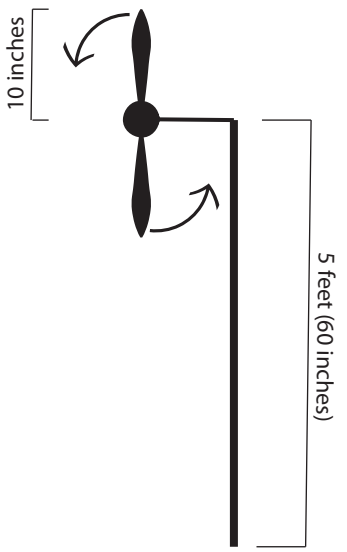
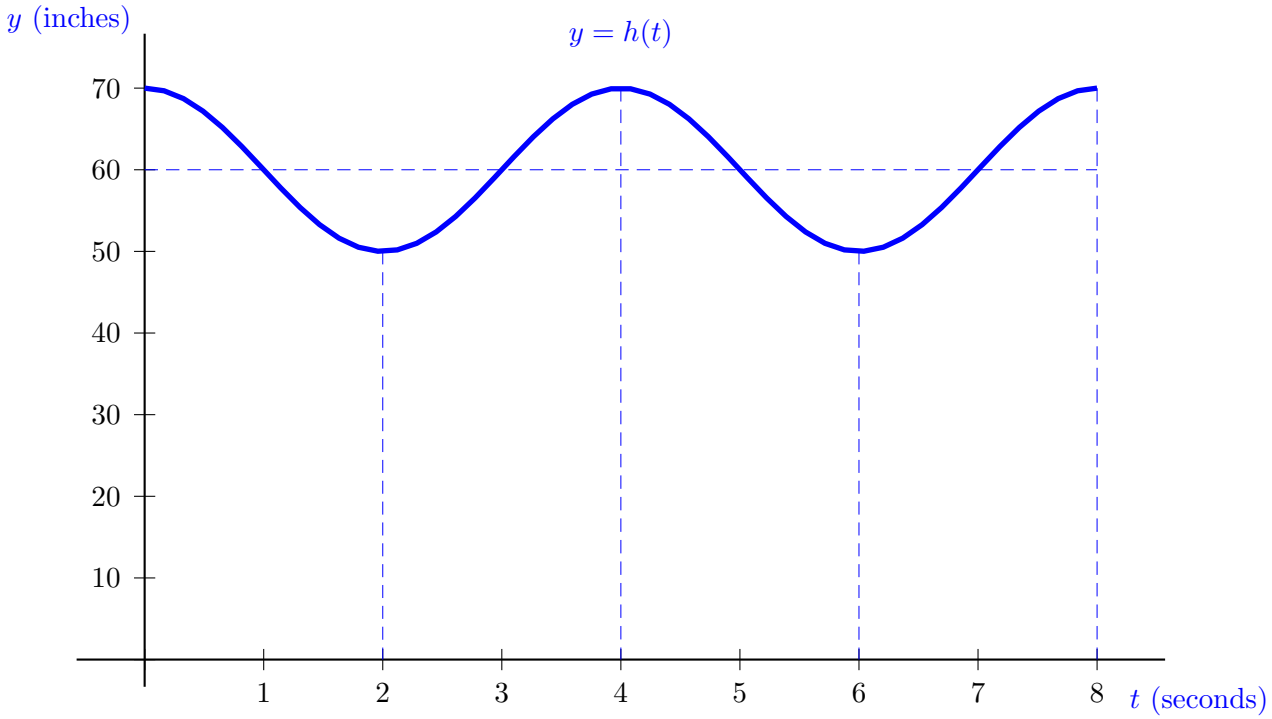
7. [10 points] A "Whirlydoodle"[1] is a small windmill that spins and lights up when the wind blows. One evening, there is a light breeze and a particular Whirlydoodle's blades are rotating at a constant rate of one revolution every 4 seconds. A moth lands on the tip of one of the blades of the Whirlydoodle 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 $0 \le t \le 8$. (Remember to label the axes (including units) and to make sure that the key features and characteristics of your graph are clear.)



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.