

Student Copy



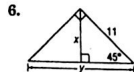
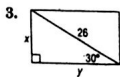
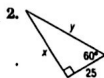
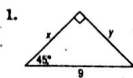
NAME \_\_\_\_\_ DATE \_\_\_\_\_ PERIOD \_\_\_\_\_

8-3

Practice

Special Right Triangles

Find  $x$  and  $y$ .

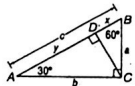


For Exercises 7-9, use the figure at the right.

7. If  $a = 4\sqrt{3}$ , find  $b$  and  $c$ .

8. If  $x = 3\sqrt{3}$ , find  $a$  and  $CD$ .

9. If  $a = 4$ , find  $CD$ ,  $b$ , and  $y$ .

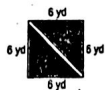


10. The perimeter of an equilateral triangle is 39 centimeters. Find the length of an altitude of the triangle.

11.  $\triangle MIP$  is a  $30^\circ$ - $60^\circ$ - $90^\circ$  triangle with right angle at  $I$ , and  $\overline{IP}$  the longer leg. Find the coordinates of  $M$  in Quadrant I for  $I(3, 3)$  and  $P(12, 3)$ .

12.  $\triangle TJK$  is a  $45^\circ$ - $45^\circ$ - $90^\circ$  triangle with right angle at  $J$ . Find the coordinates of  $T$  in Quadrant II for  $J(-2, -3)$  and  $K(3, -3)$ .

13. BOTANICAL GARDENS One of the displays at a botanical garden is an herb garden planted in the shape of a square. The square measures 6 yards on each side. Visitors can view the herbs from a diagonal pathway through the garden. How long is the pathway?



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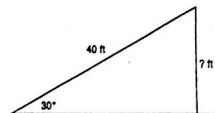
NAME \_\_\_\_\_ DATE \_\_\_\_\_ PERIOD \_\_\_\_\_

8-3

Word Problem Practice

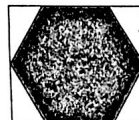
Special Right Triangles

1. ORIGAMI A square piece of paper 150 millimeters on a side is folded in half along a diagonal. The result is a  $45^\circ$ - $45^\circ$ - $90^\circ$  triangle. What is the length of the hypotenuse of this triangle?
2. ESCALATORS A 40-foot-long escalator rises from the first floor to the second floor of a shopping mall. The escalator makes a  $30^\circ$  angle with the horizontal.



How high above the first floor is the second floor?

3. HEXAGONS A box of chocolates shaped like a regular hexagon is placed snugly inside of a rectangular box as shown in the figure.



If the side length of the hexagon is 3 inches, what are the dimensions of the rectangular box?

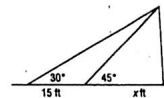
4. WINDOWS A large stained glass window is constructed from six  $30^\circ$ - $60^\circ$ - $90^\circ$  triangles as shown in the figure.



What is the height of the window?

MOVIES For Exercises 5-7, use the following information.

Kim and Yolanda are watching a movie in a movie theater. Yolanda is sitting  $x$  feet from the screen and Kim is 15 feet behind Yolanda.



The angle that Kim's line of sight to the top of the screen makes with the horizontal is  $30^\circ$ . The angle that Yolanda's line of sight to the top of the screen makes with the horizontal is  $45^\circ$ .

5. How high is the top of the screen in terms of  $x$ ?
6. What is  $\frac{x+15}{x}$ ?
7. How far is Yolanda from the screen? Round your answer to the nearest tenth.

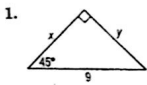
Lesson 8-3

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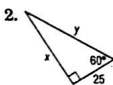
**8-3 Practice**

**Special Right Triangles**

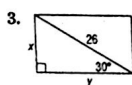
Find  $x$  and  $y$ .



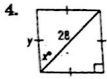
$$\frac{9\sqrt{2}}{2}, \frac{9\sqrt{2}}{2}$$



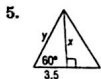
$$25\sqrt{3}, 50$$



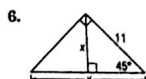
$$13, 13\sqrt{3}$$



$$45, 14\sqrt{2}$$

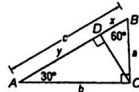


$$3.5\sqrt{3}, 7$$



$$\frac{11\sqrt{2}}{2}, 11\sqrt{2}$$

For Exercises 7–9, use the figure at the right.



