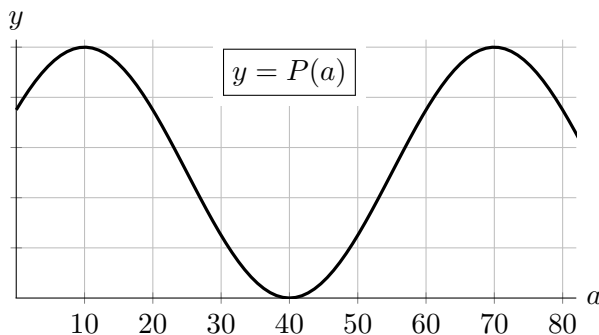


4. [12 points] Parts **a.** and **b.** below are unrelated.

- a.** [6 points] Suppose that the temperature in Staunton, Virginia, in degrees Fahrenheit ($^{\circ}\text{F}$), can be modeled by a sinusoidal function $S(t)$ where t is the time in months since January 1. Note that, for example, August 1 is seven months after January 1. A formula for $S(t)$ is

$$55 - 21 \cos\left(\frac{\pi}{6}t\right),$$

- Using this model, what is the coldest temperature in Staunton?
 - Using this model, what is the average temperature over the entire year?
 - At what time t does the temperature first reach “room temperature” (68°F)? *Give your final answer in exact form.*
- b.** [6 points] Suppose that a probe lands on some planet other than Earth, and that its recorded temperature, in degrees Fahrenheit, can be modeled by a sinusoidal function $P(a)$ where a is the time in years since the probe landed. Note that the scale on the y -axis is unknown.



When the temperature is too cold, the probe is in a state of hibernation. The first time it enters hibernation is at $a = 27$.

- At what time a does the probe leave hibernation?
- What is the period of $P(a)$?
- Use the period you found to calculate the next time at which the probe will enter hibernation.