Quiz1 Industrial control Prof M. Barghash IE Dept Sch of Eng. UoJ

Name: saleem bouri ID:

Find the inverse laplace transform for $Y(t) = \frac{1}{s(s^2+1)}$

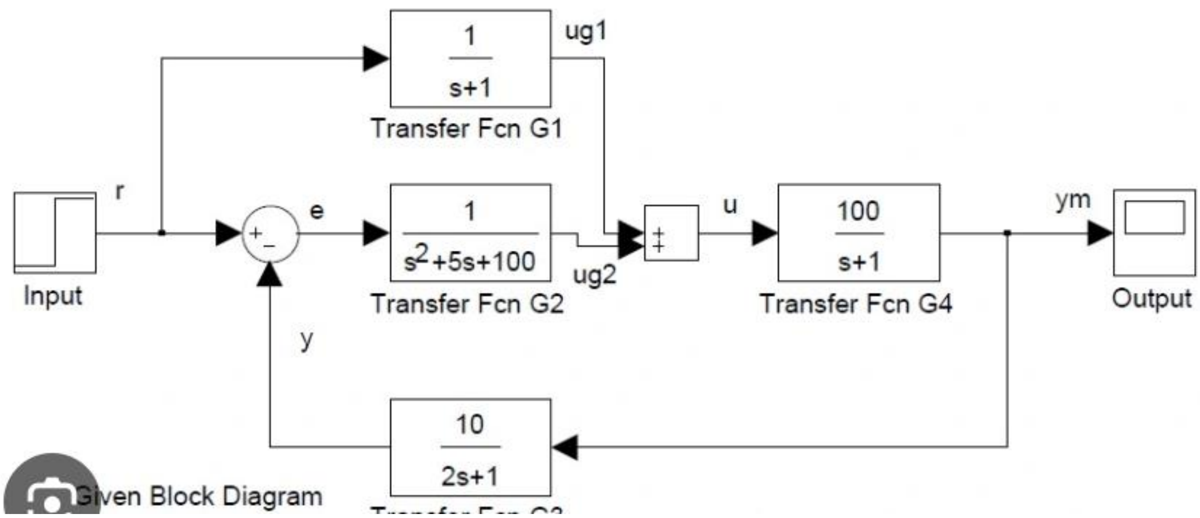
Solution

1-cos(t)

Quiz2 Industrial control Prof M. Barghash IE Dept Sch of Eng. UoJ

Name: ID:

Find the equivalent transfer function for



Solution

$$\frac{\dfrac{100}{(s^2+5s+100)(s+1)}+\dfrac{100}{(s+1)^2}}{1+\dfrac{1000}{(s^2+5s+100)(s+1)(2s+1)}}$$

QUIZ 3 INDUSTRIAL CONTROL PROF M BARGHASH IE DEPT UoJ 9/4/2023

NAME: ID:

For the following system find the rise time, settling time and percent overshoot

$$\frac{c}{R} = \frac{s+3}{s^2+s+4.25}$$

Tr=0.91second

Ts=8 second

Mp=45.58

QUIZ 3 INDUSTRIAL CONTROL PROF M BARGHASH IE DEPT UoJ 9/4/2023

NAME: ID:

For the following system find the rise time, settling time and percent overshoot

$$\frac{c}{R} = \frac{s+3}{s^2+4s+13}$$

Tr=0.71

Ts=2 second

Mp=12.64

QUIZ 3 INDUSTRIAL CONTROL PROF M BARGHASH IE DEPT UoJ 9/4/2023

NAME: ID:

