Students should then use similar triangles to form equivalent ratios to determine the missing value. Alternatively, they can find and apply the scale factor from one triangle to the other.

Since the sun’s rays are parallel to each other, the angles of each triangle formed by the shadow and the sun’s ray will be congruent to each other. Also, both triangles have a $90^\circ$ angle. Thus, the interior angles of one triangle are congruent to the corresponding angles in the other triangle. So, the two triangles will be similar.

C. Possible errors that may affect the accuracy will occur while measuring the distances in each method, for example, holding the stick at exactly a 90-degree angle or measuring the shadows within a short enough time. Also, you need to make sure your measurement units are consistent. If you measure in meters, you should give your answer in meters. If you measure in feet or yards, you should give your answer in feet or yards.

D. The tree is $33 \frac{1}{3}$ ft tall. Use the ratio of height to shadow: \[ \frac{6}{4.5} = \frac{x}{25} \] to find the value of $x$ that would make them equivalent.

Corresponding ACE Answers

Applications

15. 25 feet; sample sketch:
16.  

a. One way is to determine the scale factor between Greg’s image in the picture and Greg’s actual height. For example, if Greg is 1 inch tall in the picture and is 5 feet (or 60 inches) tall in real life, the scale factor from picture to real life is $\frac{60}{1}$. You can then measure the height of the building in the picture and multiply that height by 60 to find the actual height of the building.

b. 1.25 inches; Since Greg is 5 feet tall in real life and is $\frac{1}{4}$ (or 0.25) inch tall on the screen, the scale factor from real life to the picture is $\frac{0.25}{60}$. The building is 25 feet, or 300 inches. If you multiply that height by $\frac{0.25}{60}$, the result is the height of the building on the screen: 1.25 inches.

c. You need to take a picture with the tall object and another object that you know the actual height of. Then, you can determine the scale factor from the picture to the real object. To determine the scale factor, you need to divide one object’s real height by the object’s height in the picture. Then, measure the height of the tall object in the picture and multiply it by the scale factor.

Connections

32. a. 10 square units; 15 square units

b. 16,000 m²; 24,000 m²

33. G

34. a. Approximately 1.7 meters

Note: The triangles formed by the mirror and the heights of the student and the teacher are similar. The angles located at the mirror are congruent.
Students can use their knowledge of similarity to find the teacher's height.

**b.** Yes; a meter is a little more than a yard, which is equal to 3 feet. The teacher is almost 2 meters tall, which means that she is a little less than 6 feet tall. This is a reasonable height for an adult.

**35. a. Note:** Decimal equivalents are approximations. \( \frac{55}{60} = 0.92; \frac{60}{65} = 0.92; \frac{60}{63} = 0.95; \frac{48}{50} = 0.96; \frac{60}{58} = 1.03; \frac{65}{66} = 0.98; \frac{60}{60} = 1.0; \frac{67}{63} = 1.06; \frac{62}{67} = 0.93; \frac{70}{65} = 1.08. \)

Answers may vary for patterns that are noticed. Possible answer: All the ratios are close to 1. All the numerators of the fraction forms are similar, and all of the denominators of the fraction forms are similar.

**b.** The mean is about 0.98.

**c.** About 60.76 in.; \( \text{arm span} = \frac{\text{arm span}}{62} \) will be about 0.98, so arm span = 62(0.98) = 60.76 in.

**36. a.** complement: 70°, supplement: 160°

**b.** complement: 20°, supplement: 110°

**c.** complement: 45°, supplement: 135°

**37. a.** \( \frac{1}{3} \)

**b.** Possible answer: The ratio of 6 to 12 is equivalent to the ratio of \( x \) to 4. The ratio of 6 to \( x \) is equivalent to the ratio of 12 to 4.

**c.** \( x = 2 \) cm; the length of the short side of Rectangle A is half the length of the long side of Rectangle A. So, \( x \) must be half the length of 4 cm, which is 2 cm.

**d.** 9 : 1

**38. C**

**39. a.** M and Q are similar.

**b.** scale factor from Q to M: \( \frac{2}{3} \); scale factor from M to Q: \( \frac{3}{2} \); scale factor from L to N: \( \frac{1}{2} \); scale factor from N to L: 2.