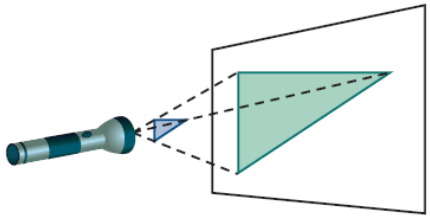
Applications

1 A flashlight is directed perpendicularly at a vertical wall 24 cm away. A cardboard triangle with sides of lengths 3, 4, and 5 cm is positioned directly between the light and the wall, parallel to the wall so that its projected shadow image is similar to it.



a. Suppose the shadow of the 4-cm side is 10 cm. Find the lengths of the shadows of the other two sides.

b. Suppose the shadow of the 5-cm side is 7.5 cm. Find the lengths of the other two sides of the shadow.

c. How far from the light source should you place the cardboard triangle so that the 4-cm side has a 12-cm shadow?

2 While pumping gas on his way to work, Josh witnessed a robber run out of the station, get into his car, and drive off. An off-duty police detective, Josh knew that he needed to document the scene before the evidence was destroyed. Using his cell phone camera and whatever he could find in his pockets, Josh took the following four pictures.

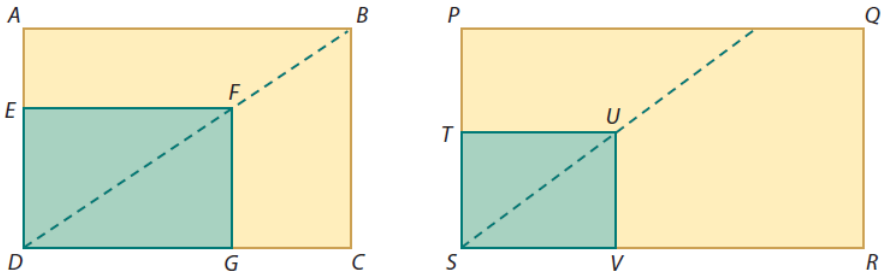
12 Suppose $\triangle ABC \sim \triangle XYZ$ with k as the scale factor from $\triangle ABC$ to $\triangle XYZ$.

a. Explain why $\frac{XY}{AB} = \frac{YZ}{BC} = \frac{XZ}{AC}$.

b. Explain why $\frac{AB}{XY} = \frac{BC}{YZ} = \frac{AC}{XZ}$.

c. Recall that a *proportion* is a statement of equality between ratios. Restate the definition of similar polygons (page 165) using the idea of proportion.

18 A quick test that engravers and photographers use to determine whether two rectangular shapes are similar is illustrated in the diagram below.



a. Explain why *rectangle ABCD* ~ *rectangle EFGD* but rectangle *PQRS* is not similar to rectangle *TUVS*.

b. Can this *diagonal test* be used to determine if two nonrectangular parallelograms are similar? Explain your reasoning.

23 Pietro's Pizza makes rectangular pizzas. The shop posted an inviting message on its sign, "Now! Our large is 20% bigger!" The original large pizza had dimensions 20 inches by 15 inches.

a. Assume 20% bigger means that the dimensions of the new pizza are 120% of the original size.

i. Why is the new pizza similar (in shape) to the original pizza?

ii. What is the scale factor relating the original pizza to the new pizza?

iii. What are the dimensions of the new pizza?

iv. Calculate the ratio of the perimeter of the new pizza to that of the original. How is this ratio related to the scale factor?

v. Calculate the ratio of the areas of the new pizza to the original pizza. How is this ratio related to the scale factor?

31 For each statement, write the converse of the statement. Then decide if the converse is true or false. If the converse is false, provide a counterexample. If the converse is true, provide reasoning to support your conclusion.

a. If $a > 0$, then $a^2 > 0$.

b. If a is an even number and b is an even number, then ab is a multiple of 4.

c. All quadrilaterals that are rectangles have four right angles.

d. If the linear regression line for two variables has positive slope, then the correlation is positive.