For the following system find the rise time, settling time and percent overshoot

$$\frac{c}{R} = \frac{s+3}{s^2+9s+18}$$

Tr=0.3666

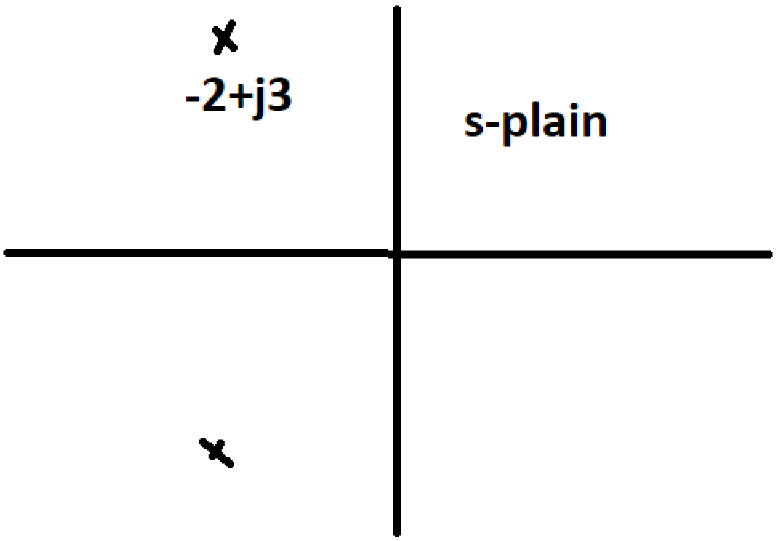
Ts=0.6666

Mp=0

QUIZ 3 INDUSTRIAL CONTROL PROF M BARGHASH IE DEPT UoJ 9/4/2023

NAME: ID:

For the following system with roots shown in the following s-plane find the rise time, settling time and percent overshoot



Tr=0.719

Ts=2

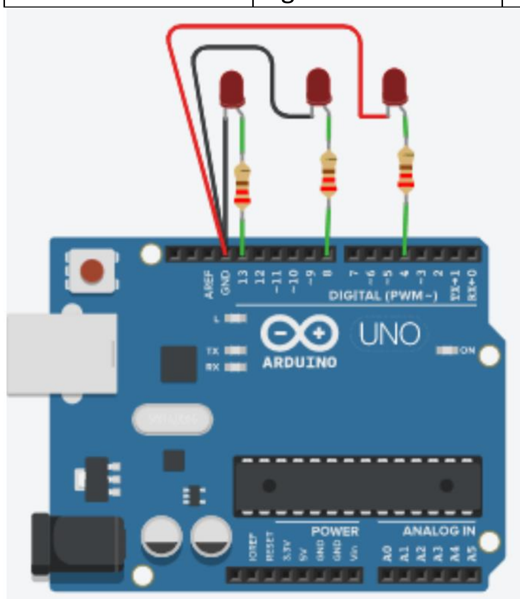
Mp=12.3

Quiz 7 Industrial control systems Prof M. Barghash IE Dept Sch of Eng UoJ 22/8/2023

Name: ID:

Write the code for the following Arduino such that we have the following lighting sequence (5 points)

Sequence step	1	2	3	4
LED1	off	Light	Off	Off
LED2	light	off	Light	Off
LED3	light	off	Light	off




```
Const int LED1=13;

Const int LED2=8;

Const int LED3=4;

Void setup(){

pinMode(LED1,OUTPUT);

PinMode(LED2,OUTPUT);

pinMode(LED3,OUTPUT);

}

Void loop(){ digitalWrite(LED1,LOW); digitalWrite(LED2,HIGH); digitalWrite(LED3,HIGH); delay(1000);

digitalWrite(LED1,HIGH); digitalWrite(LED2,LOW); digitalWrite(LED3,LOW);delay(1000);

digitalWrite(LED1,LOW); digitalWrite(LED2,HIGH); digitalWrite(LED3,HIGH); delay(1000);

digitalWrite(LED1,LOW); digitalWrite(LED2,LOW); digitalWrite(LED3,LOW); delay(1000);}
```

Quiz 8 Industrial control systems Prof M. Barghash IE Dept Sch of Eng UoJ 22/8/2023

Name: ID:

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write MATLAB code using ODE45 to solve the following differential equations

$\ddot{x} + x = \log(t), \qquad \dot{x}(0) = 0,\ x(0) = 0$

Plot(y) and plot(x) on same figure for a time interval 0 to 20 seconds.

```
Function dx=diff(t,x);

[m n]=size(x);

Dx=zeroes(m,n);

Dx(1)=x(2);

Dx(2)=log10(t)-x(1);
```

```
Clear

Clc

Tspan=[0 20];

X0=[0;0];

[t,x]=ode45(@diff,tspan,x0);

Plot(x)
```

