $B(1, 6)$, $C(3, 6)$ **similar triangle, slope triangle**

   b. $\triangle MNP$: $M(3, 1)$, $N(6, 1)$, $P(6, 7)$ **similar triangle**

   c. $\triangle RST$: $R(1, 2)$, $S(4, 2)$, $T(4, 5)$ **neither**

   d. $\triangle WXY$: $W(0, 0)$, $X(-1, -2)$, $Y(0, -2)$ **similar triangle, slope triangle**