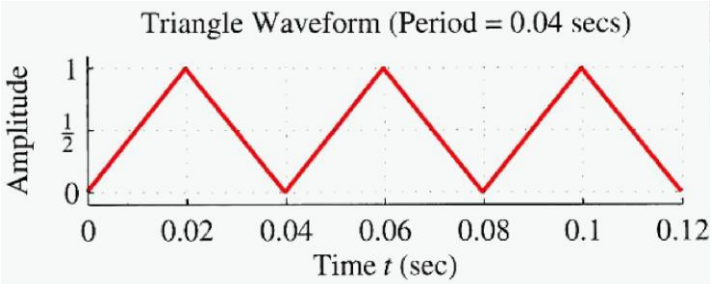
DSP2025 Homework 1 Due date: 12:00 noon, March 13, 2025

1. Find the **DC component** of the following periodical signal with the period 0.04.

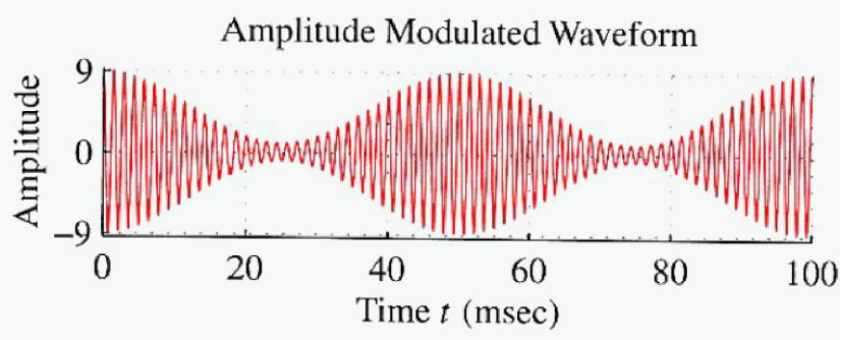


hint: write the signal $x(t)$ in a single period $[0, T_0]$, where $T_0 = 0.04$. Then use the Fourier series integral formula to find the Fourier-series coefficients.

2. The amplitude-modulation (AM) signal is a product the form,

$$x(t) = v(t)cos(2\pi f_c t)\ .$$

Consider the case where $v(t) = 5 + 4cos(40\pi t)$, and the carrier frequency $f_c = 700Hz$. The time-domain of the signal $x(t)$ is shown as



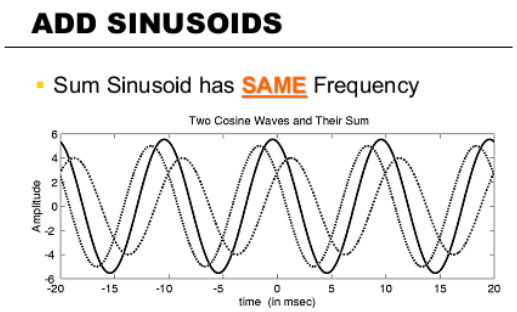
Question: Find and draw the spectrum of $x(t)$ in terms of Continuous Fourier Transform

3. Does the following statement hold?

"Sum of sinusoids of equal frequencies is still a sinusoid of the same frequency."

Show your reason.

(Here we assume that zero signal $x(t) = 0\ \forall t$ can be explained as a sinusoid of any frequency).



4. Derive that the following is a continuous Fourier transform pair $(a > 0)$, where $u(t)$ is the unit step function.