EXERCISES

For more practice, see *Extra Practice.*

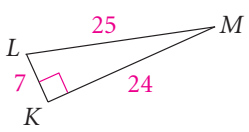
Practice and Problem Solving

A Practice by Example

Write the ratios for sin *M* and cos *M*.

Example 1 (page 477)

1.



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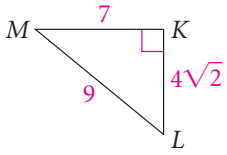

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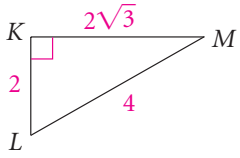
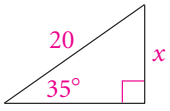


Example 2 (page 478)

Find the value of *x*. Round answers to the nearest tenth.

4.



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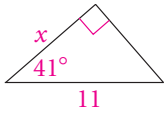

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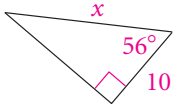

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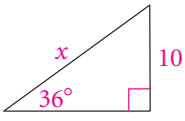

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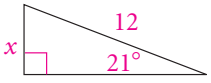

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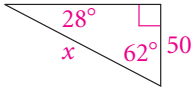
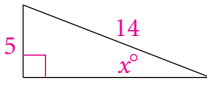


10. Escalators An escalator in the subway system of St. Petersburg, Russia, has a vertical rise of 195 ft 9.5 in., and rises at an angle of 10.4°. How long is the escalator? Round your answer to the nearest foot.

Example 3 (page 478)

Find the value of *x*. Round answers to the nearest degree.

11.



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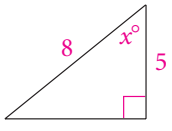

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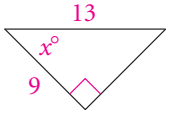

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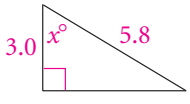

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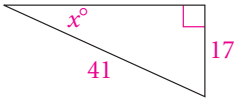

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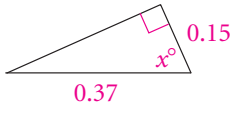
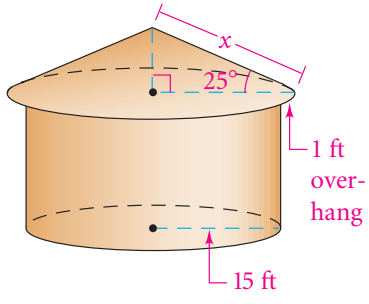


B Apply Your Skills

17. Construction Carlos is planning to build a grain bin with a radius of 15 ft. He reads that the recommended slant of the roof is 25°. He wants the roof to overhang the edge of the bin by 1 ft. What should the length *x* be? Give your answer in feet and inches.



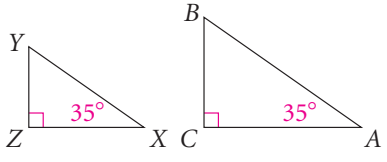
Use what you know about trigonometric ratios (and other identities) to show that each equation is an identity.

18. $\tan X = \frac{\sin X}{\cos X}$

19. $\sin X = \cos X \cdot \tan X$

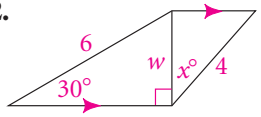
20. $\cos X = \frac{\sin X}{\tan X}$

21. Error Analysis A student states that $\sin A > \sin X$ because the lengths of the sides of $\triangle ABC$ are greater than the lengths of the sides of $\triangle XYZ$. Is the student correct? Explain.



Find the values of w and then x. Round lengths to the nearest tenth and angle measures to the nearest degree.

22.



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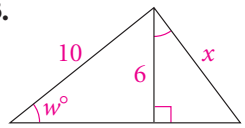

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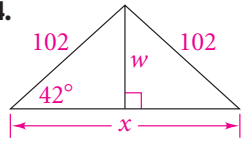
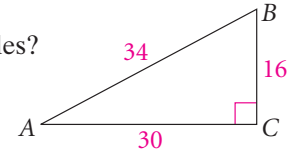


25. a. In $\triangle ABC$, how does $\sin A$ compare to $\cos B$? Is this true for the acute angles of other right triangles?

b. Reading Math The word cosine is derived from the words *complement's sine* (see page 614). Which angle in $\triangle ABC$ is the complement of $\angle A$? Of $\angle B$?

c. Explain why the derivation of the word cosine makes sense.

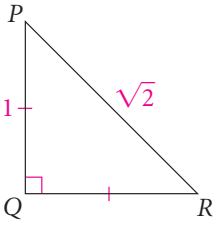


26. Find each ratio.

a. $\sin P$ **b.** $\cos P$

c. $\sin R$ **d.** $\cos R$

e. Make a conjecture about how the sine and cosine of a 45° angle are related.



Reading Math

In Exercise 27, Leona could say, "Given a side and an acute angle of a right triangle, I can solve the triangle."

27. Writing Leona said that if she had a diagram that showed the measure of one acute angle and the length of one side of a right triangle, she could find the measure of the other acute angle and the lengths of the other sides. Is she correct? Explain.

