A large, helium-filled Snoopy is moored at the beginning of a parade route awaiting the start of the parade. Two cables attached to the face of Snoopy make angles of 48° and 40° with the ground and are in the same plane as a perpendicular line from Snoopy to the ground. If the cables are attached to the ground 10 feet from each other, how high above the ground is Snoopy? (his face)

\[ \tan 48° = \frac{h}{d} \]
\[ 1.111 = \frac{h}{d} \]
\[ d = \frac{h}{1.111} \]

\[ \tan 40° = \frac{h}{d+10} \]
\[ .8391 = \frac{h}{1.111+10} \]
\[ h \cdot .8391 = \frac{h}{1.111} \times 1.111 \times .8391 \]
\[ .8391h + 9.322 = 1.111h \]
\[ 9.322 = .2719h \]
\[ h = 34.28' \]

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**Simple Harmonic Motion**

A ball is attached to a spring hung from the ceiling. You pull the ball down 4 inches and then release it. If we neglect the effects of friction and air resistance, the ball will continue bobbing up and down on the end of the spring. These up-and-down oscillations are called simple harmonic motion.
Simple Harmonic Motion
An object that moves on a coordinate axis is in simple harmonic motion if its distance from the origin, $d$, at time $t$ is given by either

$$d = a \cos \omega t \quad \text{or} \quad d = a \sin \omega t.$$ 

The motion has amplitude $a$, the maximum displacement of the object from its rest position. The period of the motion is $\frac{2\pi}{\omega}$, where $\omega > 0$. The period gives the time it takes for the motion to go through one complete cycle.

$$d = -4 \cos \frac{\pi}{3} t$$

\[ \text{Per} = \frac{2\pi}{\omega} \]

\[ \omega = \frac{2\pi}{T} \]

\[ \omega = \frac{2\pi}{1} \]

Frequency
Frequency describes the number of complete cycles per unit time and is the reciprocal of the period.

\[ \text{Per} = \frac{2\pi}{\omega} \]

\[ f_{\text{reg}} = \frac{\omega}{2\pi} \]
Figure 4.110 shows a mass on a smooth surface attached to a spring. The mass moves in simple harmonic motion described by

\[ d = 10 \cos \frac{\pi}{6} t, \]

with \( t \) measured in seconds and \( d \) in centimeters. Find:

a. the maximum displacement
b. the frequency

c. the time required for one cycle.

\[ \frac{2\pi}{\text{period}} \]

\[ \frac{10}{\frac{\pi}{6}} \cdot \frac{1}{2\pi} \]

\[ \frac{2\pi}{12} \]

\[ \frac{2\pi}{6} \]

\[ \frac{12}{12} \]

\[ a. \ 10 \]

\[ b. = \frac{1}{12} \ cycles/sec \]

\[ c. = 12 \ seconds \]

Homework

4.8
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17-25 odd
35, 36, 37, 39
55-61 odd