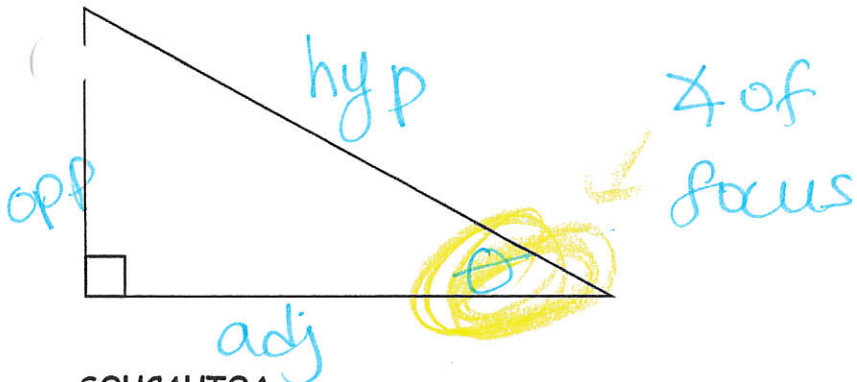


What do I remember about Right Triangle Trigonometry??

Key



1. Label one of the acute angles with  $\theta$ .
2. Label the sides of the triangle with "opposite", "adjacent" and "hypotenuse"
3. Write the trig ratios below

SOHCAHTOA

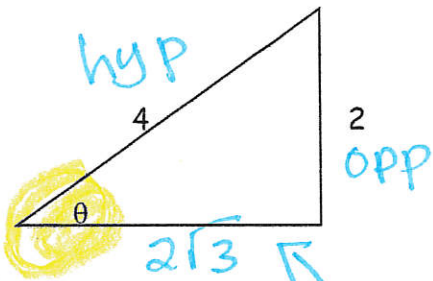
$$\sin \theta = \frac{\text{opp}}{\text{hyp}} \quad \cos \theta = \frac{\text{adj}}{\text{hyp}} \quad \tan \theta = \frac{\text{opp}}{\text{adj}}$$

The following trig ratios are the reciprocals of the three ratios written above...

$$\csc \theta = \frac{\text{hyp}}{\text{opp}} \quad \sec \theta = \frac{\text{hyp}}{\text{adj}} \quad \cot \theta = \frac{\text{adj}}{\text{opp}}$$

Example 1

Find the six trigonometric functions of  $\theta$  as shown in the figure. Give exact values, no decimals.

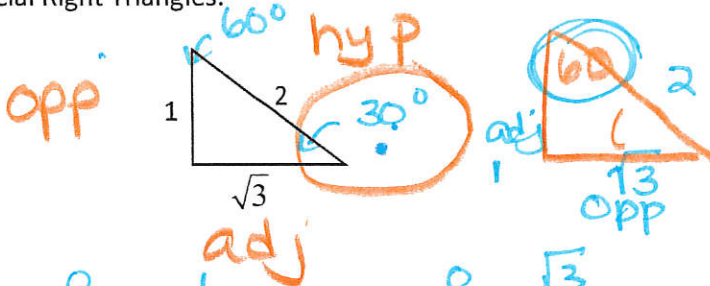


$\sin \theta = \frac{2}{4} = \frac{1}{2}$	$\cos \theta = \frac{2\sqrt{3}-\sqrt{3}}{4} = \frac{\sqrt{3}}{2}$	$\tan \theta = \frac{2}{2\sqrt{3}-\sqrt{3}} = \frac{\sqrt{3}}{3}$
$\csc \theta = \frac{4}{2} = 2$	$\sec \theta = \frac{4}{2\sqrt{3}-\sqrt{3}} = \frac{4}{\sqrt{3}}$	$\cot \theta = \frac{2\sqrt{3}-\sqrt{3}}{2} = \sqrt{3}$

