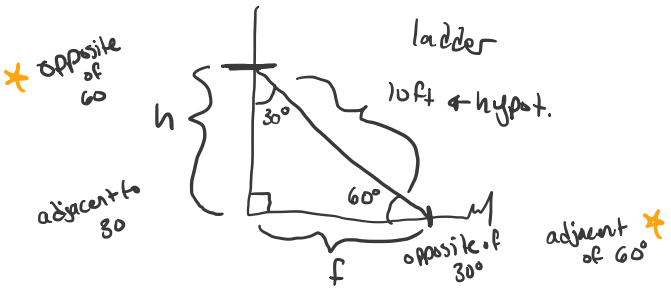
Chapter 5
Section 5.6

Learning outcome: putting all the concepts together...

Problem 1. Diego has a 10 foot ladder. He places it against a wall so that the angle it forms with the ground is equal to 60 degrees.

(a) Sketch the situation, labeling as many parts of your drawing as possible from the information given.



(b) How high off of the ground is the top of Diego's ladder?

$$\sin(60^\circ) = \frac{\text{opp.}}{\text{hyp.}} = \frac{h}{10}$$

$$10 \cdot \frac{\sqrt{3}}{2} = \frac{h}{10} \cdot 10 \Rightarrow 5\sqrt{3} = h$$

(c) How far away from the wall is the foot of the ladder?

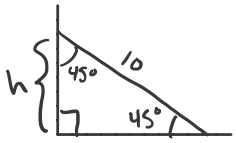
$$\cos(60^\circ) = \frac{f}{10}$$

$$10 \cdot \frac{1}{2} = \frac{f}{10} \cdot 10 \rightsquigarrow 5 = f$$

(d) Diego decides to move the ladder so that the angle it forms with the ground is now equal to 45 degrees. How high off the ground is the top of his ladder now?

$$\cos(45^\circ) = \frac{h}{10}$$

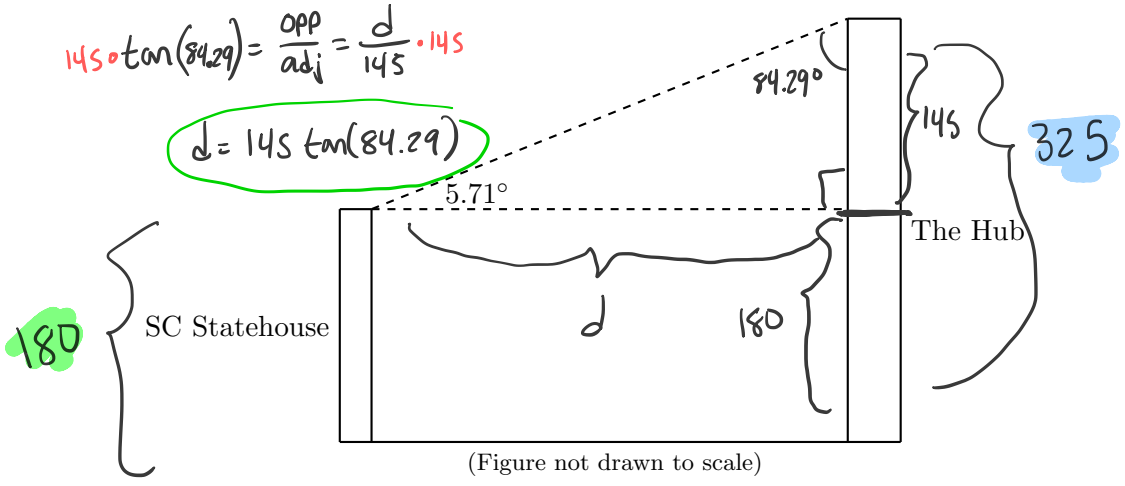
$$10 \cdot \frac{\sqrt{2}}{2} = \frac{h}{10} \cdot 10 \rightsquigarrow 5\sqrt{2} = h$$



Problem 2. Suppose you know that the height of the South Carolina Statehouse is 180 feet, and that the height of the second tallest building in downtown Columbia, the Hub, is 325 feet. Use the information shown in the figure below to determine the horizontal distance between the two buildings.

