1. a). For the waveform shown, write the first 3 non-zero terms of the Fourier series representation and draw the amplitude spectrum. (10 points).

![Waveform Diagram]

b). The first three terms in the Fourier series of a periodic waveform are

\[ v(t) = 25 \sin(100\pi t) - \frac{25}{9} \sin(300\pi t) + \sin(500\pi t) + \ldots \]

i). What is the period and the fundamental frequency in rad/s? (5 points).

ii). Draw the amplitude and phase spectra of this waveform (first 3 terms). (10 points).

iii). Calculate the average fundamental power (power due to the fundamental component) delivered to a resistor of value 25Ω. (5 points).
1. a). For the waveform shown, **write the first 3 non-zero** terms of the Fourier series representation and **draw** the amplitude spectrum. (10 points).

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2. The input waveform for a circuit is periodic and is given by

\[ v_i(t) = 1 + 5 \sin(t) - 20 \sin(100t) + 20 \cos(1000t) \]

This waveform is applied to a circuit for which the transfer function Bode magnitude and phase plots are shown below.

a). **Determine** the Fourier series representation of the output voltage \( v_o(t) \). (10 points).

b). **Write** the expression for the rms value of the output voltage waveform using the numeric values of part (a). (5 points).
2. The input waveform for the circuit shown is periodic and is given by

\[ v_i(t) = 1 + 5 \sin(t) - 20 \sin(100t) + 20 \cos(200t) \]

a). **Derive** the transfer function \( V_o(s)/V_i(s) \) for the circuit. (5 points).

b). **Determine** the Fourier series representation of the output voltage \( v_o(t) \). (*Hint:* Use the following approximations \( 1+jx = jx \) for \( x \geq 10 \) or \( 1+jx = 1 \) for \( x \leq 0.1 \)) (10 points).

c). **Write** the expression for the rms value of the output voltage waveform using the numeric values of part (b). (5 points).
2. The input waveform for the circuit shown is periodic and is given by

\[ v_s(t) = 1 + 5 \cos(t) - 20 \sin(100t) + 20 \cos(200t) \]

(a). **Derive** the transfer function \((V_o(s)/V_s(s))\) for the circuit. (5 points).

(b). **Determine** the Fourier series representation of the output voltage \(v_o(t)\). *(Hint: Use the following approximations \(1+jx = jx\) for \(x \geq 10\), \(1+jx = 1\) for \(x \leq 0.1\))* (10 points).

(c). **Write** the expression for the rms value of the output voltage waveform using the numeric values of part (b). (5 points).