

Name: Kley

Date: \_\_\_\_\_

UNIT 6

LESSON 5

AIM: HOW DO WE FIND ANGLES USING SOHCAHTOA?

*Do Now:* The diagram below shows the plans for a cell phone tower. A guy wire attached to the top of the tower makes an angle of 65 degrees with the ground. From a different point on the ground, the angle of elevation to the top of the tower is 32 degrees. If the height of the tower is 88 feet:

a) To the nearest *hundredth of a foot*, determine the distance from point L to point K. (X)

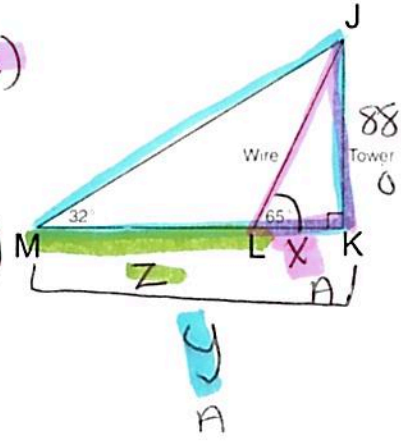
$$\begin{aligned} \tan 65 &= \frac{88}{x} \\ 88 &= x \tan 65 \\ x &= \frac{88}{\tan 65} \\ x &= 41.0353 \\ x &= 41.04 \end{aligned}$$

b) To the nearest *hundredth of a foot*, determine the distance from point M to point K. (y)

$$\begin{aligned} \tan 32 &= \frac{88}{y} \\ 88 &= y \tan 32 \\ y &= \frac{88}{\tan 32} \\ y &= 140.8294 \\ y &= 140.83 \end{aligned}$$

c) To the nearest *foot*, determine and state the distance from point M to point L. (z)

$$\begin{aligned} y - x &= z \\ 140.83 - 41.04 &= 99.79 \end{aligned}$$



HOW DO WE FIND MISSING ANGLES USING SOHCAHTOA?

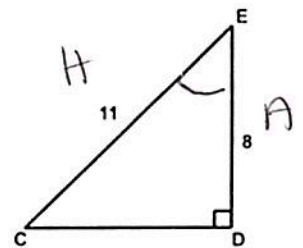
STEPS	EXAMPLE
1. Use SOHCAHTOA to determine which trig function you are using. 2. Set up proportion (see below) $\sin(\text{Angle Measure}) = \frac{\text{opposite}}{\text{hypotenuse}}$ 3. Using the 2 <sup>nd</sup> button in your calculator to get the inverse trig function, enter the ratio. <b>DO NOT CROSS MULTIPLY!</b>	$\sin^{-1}\left(\frac{3}{7}\right) = \sin^{-1}\left(\frac{3}{7}\right)$ $x = 25.4^\circ$ (Handwritten notes: SOHCAHTOA, 2nd button)

**Example 1:** Using your calculator, evaluate each of the following. Round to the nearest whole number. What do you think the purpose of these inverse trig functions are? *+ isolate 'x'!*

$\sin^{-1}(.4384) = 26$      
  $\cos^{-1}(.8290) = 34$      
  $\tan^{-1}(.6009) = 31$

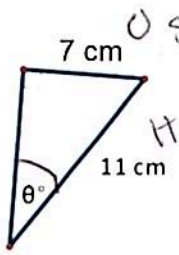
**Example 2:** Given the right triangle below, determine the measure of  $\angle E$  to the nearest degree by using your calculator and one of the inverse trig functions. Show your work and use proper notation.

$$\begin{aligned} \cos^{-1}\left(\frac{8}{11}\right) &= \cos^{-1}\left(\frac{8}{11}\right) \\ E &= 43.3417 \\ E &\approx 43^\circ \end{aligned}$$