7. If  $a = 4\sqrt{3}$ , find  $b$  and  $c$ .

$$b = 12, c = 8\sqrt{3}$$

8. If  $x = 3\sqrt{3}$ , find  $a$  and  $CD$ .

$$a = 6\sqrt{3}, CD = 9$$

9. If  $a = 4$ , find  $CD$ ,  $b$ , and  $y$ .

$$CD = 2\sqrt{3}, b = 4\sqrt{3}, y = 6$$

10. The perimeter of an equilateral triangle is 39 centimeters. Find the length of an altitude of the triangle.

$$6.5\sqrt{3} \text{ in. or about } 11.26 \text{ in.}$$

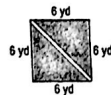
11.  $\triangle MIP$  is a  $30^\circ$ - $60^\circ$ - $90^\circ$  triangle with right angle at  $I$ , and  $\overline{IP}$  the longer leg. Find the coordinates of  $M$  in Quadrant I for  $I(3, 3)$  and  $P(12, 3)$ .

$$(3, 3 + 3\sqrt{3}) \text{ or about } (3, 8.20)$$

12.  $\triangle TJK$  is a  $45^\circ$ - $45^\circ$ - $90^\circ$  triangle with right angle at  $J$ . Find the coordinates of  $T$  in Quadrant II for  $J(-2, -3)$  and  $K(3, -3)$ .

$$(-2, 2)$$

13. **BOTANICAL GARDENS** One of the displays at a botanical garden is an herb garden planted in the shape of a square. The square measures 6 yards on each side. Visitors can view the herbs from a diagonal pathway through the garden. How long is the pathway?



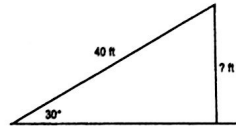
$$6\sqrt{2} \text{ yd or about } 8.49 \text{ yd}$$

**8-3 Word Problem Practice**

**Special Right Triangles**

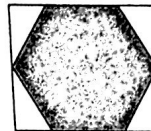
1. **ORIGAMI** A square piece of paper 150 millimeters on a side is folded in half along a diagonal. The result is a  $45^\circ$ - $45^\circ$ - $90^\circ$  triangle. What is the length of the hypotenuse of this triangle?  
 $150\sqrt{2} \text{ mm}$

2. **ESCALATORS** A 40-foot-long escalator rises from the first floor to the second floor of a shopping mall. The escalator makes a  $30^\circ$  angle with the horizontal.



How high above the first floor is the second floor?  
 $20 \text{ ft}$

3. **HEXAGONS** A box of chocolates shaped like a regular hexagon is placed snugly inside of a rectangular box as shown in the figure.



If the side length of the hexagon is 3 inches, what are the dimensions of the rectangular box?  
 $6 \text{ in. by } 3\sqrt{3} \text{ in.}$

4. **WINDOWS** A large stained glass window is constructed from six  $30^\circ$ - $60^\circ$ - $90^\circ$  triangles as shown in the figure.

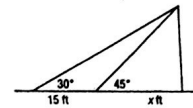


What is the height of the window?

$$\sqrt{3} \text{ m}$$

**MOVIES** For Exercises 5–7, use the following information.

Kim and Yolanda are watching a movie in a movie theater. Yolanda is sitting  $x$  feet from the screen and Kim is 15 feet behind Yolanda.



The angle that Kim's line of sight to the top of the screen makes with the horizontal is  $30^\circ$ . The angle that Yolanda's line of sight to the top of the screen makes with the horizontal is  $45^\circ$ .

5. How high is the top of the screen in terms of  $x$ ?

$$x$$

6. What is  $\frac{x+15}{x}$ ?

$$\sqrt{3}$$

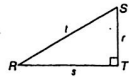
7. How far is Yolanda from the screen? Round your answer to the nearest tenth.  
 $20.5 \text{ ft}$



NAME \_\_\_\_\_ DATE \_\_\_\_\_ PERIOD \_\_\_\_\_

### 8-4 Skills Practice Trigonometry

Use  $\triangle RST$  to find  $\sin R$ ,  $\cos R$ ,  $\tan R$ ,  $\sin S$ ,  $\cos S$ , and  $\tan S$ . Express each ratio as a fraction and as a decimal to the nearest hundredth.

