

Geometry

Applications of Trig (Side Lengths)

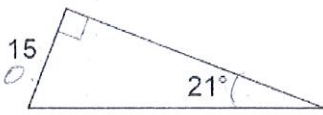
SOHCAHTOA

Name: Key

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

Warm-up: Find the missing side length.

1.



$$\sin 21 = \frac{15}{x}$$

$$x = \frac{15}{\sin 21}$$

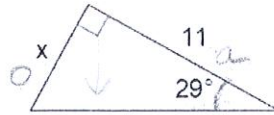
$$x \approx 41.86$$

Elevation vs Depression

The angle of elevation is the angle from the horizontal looking up to some object.

The angle of depression is the angle from the horizontal looking down to some object.

2.

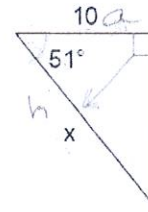


$$\tan 29 = \frac{x}{11}$$

$$11 \tan 29 = x$$

$$x \approx 6.10$$

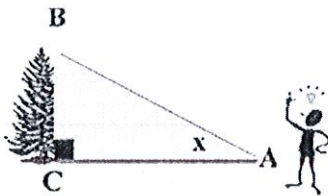
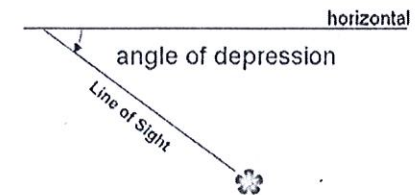
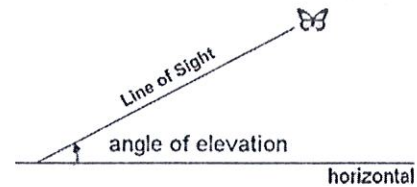
3.



$$\cos 51 = \frac{10}{x}$$

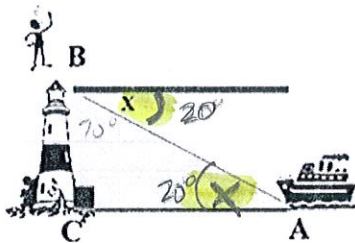
$$x = \frac{10}{\cos 51}$$

$$x \approx 15.89$$



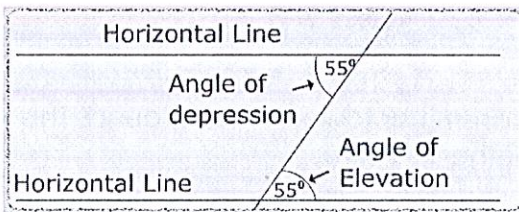
In the diagram at the left, x marks the angle of elevation of the top of the tree as seen from a point on the ground.

It is always inside the triangle.



In the diagram at the left, x marks the angle of depression of a boat at sea from the top of a lighthouse.

It is always outside the triangle.



Why does it appear that an angle of elevation and an angle of depression are the SAME?

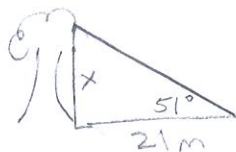
- parallel lines cut by a transversal
- alternate interior angles are congruent

Steps to Solving Trig Word Problems

1. Draw a picture (right triangle)
2. Label the given parts
3. Set up the trig ratio and solve

### Examples.

1. A tree casts a shadow 21 m long. The angle of elevation of the sun is  $51^\circ$ . What is the height of the tree?

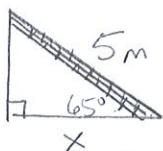


$$\tan 51 = \frac{x}{21}$$

$$21 \tan 51 = x$$

$$x \approx 25.93 \text{ m}$$

2. A ladder 5 m long leans against a vertical wall and makes a  $65^\circ$  angle with the ground. How far is the foot of the ladder from the wall?

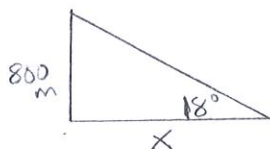


$$\cos 65 = \frac{x}{5}$$

$$5 \cos 65 = x$$

$$x \approx 2.11 \text{ m}$$

3. A small airplane climbs at an angle of  $18^\circ$  with the ground. Find the horizontal distance it has flown when it has reached an altitude of 800 m.

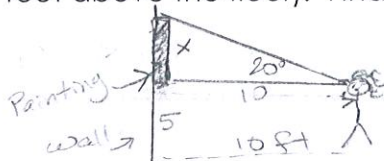


$$\tan 18 = \frac{800}{x}$$

$$x = \frac{800}{\tan 18}$$

$$x \approx 2462.15 \text{ m}$$

4. You are looking at a painting on the wall at the High Museum in Atlanta. You are standing 10 feet from the wall. Your angle of elevation to view the painting is  $20^\circ$ . (Your eyes are about 5 feet above the floor). Find how high the top of the painting is from the floor.



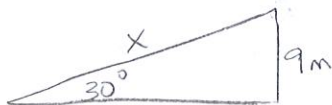
$$\tan 20 = \frac{x}{10}$$

$$10 \tan 20 = x$$

$$x = 3.64 \text{ ft.}$$

$\rightarrow 3.64 + 5$   
It is 8.64 ft from floor to the top of painting.

5. A little boy is flying a kite. The string of the kite makes an angle of  $30^\circ$  with the ground. If the kite is 9 meters in the air, find the length (in meters) of the string the boy used.

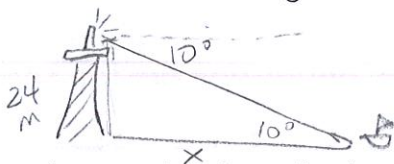


$$\sin 30 = \frac{9}{x}$$

$$x = \frac{9}{\sin 30}$$

$$x = 18 \text{ m}$$

6. An operator at the top of a lighthouse sights a sailboat. The point from which the sighting is made is 24 m above sea level. The angle of depression of the sighting is  $10^\circ$ . How far is the boat from the base of the lighthouse?

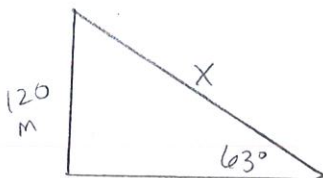


$$\tan 10 = \frac{24}{x}$$

$$x = \frac{24}{\tan 10}$$

$$x \approx 136.11 \text{ m}$$

7. A guy wire reaches from the top of a 120 m television transmitter tower to the ground. The wire makes a  $63^\circ$  angle with the ground. Find the length of the guy wire.



$$\sin 63 = \frac{120}{x}$$

$$x = \frac{120}{\sin 63}$$

$$x \approx 134.68 \text{ m}$$