ECE113, Winter 2023 **Quiz #3**
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Wednesday, 18 Jan 2023
10 points total.

Name: _____
UID: _____

1. (10 points) Consider the following signal:

$$x[n] = \sin(\frac{\pi}{3}n + \frac{\pi}{6}).$$

Write out the proof of whether $y[n]$ is periodic or not. If yes it is periodic, please also include the fundamental period:

(a) $y[n] = x[n+5]$

(b) $y[n] = x[\frac{n}{3}]$

Solution:

The fundamental period N for $x[n]$ should be 6 (Simply apply $\frac{2\pi}{N} = \frac{\pi}{3}$).

(a) Yes, $y[n+6] = x[n+6+5] = x[n+5] = y[n]$, so the fundamental period $N_y = 6$.

(b) Yes, $y[n+N_y] = x[\frac{1}{3}(n+N_y)] = x[\frac{1}{3}n + \frac{1}{3}N_y]$, if periodic, $\frac{1}{3}N_y = 6$, so $N_y = 18$. Also, you can think as follows: y[n] is actually up-sampling (expand) $x[n]$ by 3, so correspondingly, $N_y = 3N = 18$.