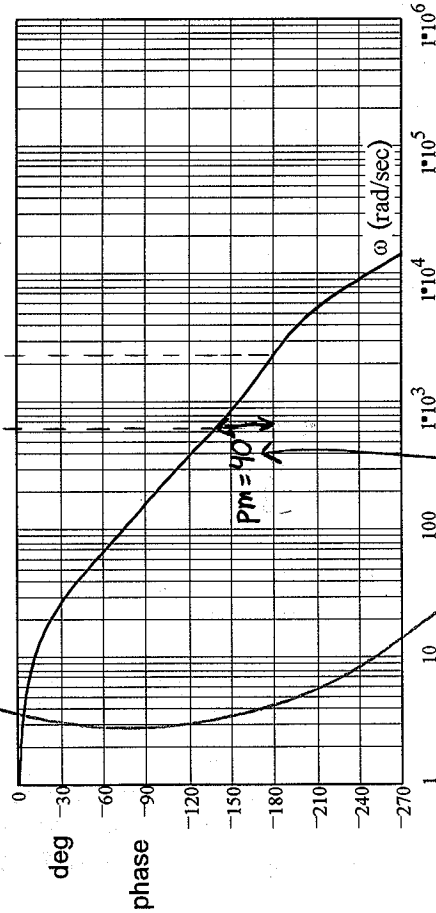
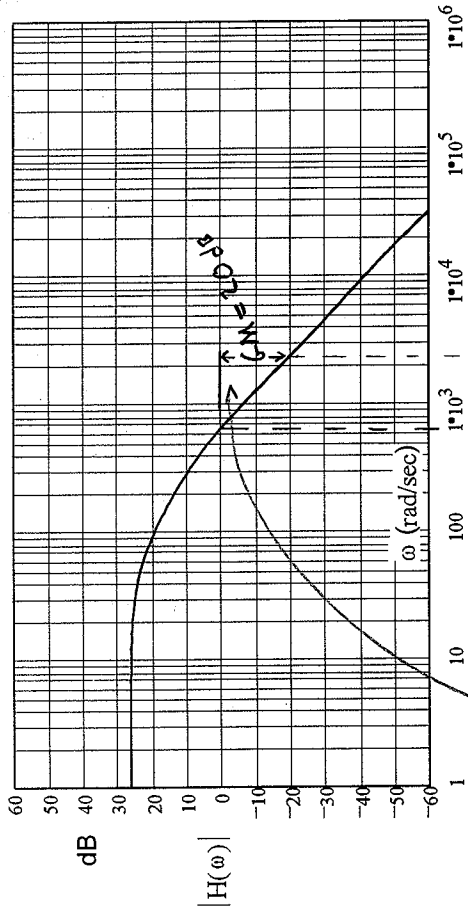


