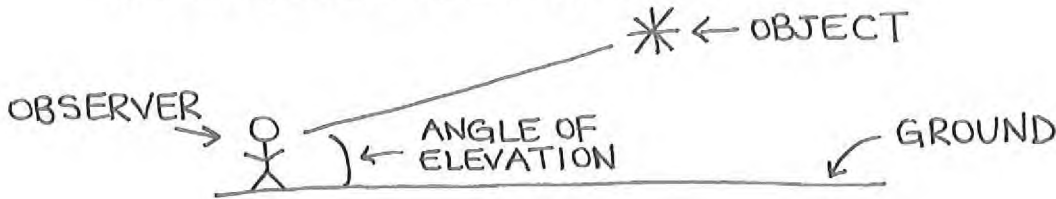


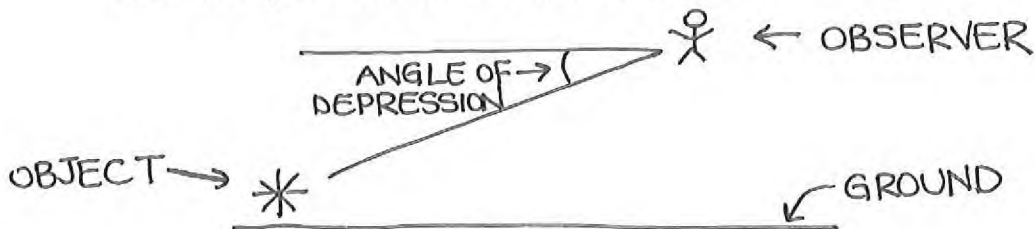
# Application Problems

#16

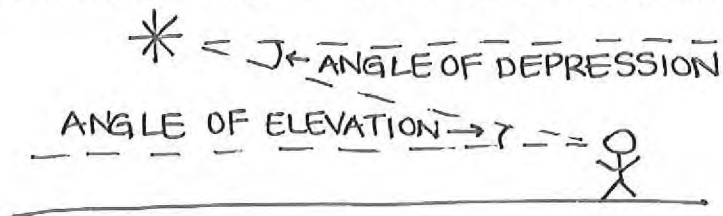
Angle of \_\_\_\_\_: The angle ABOVE horizontal that an observer must look to see an object that is higher than the observer.



Angle of \_\_\_\_\_: The angle BELOW horizontal that an observer must look to see an object that is lower than the observer.



In the same situation, the angle of elevation and the angle of depression are **congruent**.



**Ex. 1:** A hot air balloon hovers above its launch site at an altitude of 510 feet. The balloon operator sees a playground at a 10 degree angle of depression. Estimate the ground distance between the launch site and the playground.

**Ex. 2:** A scientist's eye level is 6 feet above the ground. She measures the angle of elevation to the top of a tree to be 40 degrees. The scientist is standing 100 feet from the tree. What is the height of the tree to the nearest foot?

Problem	Picture	Work & Answer (Written as a sentence)
<p><b><u>EX.3</u></b>  The top of a lighthouse is 80 feet above sea level. The angle of elevation from a fishing boat to the top of the lighthouse is 5 degrees. What is the closest distance between the boat and the base of the lighthouse?</p>		
<p><b><u>EX.4</u></b>  A package of food will be dropped from an airplane to a target on the ground, where a group of campers will retrieve it. The altitude of the plane is 700 meters. The angle of depression to the target is 15 degrees. To the nearest meter, what is the horizontal ground distance between the plane and the target?</p>		
<p><b><u>EX.5</u></b>  A blimp hovers at an altitude of 500 feet above a tennis stadium. The pilot of the blimp sights a creek at a 10 degree angle of depression. To the nearest foot, what is the horizontal distance between the creek and the stadium?</p>		

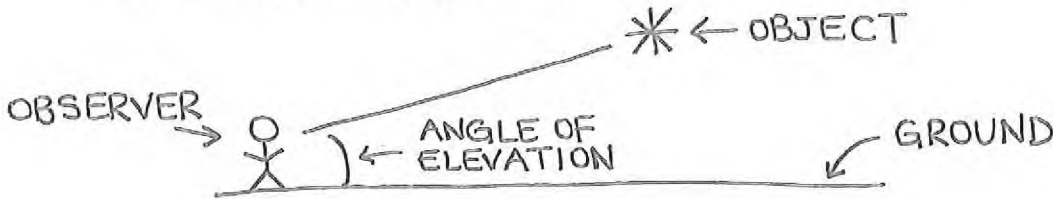
# Application Problems Practice

Draw a picture and show your work to solve each problem. (You may need to use a separate sheet of paper.)

