9.5 Start Thinking

In Lesson 9.4, we discussed the tangent ratio which involves the two legs of a right triangle. In this lesson, we will discuss the sine and cosine ratios, which are trigonometric ratios for acute angles that involve the lengths of a leg and the hypotenuse of a right triangle. Consider what you know about the length of the hypotenuse of any right triangle. If we define the ratios as shown below, what conclusions can you make about the values of the sine and cosine of an acute angle in a right triangle?

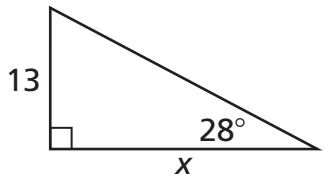
$$\text{Sine of an acute angle} = \frac{\text{length of side opposite angle}}{\text{length of hypotenuse}}$$

$$\text{Cosine of an acute angle} = \frac{\text{length of side adjacent to angle}}{\text{length of hypotenuse}}$$

9.5 Warm Up

Find the value of *x*. Round your answer to the nearest tenth.

1.



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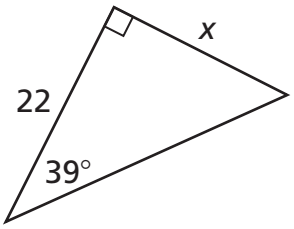

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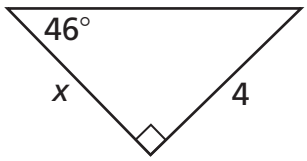


9.5 Cumulative Review Warm Up

Find the coordinates of the circumcenter of the triangle with the given vertices.

1. $A(4, 2), B(8, 5), C(8, 2)$

2. $M(3, 0), N(-2, 6), P(1, -4)$

3. $F(3, -2), D(0, 0), R(8, -4)$

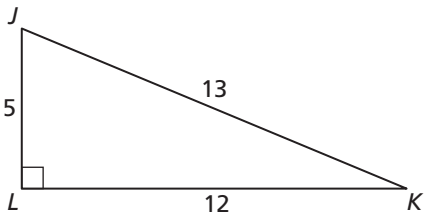
4. $X(10, -3), Y(2, 7), Z(-2, -5)$

Name_____ Date _____

9.5 Practice A

In Exercises 1 and 2, find sin *J*, sin *K*, cos *J*, and cos *K*. Write each answer as a fraction and as a decimal rounded to four places.

1.



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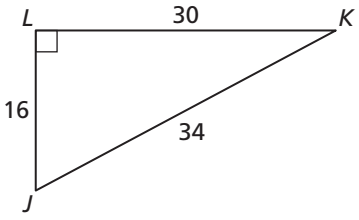
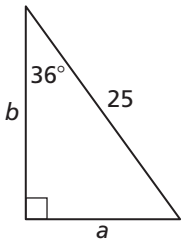


In Exercises 3–6, write the expression in terms of sine or cosine.

3. sin 22° **4.** cos 56° **5.** cos 15° **6.** sin 37°

In Exercises 7–9, find the value of each variable using sine and cosine. Round your answers to the nearest tenth.

7.



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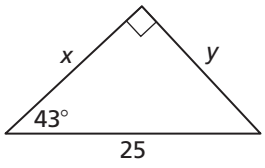

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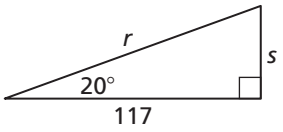
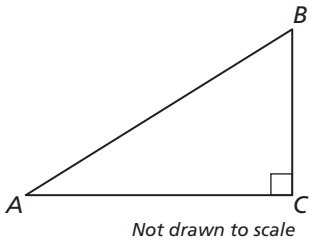


