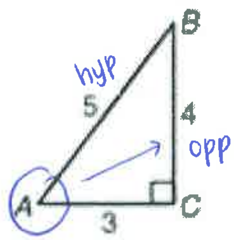
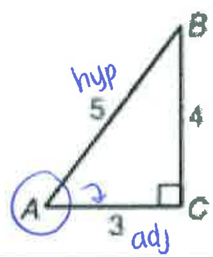
Geometry H
Section 7.6 Notes – Sine and Cosine Ratio

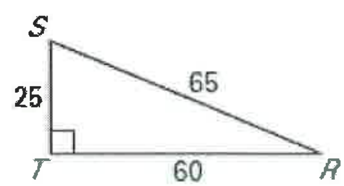
Name : Key
Date : ____________ Period : ______

LEARNING TARGETS
- I can identify sine and cosine ratios in right triangles.
- I can use sine and cosine ratios to find missing side lengths in right triangles.
- I can apply trigonometric ratios to real-world problems.

Trigonometric Ratios	
Let ΔABC be a right triangle with acute $\angle A$, then the sine of $\angle A$ (abbreviated sin$A$) is defined as: $\sin A = \dfrac{\textit{length of leg opposite } \angle A}{\textit{length of hypotenuse}}$	 $\sin A = \frac{opp}{hyp} = \frac{4}{5}$ $\sin A = 0.8$
Let ΔABC be a right triangle with acute $\angle A$, then the cosine of $\angle A$ (abbreviated cos$A$) is defined as: $\cos A = \dfrac{\textit{length of leg adjacent to } \angle A}{\textit{length of hypotenuse}}$	 $\cos A = \frac{adj}{hyp} = \frac{3}{5}$ $\cos A = 0.6$

Example 1 : Finding trigonometric ratios

Write each trigonometric ratio as a fraction and as a decimal rounded to four decimal places.



a) $sinR = \frac{opp}{hyp} = \frac{25}{65} = \frac{5}{13}$

$\sin R = 0.3846$

b) $cosR = \frac{60}{65} = \frac{12}{13}$

$\cos R = 0.9231$

d) $sinS = \frac{60}{65} = \frac{12}{13}$

$\sin S = 0.9231$

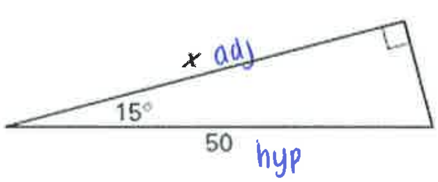
e) $cosS = \frac{25}{65} = \frac{5}{13}$

$\cos S = 0.3846$

We can use scientific and graphing calculators to calculate a trigonometric ratio! Since the angle measures of right triangles are measured in degrees, we need to make sure that our calculator mode is set to DEGREES!!!!

Example 2: Using Trigonometric Ratios to Find Lengths.

a) Find the value of x.

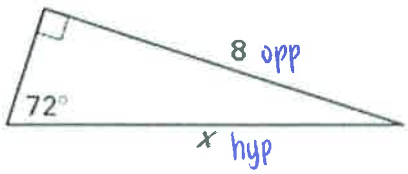


$\frac{\cos 15}{1} = \frac{x}{50}$

$x = 50 \cdot \cos 15$

$\boxed{x = 48.3}$

b) Find the value of x.



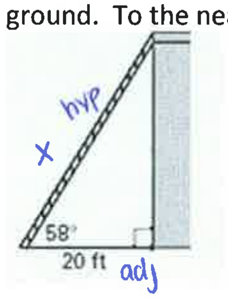
$$\frac{\sin 72}{1}=\frac{8}{x}$$

$$\frac{8}{\sin 72}=\frac{x\cdot\cancel{\sin 72}}{\cancel{\sin 72}}$$

$$x=\frac{8}{\sin 72}=\boxed{8.4}$$

Example 4 : Applying Trigonometric Ratios to Real World Situations

a) A rope staked 20 feet from the base of a building goes to the roof and forms an angle of 58° with the ground. To the nearest tenth of a foot, how long is the rope?

