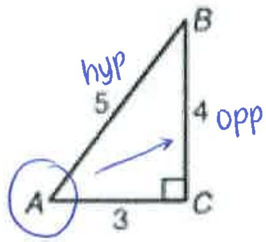
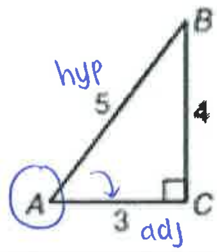
Geometry A　　　　　　　　　　　　　　　　　　Name: Key

7.6 : Apply Sine and Cosine Ratios Notes　　　　　Date: ____________ Period: ________

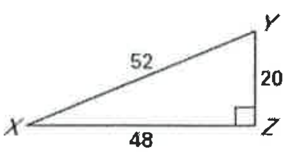
- I can identify sine and cosine ratios in right triangles.
- I can use sine and cosine ratios to find missing side lengths in right triangles.
- I can apply trigonometric ratios to real-world problems.

In the last section, we looked at the tangent ratio for an acute angle in a right triangle, which involved only the lengths of the two legs of a right triangle. The **sine** and **cosine** ratios are ratios for acute angles in right triangles that involve the length of a leg and the hypotenuse of the right triangle.

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

Example 1: Find sine ratios

Find sin$X$ and sin$Y$. Write each answer as a fraction in simplest form and as a decimal rounded to four places.

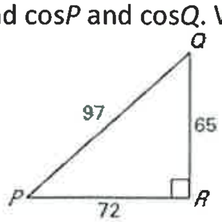


$\sin X = \dfrac{opp}{hyp} = \dfrac{20}{52} = \dfrac{5}{13}$ or $\sin X = 0.3846$

$\sin Y = \dfrac{opp}{hyp} = \dfrac{48}{52} = \dfrac{12}{13}$ or $\sin Y = 0.9231$

Example 2: Find cosine ratios.

Find cos$P$ and cos$Q$. Write each answer as a fraction in simplest form and as a decimal rounded to four places.



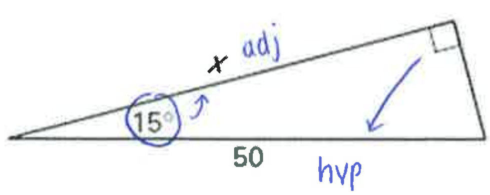
$\cos P = \dfrac{adj}{hyp} = \dfrac{72}{97}$ or $\cos P = 0.7423$

$\cos Q = \dfrac{65}{97}$ or $\cos Q = 0.6701$

Example 3: Use trigonometric ratios to find side lengths

Use a trigonometric ratio to find the value of x in the diagram. Round answer to nearest tenth.

a)

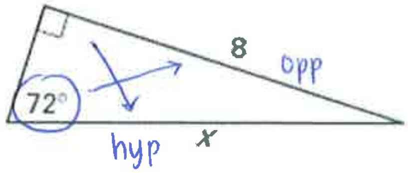


$\dfrac{\cos(15)}{1} = \dfrac{x}{50}$

$x = 50 \cdot \cos 15$

$\boxed{x = 48.3}$

b)

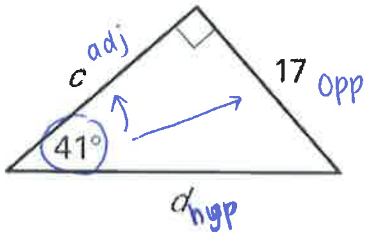


$$\frac{\sin 72}{1} = \frac{8}{x}$$

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

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

c)



$$\frac{\tan 41}{1} = \frac{17}{c}$$

$$\frac{17}{\tan 41} = \frac{c \cdot \cancel{\tan 41}}{\cancel{\tan 41}}$$

$$c = \frac{17}{\tan 41} \approx \boxed{19.6 = c}$$

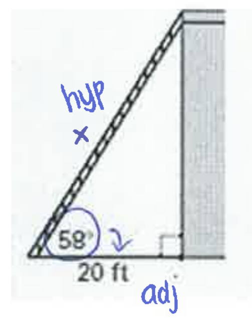
$$\frac{\sin 41}{1} = \frac{17}{d}$$

$$\frac{17}{\sin 41} = \frac{d \cdot \cancel{\sin 41}}{\cancel{\sin 41}}$$

$$d = \frac{17}{\sin 41} \approx \boxed{25.9 = d}$$

Example 4: Apply 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?



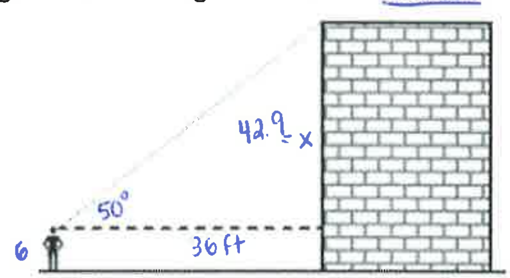
$$\frac{\cos 58}{1} = \frac{20}{x}$$

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

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

The rope is 37.7 ft long

b) Michael, whose eyes are six feet off the ground, is standing 36 feet away from the base of the building, and he looks up at a 50° angle of elevation to a point on the edge of the building's roof. To the nearest foot, how tall is the building?



$$\frac{\tan 50°}{1} = \frac{x}{36}$$

$$x = 36 \cdot \tan 50$$

$$x = 42.9$$

Height = 42.9 + 6 (height of Michael)

= 48.9 ft

≈ 49 ft tall