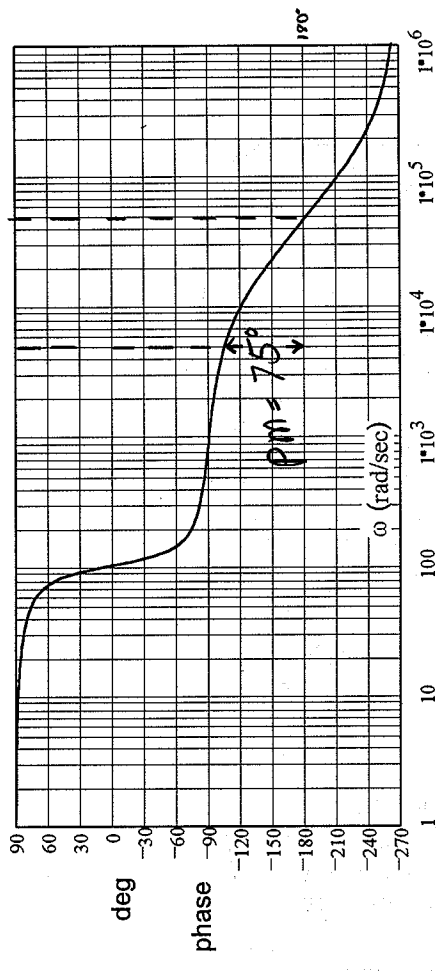
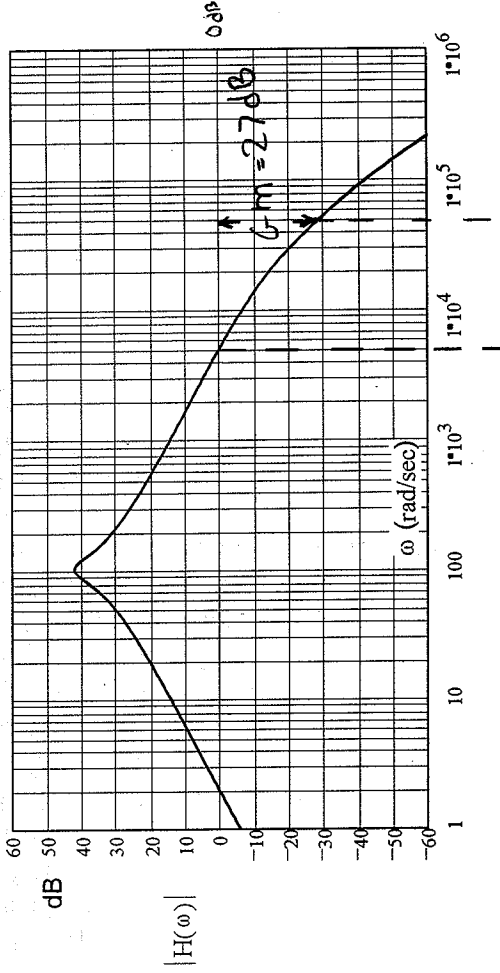
ECE 3510 Gain, Phase, and Delay margins



Gain Margin GM := 20 dB At about:  $2200 \frac{\text{rad}}{\text{sec}}$

Phase Margin PM := 40 deg At about:  $620 \frac{\text{rad}}{\text{sec}}$

Delay Margin  $f := \frac{\omega \text{ PM}}{2 \cdot \pi}$   $T := \frac{2 \cdot \pi}{\omega \text{ PM}}$  DM :=  $\left( \frac{40 \cdot \text{deg}}{360 \cdot \text{deg}} \right) \cdot T$  DM = 0.12 ms



