HW #7 Solns

1)

The DC gain of a system is found by,

$$M = \lim_{s \to 0} g(s) = g(0).$$

i) $g_1(s) = \frac{1}{s+1}$

$\Rightarrow M_1 = g_1(0) = \boxed{1}$

ii) $g_2(s) = \frac{10}{(s+1)(s+2)}$

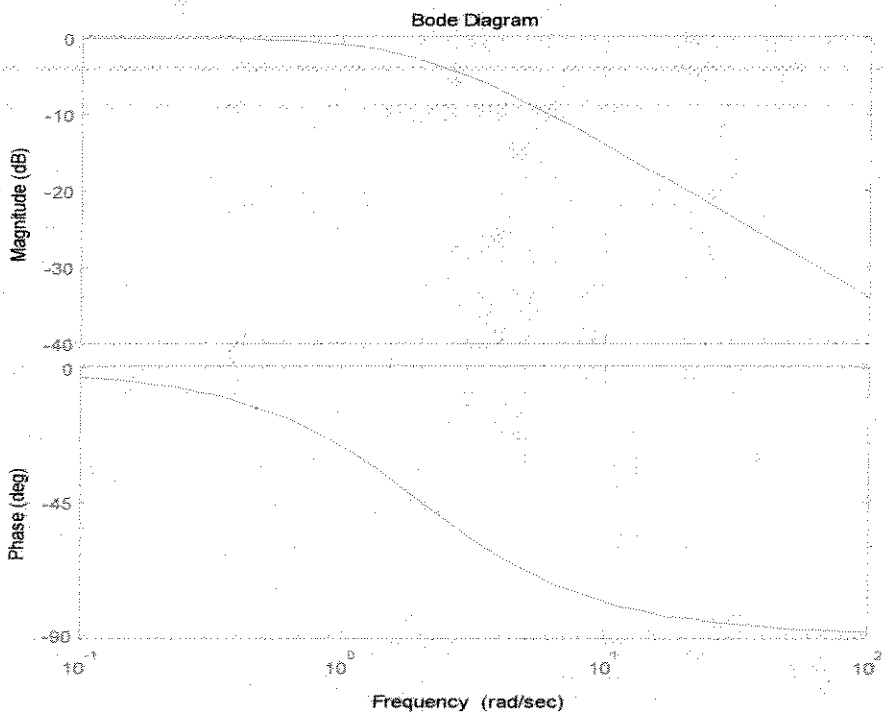
$\Rightarrow M_2 = g_2(0) = \boxed{5}$

iii) $g_3(s) = \frac{s+8}{(s+2)(s+4)}$

$\Rightarrow M_3 = g_3(0) = \boxed{1}$

```
%Homework 7, Problem 2


g4 = tf(2,[1 2]);
bode(g4)

freq = [1; 2; 10];

%compute magnitude shift
magshift = 2./sqrt(4 + freq.^2)

%compute phase shift
phaseshift = angle(2) - angle(2 + j.*freq)
```

Bode plot of g(s) = 2/(s+2)



magshift =

0.8944

0.7071

0.1961

phaseshift =

-0.4636

-0.7854

-1.3734

2c) $y_{ss}(t) = \sin(2t)$. Design $u(t)$.

Soln:

