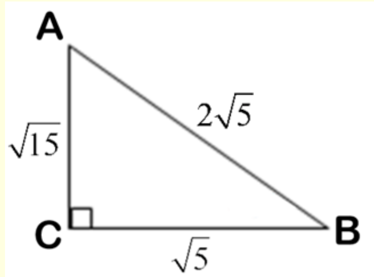
# Warm-Up

Use the triangle below to find measure of angles A & B




$m\angle A = 30^\circ$

$\sin^{-1}\left(\frac{1}{2}\right)$

$\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

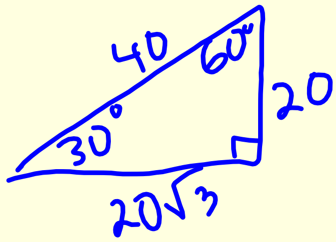
$m\angle B = 60^\circ$

$\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

$\cos^{-1}\left(\frac{1}{2}\right)$

Use your answers from Tuesday's warm-up:

1. sin A = $\frac{1}{2}$
2. sin B = $\frac{\sqrt{3}}{2}$
3. cos A = $\frac{\sqrt{3}}{2}$
4. cos B = $\frac{1}{2}$
5. tan A = $\frac{\sqrt{3}}{3}$
6. tan B = $\sqrt{3}$



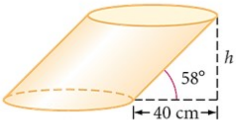

# Homework:

## What questions do you have?

ANSWERS

## 12.2 Exercises

**9.** $h \approx$ ? 64 cm




**10.** According to a Chinese legend from the Han dynasty (206 B.C.E.–220 C.E.), General Han Xin flew a kite over the palace of his enemy to determine the distance between his troops and the palace. If the general let out 800 meters of string and the kite was flying at a 35° angle of elevation, how far away was the palace from General Han Xin's position? approximately 655 m

**11.** Benny is flying a kite directly over his friend Frank, who is 125 meters away. When he holds the kite string down to the ground, the string makes a 39° angle with the level ground. How high is Benny's kite? approximately 101 m





ANSWERS

## 12.2 Exercises

**12.** The angle of elevation from a ship to the top of a 42 meter lighthouse on the shore measures 33°. How far is the ship from the lighthouse? (Assume the horizontal line of sight meets the bottom of the lighthouse.) approximately 65 m

**13.** A salvage ship's sonar locates wreckage at a 12° angle of depression. A diver is lowered 40 meters to the ocean floor. How far does the diver need to walk along the ocean floor to the wreckage? approximately 188 m

**14.** A ship's officer sees a lighthouse at a 42° angle to the path of the ship. After the ship travels 1800 m, the lighthouse is at a 90° angle to the ship's path. What is the distance between the ship and the lighthouse at this second sighting? (h)

approximately 1621 m

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Lesson 12.2 Problem Solving with Right Triangles

ANSWERS

## 12.2 Exercises

**15.** approximately 1570 m

**16a.** approximately 974 m

**b.** approximately 1007 m

**c.** Yes, the height of the balloon would be 1 m less because you don't have to account for the tripod. The distance to a point under the balloon would not change.

**15.** A meteorologist shines a spotlight vertically onto the bottom of a cloud formation. He then places an angle-measuring device 165 meters from the spotlight and measures an 84° angle of elevation from the ground to the spot of light on the clouds. How high are the clouds?

**The distance from the ground to a cloud formation is called the cloud *ceiling*.**

**16.** Meteorologist Wendy Stevens uses a theodolite (an angle-measuring device) on a 1 meter tall tripod to find the height of a weather balloon. She views the balloon at a 44° angle of elevation. A radio signal from the balloon tells her that it is 1400 meters from her theodolite.

a. How high is the balloon? ⓗ

b. How far is she from the point directly below the balloon?

c. If Wendy's theodolite were on the ground rather than on a tripod, would your answers change? Explain your reasoning.





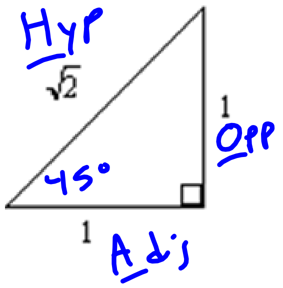
Until now, we have used the calculator to evaluate the sine, cosine, and tangent of an angle. However, it is possible to evaluate the trig functions for certain angles without using a calculator.

This is because there are twospecial triangleswhose side ratios we know! These two triangles are the 45-45-90 triangle and the 30-60-90 triangle.