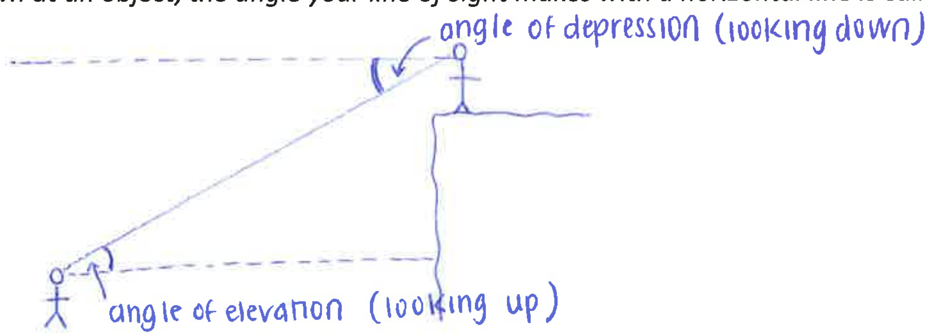


$$\frac{\cos 58}{1}=\frac{20}{x}$$

$$\frac{20}{\cos 58}=\frac{x\,\cancel{\cos 58}}{\cancel{\cos 58}}$$

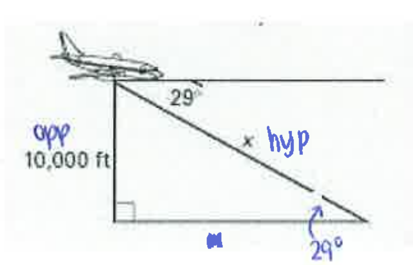
$$x=\frac{20}{\cos 58}\approx\boxed{37.7\text{ ft}}$$

*If you look up at an object, the angle your line of sight makes with a horizontal line is called the **angle of elevation**. If you look down at an object, the angle your line of sight makes with a horizontal line is called the **angle of depression.***



*Since they form a pair of alternate interior angles within parallel lines, **angle of elevation = angle of depression***

b) A pilot is looking at an airport from her plane. The angle of depression is 29°. If the plane is at an altitude of 10,000 feet, approximately how far is it from the airport?

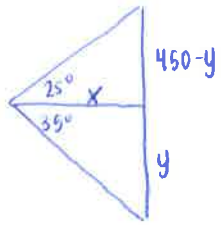


$$\frac{\sin 29}{1}=\frac{10000}{x}$$

$$\frac{10000}{\sin 29}=\frac{x\,\cancel{\sin 29}}{\cancel{\sin 29}}$$

$$x=\frac{10000}{\sin 29}=\boxed{20626.7\text{ ft}}$$

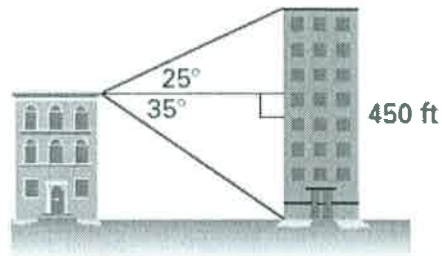
c) A 450 foot tall building is near a shorter building. A person on top of the shorter building finds the angle of elevation of the roof of the taller building to be 25 and the angle of depression of its base to be 35. How far apart are the two buildings to the nearest foot? How tall is the shorter building to the nearest foot?



Top Δ: $\frac{\tan 25}{1} = \frac{450-y}{x}$

$450 - y = x \tan 25$

$450 - x \tan 25 = y$



Bottom Δ: $\frac{\tan 35}{1} = \frac{y}{x}$

$y = x \tan 35$

Since both equations are equal to y, we can set them equal to each other:

$450 - x \tan 25 = x \tan 35$

$450 = x \tan 35 + x \tan 25$

$450 = x(\tan 35 + \tan 25)$

$x = \frac{450}{\tan 35 + \tan 25}$

$x = 385.8$

The buildings are about 386 ft apart

$y = x \tan 35$

$y = 385.8 \cdot \tan 35$

$y = 270.1$

The shorter building is about 270 ft tall