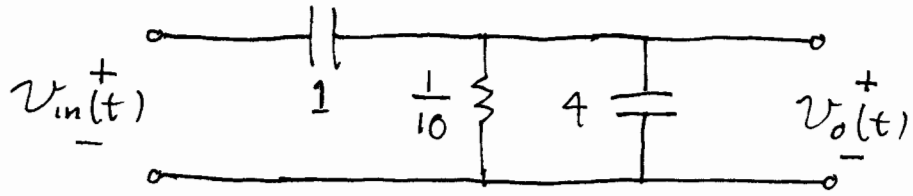
HW 2 ECE 45

1. The input, $x(t)$, and output, $y(t)$, of a dissipative network are related via the differential equation

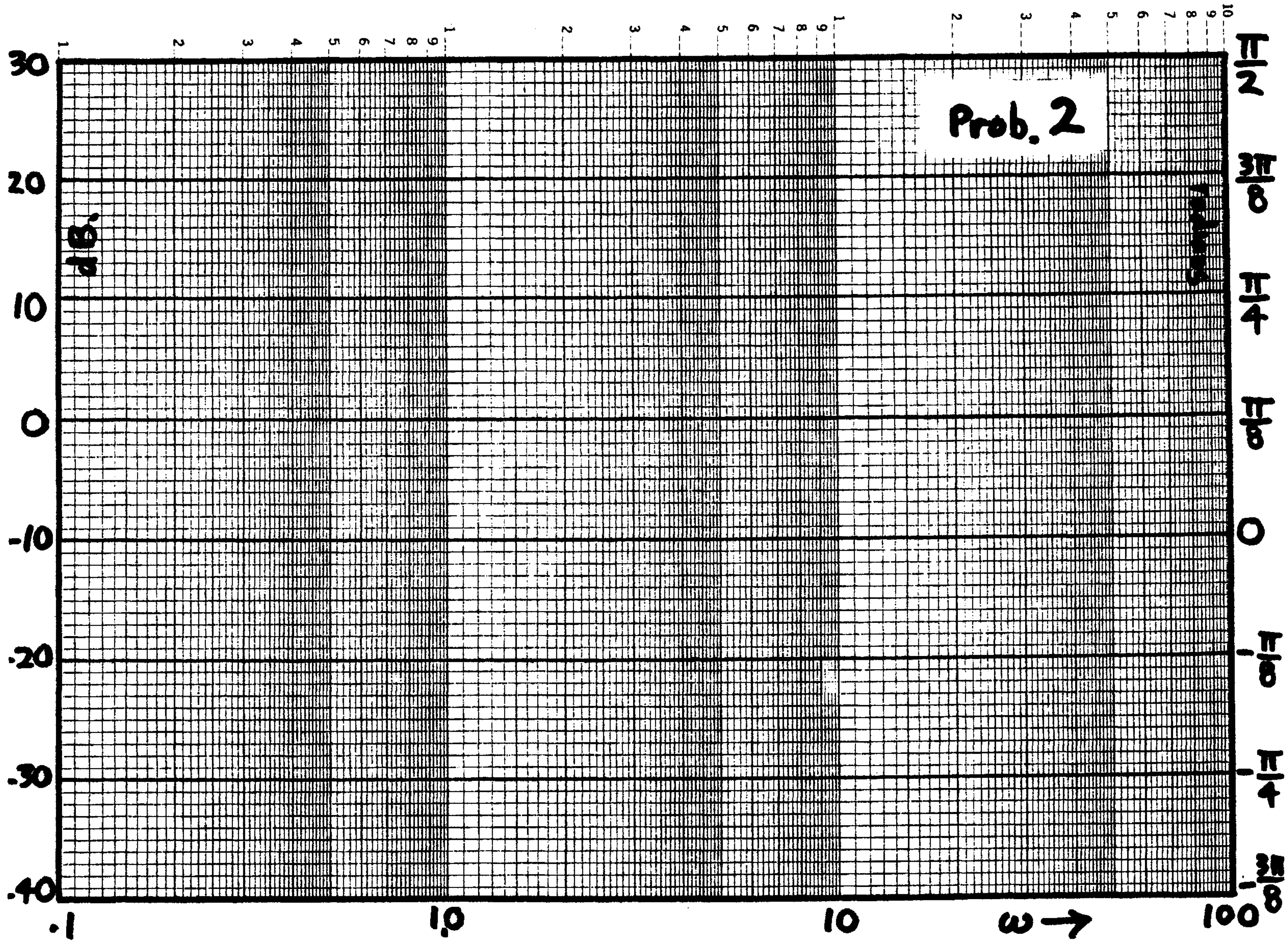
$$4\frac{d^3}{dt^3}y(t) + 2\frac{d^2}{dt^2}y(t) + 5\frac{d}{dt}y(t) + y(t) = 6\frac{d^2}{dt^2}x(t).$$

