

# Unit 13 Right Triangle Trigonometry

## Guided Notes

KEY

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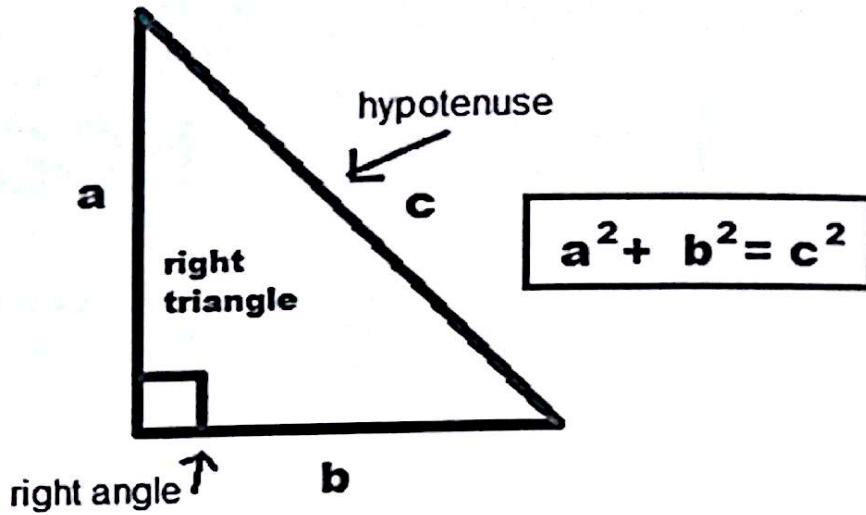
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**\*\*If found, please return to Mrs. Brandley's room, M-8.\*\***

# REVIEW-PYTHAGOREAN THEOREM



Use the Pythagorean theorem to find the missing side length. (y)

<p>1.</p> <p>6cm</p> <p>8cm</p> <p>ycm</p> <p><math>6^2 + 8^2 = y^2</math> <math>y = 10</math></p>	<p>2.</p> <p>2cm</p> <p>1cm</p> <p>ycm</p> <p><math>2^2 + 1^2 = y^2</math> <math>y = \sqrt{5}</math></p>
<p>3.</p> <p>5cm</p> <p>ycm</p> <p>7cm</p> <p><math>5^2 + y^2 = 7^2</math> <math>y = \sqrt{24}</math></p>	<p>4.</p> <p>3cm</p> <p>ycm</p> <p>6cm</p> <p><math>3^2 + y^2 = 6^2</math> <math>y = \sqrt{27}</math></p>
<p>5.</p> <p>ycm</p> <p>2cm</p> <p>12cm</p> <p><math>y^2 + 2^2 = 12^2</math> <math>y = \sqrt{140}</math></p>	<p>6.</p> <p>ycm</p> <p>7cm</p> <p>14cm</p> <p><math>y^2 + 7^2 = 14^2</math> <math>y = \sqrt{147}</math></p>

Concept 1: Trig Ratios

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

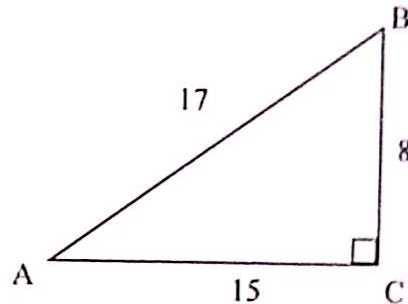
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For exercises 1-6, refer to  $\triangle ABC$ .  
Find each of the following in fraction form.

1. Sin A 8/17
2. Sin B 15/17
3. Cos A 15/17
4. Cos B 8/17
5. Tan A 8/15
6. Tan B 15/8



Use a calculator for exercises 7-12. Round your answers to 3 decimal places.

