1. **Rope Hanging from Flagpole.** A 20’ tall flagpole has a 20’ long rope attached at the top. The rope is initially hanging straight down. A 10 year old girl grabs the end of the rope at the bottom of the pole, walks in a straight line away from the pole, keeping the rope tight. She stops when the end of the rope is 4’ off the ground.

**Problem Setup:** Draw a sketch for the situation described above. Label your sketch to include all relevant information from the problem statement.

a. How far from the pole is the girl? Label your sketch above to show the desired quantity. Add additional labels for quantities needed in the problem solution.

\[ a^2 + 16^2 = 20^2, \quad a = 12' \]

b. What is the total distance traveled by the end of the rope along the path it takes by the time it is 4’ off the ground?

\[ s = r \theta, \quad r = 20', \quad \text{need } \theta \text{ (in radians)} \]
\[ \cos \theta = 16'/20', \quad \theta = 36.87^\circ \]
\[ s = (20')(36.87^\circ \frac{2\pi \text{ radians}}{360^\circ}) = 12.9' \]

2. **Standing on Dome.** When Bill stands up, his eyes are 5’ off the ground. Bill stands on top of a 30’ high hemispherical dome (perfect half sphere). How far from the base of the dome is the closest point on the ground that Bill can still see? Draw a sketch and label it as before as part of your solution.

*Looking at the large triangle:*

\[ \tan \theta = \frac{a + 30'}{30'+5'}, \quad \text{need } \theta \]

*Looking at the small triangle:*

\[ \sin \theta = \frac{30'}{30'+5'} \]
\[ \theta = 59^\circ \]
\[ \tan(59^\circ) = \frac{a + 30'}{30'+5'} \]
\[ a = 28.25' \]