10. Which statement *cannot* be true? Explain.

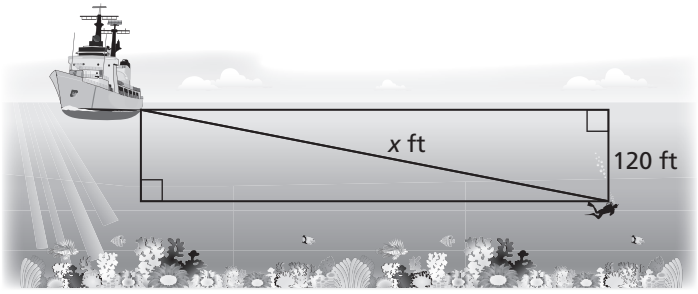
A. $\sin A = 0.5$ **B.** $\sin A = 1.2654$

C. $\sin A = 0.9962$ **D.** $\sin A = \frac{3}{4}$



Not drawn to scale

11. The angle of depression is 11° from the bottom of a boat to a deep sea diver at a depth of 120 feet. Find the distance x the diver must swim up to the boat to the nearest foot.

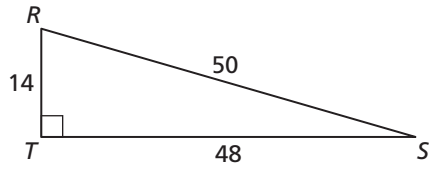


Name _____ Date _____

9.5 Practice B

In Exercises 1 and 2, find sin *R*, sin *S*, cos *R*, and cos *S*. Write each answer as a fraction and as a decimal rounded to four places.

1.



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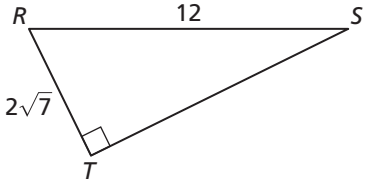


In Exercises 3–5, write the expression in terms of sine and/or cosine.

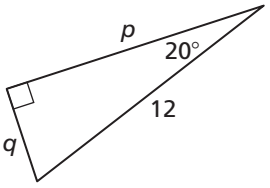
3. sin 7°

4. cos 31°

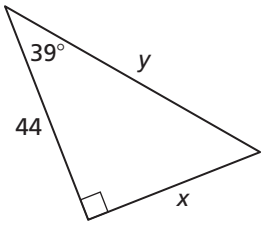
5. tan 60°

In Exercises 6–8, find the value of each variable using sine and cosine. Round your answers to the nearest tenth.

6.



7.



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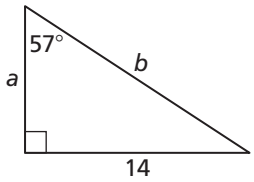
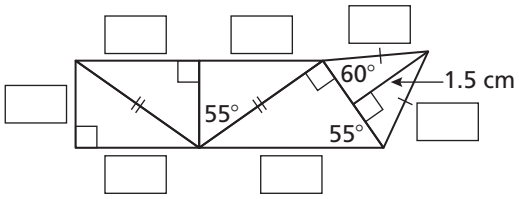
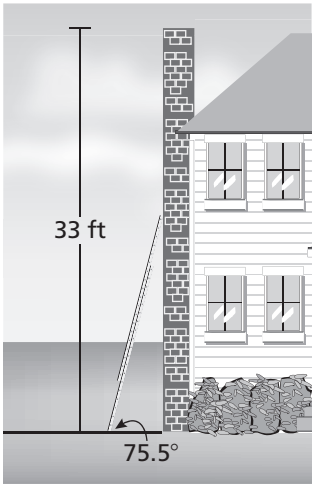


9. Find the perimeter of the figure shown. Round your answer to the nearest centimeter.



10. You use an extension ladder to repair a chimney that is 33 feet tall. The length of the extension ladder ranges in one-foot increments from its minimum length to its maximum length. For safety reasons, you should always use an angle of about 75.5° between the ground and your ladder.



a. Your smallest extension ladder has maximum length of 17 feet. How high does this ladder safely reach on the chimney? Round your answer to the nearest tenth of a foot.

b. You place the ladder 3 feet from the base of the chimney. How many feet long should the ladder be? Round your answer to the nearest foot.

c. To reach the top of the chimney, you need a ladder that reaches 30 feet high. How many feet long should the ladder be? Round your answer to the nearest foot.

