

Review of Trig

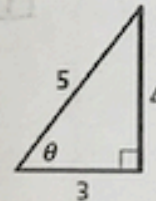
Triangles, angles, +

What are some things we already know about right triangles?

- angle measures sum to  $180^\circ$
- Area =  $\frac{1}{2}bh$
- Isosceles, scalene, equilateral, right triangles
- Right Triangle - has one  $90^\circ$  angle - 2 legs - 1 hypotenuse
- "30-60-90" and "45-45-90" special right triangles
- SOH - CAH - TOA
- Pythagorean Theorem -  $a^2 + b^2 = c^2$
- straight line measures  $180^\circ$
- Acute angle - less than  $90^\circ$
- obtuse angle - greater than  $90^\circ$

**Trigonometric Functions**

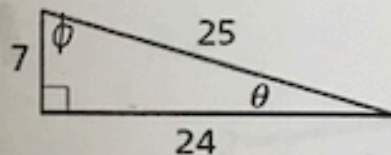
WORDS	NUMBERS	SYMBOLS
The sine (sin) of angle $\theta$ is the ratio of the length of the opposite leg to the length of the hypotenuse.	$\sin \theta = \frac{4}{5}$	$\sin \theta = \frac{\text{opp.}}{\text{hyp.}}$
The cosine (cos) of angle $\theta$ is the ratio of the length of the adjacent leg to the length of the hypotenuse.	$\cos \theta = \frac{3}{5}$	$\cos \theta = \frac{\text{adj.}}{\text{hyp.}}$
The tangent (tan) of angle $\theta$ is the ratio of the length of the opposite leg to the length of the adjacent leg.	$\tan \theta = \frac{4}{3}$	$\tan \theta = \frac{\text{opp.}}{\text{adj.}}$



In the table above, the angle is labeled as  $\theta$ , pronounced "theta". This is a Greek letter commonly used to name angles. Another common angle name is  $\phi$ , pronounced "phi". This is different from geometry courses where you typically called angles "ABC" or with an English letter. This notation will be commonly used in all future math courses.

Example #1:

Find the value of the sine, cosine, and tangent functions for  $\theta$ .

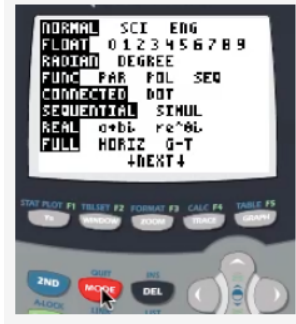


$$\begin{aligned} \sin \theta &= \frac{7}{25} & \sin \phi &= \frac{24}{25} \\ \cos \theta &= \frac{24}{25} & \cos \phi &= \frac{7}{25} \\ \tan \theta &= \frac{7}{24} & \tan \phi &= \frac{24}{7} \end{aligned}$$

You can use your Graphing Calculators to calculate trig ratios of an angle. Notice how on the home screen we have buttons for sine, cosine, and tangent.

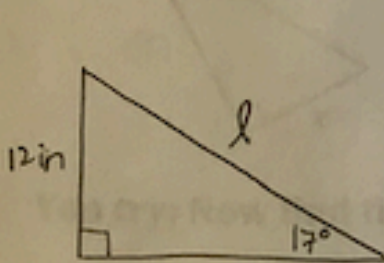


Before you push these buttons, you need to check the MODE of your calculator. Push the MODE button on the top row of your calculator. The following menu will show up. Scroll down to the third row and then use the right arrow to scroll to the word "DEGREE". Push ENTER once DEGREE is highlighted. Then push 2<sup>ND</sup> QUIT to return to the home screen. Your calculator is now ready to solve for trig ratios.



Example #2:

A skateboard ramp will have a height of 12 in., and the angle between the ramp and the ground will be 17°. To the nearest inch, what will be the length  $l$  of the ramp?



$$\sin 17^\circ = \frac{12}{l}$$

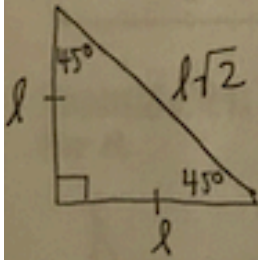
$$l \sin 17^\circ = 12$$

$$l = \frac{12}{\sin 17^\circ} \approx \boxed{41 \text{ in}}$$

You try: A school is constructing a wheelchair ramp from the ground to a deck with a height of 18 in. The angle between the ground and the ramp must be 4.8°. To the nearest inch, what should be the distance  $d$  between the end of the ramp and the deck?  $\approx \boxed{215 \text{ in}}$

