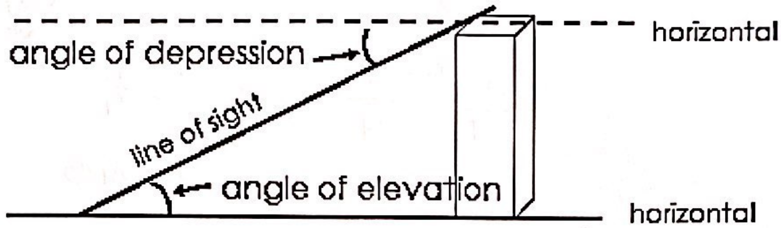
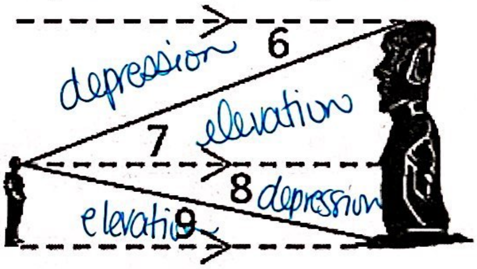
Day 9 – Applications of Right Triangle Trig – Notes

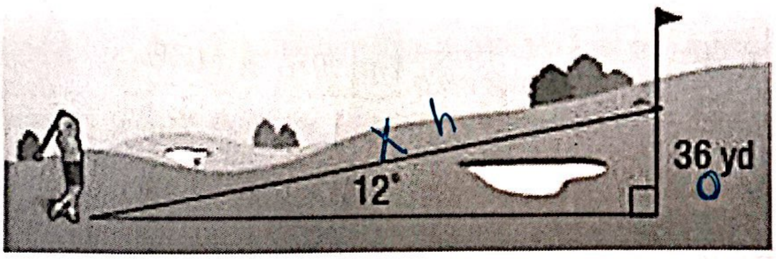
There are many real world uses for right triangle trig, but the most common use involves angles of elevation and depression. An **angle of elevation** is the angle formed by a horizontal line and a line of sight to a point above the line. An **angle of depression** is the angle from by a horizontal line and a line of sight below the line. In the figure below, the angle of depression and angle of elevation are congruent because of them being alternate interior angles.



Example 1: Classify the angles in the following pictures as angles of depression or elevation.



Example 2: . A golfer is standing at the tee, looking up to the green on a hill. If the tee is 36 yards lower than the green and the angle of elevation from the tee to the hole is 12°, find the distance from the tee to the hole.



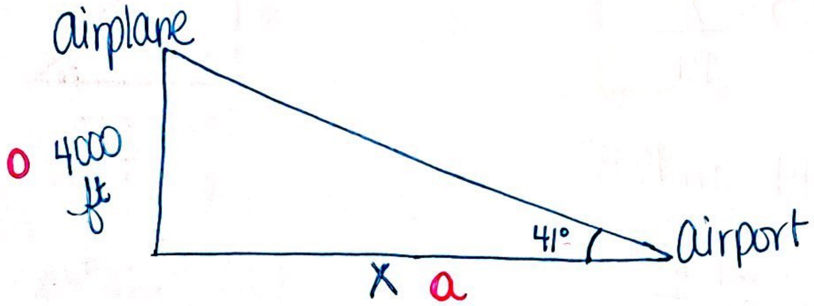
$$\frac{\sin 12^\circ}{1} = \frac{36}{x}$$

$$\frac{x \cdot \cancel{\sin} 12^\circ}{\cancel{\sin} 12^\circ} = \frac{36}{\sin 12^\circ}$$

$$x = \frac{36}{\sin 12^\circ} = \boxed{105.3\text{ ft}}$$

Example 3: Solve the problem below:

An air traffic controller at an airport sights a plane at an angle of elevation of 41°. The pilot reports that the plane's altitude is 4000 ft. What is the horizontal distance between the plane and the airport? Round to the nearest foot.