$$145 \cdot \tan(84.29) = \frac{\text{opp}}{\text{adj}} = \frac{d}{145} \cdot 145$$

$$d = 145 \tan(84.29)$$

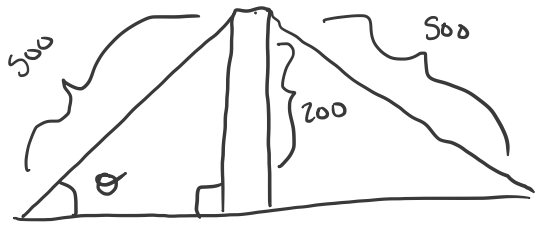


(Figure not drawn to scale)

attached to the top

Problem 3. The top of a 200-foot vertical tower is to be anchored by cables to the ground.

(a) Draw a sketch of the tower and cables.

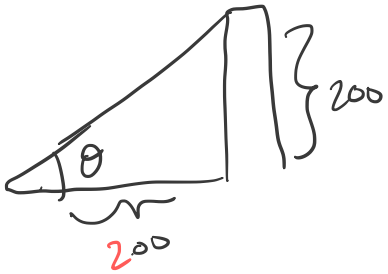


(b) If the cables are 500 feet long, what angle do they form with the ground?

$$\sin(\theta) = \frac{\text{opp}}{\text{hyp}} = \frac{200}{500} = \frac{2}{5}$$

$$\theta = \arcsin\left(\frac{2}{5}\right)$$

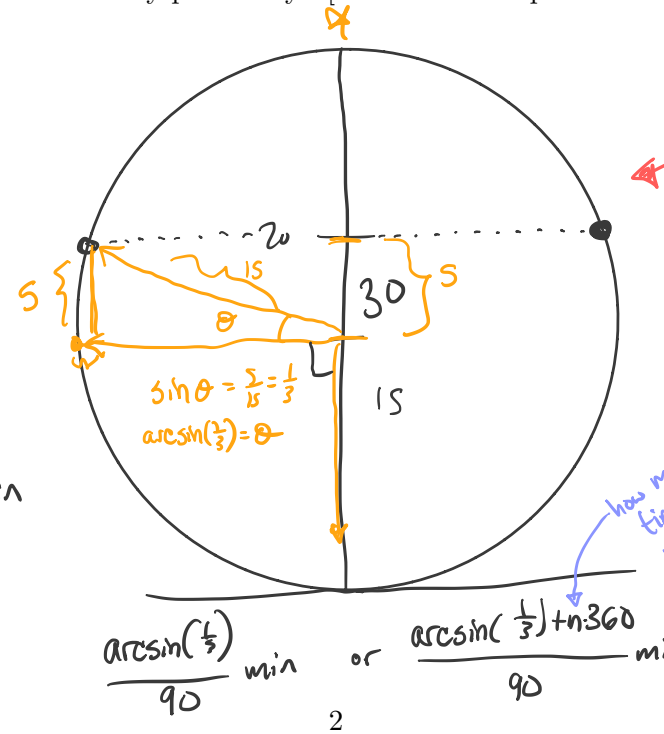
(c) If the cables are anchored 200 feet from the tower, what angle do they form with the ground?



$$\tan(\theta) = \frac{200}{200} = 1$$

$$\theta = 45°$$

Problem 4. Suppose you are 20 meters high on a Ferris wheel whose diameter is 30 meters, that the wheel makes one full rotation every 4 minutes, and that you boarded at ground level (the 6:00 position). How long might you have been on the wheel? Is this is the only possibility? [Hint: Sketch a picture first.]



$360° = 4\text{ min}$

$$\frac{\theta°}{1} \cdot \frac{4}{360} = \frac{\theta}{90}\text{ min}$$

$\sin\theta = \frac{2}{15} = \frac{1}{3}$

$\arcsin\left(\frac{1}{3}\right) = \theta$

$$\frac{\arcsin\left(\frac{1}{3}\right)}{90}\text{ min} \quad \text{or} \quad \frac{\arcsin\left(\frac{1}{3}\right)+n\cdot 360}{90}\text{ min}$$