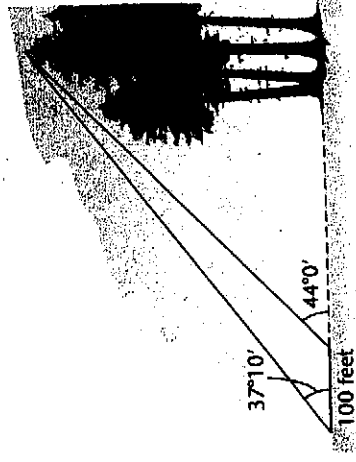


① **Coast Guard.** Two lookout posts, A and B (10.0 miles apart), are established along a coast to watch for illegal ships coming within the 3-mile limit. If post A reports a ship S at angle $BAS = 37^\circ 30'$ and post B reports the same ship at angle $ABS = 20^\circ 0'$, how far is the ship from post A ? How far is the ship from the shore (assuming the shore is along the line joining the two observation posts)?

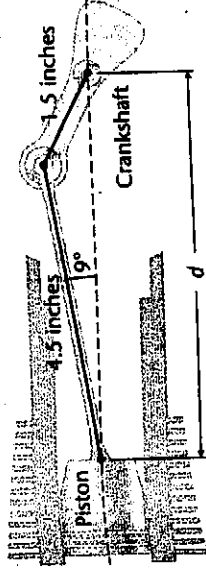
② **Fire Lookout.** A fire at F is spotted from two fire lookout stations, A and B , which are 10.0 miles apart. If station B reports the fire at angle $ABF = 53^\circ 0'$ and station A reports the fire at angle $BAF = 28^\circ 30'$, how far is the fire from station A ? From station B ?

③ **Natural Science.** The tallest trees in the world grow in Redwood National Park in California; they are taller than a football field is long. Find the height of one of these trees, given the information in the figure. (The 100-foot measurement is accurate to three significant digits.)



④ **Surveying.** To measure the height of Mt. Whitney in California, surveyors used a scheme like the one shown in the figure in Problem 37. They set up a horizontal baseline 2,000 feet long at the foot of the mountain and found the angle nearest the mountain to be $43^\circ 5'$; the angle farthest from the mountain was found to be $38^\circ 0'$. If the baseline was 5,000 feet above sea level, how high is Mt. Whitney above sea level?

⑤ **Engineering.** A 4.5-inch piston rod joins a piston to a 1.5-inch crankshaft (see the figure). How far is the base of the piston from the center of the crankshaft (distance d) when the rod makes an angle of 9° with the centerline? There are two answers to the problem.

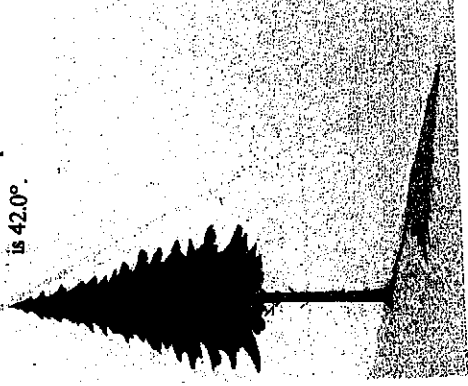


⑥ **Finding Height** Two observers are 600 ft apart on opposite sides of a flagpole. The angles of elevation from the observers to the top of the pole are 19° and 21° . Find the height of the flagpole.

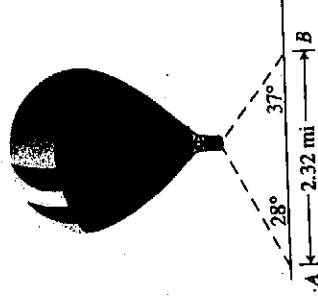
⑦ **Finding Height** Two observers are 400 ft apart on opposite sides of a tree. The angles of elevation from the observers to the top of the tree are 15° and 20° . Find the height of the tree.

⑧ **Surveying.** A tree growing on a hillside casts a 102-foot shadow straight down the hill (see the figure). Find the vertical height of the tree if, relative to the horizontal, the hill slopes 15.0° and the angle of elevation of the sun is 62.0° .

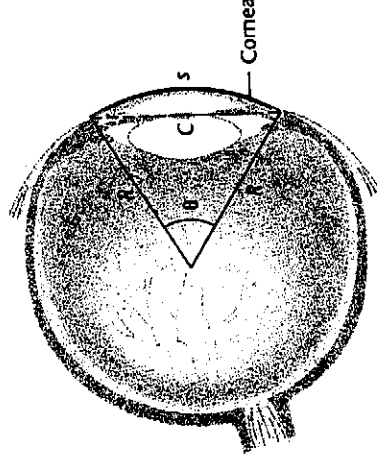
⑨ **Surveying.** Find the height of the tree in Problem 43 if the shadow length is 157 feet and, relative to the horizontal, the hill slopes 11.0° and the angle of elevation of the sun is 42.0° .



⑩ **Altitude** Observers 2.32 mi apart see a hot-air balloon directly between them but at the angles of elevation shown in the figure. Find the altitude of the balloon.



⑪ **Life Science.** A cross section of the cornea of an eye, a circular arc, is shown in the figure. Find the arc radius R and the arc length s , given the chord length $C = 11.8$ millimeters and the central angle $\theta = 98.9^\circ$.



⑫ **Group Activity Ferris Wheel Design** A Ferris wheel has 16 evenly spaced cars. The distance between adjacent chairs is 15.5 ft. Find the radius of the wheel (to the nearest 0.1 ft).