9. $\tan\left(\frac{\pi}{4}\right) = \cot(\_\_)$

For the following exercises, find the lengths of the missing sides if side a is opposite angle A, side b is opposite angle B, and side c is the hypotenuse.

10. $\cos\ B = \frac{4}{5}, a = 10$

11. $\sin\ B = \frac{1}{2},\ a = 20$

12. $\tan\ A = \frac{5}{12}, b = 6$

13. $\tan\ A = 100, b = 100$

14. $\sin\ B = \frac{1}{\sqrt{3}},\ a = 2$

15. $a = 5,\ \measuredangle A = 60°$

16. $c = 12,\ \measuredangle A = 45°$

Graphical

For the following exercises, use Figure 14 to evaluate each trigonometric function of angle A.

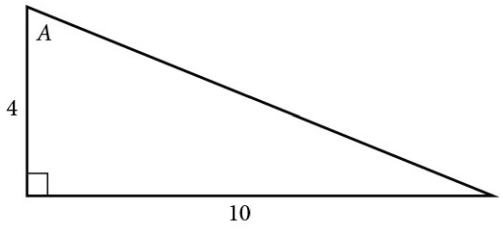


Figure 14

17. $\sin\ A$

18. $\cos\ A$

19. $\tan\ A$

20. $\csc\ A$

21. $\sec\ A$

22. $\cot\ A$

For the following exercises, use Figure 15 to evaluate each trigonometric function of angle A.

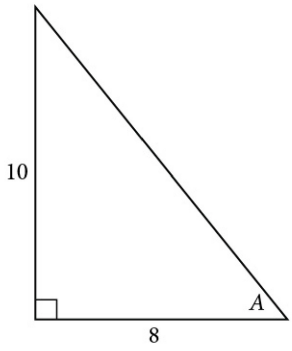


Figure 15

23. $\sin\ A$

24. $\cos\ A$

25. $\tan\ A$

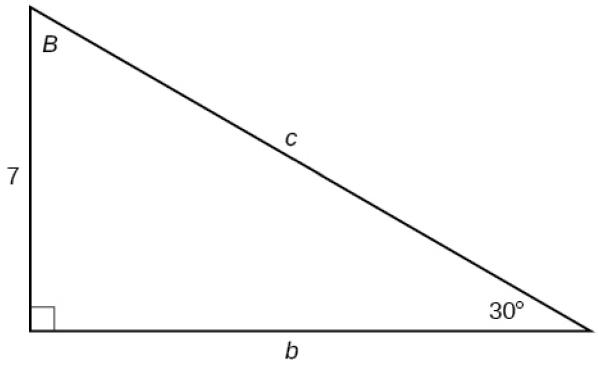
26. $\csc\ A$

27. $\sec\ A$

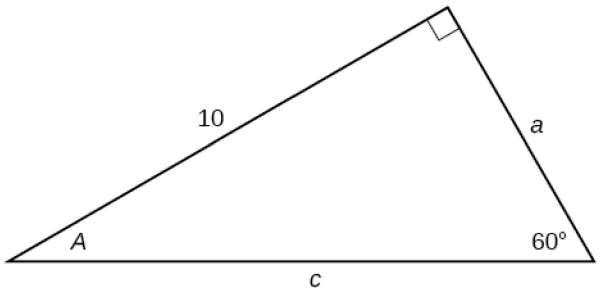
28. $\cot\ A$

For the following exercises, solve for the unknown sides of the given triangle.

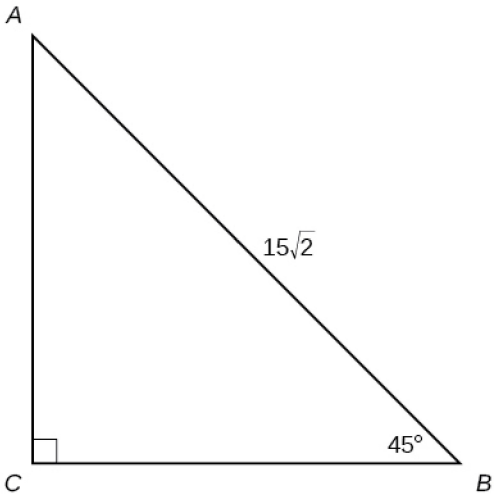
29.



