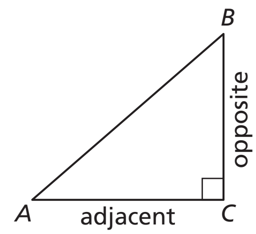
Name______________________________ Date__________

9.4 The Tangent Ratio
For use with Exploration 9.4

Essential Question How is a right triangle used to find the tangent of an acute angle? Is there a unique right triangle that must be used?

Let $\triangle ABC$ be a right triangle with acute $\angle A$. The *tangent* of $\angle A$ (written as $\tan A$) is defined as follows.

$$\tan A = \frac{\text{length of leg opposite } \angle A}{\text{length of leg adjacent to } \angle A} = \frac{BC}{AC}$$

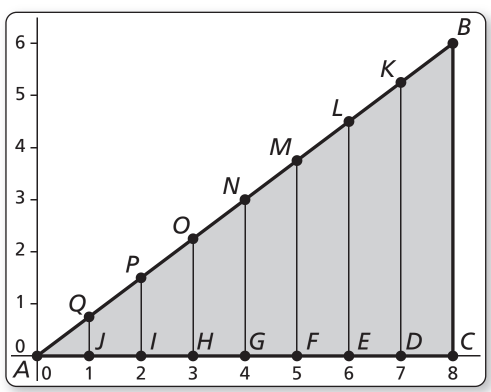


1 EXPLORATION: Calculating a Tangent Ratio

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use dynamic geometry software.

a. Construct $\triangle ABC$, as shown. Construct segments perpendicular to $\overline{AC}$ to form right triangles that share vertex A and are similar to $\triangle ABC$ with vertices, as shown.



Sample
Points
$A(0, 0)$
$B(8, 6)$
$C(8, 0)$
Angle
$m\angle BAC = 36.87°$

b. Calculate each given ratio to complete the table for the decimal value of $\tan A$ for each right triangle. What can you conclude?

Ratio	$\frac{BC}{AC}$	$\frac{KD}{AD}$	$\frac{LE}{AE}$	$\frac{MF}{AF}$	$\frac{NG}{AG}$	$\frac{OH}{AH}$	$\frac{PI}{AI}$	$\frac{QJ}{AJ}$
tan A								

9.4 The Tangent Ratio (continued)

2 EXPLORATION: Using a Calculator

Work with a partner. Use a calculator that has a tangent key to calculate the tangent of $36.87°$. Do you get the same result as in Exploration 1? Explain.

Communicate Your Answer

3. Repeat Exploration 1 for $\triangle ABC$ with vertices $A(0, 0)$, $B(8, 5)$, and $C(8, 0)$.

Construct the seven perpendicular segments so that not all of them intersect $\overline{AC}$ at integer values of x. Discuss your results.

4. How is a right triangle used to find the tangent of an acute angle? Is there a unique right triangle that must be used?

Name____ Date__________

9.4 Notetaking with Vocabulary

For use after Lesson 9.4

In your own words, write the meaning of each vocabulary term.

trigonometric ratio

tangent

angle of elevation

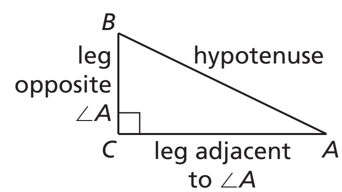
Core Concepts

Tangent Ratio

Let $\triangle ABC$ be a right triangle with acute $\angle A$.

The tangent of $\angle A$ (written as tan A) is defined as follows.

$$\tan A = \frac{\text{length of leg opposite } \angle A}{\text{length of leg adjacent to } \angle A} = \frac{BC}{AC}$$



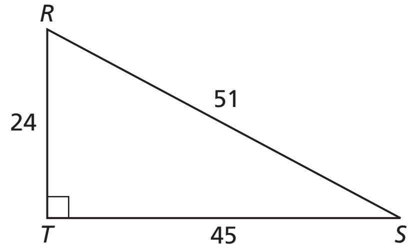
Notes:

9.4 **Notetaking with Vocabulary (continued)**

Extra Practice

In Exercises 1–3, 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.



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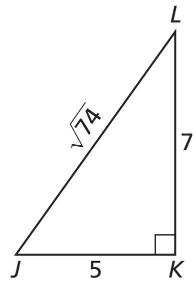

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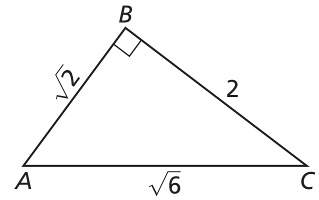
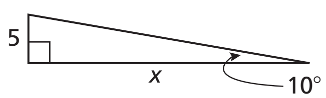
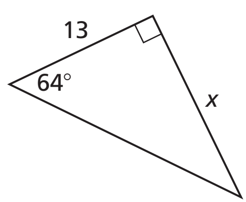


In Exercises 4–6, find the value of *x*. Round your answer to the nearest tenth.

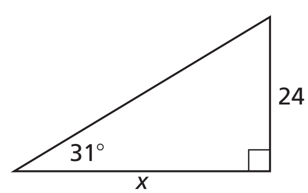
4.



5.



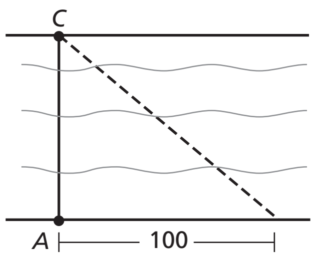
6.



7. In $\triangle CDE$, $\angle E = 90^\circ$ and $\tan C = \frac{4}{3}$. Find tan D? Write your answer as a fraction.

8. An environmentalist wants to measure the width of a river to monitor its erosion. From point *A*, she walks downstream 100 feet and measures the angle from this point to point *C* to be $40°$.

a. How wide is the river? Round to the nearest tenth.



b. One year later, the environmentalist returns to measure the same river. From point *A*, she again walks downstream 100 feet and measures the angle from this point to point *C* to be now $51°$. By how many feet has the width of the river increased?

9. A boy flies a kite at an angle of elevation of $18°$. The kite reaches its maximum height 300 feet away from the boy. What is the maximum height of the kite? Round to the nearest tenth.

10. Find the perimeter of the figure.