6.9 Exercises

Concept Check

Fill-in-the-Blank. Complete the sentences using information found in this chapter.

1. An acute angle has a measure between ____ and _____.
2. A right triangle has one _____ angle.
3. ____ trigonometric functions of the angle θ can be defined as ratios using the three sides of a right triangle.
4. The function ____ is the reciprocal of sine.
5. In one common application of right triangles, the lengths of two sides are given and you are to find one of the _____ angles.
6. The notation $\tan^{-1}$ stands for the _____ _____ function.

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

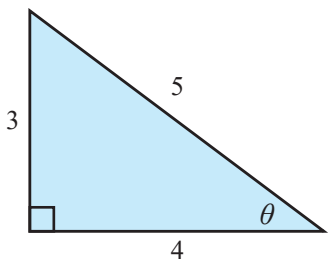
7. The hypotenuse of a right triangle is the side opposite the right angle.
8. If θ is an acute angle of a right triangle, then $\sin\theta = \frac{opp}{hyp}$.
9. If θ is an acute angle of a right triangle, then $\tan\theta = \frac{opp}{adj}$.
10. If the hypotenuse of a right triangle is 12 and the length of the side adjacent to angle θ is 5, then $\cos\theta = \frac{5}{12}$.

Practice

For the given right triangle, answer the following questions. See Example 1.

a. Which side is opposite angle θ?
b. Which side is adjacent to angle θ?
c. What are the values of sin θ, cos θ, and tan θ?

1.



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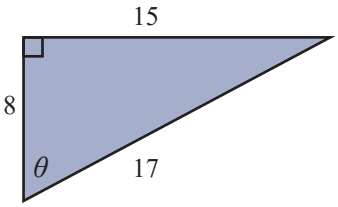

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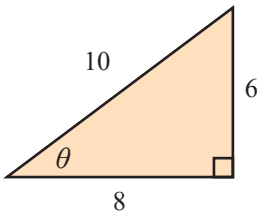

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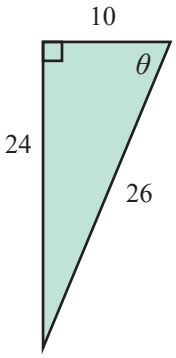

Use a calculator to determine the value of each of the following trigonometric functions (accurate to the nearest thousandth). See Example 2.

5. sin50.2°

6. sin64.5°

7. cos24.5°

8. tan80°

9. tan30.42°

10. cos2.596°

The lengths of two sides of each right triangle are given. Determine the measure of the angle θ in each triangle (accurate to the nearest tenth of a degree). See Example 4.

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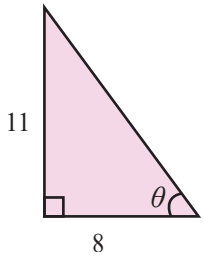

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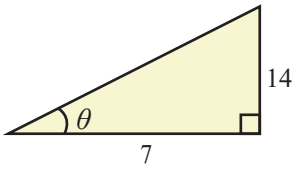

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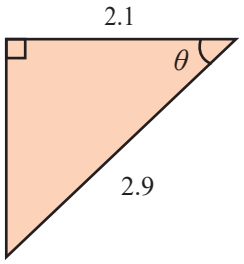

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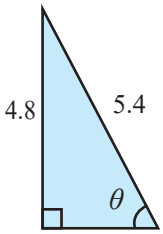
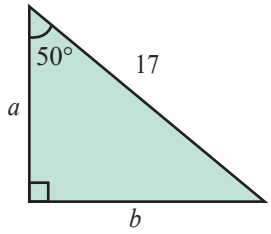


Use trigonometric functions to determine the lengths of the sides labeled *a* and *b* in each right triangle (to the nearest tenth).

15.



