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ENGR 202

HW 17

17.1) Plot the full frequency response of the network function below.

```python
import numpy as np
import matplotlib.pyplot as plt

freq = range(1, 100000)

def trans_func_mag(freq):
    H = ((100**2+freq**2)**.5 / (2500**2+freq**2)**.5)
    return H

def trans_func_phase(freq):
    P = (np.arctan2(freq,100) - np.arctan2(freq,2500))*(180/np.pi)
    return P
mag = []
phase = []

for f in freq:
    mag.append(trans_func_mag(f))
    phase.append(trans_func_phase(f))

fig, axs = plt.subplots(2, 1, figsize=(8, 8))

axs[0].plot(freq, mag, label='Magnitude')
axs[0].set_title("Frequency vs. Magnitude of H(jw)")
axs[0].set_xlabel("Frequency  w (Hz)")
axs[0].set_ylabel("Magnitude of H(jw)")
axs[0].grid(True)
axs[0].legend()

axs[1].plot(freq, phase, label='Phase')
axs[1].set_title("Frequency vs. Phase of H(jw)")
axs[1].set_xlabel("Frequency  w (Hz)")
axs[1].set_ylabel("Phase of H(jw)")
axs[1].grid(True)
axs[1].legend()

plt.show()
```
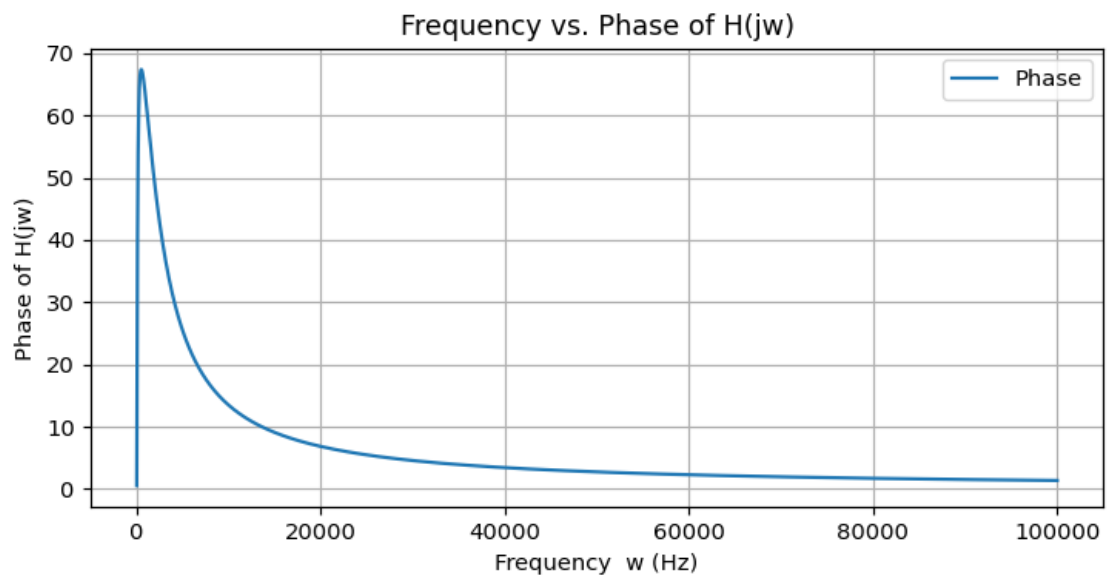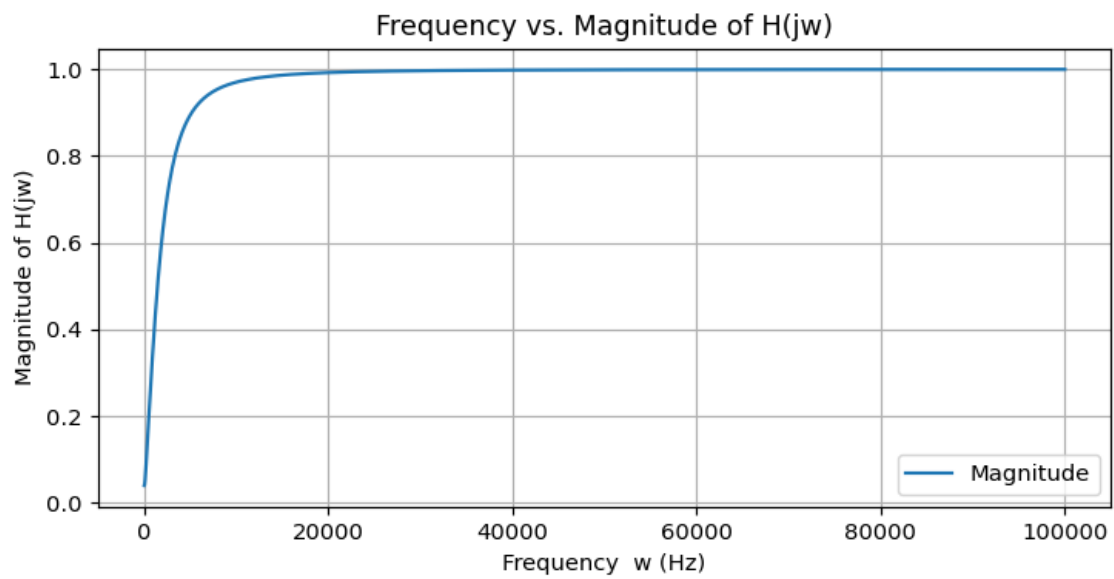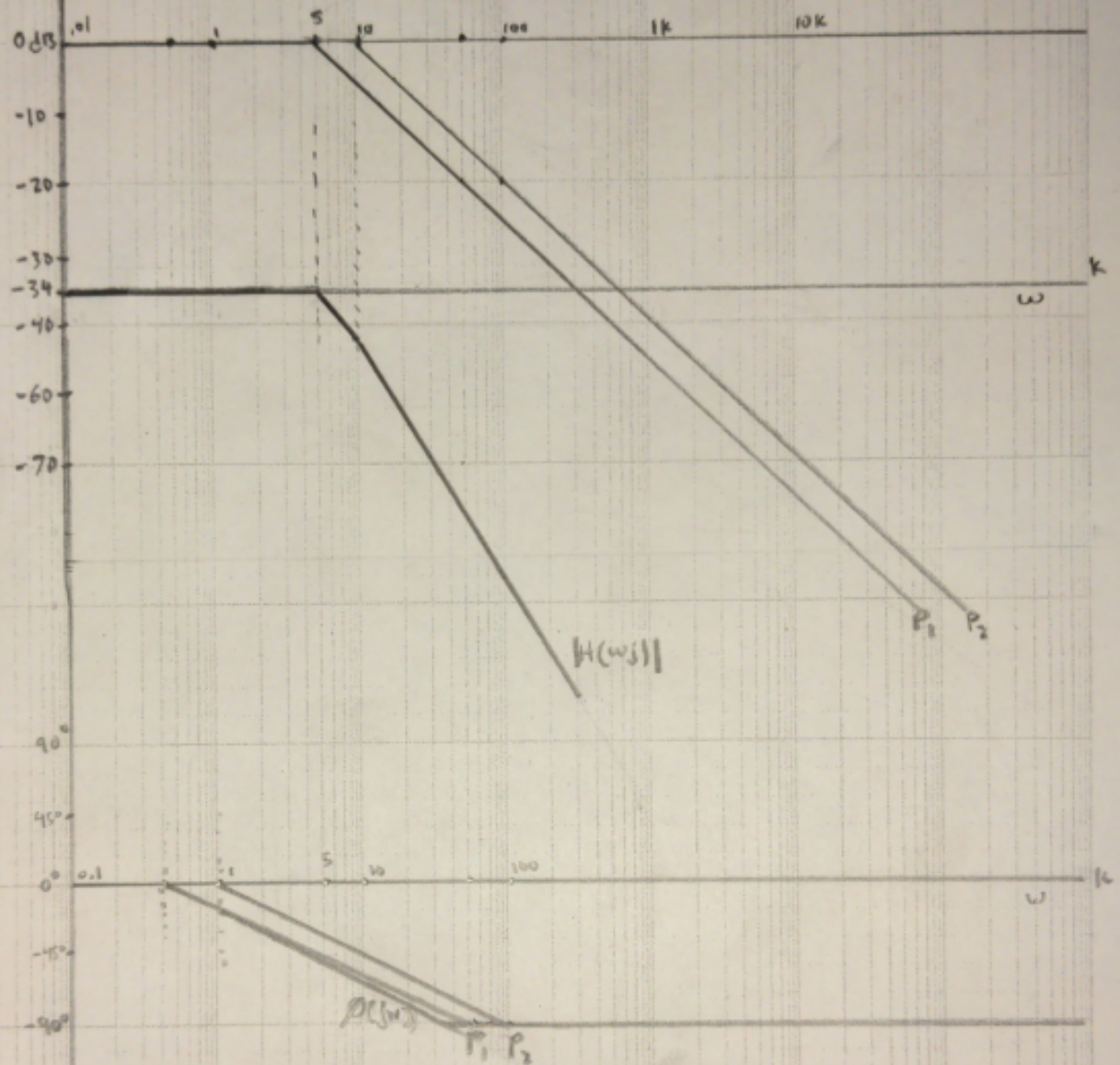
Frequency vs. Magnitude of H(jw)

Frequency vs. Phase of H(jw)

$$H(jw) = \frac{1}{(jw+5)(jw+10)} \rightarrow \frac{1}{50}\left(\frac{1}{\left(\frac{jw}{5}+1\right)\left(\frac{jw}{10}+1\right)}\right)$$

$$K = 20\log_{10}\left(\frac{1}{50}\right) = -34\,dB$$

$$P_1 = 5 \qquad P_2 = 10$$

$|H(wj)|$

$P(jw)$

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$$H(\omega j) = \frac{(jw+40)}{(jw+1)(jw+2)} \rightarrow 20 \frac{\left(\frac{jw}{40}+1\right)}{\left(\frac{jw}{1}+1\right)\left(\frac{jw}{2}+1\right)}$$

$$K = 20\log_{10}(20) = 26dB$$
$$Z_1 = 40 \qquad P_1 = 1 \qquad P_2 = 2$$