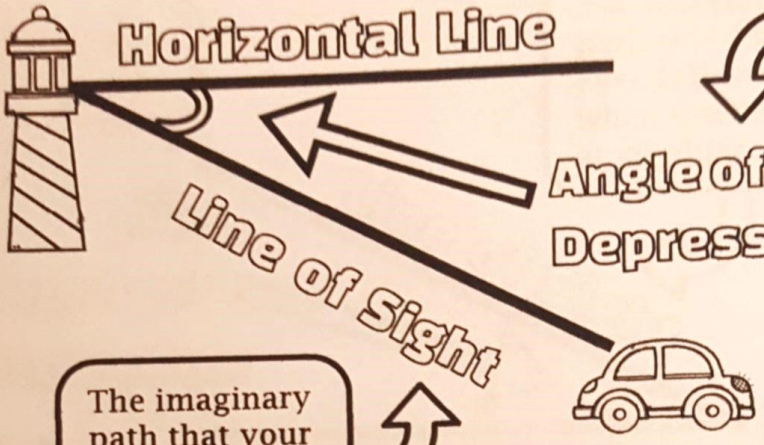
Angles of Depression

Solve using Trigonometry!

$$\sin\theta = \frac{opp}{hyp}$$

$$\cos\theta = \frac{adj}{hyp}$$

$$\tan\theta = \frac{opp}{adj}$$



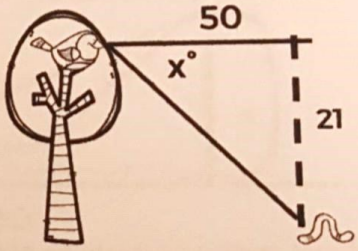
The angle between the horizontal and the line of sight to an object when looking down.

The imaginary path that your eyes follow when looking at an object.

Remember: When you connect the line of sight to the horizontal line, you get a right triangle.

Examples:

1. A bird is sitting in the top of a tree that is 21 feet tall looking down at a worm on the ground that is 50 feet from the base of the tree. What is the angle of depression from the bird to the worm?

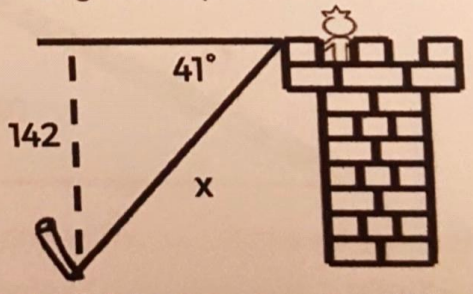


$$\tan x = \frac{21}{50}$$

$$\tan^{-1}\left(\frac{21}{50}\right) = x$$

$$22.7° = x$$

2. A queen is on the top of a 142 foot tower looking down at a 41° angle of depression at a stake attaching a rope to the top of the tower. How long is the rope?

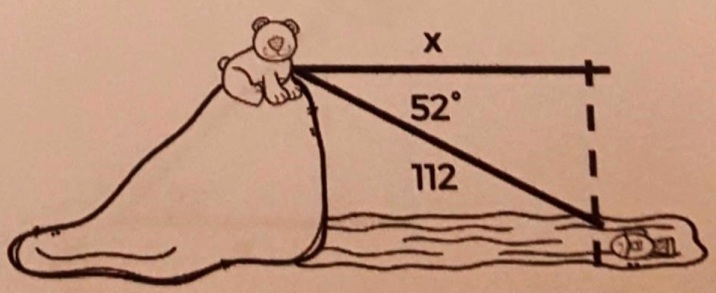


$$\sin 41 = \frac{142}{x}$$

$$x = \frac{142}{\sin 41}$$

$$x = 216.4\,ft$$

3. A polar bear is sitting on the top of an iceberg looking down at a fish in the water at a 52° angle of depression. If the fish is 112 feet from the polar bear, then how far is the fish from the base of the iceberg?