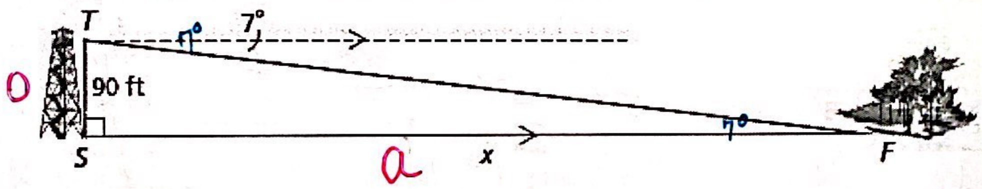
$\frac{\tan 41^\circ}{1} = \frac{4000}{x}$

$x \cdot \tan 41 = 4000$

$x = \frac{4000}{\tan 41} = \boxed{4601 \text{ ft}}$

Example 4: Solve the problem below:

A forest ranger in a 90 foot observation tower sees a fire. The angle of depression to the fire is 7°. What is the horizontal distance between the tower and the fire? Round to the nearest foot.



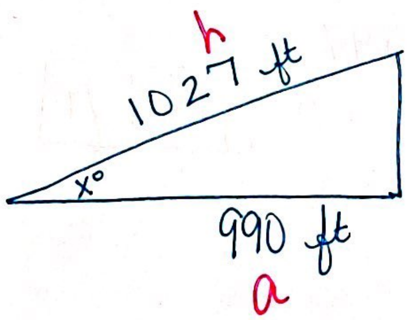
$\frac{\tan 7^\circ}{1} = \frac{90}{x}$

$x \cdot \tan 7 = 90$

$x = \frac{90}{\tan 7} = \boxed{733 \text{ ft}}$

Not all uses for right triangle trig must include angles of depression and elevation. Solve the following problems.

Example 5: *A truck driver drives 1,027 feet up a hill that has a constant slope. When the trucker reaches the top of the hill, he has traveled a horizontal distance of 990 feet. At what angle did the trucker drive to reach the top? Round your answer to the nearest degree.*

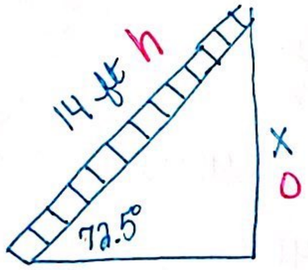


$\cos^{-1}$ $\cancel{\cos}\, x = \cos^{-1} \frac{990}{1027}$

$x = \cos^{-1}\left(\frac{990}{1027}\right)$

$\boxed{x = 15^\circ}$

Example 6: *A ladder manufacturer recommends that its ladders be used on level ground at an angle of 72.5° to the horizontal. At that angle, how far up the side of a building will the top of a 14 foot ladder reach?*

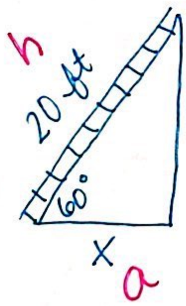


$$\frac{\sin 72.5^\circ}{1} = \frac{x}{14}$$

$$x = 14 \cdot \sin 72.5^\circ$$

$$\boxed{x = 13.4 \text{ ft}}$$

Example 7: *A construction worker leans his ladder against a building making a 60° angle with the ground. If his ladder is 20 feet long, how far away is the base of the ladder from the building? Round to the nearest tenth.*



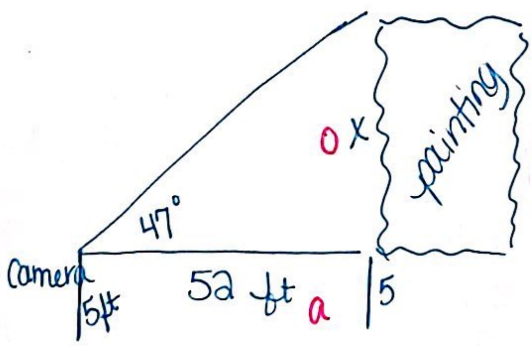
$$\frac{\cos 60}{1} = \frac{x}{20}$$

$$x = 20 \cdot \cos 60$$

$$\boxed{x = 10 \text{ ft}}$$

Notice... this is a 30-60-90 △, so you can use that pattern instead.

Example 8: *A photographer shines a camera light at a particular painting, forming an angle of 47° from the camera's horizontal line of sight. If the light is 52 feet from the wall where the painting hangs and the camera lens is 5 feet from the floor, how high above the floor is the painting?*



$$\frac{\tan 47^\circ}{1} = \frac{x}{52}$$

$$x = 52 \cdot \tan 47$$

$$x = 55.8 \text{ ft} + 5 = \boxed{60.8 \text{ ft}}$$