## 9.4 Start Thinking

Use a ruler and a protractor to draw three right triangles as shown in the diagrams below. Make one hypotenuse exactly 3 inches, one exactly 4 inches, and the other exactly 5 inches. Use a ruler to find the measures of the remaining sides of each triangle. Determine the value of each of the ratios below. Compare the ratios and make a conjecture about them in general, for any 30°-60°-90° triangle.
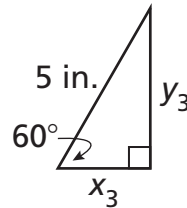
1. $\dfrac{y_1}{x_1}$
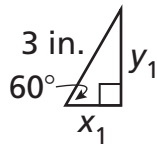
2. $\dfrac{y_2}{x_2}$
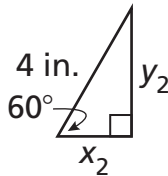
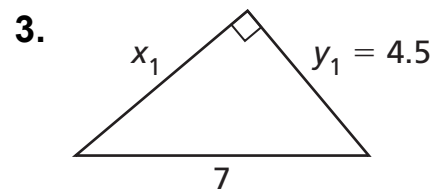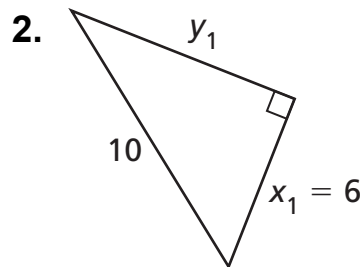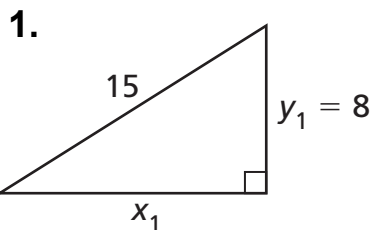**3.** $\dfrac{y_3}{x_3}$

9.4 Warm Up

Find the measure of the missing leg in the right triangle, and then calculate the ratio $\dfrac{y_1}{x_1}$.

1.

15, $y_1 = 8$, x_1

2.

y_1, 10, $x_1 = 6$

3.

x_1, $y_1 = 4.5$, 7

9.4 Cumulative Review Warm Up

Draw a segment with the given length. Construct the point that divides the segment into the given ratio.
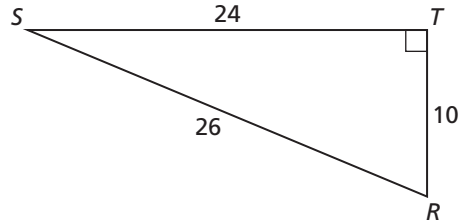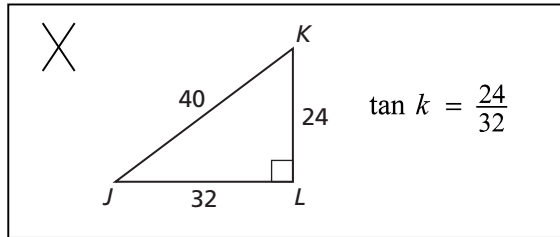
1. 4 in.; 2 to 3

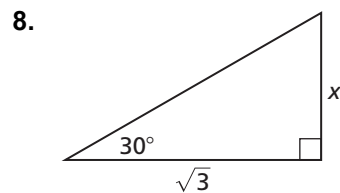**2.** 7 cm; 1 to 4

3. 12 cm; 3 to 5

Name _____ Date _____

1. Find the tangents of the acute angles in the right triangle. Write each answer as a fraction and as a decimal rounded to four decimal places.

S ———— 24 ———— *T*

26

10

R

2. Describe and correct the error in writing the statement of the tangent ratio for the given figure.

✗

K

40

24

$\tan k = \frac{24}{32}$

J   32   *L*

In Exercises 3–8, find the value of *x*. Round your answer to the nearest tenth.

3.

29

65°

x

4.

70°

3

x

5.

40°

x

15

6.

40

x

58°

7.