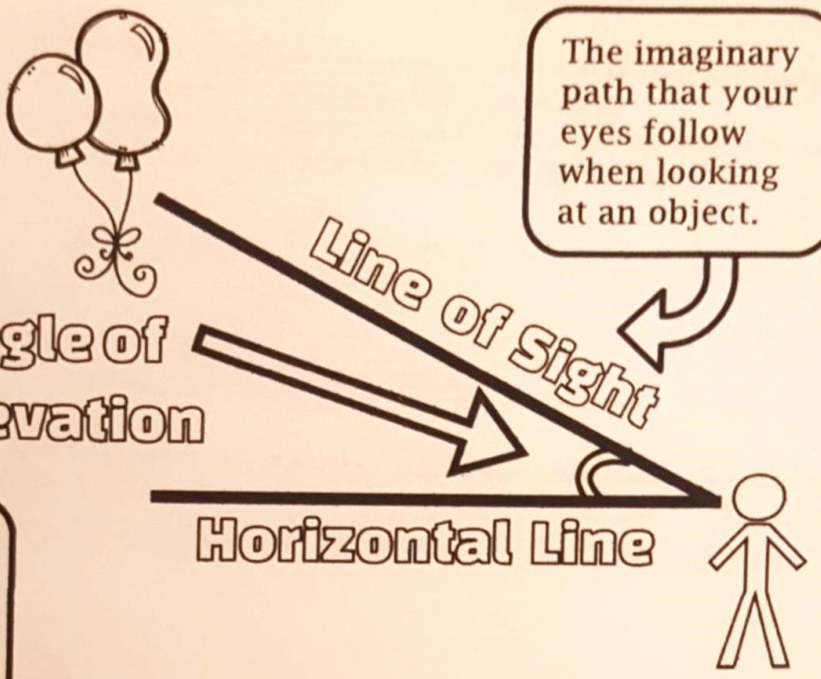
$$\cos 52 = \frac{x}{112}$$

$$x = 112\cos 52$$

$$x = 69\,ft$$

Angles of Elevation

The angle between the horizontal and the line of sight to an object when looking up.



The imaginary path that your eyes follow when looking at an object.

Solve using Trigonometry!

$$\sin\theta = \frac{opp}{hyp}$$

$$\cos\theta = \frac{adj}{hyp}$$

$$\tan\theta = \frac{opp}{adj}$$

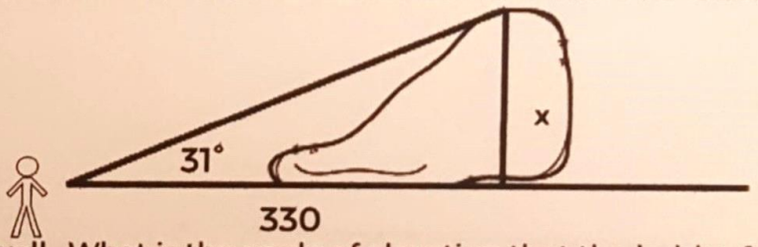
Remember: When you connect the line of sight to the horizontal line, you get a right triangle.

Examples:

1. A ranger is standing 330 feet from the base of a hill. The angle of elevation from where he is standing to the top of the hill is 31°. How tall is the hill?

$$\tan 31 = \frac{x}{330} \qquad 330(\tan 31) = x$$

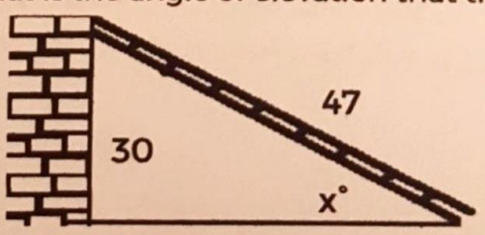
$$198.3\,ft = x$$



2. A 47 foot ladder reaches 30 feet up a brick wall. What is the angle of elevation that the ladder forms with the ground?

$$\sin x = \frac{30}{47} \qquad \sin^{-1}\left(\frac{30}{47}\right) = x$$

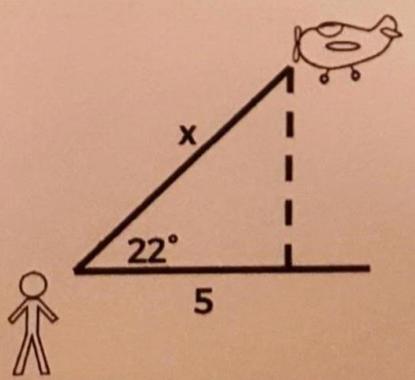
$$39.7° = x$$



3. Alex is standing on the ground and looks up to see a plane flying in the sky. If the distance along the ground is 5 miles to a point directly below the plane and the angle of elevation is 22 °, then far is the plan from Alex?

$$\cos 22 = \frac{5}{x} \qquad x = \frac{5}{\cos 22}$$

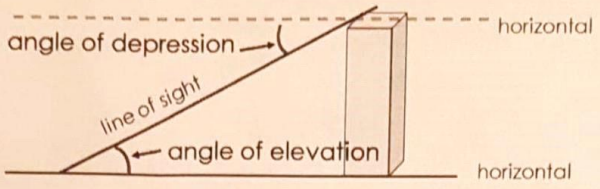
$$x = 5.4\,miles$$



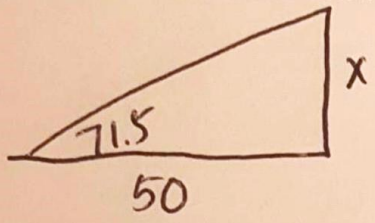
Name _____ Date _____

Day 8 – Triangle Applications

Angle of Elevation & Angle of Depression



1. A bird watcher is standing 50 feet from the base of a large tree. The surveyor measures the angle of elevation to a bird on top of the tree as 71.5°. How tall is the tree?

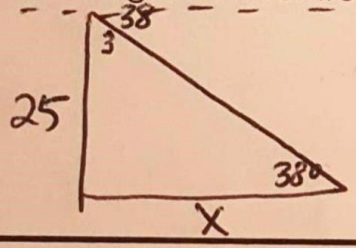


$\frac{\tan 71.5}{1} = \frac{x}{50}$

$x = 50 \tan 71.5$

$x \approx 149.4$ ft

2. The angle of depression from the top of a tower to a boulder on the ground is 38°. If the tower is 25m high, how far from the base of the tower is the boulder?