**Example 3:** Solve for the missing angle theta,  $\theta$ , to the nearest hundredth of a degree.

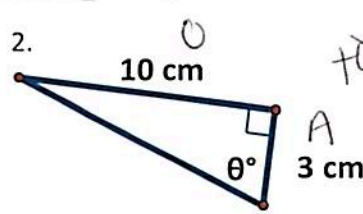
1.



$$\sin^{-1}(\sin \theta) = \left(\frac{7}{11}\right) \sin^{-1}$$

$$\theta = 39.52^\circ$$

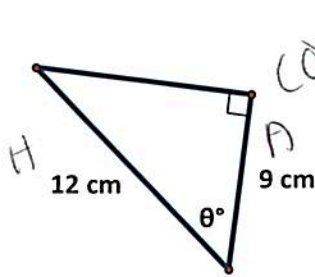
2.



$$\tan^{-1}(\tan \theta) = \left(\frac{3}{10}\right) \tan^{-1}$$

$$\theta = 73.30^\circ$$

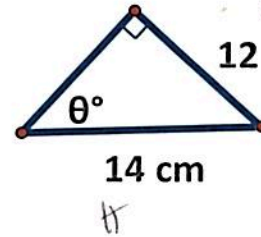
3.



$$\cos^{-1}(\cos \theta) = \left(\frac{9}{12}\right) \cos^{-1}$$

$$\theta = 41.41^\circ$$

4.



$$\sin^{-1}(\sin \theta) = \left(\frac{12}{14}\right) \sin^{-1}$$

$$\theta = 58.991^\circ$$

$$\theta = 59^\circ$$

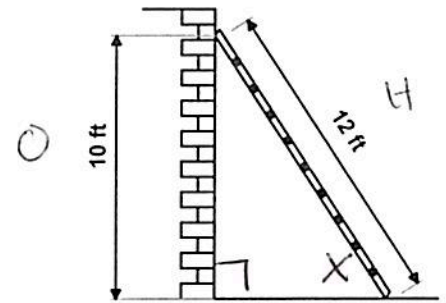
**APPLICATIONS:**

**Example 4:** A ladder will be unstable if the angle it makes with the ground is greater than  $60^\circ$ . If a 12 foot ladder is used to reach a window 10 feet above the ground, will it be unstable? Justify your answer.

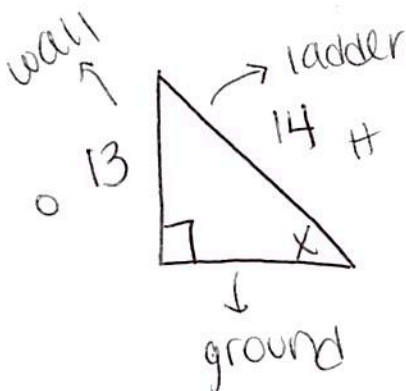
$$\sin^{-1}(\sin x) = \left(\frac{10}{12}\right) \sin^{-1}$$

$$x = 56.4426^\circ$$

It will not be unstable b/c the  $\angle$  of elevation is  $< 60^\circ$



**Example 5:** A 14 foot ladder leans against a wall, reaching 13 feet high on the wall. Determine the measure of the angle formed by the ladder and the ground, to the nearest degree.



$$\sin^{-1}(\sin x) = \left(\frac{13}{14}\right) \sin^{-1}$$

$$x = 68.2132^\circ$$

$$x \approx 68^\circ$$

$$1ft = 12in$$

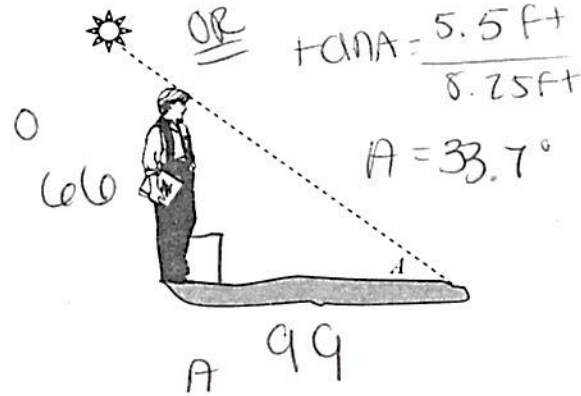
**Example 6:** A boy who is 5 feet 6 inches tall casts a shadow that is 8 feet and 3 inches long. What is the measure of the angle of elevation of the sun,  $A$ , as show in the picture. Round to the nearest tenth. *Be careful with your units in this problem.*