30.



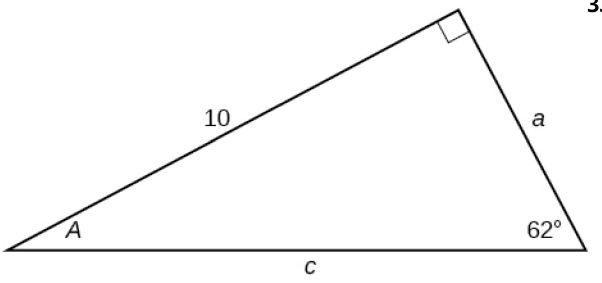
31.



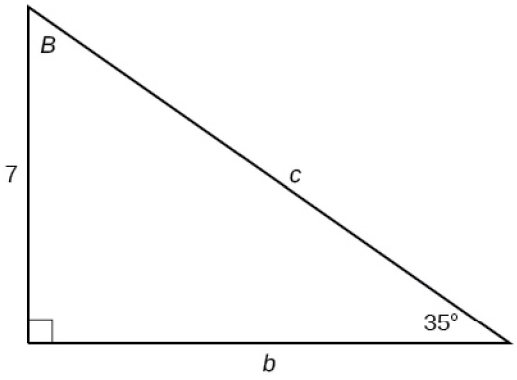
Technology

For the following exercises, use a calculator to find the length of each side to four decimal places.

32.



33.



46. A radio tower is located 400 feet from a building. From a window in the building, a person determines that the angle of elevation to the top of the tower is $36°$, and that the angle of depression to the bottom of the tower is $23°$. How tall is the tower?

47. A radio tower is located 325 feet from a building. From a window in the building, a person determines that the angle of elevation to the top of the tower is $43°$, and that the angle of depression to the bottom of the tower is $31°$. How tall is the tower?

48. A 200-foot tall monument is located in the distance. From a window in a building, a person determines that the angle of elevation to the top of the monument is $15°$, and that the angle of depression to the bottom of the tower is $2°$. How far is the person from the monument?

49. A 400-foot tall monument is located in the distance. From a window in a building, a person determines that the angle of elevation to the top of the monument is $18°$, and that the angle of depression to the bottom of the monument is $3°$. How far is the person from the monument?

50. There is an antenna on the top of a building. From a location 300 feet from the base of the building, the angle of elevation to the top of the building is measured to be $40°$. From the same location, the angle of elevation to the top of the antenna is measured to be $43°$. Find the height of the antenna.

51. There is lightning rod on the top of a building. From a location 500 feet from the base of the building, the angle of elevation to the top of the building is measured to be $36°$. From the same location, the angle of elevation to the top of the lightning rod is measured to be $38°$. Find the height of the lightning rod.

Real-World Applications

52. A 33-ft ladder leans against a building so that the angle between the ground and the ladder is $80°$. How high does the ladder reach up the side of the building?

53. A 23-ft ladder leans against a building so that the angle between the ground and the ladder is $80°$. How high does the ladder reach up the side of the building?

54. The angle of elevation to the top of a building in New York is found to be 9 degrees from the ground at a distance of 1 mile from the base of the building. Using this information, find the height of the building.

55. The angle of elevation to the top of a building in Seattle is found to be 2 degrees from the ground at a distance of 2 miles from the base of the building. Using this information, find the height of the building.

56. Assuming that a 370-foot tall giant redwood grows vertically, if I walk a certain distance from the tree and measure the angle of elevation to the top of the tree to be $60°$, how far from the base of the tree am I?