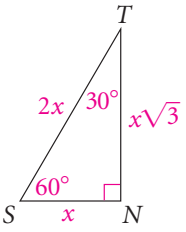
28. Find each ratio.

a. $\sin S$ **b.** $\cos S$

c. $\sin T$ **d.** $\cos T$

e. Make a conjecture about how the sine and cosine of a 30° angle are related.

f. Make a conjecture about how the sine and cosine of a 60° angle are related.



Proof **29.** Write a paragraph to prove that $\sin A < 1$, no matter how large $\angle A$ is in right $\triangle ABC$.

30. Graphing Calculator Use the **TABLE** feature of your graphing calculator to study sin X as X gets close (but $\neq$) to 90. In the **Y=** screen, enter Y1 = sin X.

a. Use the **TBLSET** feature so that X starts at 80 and changes by 1. Access the **TABLE**. From the table, what is sin X for X = 89?

b. Perform a "numerical zoom in." Use the **TBLSET** feature, so that X starts with 89 and changes by 0.1. What is sin X for X = 89.9?

c. Continue to numerically zoom in on values close to 90. What is the greatest value you can get for sin X on your calculator? How close is X to 90? Does your result contradict what you are asked to prove in Exercise 29?

d. Writing Use right triangles to explain the behavior of sin X found above.

Take It to the NET

Graphing Calculator procedures online at **www.PHSchool.com**

Web Code: afe-2111

Challenge

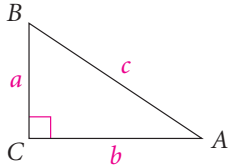
Show that each equation is an identity by showing that each expression on the left simplifies to 1.

31. $(\sin A)^2 + (\cos A)^2 = 1$

32. $(\sin B)^2 + (\cos B)^2 = 1$

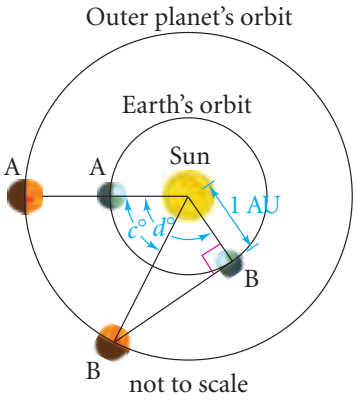
33. $\frac{1}{(\cos A)^2} - (\tan A)^2 = 1$

34. $\frac{1}{(\sin A)^2} - \frac{1}{(\tan A)^2} = 1$



35. Show that $(\tan A)^2 - (\sin A)^2 = (\tan A)^2 (\sin A)^2$ is an identity.

36. Astronomy Copernicus devised a method different from the one in Example 2 in order to find the sizes of the orbits of planets farther from the sun than Earth. His method involved noting the number of days between the times that a planet was in the positions labeled A and B in the diagram. Using this time and the number of days in each planet's year, he calculated c and d.



a. For Mars, $c = 55.2$ and $d = 103.8$. How far is Mars from the sun in astronomical units (AU)?

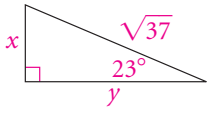
b. For Jupiter, $c = 21.9$ and $d = 100.8$. How far is Jupiter from the sun in astronomical units?

Standardized Test Prep

Multiple Choice

37. What is the value of x to the nearest whole number?

A. 2 **B.** 3
C. 4 **D.** 6



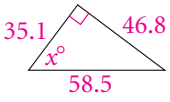
38. What is the value of y to the nearest tenth?

F. 5.4 **G.** 5.5
H. 5.6 **I.** 5.7

Take It to the NET
Online lesson quiz at **www.PHSchool.com**
Web Code: afa-0902

39. What is the value of x to the nearest whole number?

A. 53 **B.** 47
C. 43 **D.** 37

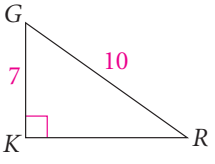


Short Response

40. Use the figure at the right.

a. Find $m\angle G$. Show your work.

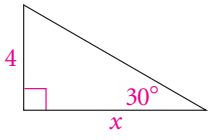
b. Find $m\angle R$ by two different methods. Show your work.



Mixed Review

Lesson 9-1 **Find the value of x. Round answers to the nearest tenth.**

41.



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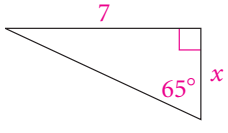

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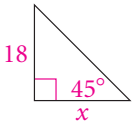
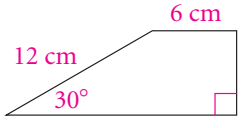


Lesson 8-2 **44.** The wall of a room is in the shape of a golden rectangle. If the height of the wall is 8 ft, what are the possible lengths of the wall to the nearest tenth?

Lesson 7-4 **Find the area of each trapezoid. Leave your answer in simplest radical form.**

45.



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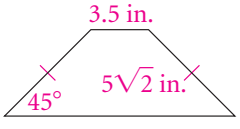

47.