$$5 \times 12 = 60in + 6 = 66in$$

$$8 \times 12 = 96 + 3 = 99in$$

$$\tan^{-1}(\tan A) = \left(\frac{66}{99}\right) \tan^{-1}$$

$$A = 33.7^\circ$$

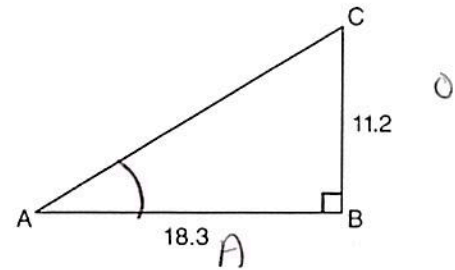


**PRACTICE:**

1. In right triangle  $ABC$  shown below,  $AB = 18.3$  and  $BC = 11.2$ . What is the measure of  $\angle A$ , to the nearest tenth of a degree?

$$\tan^{-1}(\tan A) = \left(\frac{11.2}{18.3}\right) \tan^{-1}$$

$$A = 31.4675$$



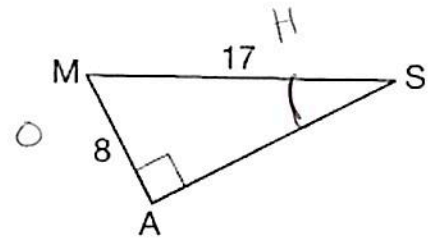
- 1) 31.5
- 2) 37.7
- 3) 52.3
- 4) 58.5

2. In the right triangle shown below, what is the measure of angle  $S$ , to the nearest ~~minute~~ <sup>degree</sup>?

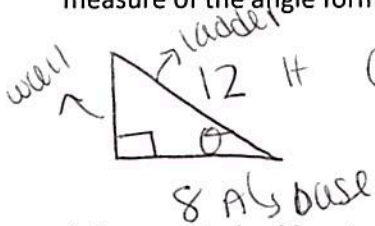
$$\sin^{-1}(\sin S) = \left(\frac{8}{17}\right) \sin^{-1}$$

$$S = 28.0724$$

$$S = 28^\circ$$



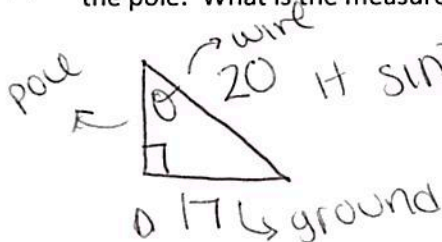
3. A 12 foot ladder leans against a building. The foot of the ladder is 8 feet from the base of the building. Determine the measure of the angle formed by the ladder and the ground, to the nearest degree.



$$\cos^{-1}(\cos \theta) = \left(\frac{8}{12}\right) \cos^{-1}$$

$$\theta = 48.1896 \approx 48^\circ$$

4. A support wire 20 meters long runs from the top of a utility pole to a point on the ground 17 meters from the base of the pole. What is the measure, to the nearest degree, of the angle formed by the pole and the wire?



$$\sin^{-1}(\sin \theta) = \left(\frac{17}{20}\right) \sin^{-1}$$

$$\theta = 58^\circ$$

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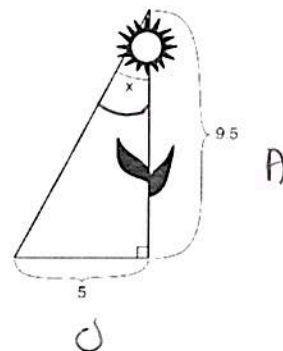
HOMEWORK

1. The diagram below shows the path a bird flies from the top of a 9.5-foot-tall sunflower to a point on the ground 5 feet from the base of the sunflower. To the nearest tenth of a degree, what is the measure of angle  $x$ ?