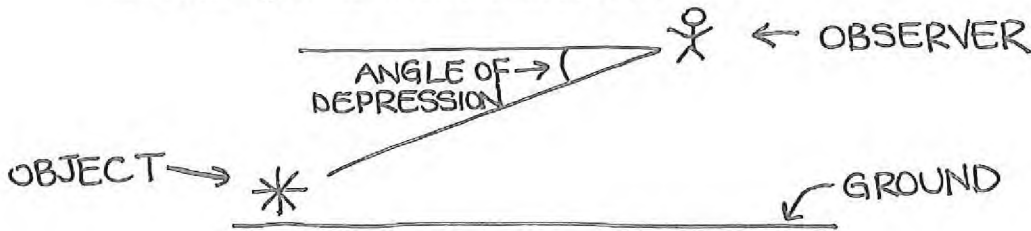
1. Nate built a skateboard ramp that covers a horizontal distance of 10 ft. The ramp rises a total of 3.5 ft. What angle does the ramp make with the ground? (Round to the nearest degree.)
2. The largest Egyptian pyramid is 146.5 m high. When Rowena stands far away from the pyramid, her line of sight to the top of the pyramid forms an angle of elevation of 20 degrees with the ground. What is the horizontal distance between the center of the pyramid and Rowena? (Round to the nearest meter.)
3. Jessie is building a ramp for loading motorcycles onto a trailer. The trailer is 2.8 feet off of the ground. To avoid making it too difficult to push a motorcycle up the ramp, Jessie decides to make the angle between the ramp and the ground 15 degrees. Find the length of the ramp. (Round to the nearest hundredth of a foot.)
4. An observer at the top of a skyscraper sights a tour bus at an angle of depression of 61 degrees. The skyscraper is 910 feet tall. What is the horizontal distance from the base of the skyscraper to the tour bus? (Round to the nearest foot.)
5. An observer in a blimp sights a football stadium at an angle of depression of 34 degrees. The blimp's altitude is 1600 ft. What is the horizontal distance from the blimp to the stadium? (Round to the nearest foot.)
6. When the angle of elevation of the sun is 78 degrees, a building casts a shadow that is 6 m long. What is the height of the building? (Round to the nearest tenth of a meter.)

# Application Problems

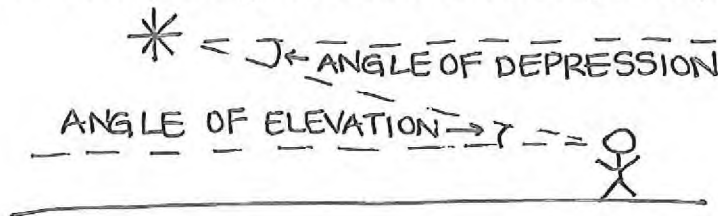
Angle of elevation: The angle ABOVE horizontal that an observer must look to see an object that is higher than the observer.



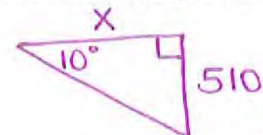
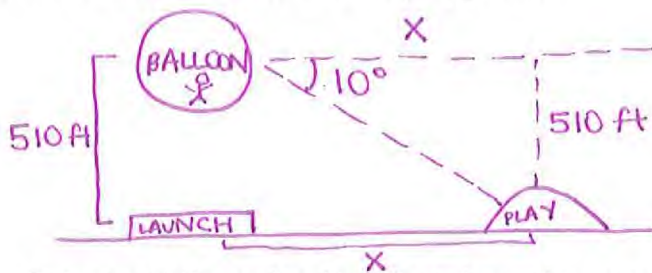
Angle of depression: The angle BELOW horizontal that an observer must look to see an object that is lower than the observer.