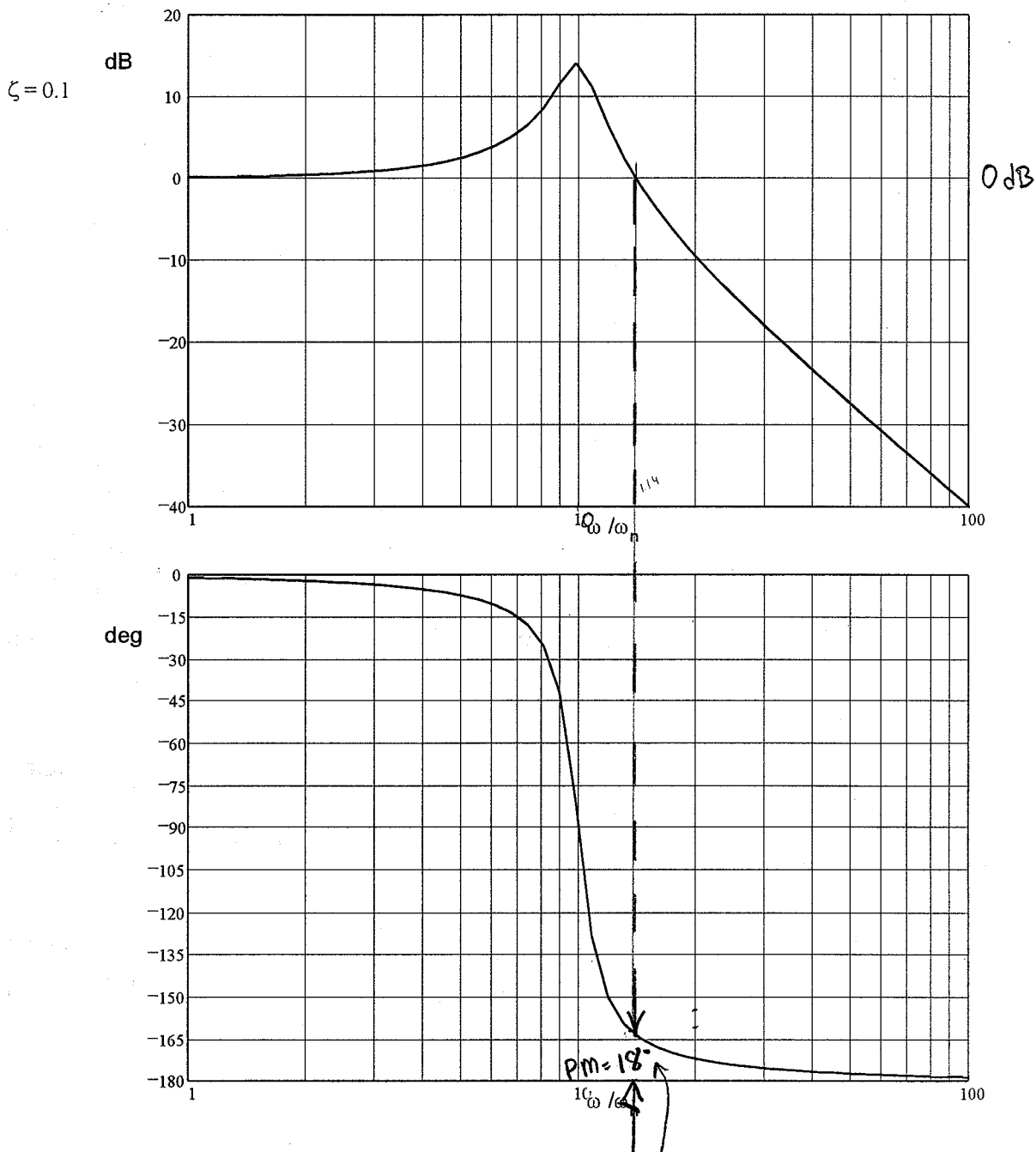
Gain Margin GM := 27 dB occurs at about:  $43000 \frac{\text{rad}}{\text{sec}}$

Phase Margin PM := 180 deg - 105 deg  $5000 \frac{\text{rad}}{\text{sec}}$

PM = 75 deg occurs at about:  $\omega \text{ PM} := 5800 \frac{\text{rad}}{\text{sec}}$

Delay Margin  $f := \frac{\omega \text{ PM}}{2 \cdot \pi}$   $T := \frac{2 \cdot \pi}{\omega \text{ PM}}$  DM :=  $\left( \frac{75 \cdot \text{deg}}{360 \cdot \text{deg}} \right) \cdot T$  DM = 0.226 ms

# ECE 3510 Gain, Phase, and Delay margins



Gain Margin

Doesn't apply *never goes to 180°*

Phase Margin

PM := 180·deg - 162·deg PM = 18·deg occurs at about:  $\omega_{PM} := 14 \frac{\text{rad}}{\text{sec}}$

Delay Margin

$f := \frac{\omega_{PM}}{2 \cdot \pi}$   $T := \frac{2 \cdot \pi}{\omega_{PM}} = 448 \text{ sec}$   $DM := \left( \frac{18 \cdot \text{deg}}{360 \cdot \text{deg}} \right) \cdot T$   $DM = 224 \cdot \text{ms}$