9

x

45°

8.

x

30°

$\sqrt{3}$
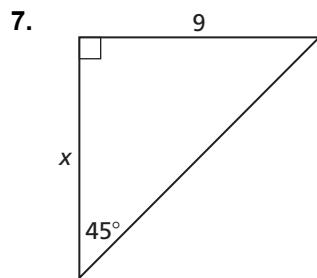
9. You are measuring the height of a water slide. You stand 58 meters from the base of the slide. You measure the angle of elevation from the ground to the top of the water slide to be 13°. Find the height *h* of the slide to the nearest meter.

h

13°

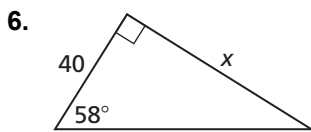58 m

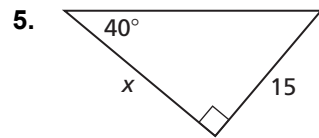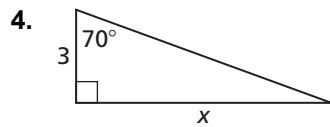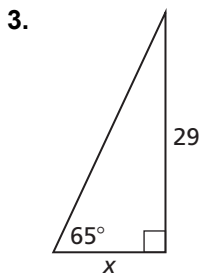Name_____ Date _____

9.4 Practice B

In Exercises 1 and 2, find the tangents of the acute angles in the right triangle. Write each answer as a fraction and as a decimal rounded to four decimal places.
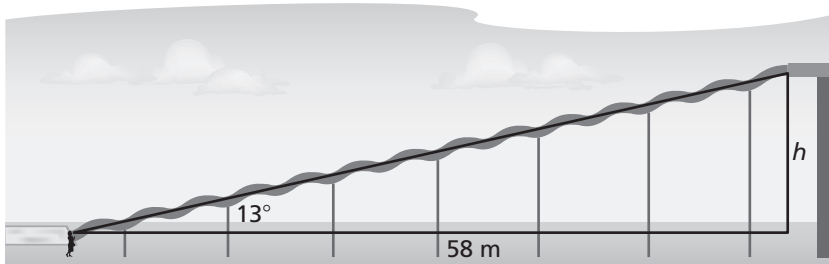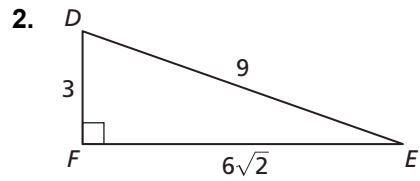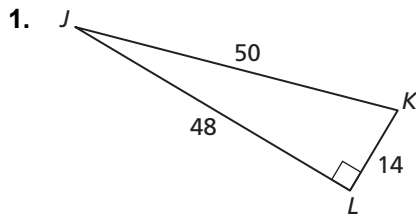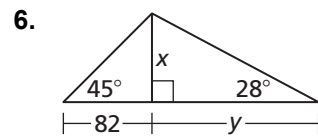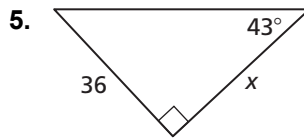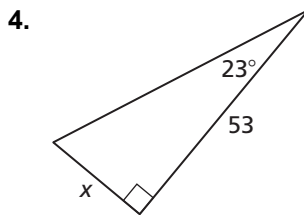
1.

50
J
K
48
14
L

2.

D
3
9
F
$6\sqrt{2}$
E

3. Draw and label the sides and angles of a triangle for which the tangents of the acute angles are equal to 1.

In Exercises 4–6, find the value(s) of the variable(s). Round your answer(s) to the nearest tenth.

4.

23°
53
x

5.

43°
36
x

6.

x
45°   28°
— 82 — y —

7. A surveyor is standing 30 feet from the base of a tall building. The surveyor measures the angle of elevation from the ground to the top of the building to be 65°. Find the height h of the building to the nearest foot.

h
65°
30 ft
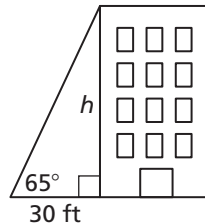
8. In the diagram, $\overline{RQ} \perp \overline{PQ}$, $m\angle QPS = 32°$, $m\angle RPS = 24°$, and $PQ = 14$. Find RS to the nearest tenth of a unit.

