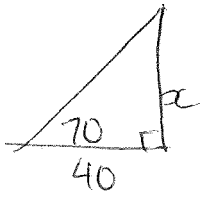
Name: _____ Date: _____

Lesson 1.2 – Applications of Trigonometric Ratios

- Learning Goal: Determine the unknown sides and angles of an acute right triangle

Example 1: You are tasked at measuring the height of a certain tall building. From 40 meters away you can measure the angle to the top of the building is 70 degrees. Find the height of the building.

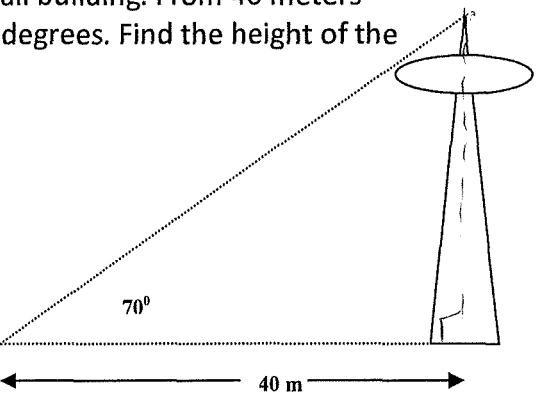


$\tan 70 = \frac{x}{40}$

$x = 40 \tan 70$

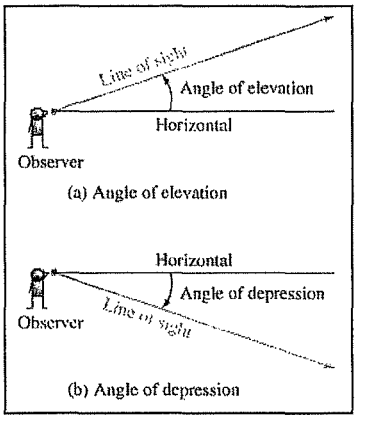
$\doteq 110$ m

∴ The building is 110m tall.



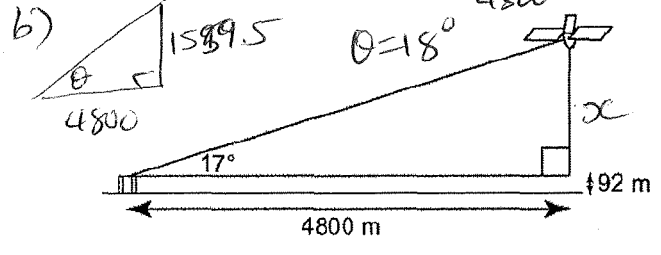
An angle from horizontal looking *up* at an object is an *angle of elevation*

An angle from horizontal looking *down* at an object is an *angle of depression*



Example 2: An air traffic controller is in a control tower 92 m above the ground. He estimates his angle of elevation to a passing airplane to be 17º. The airplane is approximately 4800 m from the control tower.

a) Approximately how high is the airplane above the ground?
b) Determine the approximate angle of elevation from the bottom of the control tower to the airplane.



$\tan\theta = \frac{1559.5}{4800}$

a) $\tan 17 = \frac{x}{4800}$

$x = (4800)(\tan 17)$

$\doteq 1467.5$

∴ The airplane is 1467.5 m + 92 m above the ground. (1559.5 m)

Example 3: A roadway rises 4 m for every 10 m along the road. What is the angle of elevation of the roadway?

$\tan\theta = \frac{4}{10}$

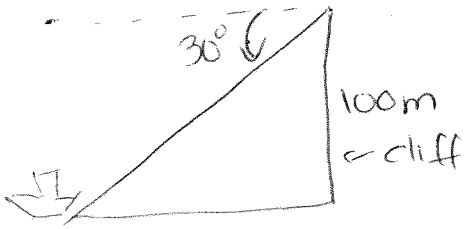
$\theta = \tan^{-1}\left(\frac{4}{10}\right)$

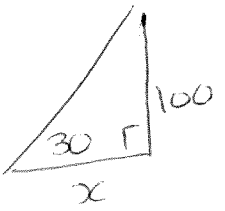
$\doteq 22°$

∴ The angle of elevation is 22°.

Name: _____ Date: _____

Example 4: From the top of a 100 metre cliff, Roger looks at a boat in the lake below. The angle of depression from Roger to the boat is 30°. What is the distance of the boat from the bottom of the cliff?





$\tan 30 = \frac{100}{x}$

$x = \frac{100}{\tan 30}$

$\doteq 173.2$ m

∴ distance from boat to the bottom of cliff was 173.2m

Example 5:

Materials

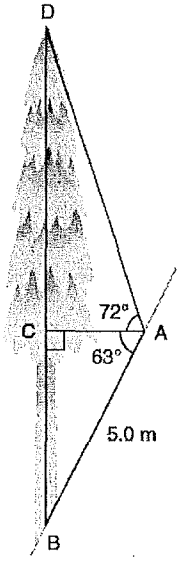
- scientific calculator

Work with a partner.

An arborist uses a clinometer to determine the height of a tree during a hazard evaluation. This diagram shows the arborist's measurements.

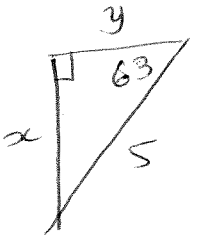
- Use △ABC.
  Determine the lengths of BC and AC.
- Use △ACD.
  Determine the length of CD.
- What is the height of the tree?

For accuracy, keep more decimal places in your calculations than you need in the final answer.



Reflect

- Describe the strategies you used to determine the height of the tree. What angles and trigonometric ratios did you use?
- Compare your results and strategies with another pair. How are they similar? How are they different?



$\sin 63 = \frac{x}{5}$ ← opp / hyp.

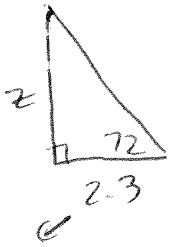
$x = (5)(\sin 63)$

$\doteq 4.5$ m

$\cos 63 = \frac{y}{5}$

$y = 5 \cos 63$

$\doteq 2.3$ m



$\tan 72 = \frac{z}{2.3}$

$z = 2.3 \tan 72$

$\doteq 7.1$ m

∴ height of the tree was 4.5+7.1

$= 11.6$ m