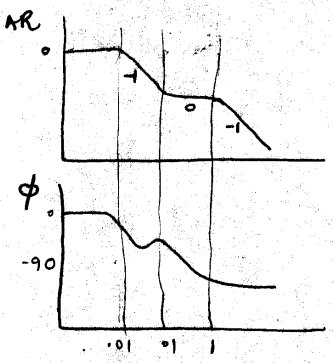
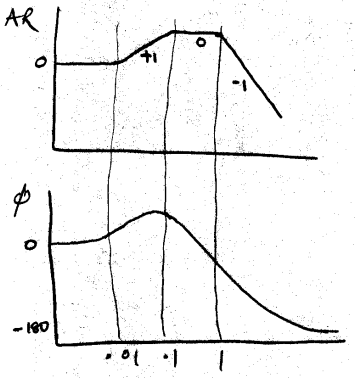
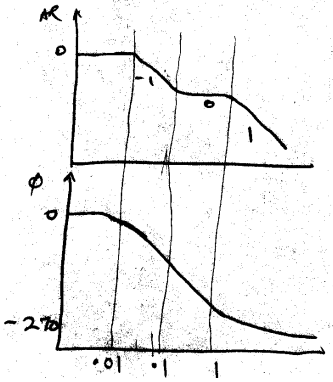
a. $\frac{10s+1}{(100s+1)(s+1)}$



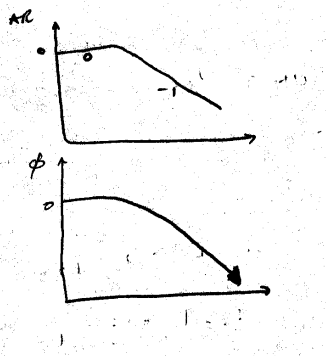
(b) $\frac{100s+1}{(10s+1)(s+1)}$



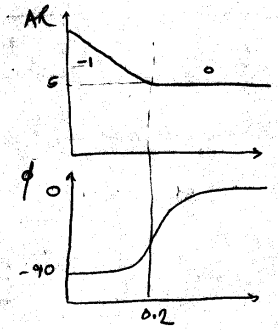
(c) $\frac{-10s+1}{(100s+1)(s+1)}$



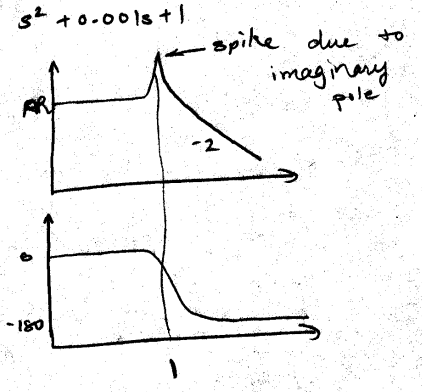
(e) $\frac{1}{(100s+1)} e^{-5s}$



(f) $5\left(1+\frac{1}{5s}\right)$



(d) $\frac{1}{s^2+0.001s+1}$



PROBLEM 2

NOTE That the proportional controller affects ONLY the AR and not ϕ.

(a) $$\text{gain margin} = \left.\frac{1}{AR}\right|_{\text{at } \omega = \omega_c}$$

$$\therefore [AR]_{\text{w/ controller}} = \frac{1}{\text{gain margin}}$$

$$[K_c]\,[AR]_{\substack{\text{open loop} \\ @\ \omega = \omega_c}} = \frac{1}{\text{gain margin}}$$

$$[K_c]\,[0.235] = \frac{1}{1.5}$$

$$\therefore \boxed{K_c = 2.84}$$

(b) Phase margin = 30 $\Rightarrow$ $\phi = -150$.

$\therefore$ At $\phi = -150$, we need $[AR]_{\text{w/ controller}} = 1$

$$\therefore [AR]_{\substack{\text{open loop} \\ @\ \phi = -150}}\,[K_c] = 1$$

$$\therefore [K_c] = \frac{1}{0.35}$$

$$\boxed{K_c = 2.86}$$