## Special Right Triangle Trig Ratios:

### 45-45-90

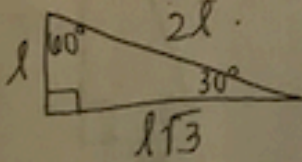


$$\sin 45^\circ = \frac{l}{l\sqrt{2}} = \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\cos 45^\circ = \frac{l}{l\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\tan 45^\circ = \frac{l}{l} = 1$$

### 30-60-90



$$\sin 30^\circ = \frac{l}{2l} = \frac{1}{2}$$

$$\cos 30^\circ = \frac{l\sqrt{3}}{2l} = \frac{\sqrt{3}}{2}$$

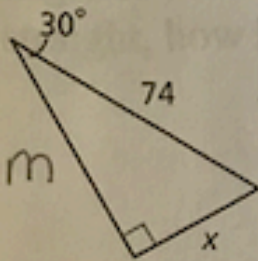
$$\tan 30^\circ = \frac{l}{l\sqrt{3}} = \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

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

You should recall these side lengths from geometry. Since these side lengths are consistent, the trig ratios are also consistent. This means that trig ratios involving 30, 60, or 45 degrees are NonCalculator types of questions.

## Review of Trig

**Example #3:** Use a trig function to find the value of  $x$  without a calculator.



$$\sin 30^\circ = \frac{x}{74}$$

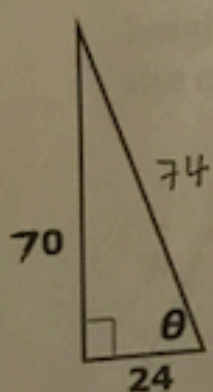
$$\begin{aligned} x &= 74 \sin 30^\circ \\ &= 74 \left( \frac{1}{2} \right) = \boxed{37} \end{aligned}$$

**You try:** Now find the other side length of the triangle.

Instead of just 3 trig ratios, there are actually 6! Each ratio that you've already learned also has a reciprocal. To remember the pairings, remember that each pair has exactly one "co" in it. For instance, cosine's reciprocal must be secant because cosecant also has a "co" in it.

Reciprocal Trigonometric Functions		
WORDS	NUMBERS	SYMBOLS
The cosecant (csc) of angle $\theta$ is the reciprocal of the sine function.	$\csc \theta = \frac{5}{4}$	$\csc \theta = \frac{1}{\sin \theta} = \frac{\text{hyp.}}{\text{opp.}}$
The secant (sec) of angle $\theta$ is the reciprocal of the cosine function.	$\sec \theta = \frac{5}{3}$	$\sec \theta = \frac{1}{\cos \theta} = \frac{\text{hyp.}}{\text{adj.}}$
The cotangent (cot) of angle $\theta$ is the reciprocal of the tangent function.	$\cot \theta = \frac{3}{4}$	$\cot \theta = \frac{1}{\tan \theta} = \frac{\text{adj.}}{\text{opp.}}$

**Example #4: Find the values of the six trigonometric functions for  $\theta$ .**



$$\sin \theta = \frac{70}{74}$$

$$\csc \theta = \frac{74}{70}$$

$$\cos \theta = \frac{24}{74}$$

$$\sec \theta = \frac{74}{24}$$

$$\tan \theta = \frac{70}{24}$$

$$\cot \theta = \frac{24}{70}$$

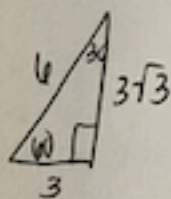
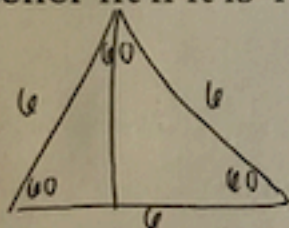
When there is a missing length in a right triangle, remember that we can use Pythagorean Theorem to solve.

Review of Trig

1. A boy flying a kite lets out 300 feet of string that makes an angle of  $38^\circ$  with the ground. Assuming that the string is straight, how high above the ground is the kite?

$$\approx 184.7 \text{ ft.}$$

2. A decorative pin is in the shape of an equilateral triangle. The length of each side is 6 centimeters. Josh will attach the fastener to the back along the height of the pin. Will the fastener fit if it is 4 centimeters long?



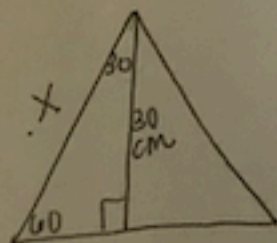
Yes!

$$3\sqrt{3} > 4$$

3. A straight road to the top of a hill is 2500 feet long and makes an angle of  $12^\circ$  with the horizontal. Find the height of the hill.

$$\approx 519.8 \text{ ft.}$$

4. A manufacturer wants to make an equilateral case with a height of 30 centimeters. What is the length of each side of the case? Round to the nearest tenth.



$$20\sqrt{3} \approx 34.6 \text{ cm}$$