

Name: \_\_\_\_\_

Class Period: \_\_\_\_\_

## Precalculus - Unit 1 Day 3

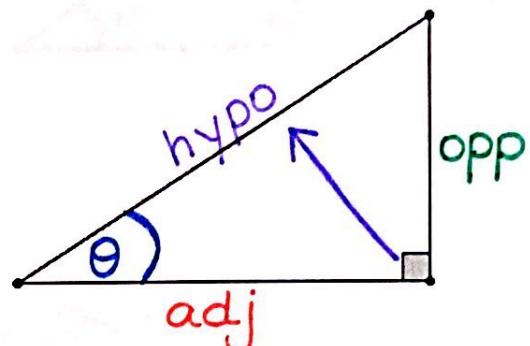
# Right Triangle Trigonometry

SHTCATA

The six trigonometric functions of a right triangle, with an acute angle  $\theta$ , are defined by the **ratios** of two sides of the triangle.

The sides of the right triangle are:

- The side opposite the acute angle  $\theta$ ,
- The side adjacent to the acute angle  $\theta$ ,
- And the hypotenuse of the right triangle.



The six trigonometric functions are:

$$\sin = \frac{\text{opp}}{\text{hypo}}$$

$$\cos = \frac{\text{adj}}{\text{hypo}}$$

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

$$\csc = \frac{\text{hypo}}{\text{opp}}$$

$$\sec = \frac{\text{hypo}}{\text{adj}}$$

$$\cot = \frac{\text{adj}}{\text{opp}}$$

Reciprocal functions: another way to look at it:

$$\sin \theta = \frac{1}{\csc \theta}$$

$$\cos \theta = \frac{1}{\sec \theta}$$

$$\tan \theta = \frac{1}{\cot \theta}$$

$$\csc \theta = \frac{1}{\sin \theta}$$

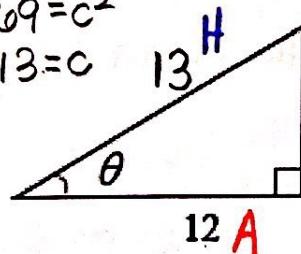
$$\sec \theta = \frac{1}{\cos \theta}$$

$$\cot \theta = \frac{1}{\tan \theta}$$

Given two sides of a right triangle, you should be able to find the value of all six trigonometric functions.

$$5^2 + 12^2 = c^2$$

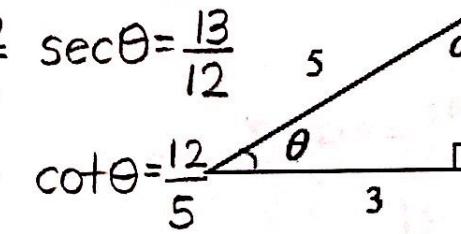
$$169 = c^2$$



$$\sin \theta = \frac{5}{13} \quad \csc \theta = \frac{13}{5}$$

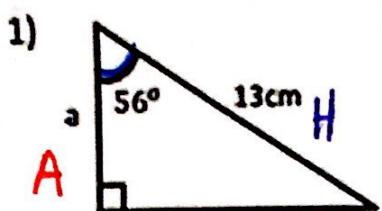
$$\cos \theta = \frac{12}{13} \quad \sec \theta = \frac{13}{12}$$

$$\tan \theta = \frac{5}{12} \quad \cot \theta = \frac{12}{5}$$



$$\begin{aligned} \sin \alpha &= \frac{4}{5} & \sin \alpha &= \frac{3}{5} \\ \csc \alpha &= \frac{5}{4} & \csc \alpha &= \frac{5}{3} \\ \cos \alpha &= \frac{3}{5} & \cos \alpha &= \frac{4}{5} \\ \sec \alpha &= \frac{5}{3} & \sec \alpha &= \frac{5}{4} \\ \tan \alpha &= \frac{4}{3} & \tan \alpha &= \frac{3}{4} \\ \cot \alpha &= \frac{3}{4} & \cot \alpha &= \frac{4}{3} \end{aligned}$$