7.  $\sin 26^\circ$  .438
8.  $\cos 53^\circ$  .602
9.  $\cos 34^\circ$  .829
10.  $\sin 12^\circ$  .208
11.  $\tan 12^\circ$  .213
12.  $\tan 21^\circ$  .384

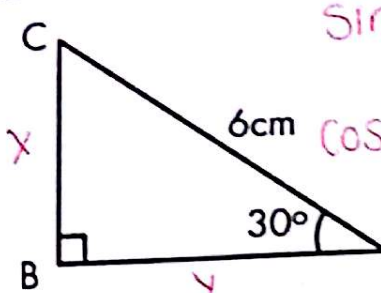
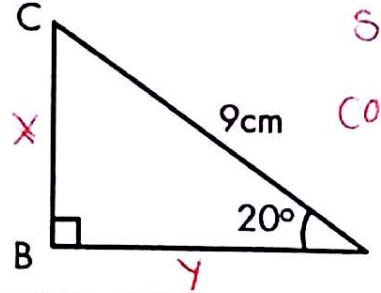
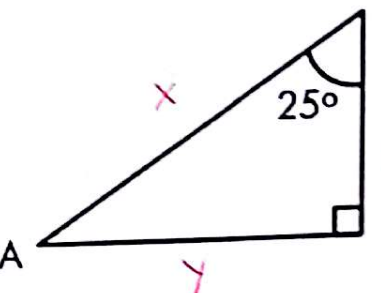
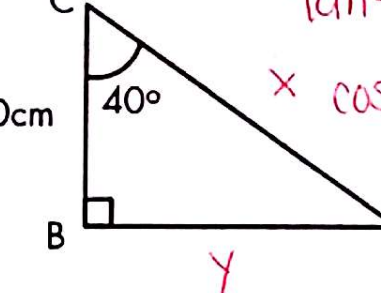
An inverse sine, cosine, or tangent "Undoes" the sine, cosine, or tangent, allowing us to solve for more variables.

Use a calculator for exercises 16-33. Round your answers to 3 decimal places.

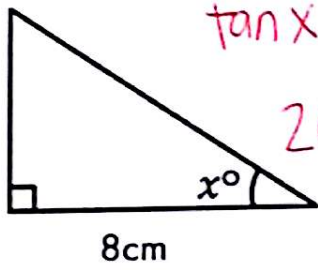
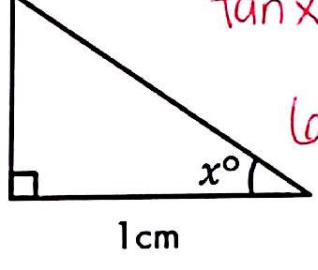
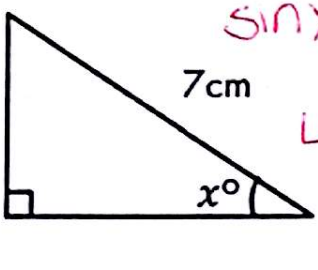
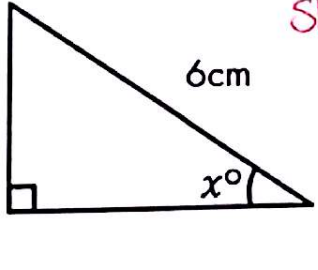
13.  $\sin^{-1}(.5)$  30
14.  $\cos^{-1}(.25)$  75.522
15.  $\sin^{-1}(\frac{8}{17})$  28.072
16.  $\cos^{-1}(\frac{15}{17})$  28.072
17.  $\tan^{-1}(\frac{5}{12})$  22.620
18.  $\tan^{-1}(\frac{17}{13})$  52.595

## Concept 2: Trig Ratios-Solving for Missing Piece

Find the remaining two side lengths using sine, cosine, and tangent

<p>1. </p> <p><math>\sin 30 = \frac{x}{6}</math>  <math>\cos 30 = \frac{y}{6}</math>  <math>x = 3 \text{ cm}</math>  <math>y = 5.2 \text{ cm}</math></p>	<p>2. </p> <p><math>\sin 20 = \frac{x}{9}</math>  <math>\cos 20 = \frac{y}{9}</math>  <math>x = 3.1 \text{ cm}</math>  <math>y = 8.5 \text{ cm}</math></p>
<p>3. </p> <p><math>\tan 25 = \frac{12}{y}</math>  <math>\cos 25 = \frac{12}{x}</math>  <math>x = 13.2 \text{ cm}</math>  <math>y = 5.6 \text{ cm}</math></p>	<p>4. </p> <p><math>\tan 40 = \frac{10}{y}</math>  <math>\cos 40 = \frac{10}{x}</math>  <math>x = 13.1 \text{ cm}</math>  <math>y = 8.4 \text{ cm}</math></p>

Find the missing angle x.