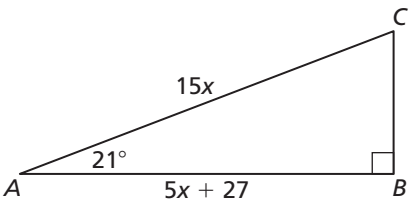
Name_____ Date _____

9.5 Enrichment and Extension

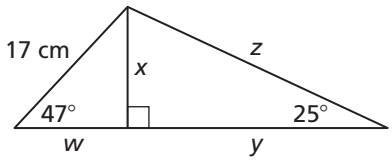
The Sine and Cosine Ratios

In Exercises 1 and 2, find the missing variable(s). Round your answers to the nearest thousandths.

1.

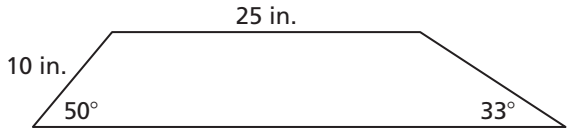


2.



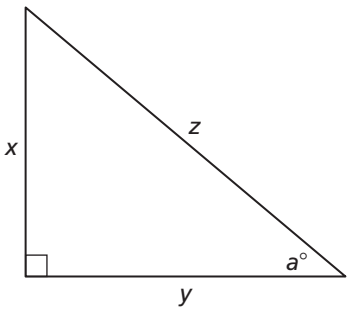
3. In right $\triangle RTX$, $\sin R = \frac{5}{13}$. If the hypotenuse of the triangle is 117 units, what is the triangle's perimeter?

4. Find the perimeter of the isosceles trapezoid. Round your answer to the nearest tenth.



5. In right $\triangle ABC$, $m\angle B = 90°$ and $m\angle A = 30°$. What is the ratio of the longest leg to the hypotenuse?

In Exercises 6 and 7, use the diagram at the right.



6. Write an expression for $(\sin a°)^2 + (\cos a°)^2$ in terms of x, y, and z. Then use the Pythagorean Theorem (Theorem 9.1) to simplify the expression.

7. Suppose $\sin a° = 0.6$. What is the value of $\cos a°$?

Name _____ Date _____

9.5 Puzzle Time

What Is A Computer Virus?

Write the letter of each answer in the box containing the exercise number.

Complete the sentence.

1. The _____ and cosine ratios are trigonometric ratios for acute angles that involve the lengths of a leg and the hypotenuse of a right triangle.
2. The sine of an angle is equal to the _____ of its complement.
3. The cosine of an angle is equal to the sine of its _____.
4. The angle that a downward line of sight makes with a horizontal line is called the angle of _____.

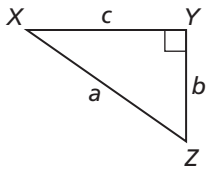
Write the sine in terms of cosine.

5. sin 48° **6.** sin 78° **7.** sin 25°

Write the cosine in terms of sine.

8. cos 36° **9.** cos 15° **10.** cos 71°

Find the indicated value using the diagram. Round to four decimal places.



11. $a = 17$, $b = 15$, $c = 8$; Find the sine of angle X.

12. $a = 26$, $b = 10$, $c = 24$; Find the cosine of angle Z.

13. $a = 25$, $b = 24$, $c = 7$; Find the cosine of angle X.

14. $a = 15$, $b = 9$, $c = 12$; Find the sine of angle Z.

15. $a = 22$, $m\angle Z = 41°$; Find b.

16. $a = 22$, $m\angle Z = 41°$; Find c.

Answers

L. sin 54°	**M.** 14.4333
A. tangent	**M.** cos 48°
N. cosine	**T.** sine
E. sin 19°	**A.** sin 75°
L. cos 12°	**I.** 0.8000
A. 0.8824	**S.** 0.8213
S. cos 65°	**S.** cos 42°
O. elevation	**N.** supplement
L. 0.3846	**N.** depression
U. cos 35°	**R.** 0.2800
V. sin 13°	
I. complement	**E.** 16.6036
D. 0.6554	**G.** 12.7998

9		1	10	13	16	14	4	11	6		3	12	8	2	15	7	5