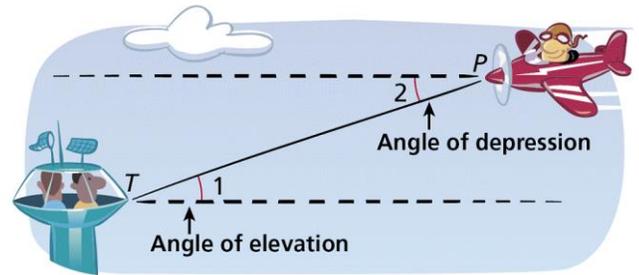


key

## 8.4 Angles of Elevation and Depression

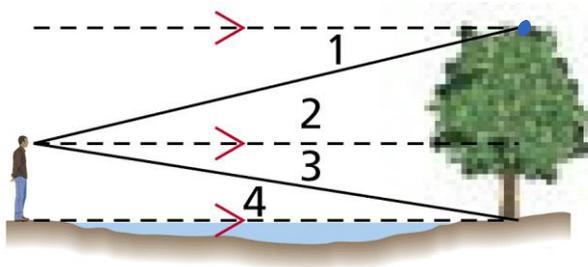
**Angle of Elevation:** is the angle formed by a horizontal line and a line of sight to a point above the line.

**Angle of Depression:** is the angle formed by a horizontal line and a line of sight to a point below the line.



### Angle of Elevation vs. Depression

Classify each angle as an angle of elevation or an angle of depression.



- $\angle 1 =$  depression
- $\angle 2 =$  elevation
- $\angle 3 =$  depression
- $\angle 4 =$  elevation

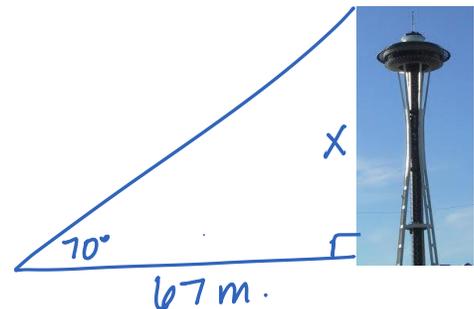
### Finding Distance by Using Angle of Elevation

1) The Seattle Space Needle casts a 67-meter shadow. If the angle of elevation from the tip of the shadow to the top of the Space Needle is  $70^\circ$ , how tall is the Space Needle? Round to the nearest meter.

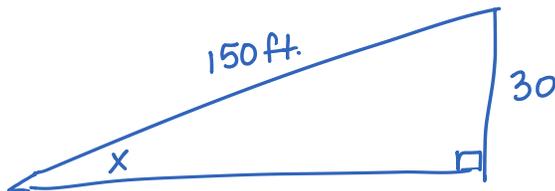
$$\frac{\tan 70^\circ}{1} = \frac{x}{67}$$

$$67 \cdot \tan 70^\circ = x$$

$$x = 184 \text{ m}$$



2) In a movie theater, the aisle is 150 feet long and the floor is sloped so there is a difference of 30 feet in height between the front and back of the theater. What is the angle of elevation? Round to the nearest tenth.



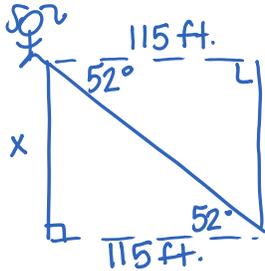
$$\sin x = \frac{30}{150}$$

$$x = \sin^{-1}\left(\frac{30}{150}\right)$$

$$x = 11.5^\circ$$

### Finding Distance by Using Angle of Depression

3) An ice climber stands at the edge of a crevasse that is 115 feet wide. The angle of depression from the edge where she stands to the bottom of the opposite side is  $52^\circ$ . How deep is the crevasse at this point? Round to the nearest foot.