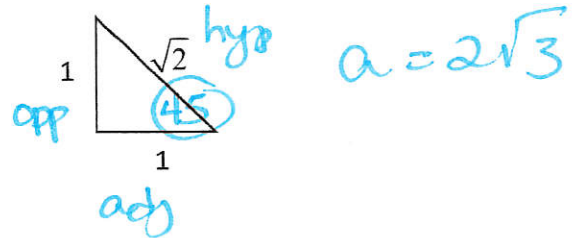
What is  $\theta$ ? \_\_\_\_\_

use P.T.  $a^2 + b^2 = c^2$   $a^2 = 12$   
 $a^2 + 2^2 = 4^2$   $a = \sqrt{12}$   
 $a = 2\sqrt{3}$

Special Right Triangles:



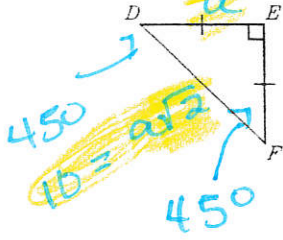
$$\begin{aligned} \sin 30^\circ &= \frac{opp}{hyp} = \frac{1}{2} & \sin 60^\circ &= \frac{opp}{hyp} = \frac{\sqrt{3}}{2} \\ \cos 30^\circ &= \frac{adj}{hyp} = \frac{\sqrt{3}}{2} & \cos 60^\circ &= \frac{adj}{hyp} = \frac{1}{2} \\ \tan 30^\circ &= \frac{opp}{adj} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3} & \tan 60^\circ &= \frac{opp}{adj} = \sqrt{3} \end{aligned}$$



$$\begin{aligned} \sin 45^\circ &= \frac{1}{\sqrt{2}} \\ \cos 45^\circ &= \frac{1}{\sqrt{2}} \\ \tan 45^\circ &= 1 \end{aligned}$$

Find the missing sides of the following Special Right Triangles.

3. If  $DF = 10$ , find the length of  $EF$ .

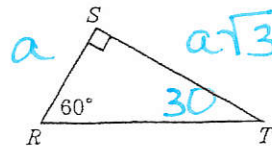


$$10 = a\sqrt{2}$$

$$\frac{10}{\sqrt{2}} = a$$

$$\frac{10\sqrt{2}}{\sqrt{2}\sqrt{2}} = \frac{10\sqrt{2}}{2} = 5\sqrt{2}$$

4. If  $RT = 4$ , find the length of  $ST$  and  $SR$ .



$$2a = 4$$

$$a = 2$$

$$ST = 2\sqrt{3}$$

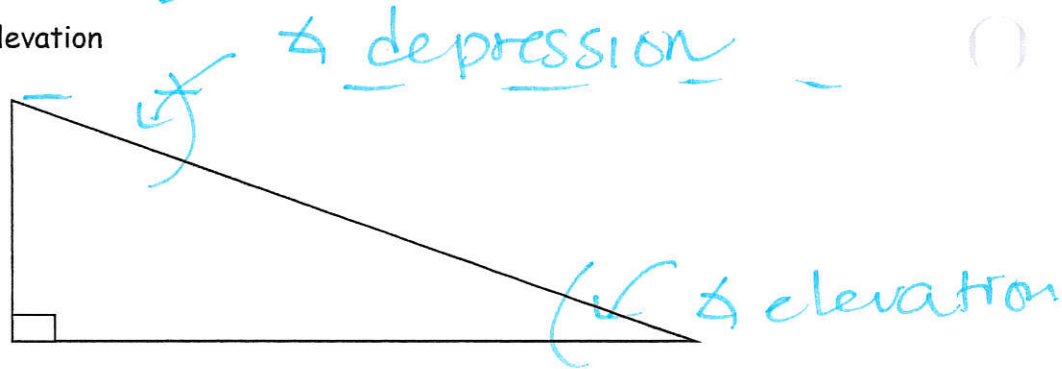
$$SR = 2$$

Fill out the following chart:

	30°	45°	60°
sin $\theta$	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$
cos $\theta$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$
tan $\theta$	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$