In the same situation, the angle of elevation and the angle of depression are congruent.

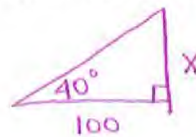
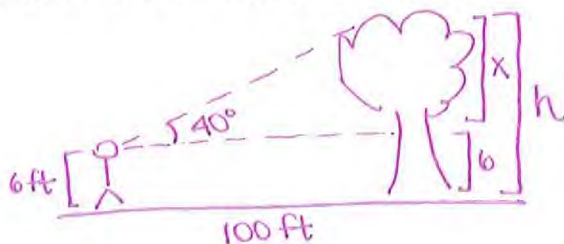


**Ex. 1:** A hot air balloon hovers above its launch site at an altitude of 510 feet. The balloon operator sees a playground at a 10 degree angle of depression. Estimate the ground distance between the launch site and the playground.



$$\begin{aligned} \tan 10^\circ &= \frac{510}{X} \\ X \cdot \tan 10^\circ &= 510 \\ X &= \frac{510}{\tan 10^\circ} = 2892.4 \text{ ft} \end{aligned}$$

**Ex. 2:** A scientist's eye level is 6 feet above the ground. She measures the angle of elevation to the top of a tree to be 40 degrees. The scientist is standing 100 feet from the tree. What is the height of the tree to the nearest foot?



$$\begin{aligned} \tan 40^\circ &= \frac{X}{100} \\ 100 \cdot \tan 40^\circ &= X \\ 84 &= X \end{aligned}$$

$$\begin{aligned} h &= X + 6 \\ &= 84 + 6 \\ h &= 90 \text{ ft} \end{aligned}$$



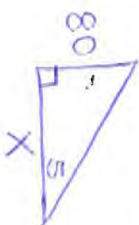
Problem

Picture

Work & Answer (Written as a sentence)

### EX.3

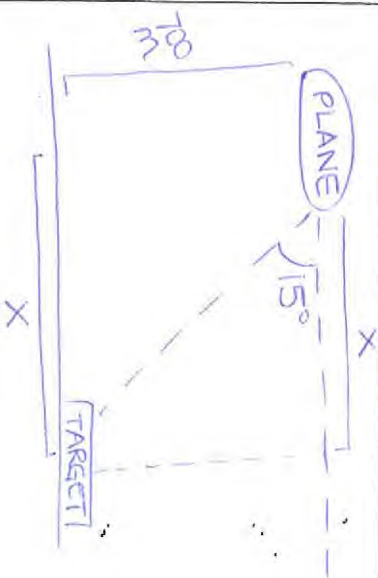
The top of a lighthouse is 80 feet above sea level. The angle of elevation from a fishing boat to the top of the lighthouse is 5 degrees. What is the closest distance between the boat and the base of the lighthouse?



$$\begin{aligned} \tan 5^\circ &= \frac{80}{X} \\ X \cdot \tan 5^\circ &= 80 \\ X &= \frac{80}{\tan 5^\circ} \\ X &= 914.4 \text{ ft} \end{aligned}$$

### EX.4

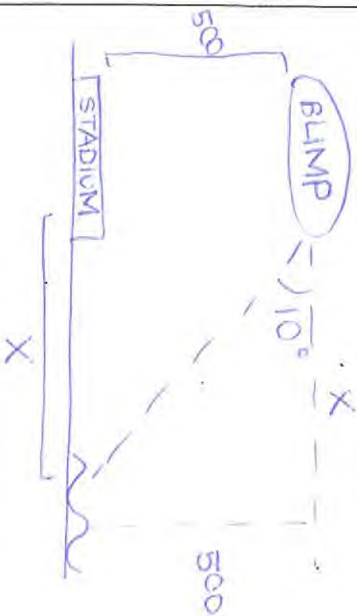
A package of food will be dropped from an airplane to a target on the ground, where a group of campers will retrieve it. The altitude of the plane is 700 meters. The angle of depression to the target is 15 degrees. To the nearest meter, what is the horizontal ground distance between the plane and the target?



$$\begin{aligned} \tan 15^\circ &= \frac{700}{X} \\ X \cdot \tan 15^\circ &= 700 \\ X &= \frac{700}{\tan 15^\circ} \\ X &= 2612 \text{ m} \end{aligned}$$

