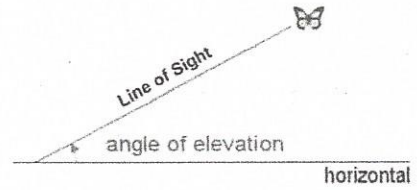MGSE9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Elevation vs **Depression**

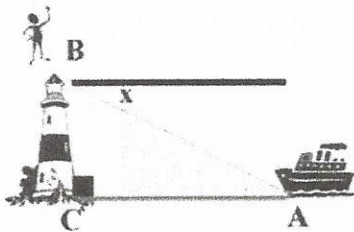The _Angle of Elevation_ is the angle from the horizontal looking up to some object.

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

Line of Sight
angle of elevation
horizontal

angle of depression
Line of Sight
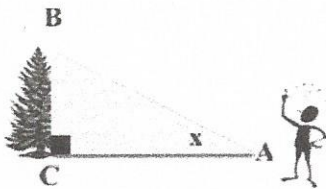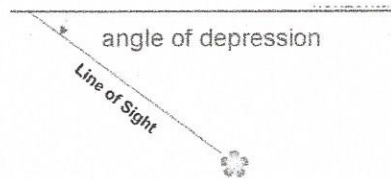
In the diagram at the left, x marks the angle of _elevation_ of the top of the tree as seen from a point on the ground.
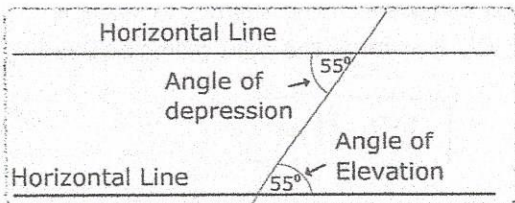
It is always _inside_ the triangle.

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.

Horizontal Line
Angle of depression → 55°
Angle of Elevation
Horizontal Line 55°

Why does it appear that an angle of elevation and an angle of depression are the SAME?
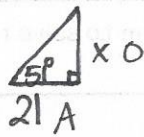
- parallel lines cut by a _transversal_
- _Alternate interior angles_ are congruent

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°. What is the height of the tree?
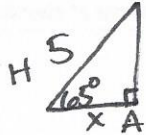
$$\tan 51° = \frac{x}{21}$$
$$21\tan 51° = x$$
$$25.93 \approx x$$

$$\boxed{25.93m}$$

2. A ladder 5 m long leans against a vertical wall and makes a 65° angle with the ground. How far is the foot of the ladder from the wall?
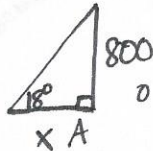
$$\cos 65° = \frac{x}{5}$$
$$5\cos 65° = x$$
$$2.11 \approx x$$

$$\boxed{2.11m}$$

3. A small airplane climbs at an angle of 18° with the ground. Find the horizontal distance it has flown when it has reached an altitude of 800 m.
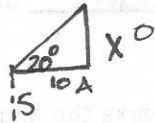
$$\tan 18° = \frac{800}{x}$$
$$\frac{x\tan 18°}{\tan 18°} = \frac{800}{\tan 18°}$$
$$x \approx 2,462.15m$$

$$\boxed{2,462.15m}$$

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°. (Your eyes are about 5 feet above the floor). Find how high the top of the painting is from the floor.
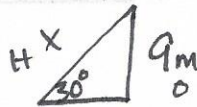
$$\tan 20° = \frac{x}{10}$$
$$10\tan 20° = x$$
$$3.64 \approx x$$

$$3.64 + 5 = \boxed{8.64 ft.}$$

5. A little boy is flying a kite. The string of the kite makes an angle of 30° with the ground. If the kite is 9 meters in the air, find the length (in meters) of the string the boy used.
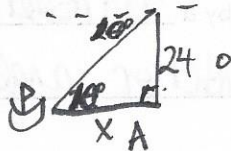
$$\sin 30° = \frac{9}{x}$$
$$\frac{x\sin 30°}{\sin 30°} = \frac{9}{\sin 30°}$$
$$x = 18$$

$$\boxed{18m}$$

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°. How far is the boat from the base of the lighthouse?
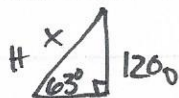
$$\tan 10° = \frac{24}{x}$$
$$\frac{x\tan 10°}{\tan 10°} = \frac{24}{\tan 10°}$$
$$x \approx 136.11$$

$$\boxed{136.11m}$$

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

$$\sin 63° = \frac{120}{x}$$
$$\frac{x\sin 63°}{\sin 63°} = \frac{120}{\sin 63°}$$
$$x \approx 134.68m$$

$$\boxed{134.68m}$$