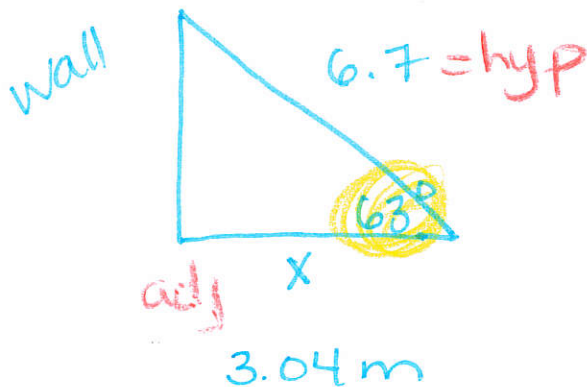
3

Angle of depression vs. Angle of elevation



Now...let's solve some situations (Truncate to 3 decimal places when necessary):

4. You lean a ladder 6.7 meters long against the wall. It makes an angle of  $63^\circ$  with the ground. How far is the ladder from the base of the building?

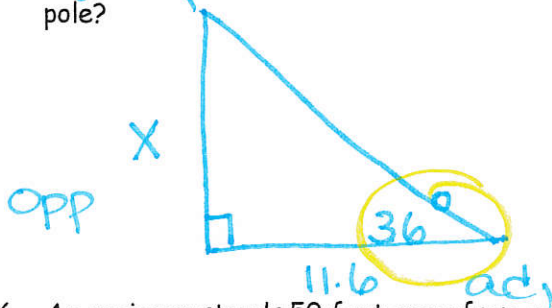


$$\cos 63 = \frac{x}{6.7}$$

$$6.7 \cos 63 = x$$

$$3.04_m = x$$

5. You must order a new rope for the flagpole. To find out what length of rope is needed, you observe that the pole casts a shadow 11.6 meters on the ground. The angle of elevation of the sun is  $36^\circ$ . How tall is the pole?



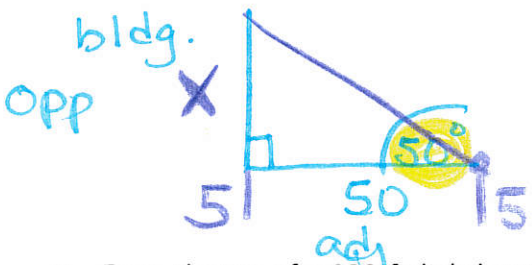
$$\tan 36^\circ = \frac{x}{11.6}$$

8.43 meters

$$11.6 \tan 36 = x$$

$$8.43 = x$$

6. An engineer stands 50 feet away from a building and sights the top of the building with a surveying device mounted on a tripod. If the surveying device is 5 feet above the ground and the angle of elevation is  $50^\circ$ , how tall is the building?



$$\tan 50 = \frac{x}{50}$$

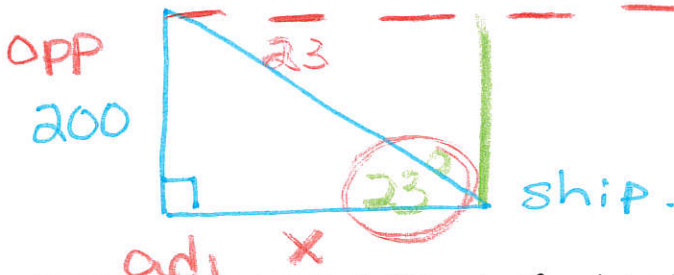
$$x + 5 = 64.6$$

$$50 \tan 50 = x$$

$$x = 59.6 \text{ ft}$$

bldg is 64.6 ft tall.

7. From the top of a 200 ft lighthouse, the angle of depression to a ship in the ocean is  $23^\circ$ . How far is the ship from the base of the lighthouse?