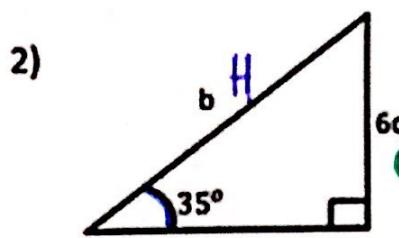
### A. Solve for Missing Sides



$$\cos 56^\circ = \frac{a}{13}$$

$$13 \cos 56^\circ = a$$

$$a = 7.270$$

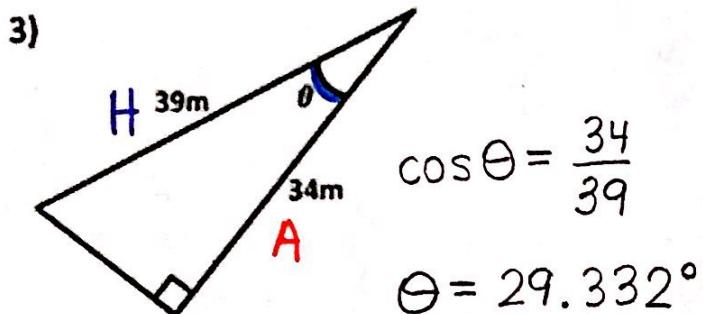


$$\sin 35^\circ = \frac{6}{b}$$

$$b = \frac{6}{\sin 35^\circ}$$

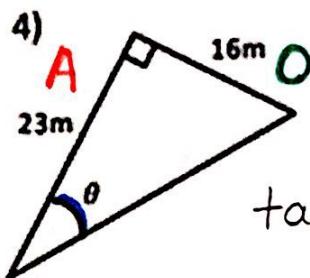
$$b = 10.461$$

### B. Solve for Missing Angles



$$\cos \theta = \frac{34}{39}$$

$$\theta = 29.332^\circ$$

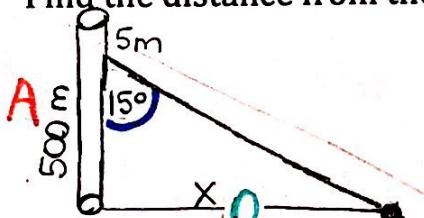


$$\tan \theta = \frac{16}{23}$$

$$\theta = 34.824^\circ$$

### C. Applications

5. To secure a 500-meter radio tower against high winds, guy wires are attached to a ring 5 meters from the top of the tower. The wires form a  $15^\circ$  angle with the tower. Find the distance from the tower to the guy wire anchor in the ground.



$$\tan 15^\circ = \frac{x}{495} \quad x = 132.635 \text{ m}$$

$$495 \tan 15^\circ = x$$

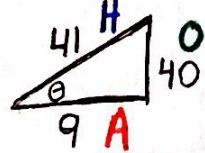
6. A trolley car track rises vertically 40 feet over a horizontal distance of 630 feet. What is the angle of elevation of the track?



$$\tan \theta = \frac{40}{630} \quad \theta = 3.633^\circ$$

### D. Find Remaining Ratios

$$7. \csc \theta = \frac{41}{40}$$



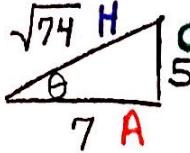
$$\sin \theta = \frac{40}{41}$$

$$\cos \theta = \frac{9}{41}$$

$$\tan \theta = \frac{40}{9}$$

$$\cot \theta = \frac{9}{40}$$

$$8. \tan \theta = \frac{5}{7}$$



$$\sin \theta = \frac{5\sqrt{74}}{74}$$

$$\csc \theta = \frac{\sqrt{74}}{5}$$

$$\cos \theta = \frac{7\sqrt{74}}{74}$$

$$\sec \theta = \frac{\sqrt{74}}{7}$$

$$\cot \theta = \frac{7}{5}$$