Tutorial 1 on Week 2

1. Consider a discrete-time signal of the form:

$$x[n] = \cos(\omega_0 n)$$

   Determine the condition of ω_0 if $x[n]$ is periodic.

2. Show that any continuous-time signal $x(t)$ can be represented as:

$$x(t) = x_e(t) + x_o(t)$$

   where

$$x_e(t) = \frac{1}{2}[x(t) + x(-t)] \quad \text{and} \quad x_o(t) = \frac{1}{2}[x(t) - x(-t)]$$

   are even and odd functions, respectively.

3. Determine the imaginary part of $x(t)$:

$$x(t) = \sqrt{2} e^{j\pi/4} \cos(3t + 2\pi)$$

4. Determine the real and imaginary parts as well as magnitude and phase of

$$\frac{a + jb}{b - jc}$$

5. Determine if the following signal is energy or power signal and then compute its energy or power:

$$x(t) = \begin{cases} e^{-at}, \ 0 < t < \infty, & a > 0 \\ 0, & \text{otherwise} \end{cases}$$

6. Consider a periodic continuous-time signal $x(t)$. Can it be an energy or power signal? If it can be an energy or power signal, will its energy or power be changed with time shift, time scaling and time reversal?

7. Given

$$r[n] = nu[n] = \begin{cases} n, & n \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

Find $y[n] = 2r[1-n]$.

8. Evaluate the following expression:

$$\int_{-\infty}^{\infty} \sin(3t)\delta\left(t - \frac{\pi}{2}\right) dt$$