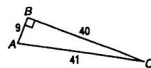


1.  $r = 16, s = 30, t = 34$       2.  $r = 10, s = 24, t = 26$

Use a calculator to find each value. Round to the nearest ten-thousandth.

3.  $\sin 5$       4.  $\tan 23$       5.  $\cos 61$   
6.  $\sin 75.8$       7.  $\tan 17.3$       8.  $\cos 52.9$

Use the figure to find each trigonometric ratio. Express answers as a fraction and as a decimal rounded to the nearest ten-thousandth.

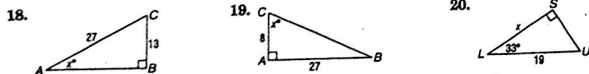


9.  $\tan C$       10.  $\sin A$       11.  $\cos C$

Find the measure of each acute angle to the nearest tenth of a degree.

12.  $\sin B = 0.2985$       13.  $\tan A = 0.4168$       14.  $\cos R = 0.8443$   
15.  $\tan C = 0.3894$       16.  $\cos B = 0.7329$       17.  $\sin A = 0.1176$

Find  $x$ . Round to the nearest tenth.

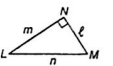


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### 8-4 Practice Trigonometry

NAME \_\_\_\_\_ DATE \_\_\_\_\_ PERIOD \_\_\_\_\_

Use  $\triangle LMN$  to find  $\sin L$ ,  $\cos L$ ,  $\tan L$ ,  $\sin M$ ,  $\cos M$ , and  $\tan M$ . Express each ratio as a fraction and as a decimal to the nearest hundredth.

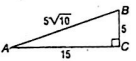


1.  $l = 15, m = 36, n = 39$       2.  $l = 12, m = 12\sqrt{3}, n = 24$

Use a calculator to find each value. Round to the nearest ten-thousandth.

3.  $\sin 72.5$       4.  $\tan 27.5$       5.  $\cos 64.8$

Use the figure to find each trigonometric ratio. Express answers as a fraction and as a decimal rounded to the nearest ten-thousandth.

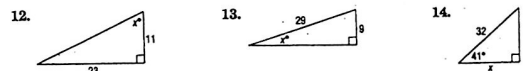


6.  $\cos A$       7.  $\tan B$       8.  $\sin A$

Find the measure of each acute angle to the nearest tenth of a degree.

9.  $\sin B = 0.7823$       10.  $\tan A = 0.2356$       11.  $\cos R = 0.6401$

Find  $x$ . Round to the nearest tenth.



15. **GEOGRAPHY** Diego used a theodolite to map a region of land for his class in geomorphology. To determine the elevation of a vertical rock formation, he measured the distance from the base of the formation to his position and the angle between the ground and the line of sight to the top of the formation. The distance was 43 meters and the angle was 36 degrees. What is the height of the formation to the nearest meter?

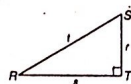


Lesson 8-4

### 8-4 Skills Practice

#### Trigonometry

Use  $\triangle RST$  to find  $\sin R$ ,  $\cos R$ ,  $\tan R$ ,  $\sin S$ ,  $\cos S$ , and  $\tan S$ . Express each ratio as a fraction and as a decimal to the nearest hundredth.



1.  $r = 16, s = 30, t = 34$

$\sin R = \frac{16}{34} \approx 0.47;$

$\cos R = \frac{30}{34} \approx 0.88;$

$\tan R = \frac{16}{30} \approx 0.53;$

$\sin S = \frac{30}{34} \approx 0.88;$

$\cos S = \frac{16}{34} \approx 0.47;$

$\tan S = \frac{30}{16} \approx 1.88$

2.  $r = 10, s = 24, t = 26$

$\sin R = \frac{10}{26} \approx 0.38;$

$\cos R = \frac{24}{26} \approx 0.92;$

$\tan R = \frac{10}{24} \approx 0.42;$

$\sin S = \frac{24}{26} \approx 0.92;$

$\cos S = \frac{10}{26} \approx 0.38;$

$\tan S = \frac{24}{10} = 2.4$

Use a calculator to find each value. Round to the nearest ten-thousandth.

3.  $\sin 5 \approx 0.0872$

4.  $\tan 23 \approx 0.4245$

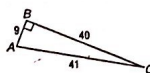
5.  $\cos 61 \approx 0.4848$

6.  $\sin 75.8 \approx 0.9694$

7.  $\tan 17.3 \approx 0.3115$

8.  $\cos 52.9 \approx 0.6032$

Use the figure to find each trigonometric ratio. Express answers as a fraction and as a decimal rounded to the nearest ten-thousandth.