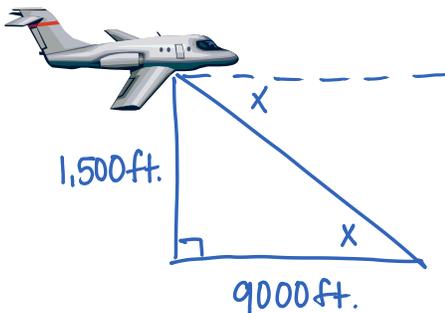
$$\tan 52 = \frac{x}{115}$$

$$115 \cdot \tan 52 = x$$

$$x = 147 \text{ ft.}$$



4) An air force pilot is flying at an altitude of 1500 feet and must descend over a distance of 9000 feet to land smoothly on an aircraft carrier. What is the plane's angle of descent? Round to the nearest hundredth of a degree.

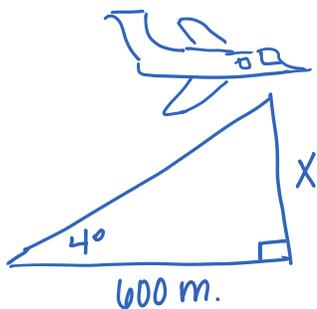


$$\tan x = \frac{1,500}{9,000}$$

$$x = \tan^{-1} \left( \frac{1,500}{9,000} \right)$$

$$x = 9.46^\circ$$

5. A small plane takes off from an airport and rises uniformly at an angle of elevation of  $4^\circ$ . After it has traveled over a horizontal distance of 600m, what is the altitude of the plane to the nearest meter?

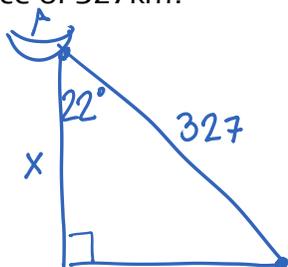


$$\tan 4 = \frac{x}{600}$$

$$600 \cdot \tan 4 = x$$

$$x = 42 \text{ m}$$

6. A ship sailed from a port with a bearing of  $S22^\circ E$ . How far south has the ship traveled after covering a distance of 327km?

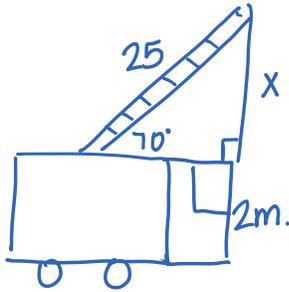


$$\cos 22 = \frac{x}{327}$$

$$327 \cdot \cos 22 = x$$

$$x = 303.19 \text{ km}$$

7. A ladder on a fire truck can be turned to a maximum angle of  $70^\circ$  and can be extended to a maximum length of 25m. If the base of the ladder is mounted on the fire truck 2m above the ground, how high above the ground will the ladder reach?



$$\sin 70 = \frac{x}{25}$$

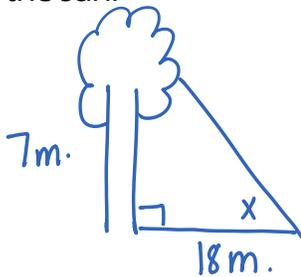
$$25 \cdot \sin 70 = x$$

$$x = 23.49$$

$$+ 2$$

$$\boxed{25.49 \text{ m}}$$

8. A tree that is 7 meters high casts a shadow that is 18 meters long. Find the measure of the angle of elevation of the sun.

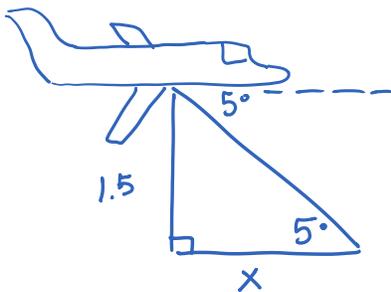


$$\tan x = \frac{7}{18}$$

$$x = \tan^{-1} \left( \frac{7}{18} \right)$$

$$\boxed{x = 21^\circ}$$

9. A plane is flying at an altitude of 1.5km. The pilot wants to descend into an airport so that its angle of depression is  $5^\circ$ . How far from the airport (horizontal distance) should the descent begin?



$$\tan 5 = \frac{1.5}{x}$$

$$x \cdot \frac{\tan 5}{\tan 5} = \frac{1.5}{\tan 5}$$

$$\boxed{x = 17.15 \text{ km}}$$