- 1) 27.8
- 2) 31.8
- 3) 58.2
- 4) 62.2

$$\tan^{-1}(\tan x) = \left(\frac{5}{9.5}\right) \tan^{-1}$$

$$x = 27.7585^\circ$$



2. A 16 feet ladder leans against a wall. The foot of the ladder is 7 feet from the wall. Determine the measure of the angle formed by the ladder and the ground, to the nearest degree.

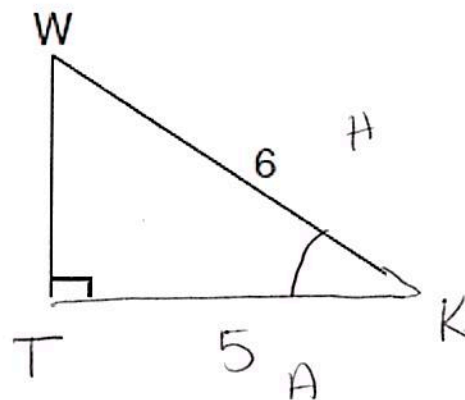
$$\cos^{-1}\left(\frac{7}{16}\right) \cos^{-1}$$

$$\theta = 64.0555 \approx \boxed{64^\circ}$$

3. In the diagram below of right triangle  $KTW$ ,  $KW = 6$ ,  $KT = 5$ , and  $m\angle KTW = 90$ . What is the measure of  $\angle K$ , to the nearest tenth of a degree?

$$\cos^{-1}\left(\frac{5}{6}\right) \cos^{-1}$$

$$\boxed{K = 33.6^\circ}$$



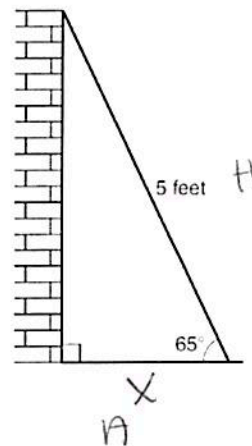
Review Question

4. As shown in the diagram below, a ladder 5 feet long leans against a wall and makes an angle of  $65^\circ$  with the ground. Find, to the nearest tenth of a foot, the distance from the wall to the base of the ladder.