### EX.5

A blimp hovers at an altitude of 500 feet above a tennis stadium. The pilot of the blimp sights a creek at a 10 degree angle of depression. To the nearest foot, what is the horizontal distance between the creek and the stadium?



$$\begin{aligned} \tan 10^\circ &= \frac{500}{X} \\ X \cdot \tan 10^\circ &= 500 \\ X &= \frac{500}{\tan 10^\circ} \\ X &= 2836 \text{ ft} \end{aligned}$$

# Application Problems Practice

Draw a picture and show your work to solve each problem. (You may need to use a separate sheet of paper.)

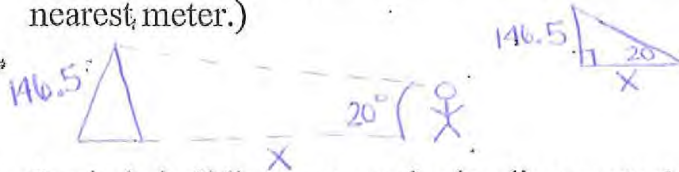
1. Nate built a skateboard ramp that covers a horizontal distance of 10 ft. The ramp rises a total of 3.5 ft. What angle does the ramp make with the ground? (Round to the nearest degree.)



$$\tan(x) = \frac{3.5}{10}$$

$$x = \tan^{-1}\left(\frac{3.5}{10}\right) = 19^\circ$$

2. The largest Egyptian pyramid is 146.5 m high. When Rowena stands far away from the pyramid, her line of sight to the top of the pyramid forms an angle of elevation of 20 degrees with the ground. What is the horizontal distance between the center of the pyramid and Rowena? (Round to the nearest meter.)

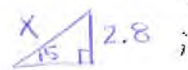


$$\tan 20^\circ = \frac{146.5}{x}$$

$$x \cdot \tan 20^\circ = 146.5$$

$$x = \frac{146.5}{\tan 20^\circ} = 403 \text{ m}$$

3. Jessie is building a ramp for loading motorcycles onto a trailer. The trailer is 2.8 feet off of the ground. To avoid making it too difficult to push a motorcycle up the ramp, Jessie decides to make the angle between the ramp and the ground 15 degrees. Find the length of the ramp. (Round to the nearest hundredth of a foot.)

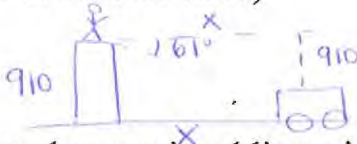


$$\sin 15^\circ = \frac{2.8}{x}$$

$$x \cdot \sin 15^\circ = 2.8$$

$$x = \frac{2.8}{\sin 15^\circ} = 10.82 \text{ ft}$$

4. An observer at the top of a skyscraper sights a tour bus at an angle of depression of 61 degrees. The skyscraper is 910 feet tall. What is the horizontal distance from the base of the skyscraper to the tour bus? (Round to the nearest foot.)

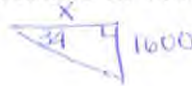
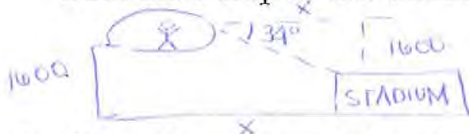


$$\tan 61^\circ = \frac{910}{x}$$

$$x \cdot \tan 61^\circ = 910$$

$$x = \frac{910}{\tan 61^\circ} = 504 \text{ ft}$$

5. An observer in a blimp sights a football stadium at an angle of depression of 34 degrees. The blimp's altitude is 1600 ft. What is the horizontal distance from the blimp to the stadium? (Round to the nearest foot.)



$$\tan 34^\circ = \frac{1600}{x}$$

$$x \cdot \tan 34^\circ = 1600$$

$$x = \frac{1600}{\tan 34^\circ} = 2372 \text{ ft}$$

6. When the angle of elevation of the sun is 78 degrees, a building casts a shadow that is 6 m long. What is the height of the building? (Round to the nearest tenth of a meter.)



$$\tan 78^\circ = \frac{x}{6}$$

$$6 \cdot \tan 78^\circ = x$$

$$28.2 \text{ m}$$