1. From the log plots, the gain and phase at DC (\(\omega=0\)) and \(\omega=100\) are:
   \(\omega=0\): Gain=(0 dB)=1; Phase=0.
   \(\omega=100\): Gain=(-20 dB)=0.1; Phase=-45°.

1a. (i) \(0.1 \cos(100t - 45°)\); (ii) \(7 + 0.3 \cos(100t - 25°)\).

1b. (i) \(10 \cos(100t + 45°)\); (ii) \(7 + 30 \cos(100t + 65°)\).

2. Plotted below left. Approaching an exponential function (\(e^{3-t}, 0 < t < 3\), in fact).

3. Gain at \(\omega=2\) is \(15/3=5\); Gain at \(\omega=8\) is \(10/5=2\). Solve 2 equations in 2 unknowns:
   \[ \frac{B}{2^2 + A^2} = 5 \Rightarrow B - 5A = 20; \]
   \[ \frac{B}{8^2 + A^2} = 2 \Rightarrow B - 2A = 128. \]
   Solving for \(A=6, B=200\).

4a. \(x(t) = \begin{cases} 1-t, & \text{for } 0 < t < 1; \\ 1+t, & \text{for } -1 < t < 0. \end{cases}\)

   Since \(x(t)\) is an even function (symmetric about \(t=0\)), we have \(b_n=0\).

   \[ a_n = \frac{2}{\pi} \int_{-1}^{0} (1+t) \cos(n\pi t) dt + \frac{2}{\pi} \int_{0}^{1} (1-t) \cos(n\pi t) dt = 2 \int_{0}^{1} (1-t) \cos(n\pi t) dt \]
   \[ = 2 \int_{0}^{1} \cos(n\pi t) dt - 2 \int_{0}^{1} t \cos(n\pi t) dt = \frac{2}{n\pi} \sin(n\pi t) \bigg|_{0}^{1} - 2 \frac{\cos(n\pi t) \bigg|_{0} - 2 \frac{t \sin(n\pi t) \bigg|_{0}}{n\pi}} \]
   \[ = \frac{2}{\pi^2 n^2} (1 - (-1)^n) = \begin{cases} 4/\pi^2 n^2), & \text{for } n \text{ odd}; \\ 0, & \text{for } n \text{ even}. \end{cases} \]

   Only middle term above is non-zero.

   \[ a_o = \frac{1}{2} \int_{-1}^{0} (1+t) dt + \frac{1}{2} \int_{0}^{1} (1-t) dt = \frac{1}{2} \int_{0}^{1} (1-t) dt = 1/2 \text{ using symmetry}. \]

   \[ x(t) = \frac{1}{2} + \frac{4}{\pi^2} \cos(\pi t) + \frac{4}{9\pi^2} \cos(3\pi t) + \frac{4}{25\pi^2} \cos(5\pi t) + \frac{4}{49\pi^2} \cos(7\pi t) + ... \]

4b. 2 Hertz: \(\omega = 4\pi \rightarrow \) keep 1st 3 terms of this series: \(\frac{1}{2} + \frac{4}{\pi^2} \cos(\pi t) + \frac{4}{9\pi^2} \cos(3\pi t)\).

   Plotted below right. Attenuation of high freqs→round corners: can’t change quickly.