$$\cos 65 = \frac{x}{5}$$

$$x = 5 \cos 65$$

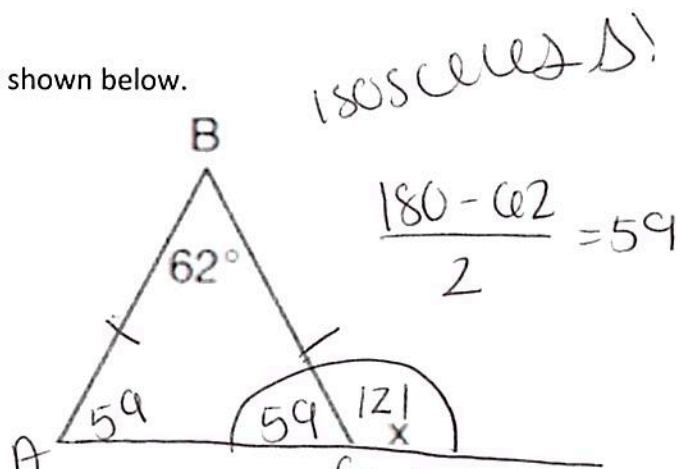
$$\boxed{x = 2.1 \text{ ft}}$$



5. Given  $\triangle ABC$  with  $m\angle B = 62^\circ$  and side  $\overline{AC}$  extended to D, as shown below.

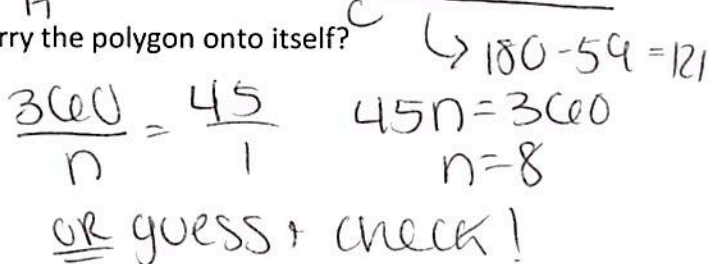
Which value of  $x$  makes  $\overline{AB} \cong \overline{CB}$ ?

- (1)  $59^\circ$
- (2)  $62^\circ$
- (3)  $118^\circ$
- (4)  $121^\circ$

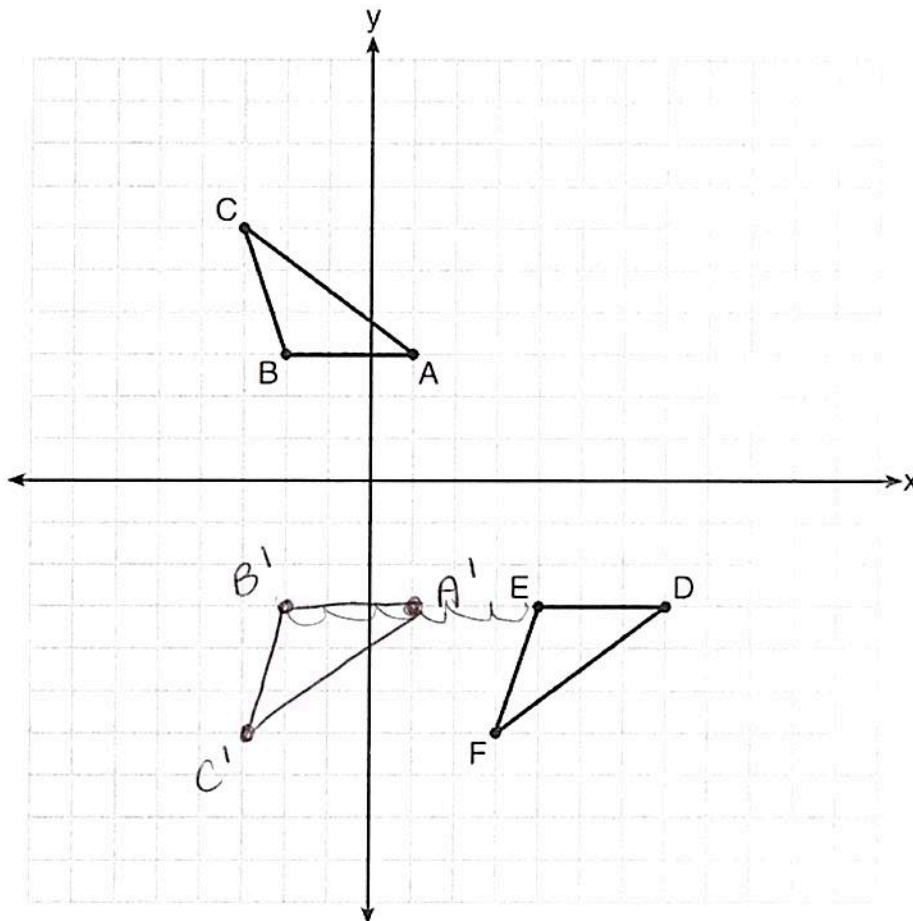


6. Which regular polygon has a minimum rotation of  $45^\circ$  to carry the polygon onto itself?

- (1) octagon
- (2) decagon
- (3) hexagon
- (4) pentagon



7. Describe a sequence of transformations that will map  $\triangle ABC$  onto  $\triangle DEF$  as shown below.



A reflection over the x-axis followed by a translation of right 6 units