1. **Determine A, ω, and φ** in following sequences. They are part of a sinusoidal sequence of the form $x[n] = A\cos(\omega_o n + \varphi)$. Note: There are three different operations that make neither A, ω, or φ unique:
   a) A can be replaced by –A if π is added to φ
   b) any multiple of 2π can be added to φ or to ω_o
   c) one could negate the entire cosine argument (both ω_o and φ) since cosine is even
   Therefore, to keep the answers unique, please conform to the most common standard which is
   $A \geq 0$, $0 \leq \omega_0 \leq \pi$, and $-\pi < \varphi \leq \pi$.

   a. {3 -3}
      ↑

   b. {0 1.5 0 -1.5}
      ↑

2. Given the continuous-time voltage signal of an AC powerline $v(t) = 120\cos(2\pi 60 t)$

   a. Find the minimum sampling frequency in samples/second that prevents aliasing.

   b. What is the formula for the sampled sequence v[n] if v(t) is sampled at $f_s = 600$ Hz (i.e. at 600 samples/second) ?

   c. What is the discrete sampling frequency ω_o in rads/sample for v[n] in the above problem, where $0 \leq \omega_o < \pi$?

   d. What is the discrete sampling frequency ω_o in rads/sample for v[n] in the above problem,where $0 \leq \omega_o < \pi$, if v(t) was sampled at $f_s = 10$ Hz? What is happening in this example?

3. You are asked to develop a powerline voltage and frequency measuring device using a microcontroller. The microcontroller has a built-in A/D converter that can accept a voltage from 0 to 5V.

   a. Attach a design of the electronics. You will have to figure out a way to change the $120V_{rms}$ signal into the range 0 to 5V for the microcontroller's A/D converter.

   b. What issues set the lower limit at which you would want to sample the powerline voltage? What issues set the upper limit at which you would want to sample the powerline voltage?