Geometry
Unit 5 Day 7

Name: Answer Key

Date: _____ Period: _____

5.7 Apply the Tangent Ratio

Goal • Use the tangent ratio for indirect measurement.

Your Notes

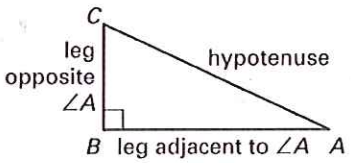
VOCABULARY

Trigonometric ratio the ratio between the lengths of two sides of a right triangle

Tangent the trig. ratio for acute angles that involve the lengths of the legs of a right triangle

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:



$$\tan A = \frac{\text{length of leg opposite } \angle A}{\text{length of leg adjacent to } \angle A} = \frac{\overline{CB}}{\overline{AB}}$$

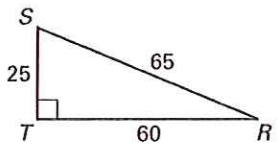
Inverse Tangent If $\tan A = x$, then $\tan^{-1} x = m\angle A$.

Remember these abbreviations: tangent → tan, opposite → opp., adjacent → adj.

Adjacent is NEVER the hypotenuse

Example 1 *Find tangent ratios*

Find tan S and tan R. Write each answer as a fraction and as a decimal rounded to four places, if necessary.



$\tan S = \frac{opp}{adj}$

$\tan S = \frac{60}{25}$

$\tan S = 2.4$

$\tan R = \frac{opp}{adj}$

$\tan R = \frac{25}{60}$

$\tan R = 0.4167$

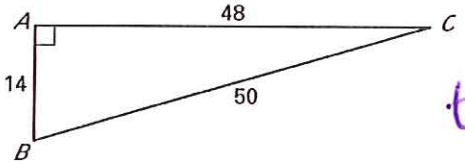
Unless told otherwise, round values of trigonometric ratios to the ten-thousandths' place and round lengths to the tenths' place.

(4 decimal places)

Your Notes

Checkpoint Find tan *B* and tan *C*. Write each answer as a fraction and as a decimal rounded to four places.

1.



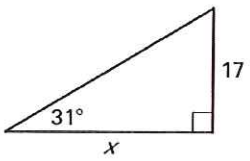
$\tan B = 3.4286$

$\tan C = 0.2917$

Example 2 *Find a leg length*

Find the value of *x*.

Use the tangent of an acute angle to find a leg length.



$\tan 31° = \frac{17}{x}$

$0.6009 = \frac{17}{x}$

$x \cdot 0.6009 = 17$

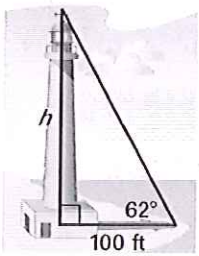
$x = \frac{17}{0.6009}$

$x = 28.29$

can take tangent of a degree and get a new # (MODE → DEGREE)

Example 3 *Estimate height using tangent*

Lighthouse Find the height *h* of the lighthouse to the nearest foot.



$\tan 62° = \frac{h}{100}$

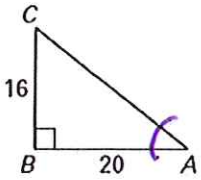
$1.8807 = \frac{h}{100}$

$100 \cdot 1.8807 = h$

$h = 188.07 \text{ ft} \rightarrow$ **188 ft**

Example 4 *Use an inverse tangent to find an angle measure*

Use a calculator to approximate the measure of ∠*A* to the nearest tenth of a degree.



$\tan A = \frac{16}{20}$

$A = \tan^{-1}\left(\frac{16}{20}\right)$

$A = 38.7°$

$\tan^{-1}(\tan A) = \tan^{-1}\left(\frac{16}{20}\right)$

Your Notes

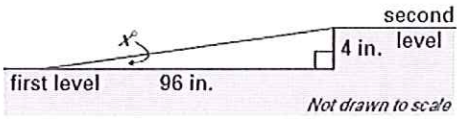
Checkpoint **Complete the following exercise.**

1. In Example 4, use a calculator and an inverse tangent to approximate $m\angle C$ to the nearest tenth of a degree. $\tan C = \frac{20}{16}$ $C = 51.3°$

5.

Example 4 ***Solve a real-world problem***

Model Train You are building a track for a model train. You want the track to incline from the first level to the second level, 4 inches higher, in 96 inches. Is the angle of elevation less than 3°?



$\tan x = \frac{opp}{adj}$

$\tan x^\circ = \frac{4}{96}$

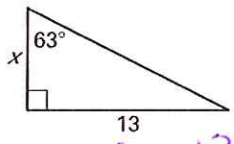
$\tan^{-1}(\tan x^\circ) = \tan^{-1}(\frac{4}{96})$

$x = \tan^{-1}(\frac{4}{96})$

$x = 2.4°$ YES

Checkpoint **In Exercises 2 and 3, find the value of x. Round to the nearest tenth.**

2.

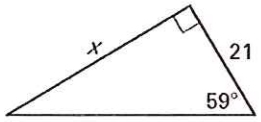


$\tan 63^\circ = \frac{13}{x}$

$x = 6.6$

$x = \frac{13}{\tan 63^\circ}$ ←

3.



$\tan 59^\circ = \frac{x}{21}$

$x = 34.9$