If the input is $x(t) = \cos t + 2\sin t$, find the steady state output $y(t)$.

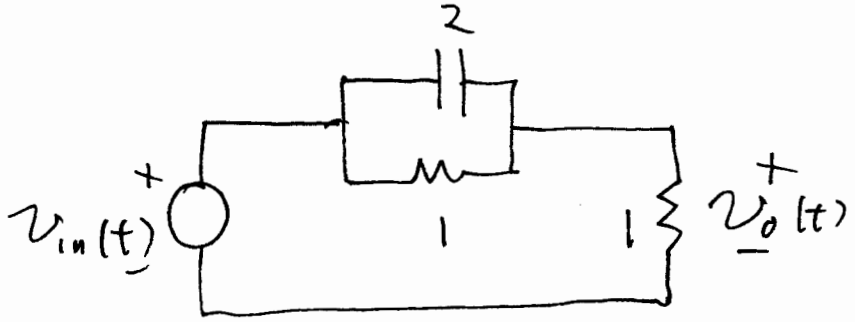
2. Determine the transfer function $H(i\omega) = \frac{V_o}{V_{in}}$ for the following circuit.



On the attached graph paper plot the straight-line approximations (Bode plots) for $H(i\omega)$. Plot both the amplitude and phase approximations on the same graph using a SOLID line for the amplitude and a DASHED line for the phase. Use the scales provided

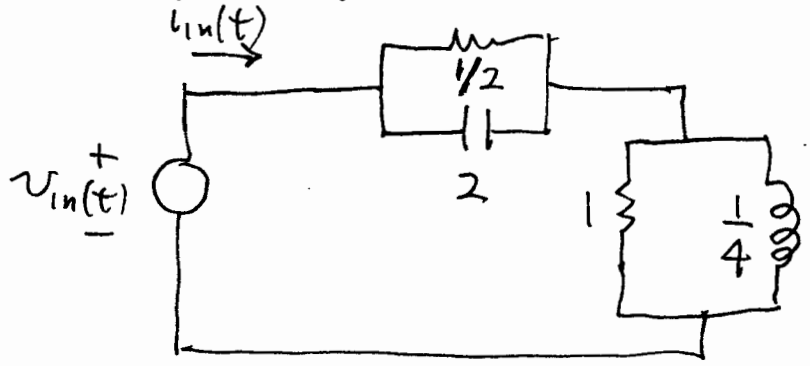

Prob. 2
dB.
radians
30
20
10
0
-10
-20
-30
-40
π/2
3π/8
π/4
π/8
0
-π/8
-π/4
-3π/8
.1
1.0
10
100
ω →

3. In the circuit below $v_{in}(t) = 4\cos t + 5\sin\frac{1}{2}t$.



Find the steady state response $v_o(t)$.

4. The circuit below is operating in the steady state with $v_{in}(t)$ a sinusoidal wave form with radian frequency ω, $\omega \neq 0$.



Find the frequency, ω_o, at which the steady state current, $i_{in}(t)$, is in phase with the applied sinusoid $v_{in}(t)$. That is, find the resonant frequency, ω_o.