Quiz 9 Industrial control systems Prof M. Barghash IE Dept Sch of Eng UoJ 22/8/2023

Name: ID:

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write MATLAB symbolic code to solve the following differential equations

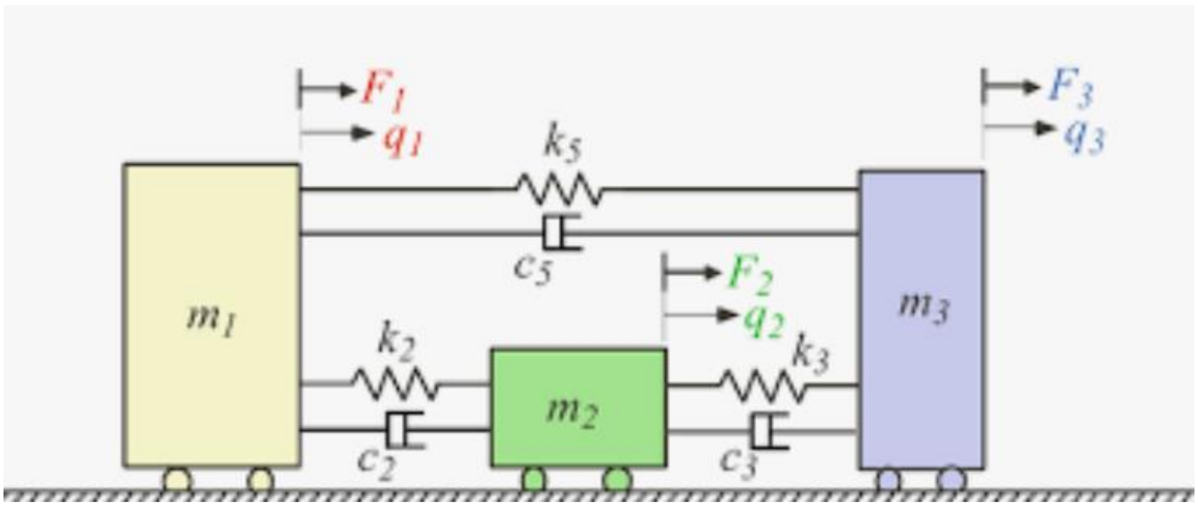
$\ddot{x}y + y = \log(t)$, $\ddot{y}x + \dot{y} = t$, $\dot{x}(0) = 0$, $\dot{y}(0) = 0, x(0) = 0$, $y(0) = 0$

```
Syms x(t) y(t)

Eqn=[diff(x,t,2)==(log10(t)-y)/y, diff(y,t,2)==(t-diff(y,t))/x];

Dx=diff(x,t);

Dy=diff(y,t);

Cond=[x(0)==0,y(0)==0,dx(0)==0,dy(0)==0];

[x,y]=dsolve(Eqn,Cond)
```

Quiz 10 Industrial control systems Prof M. Barghash IE Dept Sch of Eng UoJ 22/8/2023

Name: ID:

Write the differential equaions describing the following system



F1=m1q1’’+k2(q1-q2)+c2(q1’-q2’)+k5(q1-q3)+c5(q1’-q3’)

F2=m2q2’’+k2(q2-q1)+c2(q2’-q1’)+k3(q2-q3)+c3(q2’-q3’)

F3=m3q3’’+k3(q3-q2)+c3(q3’-q2’)+k5(q3-q1)+c5(q3’-q1’)

MID exam 20_8_2023 control systems (computer engineering) Prof. M. Barghash IE SoE UoJ

Name ID

Q1)a)Find the solution of the following differential equation using inverse laplace transform (4 points)

