7. [10 points] A “Whirlydoodle”\(^1\) is a small windmill that spins and lights up when the wind blows. One evening, there is a light breeze and a particular Whirlydoodle’s blades are rotating at a constant rate of one revolution every 4 seconds. A moth lands on the tip of one of the blades of the Whirlydoodle when the blade is pointed straight up. (The moth then hangs on and rides for a minute.) This Whirlydoodle is mounted 5 feet (60 inches) above the ground, and each blade is 10 inches long, as shown in the diagram on the right.

Let \(h(t)\) be the height (in inches) of the moth above the ground \(t\) seconds after the moth lands on the Whirlydoodle.

**a.** [6 points] Sketch a graph of \(y = h(t)\) for \(0 \leq t \leq 8\). (Remember to label the axes (including units) and to make sure that the key features and characteristics of your graph are clear.)

![Graph of \(y = h(t)\)](image)

**b.** [4 points] Find a formula for \(h(t)\).

**Solution:** \(h\) is a sinusoidal function with period 4 seconds. The graph of \(y = h(t)\) has amplitude 10 (inches) and midline \(y = 60\). (Since the function attains a maximum at \(t = 0\), it is convenient to write \(h(t)\) using transformations of the function \(\cos t\). However, there are many other possible answers.)

**Answer:** \[h(t) = 10 \cos \left(\frac{\pi}{2} t\right) + 60\]

\(^1\)“Whirlydoodles” can be seen around downtown Ann Arbor.