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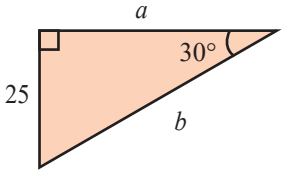

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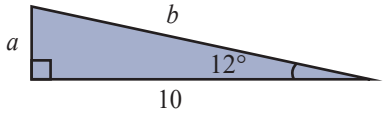

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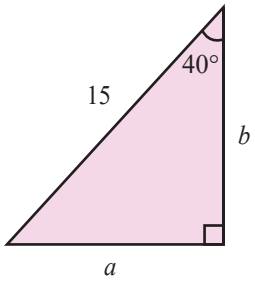


Applications

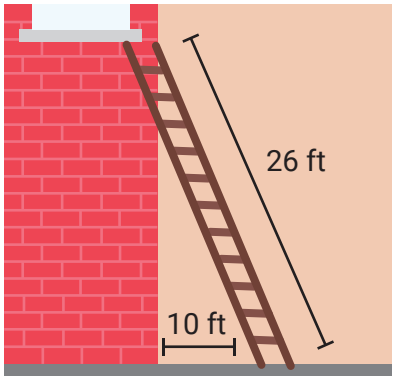
Solve. For the following problems, make sure your calculator is set to display angles in degrees. Round your each length to the nearest tenth, if necessary. Round each angle to the nearest hundredth, if necessary.

19. A ladder 26 feet long is leaning against a wall of a building. The bottom of the ladder is 10 feet from the wall.

a. What is the measure of the angle (to the nearest tenth of a degree) the ladder makes with the wall?

b. What is the measure of the angle (to the nearest tenth of a degree) the ladder makes with the ground?

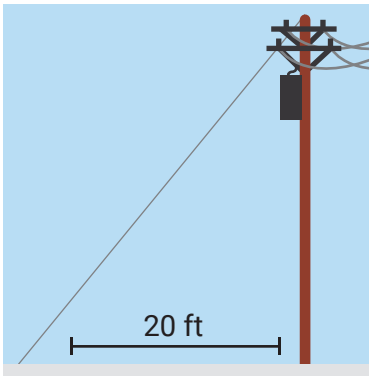
c. How many feet above the ground is the point where the ladder touches the wall?



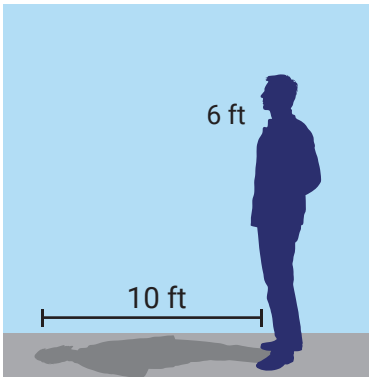
20. A telephone pole is 30 feet tall. A guy wire reaches from the top of the pole to a point 20 feet from the base of the pole.

a. Approximately how long is the guy wire (to the nearest tenth of a foot)?

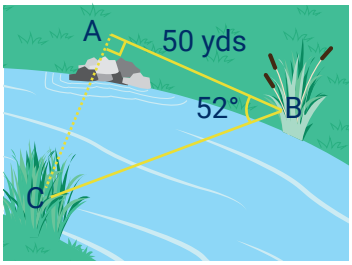
b. What is the measure of the angle that the guy wire makes with the ground (to the nearest tenth of a degree)?



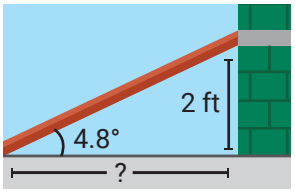
21. The tip of the shadow of a person 6 feet tall is 10 feet from the person's feet. What is the angle of elevation (to the nearest tenth of a degree) of the sun at this time? (See figure.)



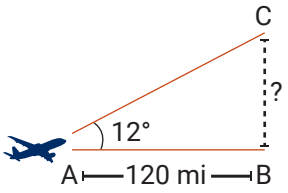
22. To find the width of a river an ecologist measures 50 yards from a point A to point B on one side of a river. Then, from point B, she sights a point C on the shore directly opposite point A. With a sextant she measures the angle to be 52°. What is the approximate width of the river (accurate to the nearest yard)?