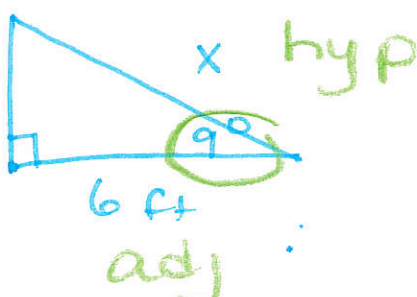
$$\tan 23 = \frac{200}{x}$$

471.2 ft

$$x \tan 23 = 200$$

$$x = 200 / \tan 23$$

8. A ladder leans against the building at a  $9^\circ$  angle made with the ground. If the base of the ladder is 6 ft. from the base of the building, how long is the ladder?



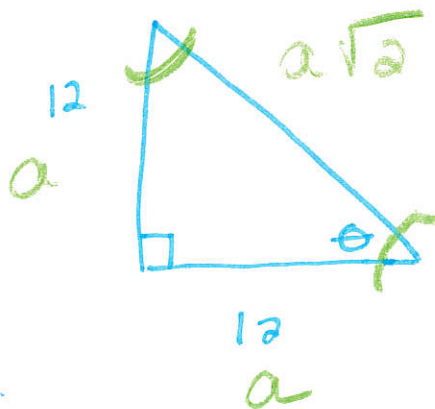
$$\cos 9^\circ = \frac{6}{x}$$

6.07 ft.

$$x \cos 9 = 6$$

$$x = 6 / \cos 9$$

9. A 12-meter flagpole casts a 12-meter shadow. Find the angle of elevation to the sun (degrees).



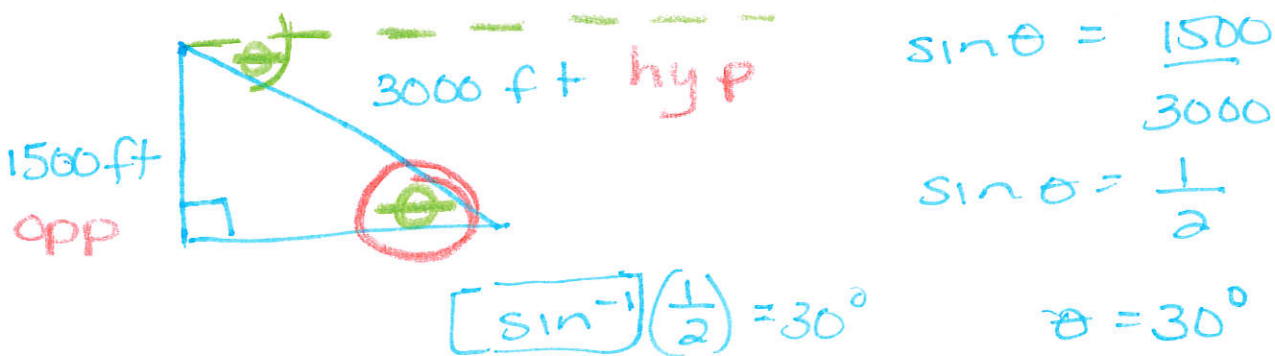
$$\tan \theta = \frac{12}{12} = 1$$

$$\tan^{-1} 1 = 45^\circ$$

10. A ramp  $17\frac{1}{2}$  feet in length rises to a loading platform that is  $3\frac{1}{2}$  feet off the ground. Find the angle that the ramp makes with the ground (degrees). (Hint: This is where you will use the  $\sin^{-1}$  key on the calculator).



11. You are about to ski down a mountain with a vertical height of 1500 feet. The distance from the top of the mountain to the base is 3000 feet. What is your angle of depression from the top to the bottom of the mountain (degrees)?



12. From a point 100 meters away from a building the angle of elevation to the 2<sup>nd</sup> floor window is  $40.5^\circ$  and the angle of elevation to the 5<sup>th</sup> floor window is  $50.2^\circ$ . What is the distance from the 2<sup>nd</sup> floor window to the 5<sup>th</sup> floor window?