9.  $\tan C$

$\frac{9}{40} \approx 0.2250$

10.  $\sin A$

$\frac{40}{41} \approx 0.9756$

11.  $\cos C$

$\frac{40}{41} \approx 0.9756$

Find the measure of each acute angle to the nearest tenth of a degree.

12.  $\sin B = 0.2985 \rightarrow 17.4$

13.  $\tan A = 0.4168 \rightarrow 22.6$

14.  $\cos R = 0.8443 \rightarrow 32.4$

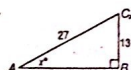
15.  $\tan C = 0.3894 \rightarrow 21.3$

16.  $\cos B = 0.7329 \rightarrow 42.9$

17.  $\sin A = 0.1176 \rightarrow 6.8$

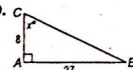
Find  $x$ . Round to the nearest tenth.

18.



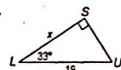
28.8

19.



73.5

20.

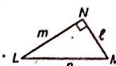


15.9

### 8-4 Practice

#### Trigonometry

Use  $\triangle LMN$  to find  $\sin L$ ,  $\cos L$ ,  $\tan L$ ,  $\sin M$ ,  $\cos M$ , and  $\tan M$ . Express each ratio as a fraction and as a decimal to the nearest hundredth.



1.  $l = 15, m = 36, n = 39$

$\sin L = \frac{15}{39} \approx 0.38;$

$\cos L = \frac{36}{39} \approx 0.92;$

$\tan L = \frac{15}{36} \approx 0.42;$

$\sin M = \frac{36}{39} \approx 0.92;$

$\cos M = \frac{15}{39} \approx 0.38;$

$\tan M = \frac{36}{15} = 2.4$

2.  $l = 12, m = 12\sqrt{3}, n = 24$

$\sin L = \frac{12}{24} = 0.50;$

$\cos L = \frac{12\sqrt{3}}{24} \approx 0.87;$

$\tan L = \frac{12}{12\sqrt{3}} \approx 0.58;$

$\sin M = \frac{12\sqrt{3}}{24} \approx 0.87;$

$\cos M = \frac{12}{24} = 0.50;$

$\tan M = \frac{12\sqrt{3}}{12} \approx 1.73$

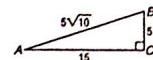
Use a calculator to find each value. Round to the nearest ten-thousandth.

3.  $\sin 72.5 \approx 0.9537$

4.  $\tan 27.5 \approx 0.5206$

5.  $\cos 64.8 \approx 0.4258$

Use the figure to find each trigonometric ratio. Express answers as a fraction and as a decimal rounded to the nearest ten-thousandth.



6.  $\cos A$

$\frac{3\sqrt{10}}{10} \approx 0.9487$

7.  $\tan B$

$\frac{3}{1} = 3.0000$

8.  $\sin A$

$\frac{\sqrt{10}}{10} \approx 0.3162$

Find the measure of each acute angle to the nearest tenth of a degree.

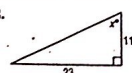
9.  $\sin B = 0.7823 \rightarrow 51.5$

10.  $\tan A = 0.2356 \rightarrow 13.3$

11.  $\cos R = 0.6401 \rightarrow 50.2$

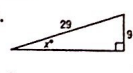
Find  $x$ . Round to the nearest tenth.

12.



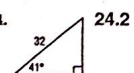
64.4

13.



18.1

14.



24.2

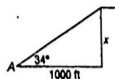
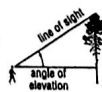
15. GEOGRAPHY Diego used a theodolite to map a region of land for his class in geomorphology. To determine the elevation of a vertical rock formation, he measured the distance from the base of the formation to his position and the angle between the ground and the line of sight to the top of the formation. The distance was 43 meters and the angle was 36 degrees. What is the height of the formation to the nearest meter? 31 m



## 8-5 Study Guide and Intervention

### Angles of Elevation and Depression

**Angles of Elevation** Many real-world problems that involve looking up to an object can be described in terms of an angle of elevation, which is the angle between an observer's line of sight and a horizontal line.



**Example** The angle of elevation from point A to the top of a cliff is  $34^\circ$ . If point A is 1000 feet from the base of the cliff, how high is the cliff?