<p>1. </p> <p><math>\tan x = \frac{4}{8}</math>  <math>26.6^\circ</math></p>	<p>2. </p> <p><math>\tan x = \frac{2}{1}</math>  <math>63.4^\circ</math></p>
<p>3. </p> <p><math>\sin x = \frac{5}{7}</math>  <math>45.6^\circ</math></p>	<p>4. </p> <p><math>\sin x = \frac{3}{6}</math>  <math>30^\circ</math></p>

Find each angle measure to the nearest degree.

5.  $\sin y = 0.766$

$50^\circ$

6.  $\tan w = 1$

$45^\circ$

7.  $\cos v = 0.7314$

$43^\circ$

8.  $\cos b = 0.9925$

$7^\circ$

9.  $\tan w = 3.0777$

$72^\circ$

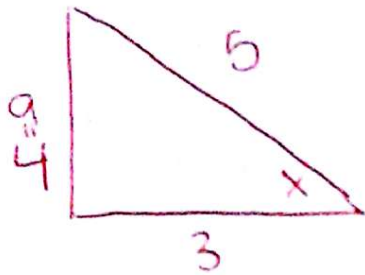
10.  $\sin z = 0.9986$

$87^\circ$



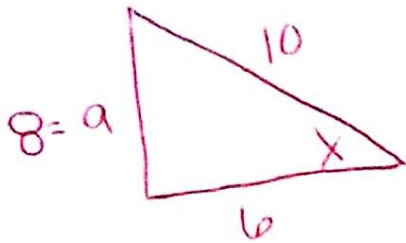
### Concept 3 Complementary Angles

1. If  $\cos x = \frac{3}{5}$ , what is the  $\sin x = \frac{4}{5}$



$$a^2 + 3^2 = 5^2 \quad a = 4$$

3. If  $\cos x = \frac{6}{10}$ , what is the  $\tan x = \frac{8}{6}$

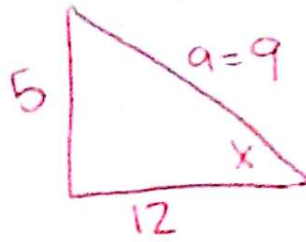


$$a^2 + 6^2 = 10^2$$

$$a^2 + 36 = 100$$

$$a^2 = 64 \quad a = 8$$

2. If  $\tan x = \frac{5}{12}$ , what is the  $\sin x = \frac{5}{13}$



$$5^2 + 12^2 = a^2$$

$$25 + 144 = a^2$$

$$169 = a^2 \quad a = 13$$

4. If  $\sin x = \frac{3}{6}$ , what is the  $\cos x = \frac{\sqrt{27}}{6}$



$$a = \sqrt{27}$$

$$3^2 + a^2 = 6^2$$

$$9 + a^2 = 36$$

$$a^2 = 27$$

$$a = \sqrt{27}$$

Complementary Angles: Two angles that add to 90 degrees. The two acute angles in a right triangle are complementary since all three angles must add up to 180 degrees.

Sine and Cosine are what is called "cofunctions" which means that the sine of one angle is equal to the cosine of that angle's complement and vice versa.

EXAMPLE:  $\sin(30) = \cos(60)$  or  $\cos(42) = \sin(48)$

Rewrite each equation using complements and the other trig function.

5.  $\cos 8^\circ = \underline{\sin(82^\circ)}$

6.  $\sin 47^\circ = \underline{\cos(43^\circ)}$

7.  $\sin 1^\circ = \underline{\cos(89^\circ)}$

8.  $\cos 33^\circ = \underline{\sin(57^\circ)}$

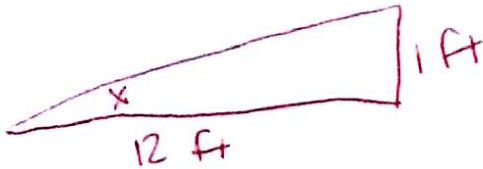
9.  $\sin 13^\circ = \underline{\cos(77^\circ)}$

10.  $\sin x^\circ = \underline{\cos(90 - x^\circ)}$

### Concept 4: Trig Story Problems

For each of the following, draw a picture and then solve for the missing variable.