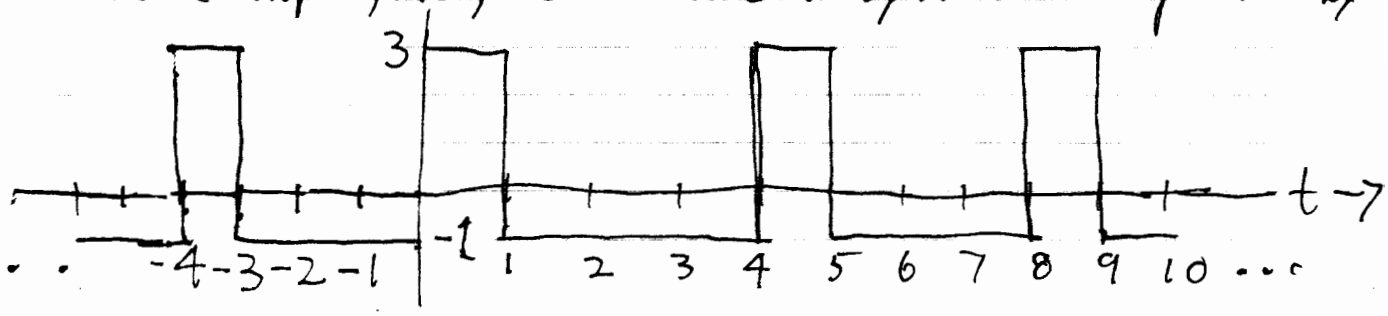
5. Let $f(t) = 4(\cos t)\cdot(\cos 3t)$. Determine the period of $f(t)$ and find its complex Fourier series coefficients.

6. The function $f(t)$ is given by

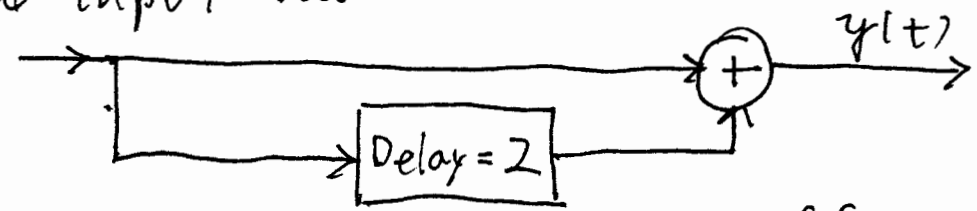
$$f(t) = |\cos t| \qquad -\infty < t < \infty.$$

Find the complex Fourier series coefficients for $f(t)$.

7. The input, $x(t)$, to a linear system is given by

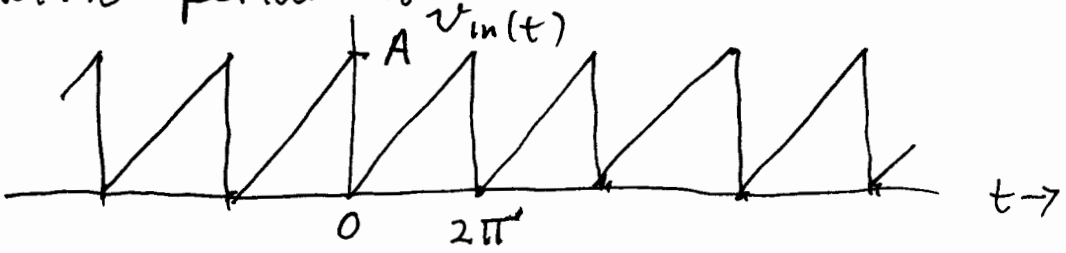


The output of the system is related to the input via

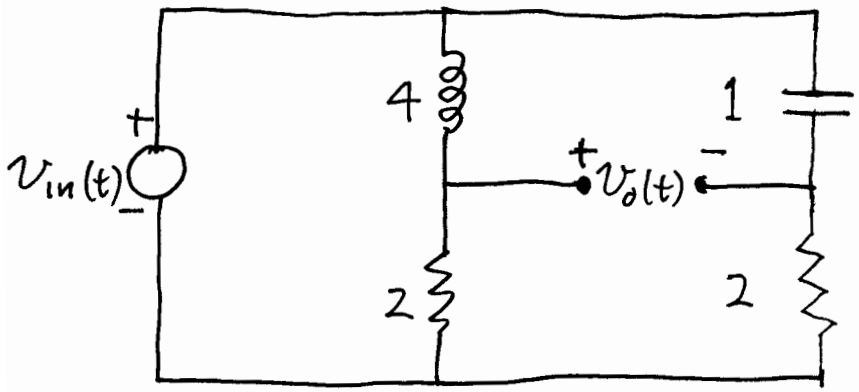


Find the Fourier series coefficients of $y(t)$.

8. The input to a system is a periodic function with period T_0



The following network is operating in the steady state



Find the complex Fourier coefficients of the output $v_o(t)$.