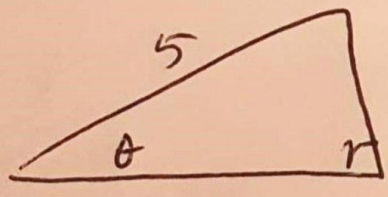


$\frac{\tan 38}{1} = \frac{25}{x}$

$x \frac{\tan 38}{\tan 38} = \frac{25}{\tan 38}$

$x \approx 32$m

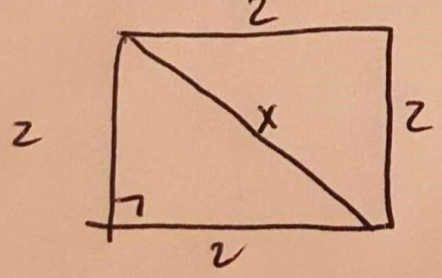
3. A rocket is launched at an angle into outer space. After a minute, the rocket traveled 5 miles and had an altitude of 3.5 miles. What is the angle of elevation that the rocket was launched at?



3.5 or $\theta = \sin^{-1}\left(\frac{5}{3.5}\right)$

$\theta \approx 44.4°$

4. Tom went to a park that is the shape of a square. If he runs a total of 8 miles around the park, how far would it have been if he ran diagonally across the park?



$a^2 + b^2 = c^2$

$2^2 + 2^2 = c^2$

$4 + 4 = c^2$

$\sqrt{8} = \sqrt{c^2}$

$c = 2\sqrt{2}$

Name: _____ Date: _____

TRIG ANGLES OF ELEVATION/DEPRESSION

For #1-24, label the horizontal, vertical, line of sight, angle of elevation and angle of depression on the given diagram. Write a trigonometric expression to solve each problem to the nearest 100th. Use proper units.

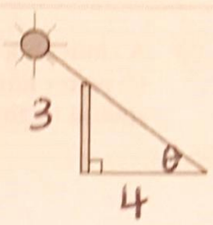
① **When the sun's angle of elevation is 57°, a building casts a shadow of 21 meters long. How high should the building be?**

$\frac{\tan 37}{1} = \frac{X}{21}$

$X = 21 \tan 37$

$X = 15.82m$

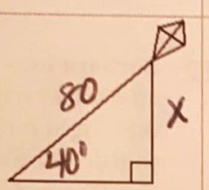
② **A 3 meter tall vertical pole casts a shadow 4 meters long. What should be the angle of elevation of the sun?**



$\theta = \tan^{-1}\left(\frac{3}{4}\right)$

$\theta = 36.87°$

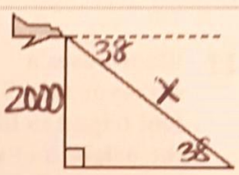
③ **A kite is flying at an angle of elevation of 40°. All 80 meters of string have been let out. What should be the height of the kite?**



$\frac{\sin 40}{1} = \frac{X}{80}$

$X = 80 \sin 40$ $X = 51.42m$

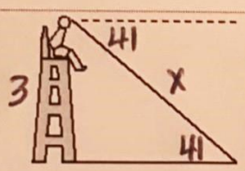
④ **A plane flies at an altitude of 2000 meters. The angle of depression to a control tower is 38°. What should be the line of sight?**



$\frac{\sin 38}{1} = \frac{2000}{X}$

$X = \frac{2000}{\sin 38}$ $X = 3248.54m$

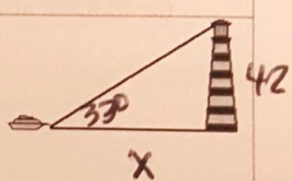
⑤ **The angle of depression of a life guard from the top of a 3 meter tower to the beach is 41°. What should be the line of sight from the life guard to the beach?**



$\frac{\sin 41}{1} = \frac{3}{X}$

$X = 3/\sin 41$ $X = 4.57m$

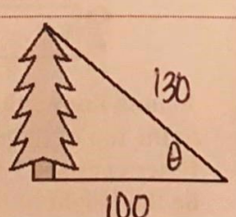
⑥ **The angle of elevation from a ship to the top of a 42 meter lighthouse on the shore is 33°. How far should the ship be from the shore?**



$\frac{\tan 33}{1} = \frac{42}{X}$

$X = 42/\tan 33$ $X = 64.67\ m$

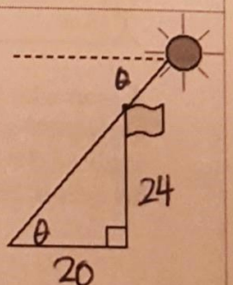
⑦ **A birdwatcher who is 100 meters from a tree has a line of sight 130 meters to the top of the tree. What should be the angle of elevation?**



$\theta = \cos^{-1}\left(\frac{100}{130}\right)$

$\theta = 39.72$

⑧ **The sun casts a shadow of 20 meters for a 24 meter tall flag. What should be the sun's angle of depression to the flag?**



$\theta = \tan^{-1}\left(\frac{24}{20}\right)$ $\theta = 50.19°$