Let  $x$  = the height of the cliff.

$$\begin{aligned} \tan 34^\circ &= \frac{x}{1000} & \tan &= \frac{\text{opposite}}{\text{adjacent}} \\ 1000(\tan 34^\circ) &= x & \text{Multiply each side by 1000.} \\ 674.5 &= x & \text{Use a calculator.} \end{aligned}$$

The height of the cliff is about 674.5 feet.

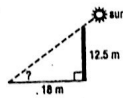
#### Exercises

Solve each problem. Round measures of segments to the nearest whole number and angles to the nearest degree.

- The angle of elevation from point A to the top of a hill is  $49^\circ$ . If point A is 400 feet from the base of the hill, how high is the hill?



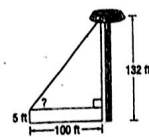
- Find the angle of elevation of the sun when a 12.5-meter-tall telephone pole casts an 18-meter-long shadow.



- A ladder leaning against a building makes an angle of  $78^\circ$  with the ground. The foot of the ladder is 5 feet from the building. How long is the ladder?



- A person whose eyes are 5 feet above the ground is standing on the runway of an airport 100 feet from the control tower. That person observes an air traffic controller at the window of the 132-foot tower. What is the angle of elevation?

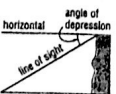


Lesson 8-5

## 8-5 Study Guide and Intervention (continued)

### Angles of Elevation and Depression

**Angles of Depression** When an observer is looking down, the angle of depression is the angle between the observer's line of sight and a horizontal line.

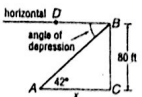


**Example** The angle of depression from the top of an 80-foot building to point A on the ground is  $42^\circ$ . How far is the foot of the building from point A?

Let  $x$  = the distance from point A to the foot of the building. Since the horizontal line is parallel to the ground, the angle of depression  $\angle DBA$  is congruent to  $\angle BAC$ .

$$\begin{aligned} \tan 42^\circ &= \frac{80}{x} & \tan &= \frac{\text{opposite}}{\text{adjacent}} \\ x(\tan 42^\circ) &= 80 & \text{Multiply each side by } x. \\ x &= \frac{80}{\tan 42^\circ} & \text{Divide each side by } \tan 42^\circ. \\ x &\approx 88.8 & \text{Use a calculator.} \end{aligned}$$

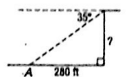
Point A is about 89 feet from the base of the building.



#### Exercises

Solve each problem. Round measures of segments to the nearest whole number and angles to the nearest degree.

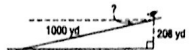
- The angle of depression from the top of a sheer cliff to point A on the ground is  $35^\circ$ . If point A is 280 feet from the base of the cliff, how tall is the cliff?



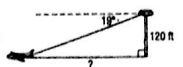
- The angle of depression from a balloon on a 75-foot string to a person on the ground is  $36^\circ$ . How high is the balloon?



- A ski run is 1000 yards long with a vertical drop of 208 yards. Find the angle of depression from the top of the ski run to the bottom.



- From the top of a 120-foot-high tower, an air traffic controller observes an airplane on the runway at an angle of depression of  $19^\circ$ . How far from the base of the tower is the airplane?



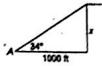
8-5 Study Guide and Intervention

Angles of Elevation and Depression

**Angles of Elevation** Many real-world problems that involve looking up to an object can be described in terms of an angle of elevation, which is the angle between an observer's line of sight and a horizontal line.



**Example** The angle of elevation from point A to the top of a cliff is  $34^\circ$ . If point A is 1000 feet from the base of the cliff, how high is the cliff?  
Let  $x$  = the height of the cliff.



$$\tan 34^\circ = \frac{x}{1000} \quad \tan = \frac{\text{opposite}}{\text{adjacent}}$$

$$1000(\tan 34^\circ) = x \quad \text{Multiply each side by 1000.}$$

$$674.5 = x \quad \text{Use a calculator.}$$

The height of the cliff is about 674.5 feet.

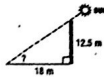
Exercises

Solve each problem. Round measures of segments to the nearest whole number and angles to the nearest degree.