P
14 32° 24°
Q   S   R
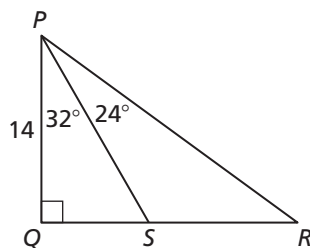
9.4 Enrichment and Extension

The Tangent Ratio

1. Quadrilateral $ABCD$ is a rhombus. Given that $AC = 10$ and $BD = 16$, find all side lengths and angle measures in the figure below. Explain your reasoning.
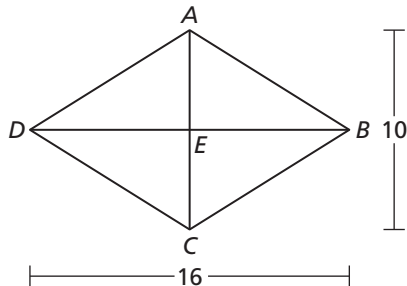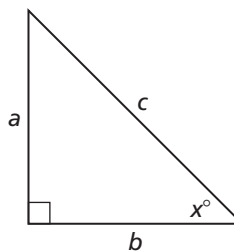
In Exercises 2–4, use the diagram.

2. Write an equation for $\tan x°$ and an equation for $\tan(90° - x°)$ in terms of a, b, and c.

3. How are the expressions in Exercise 2 related?

4. For what value of x is the relationship in Exercise 3 between the tangent of an angle and the tangent of the angle's complement true? Explain.

5. What is the perimeter of an equilateral triangle with an altitude of 15 inches? Round your answer to the nearest hundredth.

6. In the diagram at the right, $AC = 42$. What is AD? Round your answer to the nearest tenth.
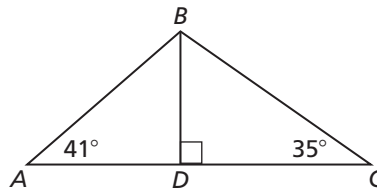
7. Explain how you can use the special right triangle below to show that $\tan a° + \tan b° \neq \tan(a° + b°)$.
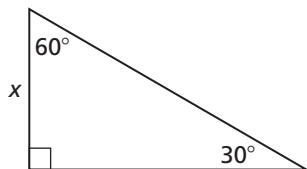
8. Find the measure of the acute angle formed by the intersecting lines $3x + 2y = 12$ and $x - 2y = -2$, to the nearest tenth of a degree.

9.4 Puzzle Time

What Exam Does An Exterminator Have To Take?

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

Complete the sentence.

1. A(n) _____ of the lengths of two sides in a right triangle is called a trigonometric ratio.

2. The tangent ratio is a(n) _____ for acute angles that involves the lengths of the legs of a right triangle.

3. The angle that an upward line of sight makes with a line drawn horizontally is called the angle of _____.

4. The _____ is the ratio of the leg opposite a given angle to the leg adjacent to the given angle in a right triangle.

Use the diagram. Round your answer to the nearest tenth.
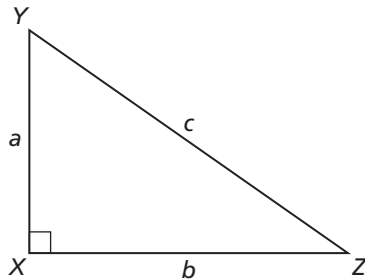
5. $a = 10, b = 15, c = 5\sqrt{13}$; Find the tangent of $\angle Z$.

6. $a = 10, b = 15, c = 5\sqrt{13}$; Find the tangent of $\angle Y$.

7. $a = 18, m\angle Y = 42°$; Find b.

8. $b = 22, m\angle Z = 30°$; Find a.

9. $b = 28, m\angle Y = 64°$; Find a.

Answers

O. geometric ratio

T. tangent

A. 0.7

N. side

P. ratio

T. hypotenuse

S. 13.7

H. 1.1

E. 0.1

S. trigonometric ratio

E. 1.5

R. 1.6

T. elevation

U. 22

T. 16.2

B. 28

S. depression

E. 12.7

5		1	8	2	3		7	6	9	4