$\omega = 2$, $g_4(s) = \frac{2}{s+2}$

If,

$g_4(j\omega)^{-1} = M(\omega)\, e^{j\theta(\omega)}$

$\min\ u(t) = M(\omega)\sin(\omega t + \theta(\omega))$

$g_4(2j)^{-1} = j\frac{2+2}{2} = 1+j$

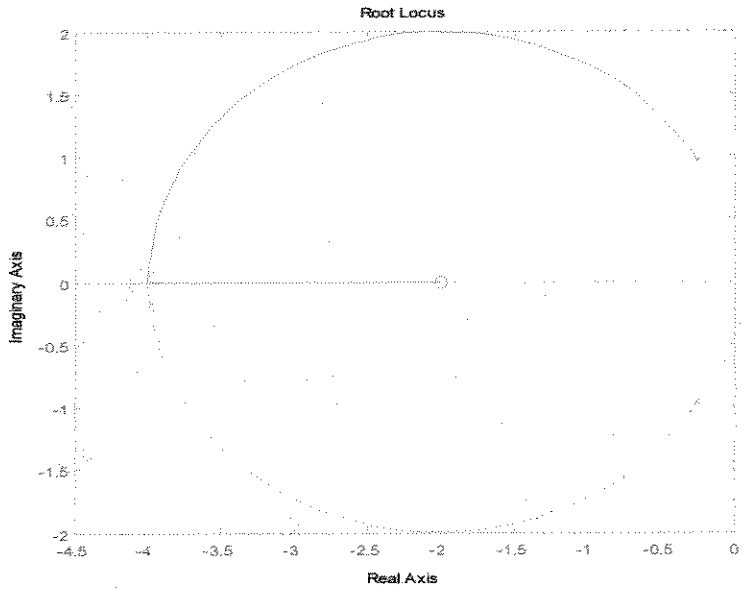
$M(2) = |g_4(2j)^{-1}| = \sqrt{2}$

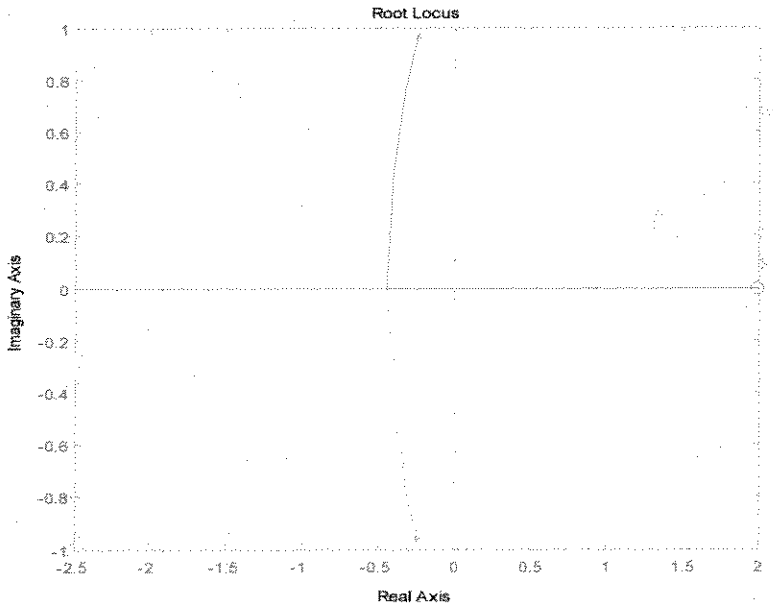
$\theta(2) = \angle g_4(2j)^{-1} = \arctan(1) = \frac{\pi}{4}$

So, $\boxed{u(t) = \sqrt{2}\sin\left(2t + \frac{\pi}{4}\right)}$

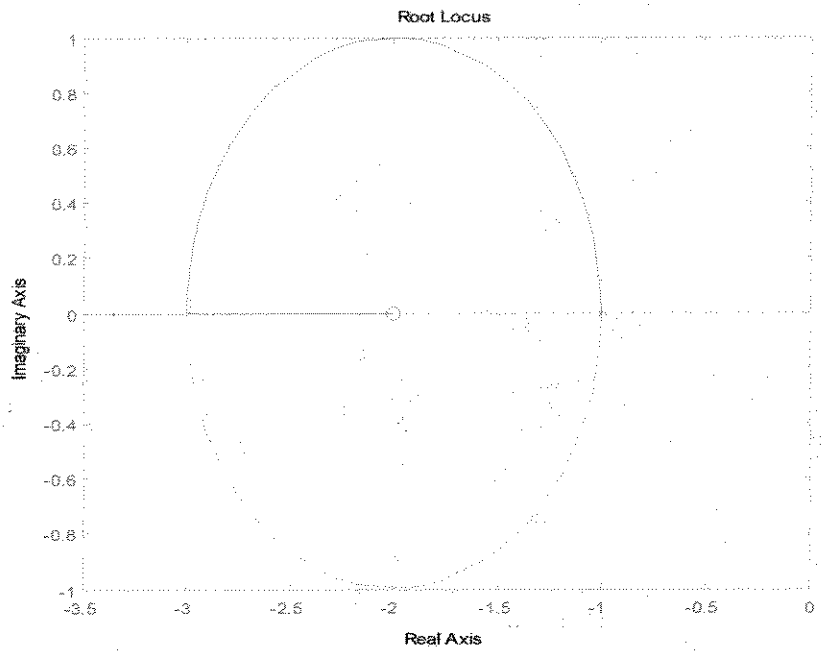
Root Locus Plots for the following transfer functions:

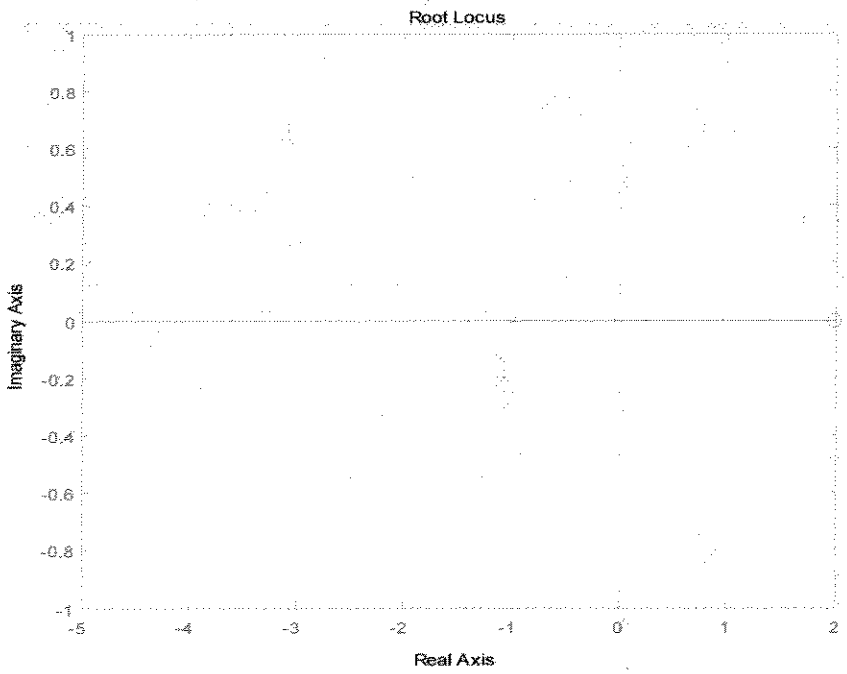
$$g(s) = (s \pm 2)/(s^2 + .5s + 1)$$





$$g(s) = (s \pm 2)/(s^2 + 2s + 1)$$





$$g(s) = (s \pm 2)/(s^2 + 10s + 1)$$