Using MathCad to obtain Bode Plots and Nyquist Plots of Transfer Functions:

Step 1: Define the range of frequencies as powers of 10, i.e. in anticipation of logarithmic scale,

$$Number\_of\_terms := 200$$

$$k := 0 .. Number\_of\_terms$$

$$Min\_exponent := -1$$ *(this will make the lower bound of ω as 10^{-1})*

$$Max\_exponent := 1$$ *(this will make the upper bound of ω as 10^{1})*

$$Exponent(k) := Min\_exponent + \frac{k}{Number\_of\_terms} \cdot (Max\_exponent - Min\_exponent)$$

(this is just a simple linear interpolation formula)

$$\omega_k := 10^{Exponent(k)}$$ *(Note that "[" was used for subscript here.)*

Step 2. Set the parameters and define G(s).

$$K := 1.0$$

$$\tau_n := 1.0$$ *(Note that "." was used for subscript here.)*

$$\zeta := 0.1$$

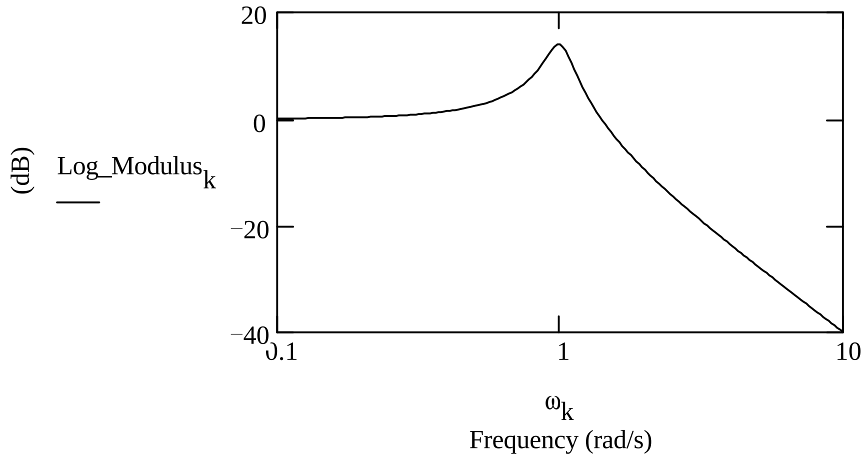
$$G(s) := \frac{K}{{\tau_n}^2 \cdot s^2 + 2 \cdot \tau_n \cdot \zeta \cdot s + 1}$$

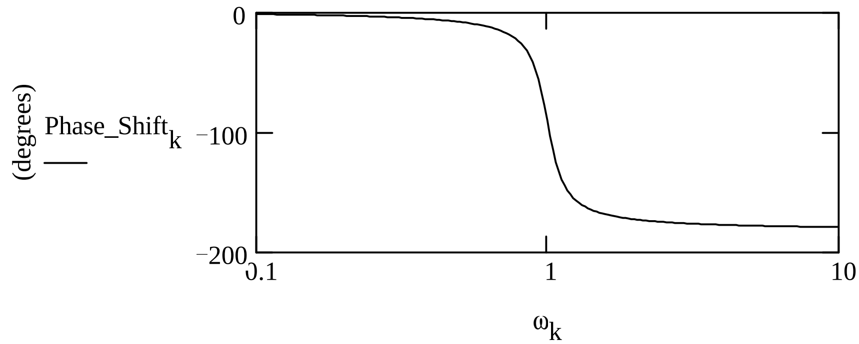
Step 3. Next calculate the log modulus and phase shift.

$$Log\_Modulus_k := 20 \cdot \log\left(\left|G\left(i \cdot \omega_k\right)\right|\right)$$

(Note that the function log *in MathCAD is already in base 10. Also, key in "1i" for the imaginary number, key in "2i" for 2 times the imaginary number, etc.)*

$$Phase\_Shift_k := \arg\left(G\left(i \cdot \omega_k\right)\right) \cdot \frac{180}{\pi}$$





Step 4. For the Nyquist plots,

$$Real\_G_k := Re(G(i \cdot \omega_k))$$

$$Imag\_G_k := Im(G(i \cdot \omega_k))$$