

ECE113, Winter 2023

Digital Signal Processing

University of California, Los Angeles; Department of ECE

Quiz #2

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10 points total.

Name: _____

UID: _____

1. (10 points) Consider the following sequences:

$$x[n] = \operatorname{Re} \left(e^{j\pi n/8} \right),$$

$$y[n] = \operatorname{Im} \left(e^{j\pi n/5} \right),$$

$$z[n] = x[n] + y[n],$$

- (a) What is the fundamental period of $x[n]$?
- (b) What is the fundamental period of $y[n]$?
- (c) Is $z[n]$ periodic? If yes, what is the fundamental period? If no, why?

Solutions:

- (a) By Euler's formula: $x[n] = \operatorname{Re} \left(e^{j\pi n/8} \right) = \cos(\frac{\pi}{8}n)$, $x[n + N_x] = \cos(\frac{\pi}{8}(n + N_x)) = \cos(\frac{\pi}{8}n + \frac{\pi}{8}N_x)$. Since $x[n] = x[n + N_x]$, it should be $\frac{\pi}{8}N_x = 2\pi$, so $N_x = 16$.
- (b) Similarly, $y[n] = \sin(\frac{\pi}{5}n)$, $N_y = 10$.
- (c) Yes. $N_z = \operatorname{LCM}(N_x, N_y) = 80$.