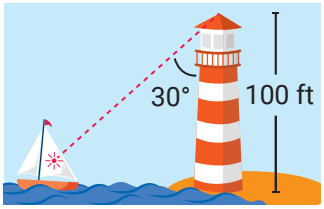
23. A carpenter must construct a wheelchair access ramp according to certain specifications. The ramp must be 2 feet high and have a 4.8° incline. Determine how far away from the building the ramp must start.



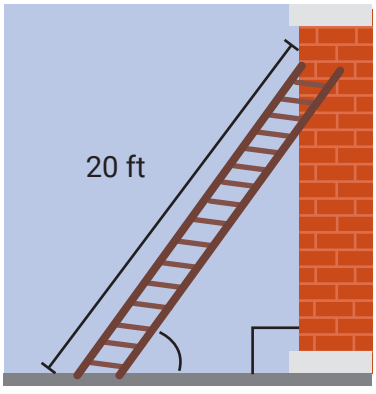
24. A pilot was flying directly from point A to point B. A storm forced her to deviate from the original course by 12°, making her land at point C. How far away is the pilot from her original destination if the distance between points A and C is 120 miles.



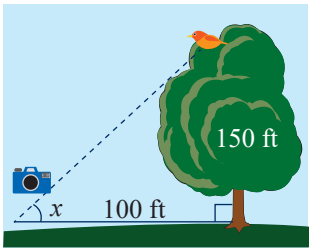
25. A person standing atop of 100 ft tall a lighthouse points a laser beam towards a ship. The angle between the laser beam and the lighthouse is 30°. How far away is the ship from the base of the lighthouse?



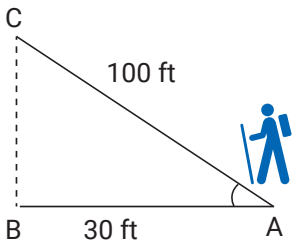
26. The safety instructions for a 20 ft ladder state that it is only safe to use when the ladder's angle with a level floor is between 60° and 70°. Determine the lowest point and the highest point up a wall that the top of the ladder can safely rest against the wall.



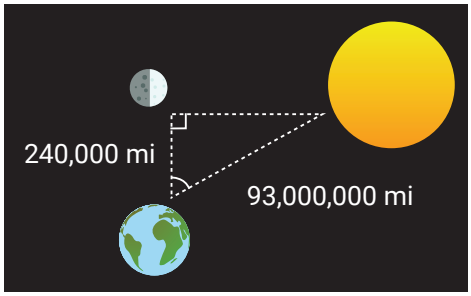
27. A biologist is 100 ft away from the bottom of a tree. She is trying to take pictures of birds that are perched on top of the tree. She knows that the height of the tree is 150 ft. Determine the angle she must elevated her camera in order to photograph the birds, assuming the camera is at ground level.



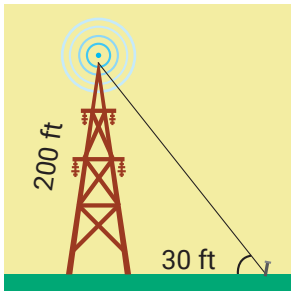
28. A hiker planned to walk 8 miles west, in a straight line, from point A to point B. Unfortunately, he got slightly disoriented and end up at point C, which is 8.5 miles from point A and directly north of point B. Determine how many degrees off-course the hiker was.



29. During a quarter moon (the phase when half of the moon is illuminated) the Earth, Moon, and Sun create a right triangle. The distance between the Moon and the Earth is approximately 240,000 miles while the distance between the Sun and the Earth is approximately 93,000,000 miles. Determine the angle between these two distances.



30. A cellphone tower is 200 ft tall. An engineer specifies that a support cable must but attached to the top of the tower and to a point 30 ft away from the base of the tower. Determine the angle between the ground and the tethering cable.



Writing & Thinking

31. Explain why it is not possible for the cosine of any angle to be equal to 2. Think about what would have to be true about the relative size of the adjacent side and the hypotenuse of a right triangle with such an angle.

32. Now, generalize your thoughts for question 31 and explain why neither the cosine nor sine of any angle can never be a number greater than 1.

33. Explain why any positive number can be the tangent of an angle.