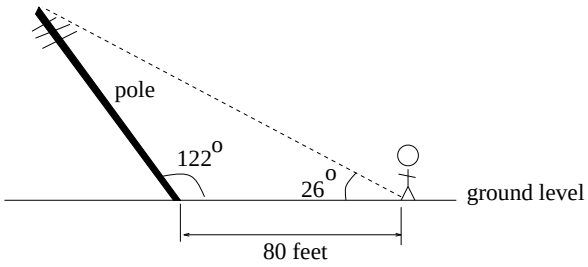
3.7 Relating Sides in General Triangles

1. After a windstorm a telephone pole is partially blown out of vertical and now makes an angle of 122^o with the ground. Suppose you are standing 80 feet in front of the pole and that the angle from your location to the top of the pole is 26^o.

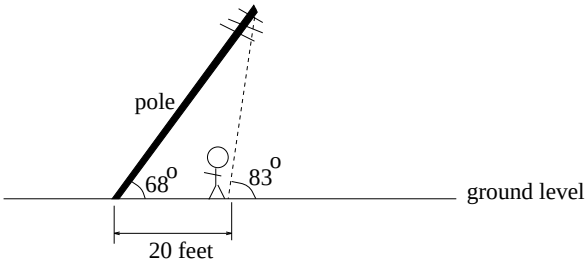


   (a) How high is the top of the pole above the ground?

   (b) How long is this telephone pole?

   (c) How far from the base of the pole must you stand in order to avoid any loose hanging wires?

2. After a windstorm a telephone pole is partially blown out of vertical and now makes an angle of 68^o with the ground. Suppose you are standing 20 feet in front of the pole and that the angle from your location to the top of the pole is 83^o.

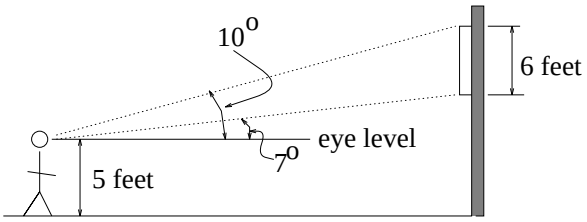


   (a) How high is the top of the pole above the ground?

   (b) How long is this telephone pole?

   (c) How far must you move to the right in order to avoid any loose hanging wires?

3. While visiting the *Metropolitan Museum of Art* in New York, you observe a painting hanging on the wall. According to the Museum brochure, this particular piece is 6 feet high.



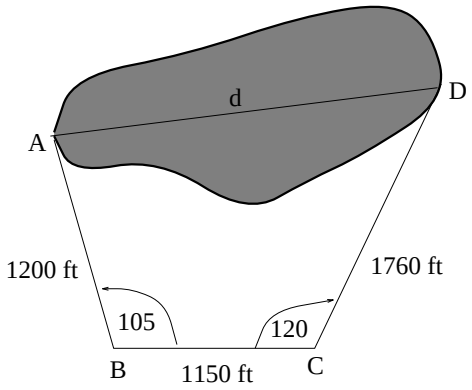
   The angle of elevation from your eye (5 feet above the ground) to the top of the picture is 10^o and the angle of elevation to the bottom of the picture is 7^o.

   (a) How far in front of the picture are you standing?

   (b) How high above the floor is the bottom of the picture?

   Try to answer each question using two different approaches. First, use the law of sines. Secondly, use right triangle techniques. Which approach do you find easier?

4. Two surveyors need to find the length d of a mountain lake. They cannot measure the distance directly, but can gather the information indicated in the picture. What is the length of the lake?



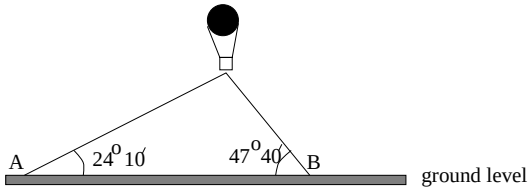
5. Two archers shoot arrows into the bullseye of a target at exactly the same instant. There is an angle of 23^o between the paths of the two arrows as they enter the target. One archer is 150 from the target and 75 feet from the second archer.

   (a) Sketch a picture of the situation, introducing a triangle with sides 75, 150 and an angle of 23^o. There are two possible locations for the second archer using the picture.

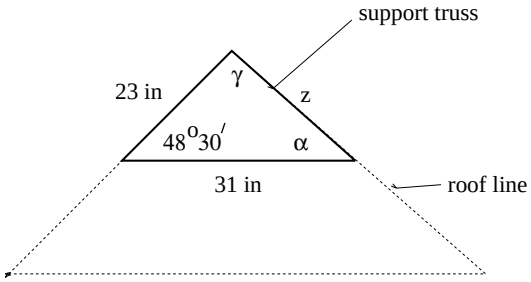
   (b) How far is the second archer from the target if she is standing behind the first archer?

   (c) How far is the second archer from the target if she is standing in front of the first archer?

6. A balloon is airborne between two spotting stations which are located on flat ground 8.4 miles apart. If the angles of observation to the balloon are $24^o10'$ and $47^o40'$, determine the height of the balloon above the ground.



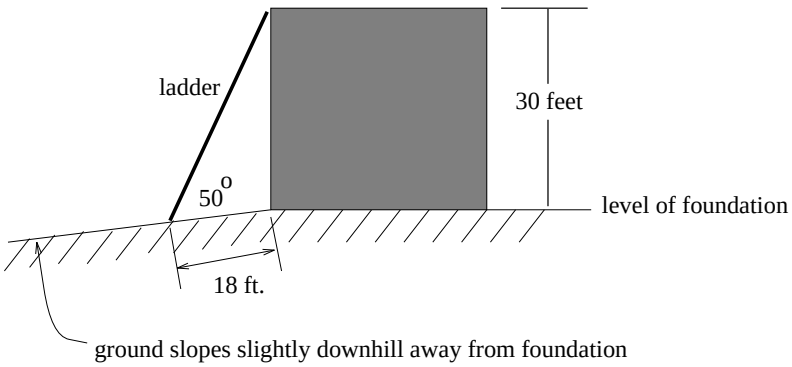
7. The architectural drawings for a house detail special roof support trusses which are triangular as pictured below. The site contractor needs to determine all sides and angles for these trusses and asks for your assistance.



Roof detail

8. Using the law of cosines, compute d in Example 3.1.6 in §3.1 and compare to the arc length.

9. A ladder is needed to reach the top of a 30 ft. high building. The ground slopes away slightly from the building. Assume the ladder is placed as in the picture below, just reaching the top of the building.



(a) Find the length of the pictured ladder.

(b) Find the angle between the top of the ladder and the side of the building.

(c) Find the downhill slope of the ground away from the foundation of the building.