## 45-45-90 triangles

$$\frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

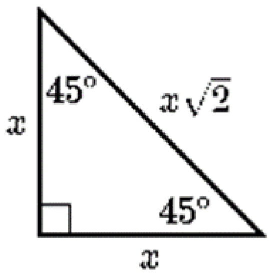
$$\frac{1}{\sqrt{x}} = \frac{\sqrt{x}}{x}$$




This is an isosceles right triangle. As such the sides opposite the same angles are also the same. If a side is, say 1, then by the Pythagorean Theorem the other side, the hypotenuse, is $\sqrt{2}$

$\sin 45° = \frac{opp}{hyp} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$ $\cos 45° = \frac{adj}{hyp} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$ $\tan 45° = \frac{opp}{adj} = \frac{1}{1} = 1$

## 45-45-90 triangles



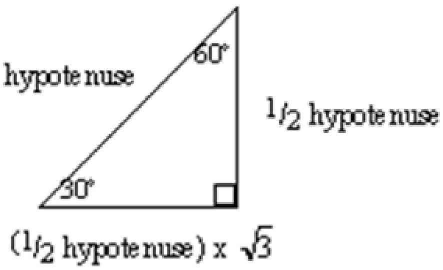

The hypotenuse is the square root of 2 times longer than either leg.

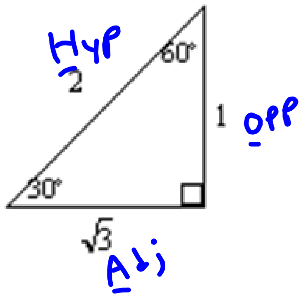
$sin45° = \frac{\cancel{x}}{\cancel{x}\sqrt{2}} = \frac{1}{\sqrt{2}}$ $cos45° = \frac{\cancel{x}}{\cancel{x}\sqrt{2}} = \frac{1}{\sqrt{2}}$ $tan45° = \frac{\cancel{x}}{\cancel{x}} = 1$

$$\boxed{sin45° = \frac{\sqrt{2}}{2} \qquad cos45° = \frac{\sqrt{2}}{2} \qquad tan45° = 1}$$

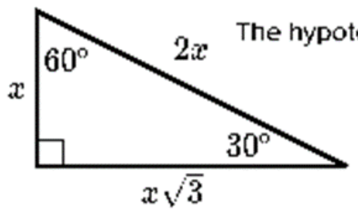
## 30-60-90 triangles

The other special right triangle is the 30-60-90. The values are determined thus: the side opposite the 30° angle is equal to half the value of the hypotenuse; the side opposite the 60° angle is equal to half the hypotenuse times the square root of 3.




### 30-60-90 triangles




The hypotenuse is twice as long as the shortest leg.

The longer leg is the square root of 3 times the shorter leg.

$sin30° = \frac{x}{2x} = \frac{1}{2}$ $cos30° = \frac{\cancel{x}\sqrt{3}}{2\cancel{x}}$ $tan30° = \frac{\cancel{x}}{\cancel{x}\sqrt{3}} = \frac{1}{\sqrt{3}}$

$sin30° = \frac{1}{2}$ $cos30° = \frac{\sqrt{3}}{2}$ $tan30° = \frac{\sqrt{3}}{3}$

$\sin 60 = \frac{x\sqrt{3}}{2x}$ $\cos 60 = \frac{x}{2x}$ $\tan 60 = \frac{\cancel{x}\sqrt{3}}{\cancel{x}}$

$\sin 60 = \frac{\sqrt{3}}{2}$ $\cos 60 = \frac{1}{2}$ $\tan 60 = \sqrt{3}$

**Special Triangles Trigonometry** Name: ____________________

| Angle | SINE | COSINE | TANGENT |
|---|---|---|---|
| **0** | 0 | 1 | 0 |
| **30** | $1/2$ | $\sqrt{3}/2$ | $\sqrt{3}/3$ |
| **45** | $\frac{\sqrt{2}}{2}$ | $\frac{\sqrt{2}}{2}$ | 1 |
| **60** | $\sqrt{3}/2$ | $1/2$ | $\sqrt{3}$ |
| **90** | 1 | 0 | undefined |

**Special Triangles Trigonometry** Name: ____________________

| Angle | SINE | COSINE | TANGENT |
|---|---|---|---|
| **0** | | | |
| **30** | | | |
| **45** | | | |
| **60** | | | |
| **90** | | | |

https://www.geogebra.org/m/zctE8msW#material/VB2SAg8F

# Assignment: Chapter 12 Review Worksheet