- The angle of elevation from point A to the top of a hill is  $49^\circ$ . If point A is 400 feet from the base of the hill, how high is the hill?  
460 ft



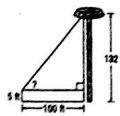
- Find the angle of elevation of the sun when a 12.5-meter-tall telephone pole casts an 18-meter-long shadow.  
 $35^\circ$



- A ladder leaning against a building makes an angle of  $78^\circ$  with the ground. The foot of the ladder is 5 feet from the building. How long is the ladder?  
24 ft



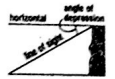
- A person whose eyes are 5 feet above the ground is standing on the runway at an airport 100 feet from the control tower. That person observes an air traffic controller at the window of the 122-foot tower. What is the angle of elevation?  
 $52^\circ$



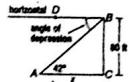
8-5 Study Guide and Intervention (continued)

Angles of Elevation and Depression

**Angles of Depression** When an observer is looking down, the angle of depression is the angle between the observer's line of sight and a horizontal line.



**Example** The angle of depression from the top of an 80-foot building to point A on the ground is  $42^\circ$ . How far is the foot of the building from point A?  
Let  $x$  = the distance from point A to the foot of the building. Since the horizontal line is parallel to the ground, the angle of depression  $\angle DBA$  is congruent to  $\angle BAC$ .



$$\tan 42^\circ = \frac{80}{x} \quad \tan = \frac{\text{opposite}}{\text{adjacent}}$$

$$x(\tan 42^\circ) = 80 \quad \text{Multiply each side by } x.$$

$$x = \frac{80}{\tan 42^\circ} \quad \text{Divide each side by } \tan 42^\circ.$$

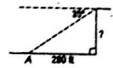
$$x \approx 88.8 \quad \text{Use a calculator.}$$

Point A is about 89 feet from the base of the building.

Exercises

Solve each problem. Round measures of segments to the nearest whole number and angles to the nearest degree.

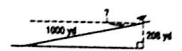
- The angle of depression from the top of a sheer cliff to point A on the ground is  $35^\circ$ . If point A is 280 feet from the base of the cliff, how tall is the cliff?  
196 ft



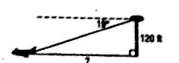
- The angle of depression from a balloon on a 75-foot string to a person on the ground is  $36^\circ$ . How high is the balloon?  
44 ft



- A ski run is 1000 yards long with a vertical drop of 208 yards. Find the angle of depression from the top of the ski run to the bottom.  
 $12^\circ$



- From the top of a 120-foot-high tower, an air traffic controller observes an airplane on the runway at an angle of depression of  $19^\circ$ . How far from the base of the tower is the airplane?  
349 ft



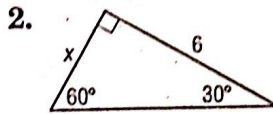
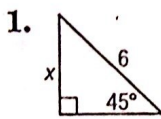
# 8

## Chapter 8 Quiz 2

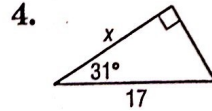
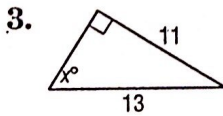
(Lesson 8-3 and 8-4.)

SCORE \_\_\_\_\_

For Questions 1 and 2, find  $x$ .



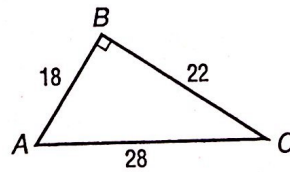
For Questions 3 and 4, find  $x$  to the nearest tenth.



5. A rectangle has a diagonal 20 inches long that forms angles of  $60^\circ$  and  $30^\circ$  with the sides. Find the perimeter of the rectangle.
6. Find  $\sin 52^\circ$ . Round to the nearest ten-thousandth.
7. If  $\cos A = 0.8945$ , find  $m\angle A$  to the nearest degree.
8. The distance along a hill is 24 feet. If the land slopes uphill at an angle of  $8^\circ$ , find the vertical distance from the top to the bottom of the hill.

For Questions 9-10, use the figure.

9. Find  $\sin A$  to the nearest hundredth.
10. Find  $\tan C$  to the nearest hundredth.



1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

# Quiz 2 (Lessons 8-3 and 8-4)

Page 59

1.  $3\sqrt{2}$

2.  $2\sqrt{3}$

3.  $57.8^\circ$

4. 14.6

5.  $20\sqrt{3} + 20$  in.

6. 0.7880

7. 27

8. 3.3 ft

9. 0.79

10. 0.82