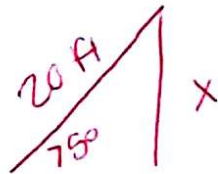
1. According to the Americans With Disabilities Act, a ramp can rise no more than 1 ft. for every 12 ft. of horizontal distance. What is the maximum angle that the ramp can form with the ground?



$$\tan x = \frac{1}{12}$$

$$4.8^\circ$$

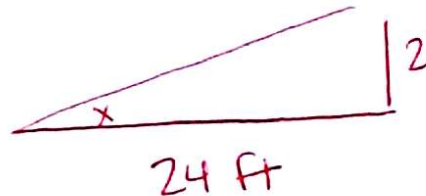
2. To guard against fall, a ladder should make an angle of  $75^\circ$  or less with the ground. What is the maximum height that a 20 foot ladder can reach safely?



$$\sin 75 = \frac{x}{20}$$

$$19.3 \text{ ft}$$

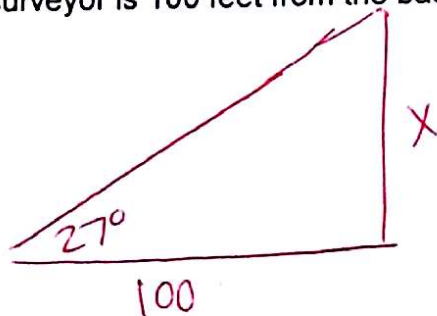
3. Mr. Boone is building a wooden ramp to allow people who use wheelchairs easier access to the public library. The ramp must be 2 ft tall. Find the angle of elevation if the ramp begins 24 ft away from the library.



$$\tan x = \frac{2}{24}$$

$$4.8^\circ$$

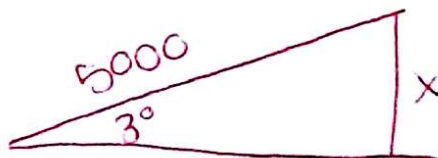
4. A forest ranger sights a tree through a surveying instrument. The angle of elevation to the top of the tree is  $27^\circ$ . The surveyor is 100 feet from the base of the tree. How tall is the tree?



$$\tan 27 = \frac{x}{100}$$

$$51 \text{ ft}$$

5. A train travels 5000 meters along a track whose angle of elevation has a measurement of  $3^\circ$ . How much did the train rise during this distance.

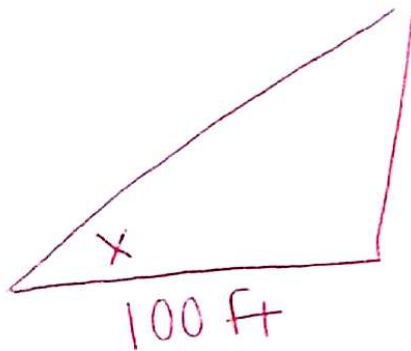


$$\sin 3 = \frac{x}{5000}$$

$$261.7 \text{ ft}$$

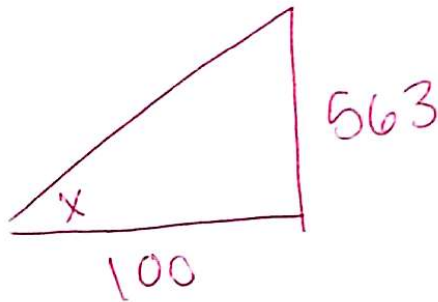
6. The heights of several tourist attractions are given in below. Find the angle of elevation from a point 100 feet from the base of each attraction to its top.

a. Gateway to the West Arch, St. Louis 1368 ft.



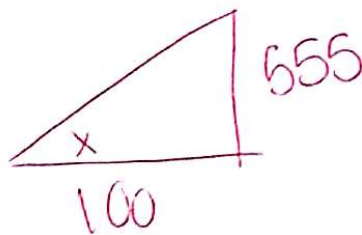
$$\tan x = \frac{1368}{100}$$
$$x = 85.8^\circ$$

b. Chief Crazy Horse Statue, South Dakota 563 ft.



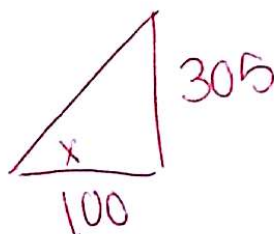
$$\tan x = \frac{563}{100}$$
$$x = 79.9^\circ$$

c. Washington Monument, Washington, D.C. 555 ft.



$$\tan x = \frac{555}{100}$$
$$x = 79.8^\circ$$

d. Statue of Liberty, New York City 305 ft.



$$\tan x = \frac{305}{100}$$
$$x = 71.8^\circ$$