$\ddot{X} + 3\dot{X} + 2X = t^2$

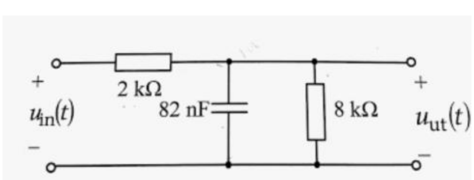
	$f(t)$	$F(s)$		$f(t)$	$F(s)$
1.	1	$\frac{1}{s}$	2.	$\mathbf{e}^{at}$	$\frac{1}{s-a}$
3.	$t^n, \quad n=1,2,3,\ldots$	$\frac{n!}{s^{n+1}}$	4.	$t^p, p>-1$	$\frac{\Gamma(p+1)}{s^{p+1}}$
5.	$\sqrt{t}$	$\frac{\sqrt{\pi}}{2s^{\frac{3}{2}}}$	6.	$t^{n-\frac{1}{2}}, \quad n=1,2,3,\ldots$	$\frac{1\cdot 3\cdot 5\cdots(2n-1)\sqrt{\pi}}{2^n s^{n+\frac{1}{2}}}$
7.	$\sin(at)$	$\frac{a}{s^2+a^2}$	8.	$\cos(at)$	$\frac{s}{s^2+a^2}$
9.	$t\sin(at)$	$\frac{2as}{\left(s^2+a^2\right)^2}$	10.	$t\cos(at)$	$\frac{s^2-a^2}{\left(s^2+a^2\right)^2}$
11.	$\sin(at)-at\cos(at)$	$\frac{2a^3}{\left(s^2+a^2\right)^2}$	12.	$\sin(at)+at\cos(at)$	$\frac{2as^2}{\left(s^2+a^2\right)^2}$
13.	$\cos(at)-at\sin(at)$	$\frac{s\left(s^2-a^2\right)}{\left(s^2+a^2\right)^2}$	14.	$\cos(at)+at\sin(at)$	$\frac{s\left(s^2+3a^2\right)}{\left(s^2+a^2\right)^2}$
15.	$\sin(at+b)$	$\frac{s\sin(b)+a\cos(b)}{s^2+a^2}$	16.	$\cos(at+b)$	$\frac{s\cos(b)-a\sin(b)}{s^2+a^2}$
17.	$\sinh(at)$	$\frac{a}{s^2-a^2}$	18.	$\cosh(at)$	$\frac{s}{s^2-a^2}$
19.	$\mathbf{e}^{at}\sin(bt)$	$\frac{b}{(s-a)^2+b^2}$	20.	$\mathbf{e}^{at}\cos(bt)$	$\frac{s-a}{(s-a)^2+b^2}$
21.	$\mathbf{e}^{at}\sinh(bt)$	$\frac{b}{(s-a)^2-b^2}$	22.	$\mathbf{e}^{at}\cosh(bt)$	$\frac{s-a}{(s-a)^2-b^2}$
23.	$t^n\mathbf{e}^{at}, \quad n=1,2,3,\ldots$	$\frac{n!}{(s-a)^{n+1}}$	24.	$f(ct)$	$\frac{1}{c}F\left(\frac{s}{c}\right)$
25.	$u_c(t)=u(t-c)$ Heaviside Function	$\frac{\mathbf{e}^{-cs}}{s}$	26.	$\delta(t-c)$ Dirac Delta Function	$\mathbf{e}^{-cs}$
27.	$u_c(t)f(t-c)$	$\mathbf{e}^{-cs}F(s)$	28.	$u_c(t)g(t)$	$\mathbf{e}^{-cs}\mathfrak{L}\{g(t+c)\}$
29.	$\mathbf{e}^{ct}f(t)$	$F(s-c)$	30.	$t^n f(t), \quad n=1,2,3,\ldots$	$(-1)^n F^{(n)}(s)$
31.	$\frac{1}{t}f(t)$	$\int_s^{\infty} F(u)\,du$	32.	$\int_0^t f(v)\,dv$	$\frac{F(s)}{s}$
33.	$\int_0^t f(t-\tau)g(\tau)\,d\tau$	$F(s)G(s)$	34.	$f(t+T)=f(t)$	$\frac{\int_0^T \mathbf{e}^{-st}f(t)\,dt}{1-\mathbf{e}^{-sT}}$
35.	$f'(t)$	$sF(s)-f(0)$	36.	$f''(t)$	$s^2F(s)-sf(0)-f'(0)$
37.	$f^{(n)}(t)$	$s^nF(s)-s^{n-1}f(0)-s^{n-2}f'(0)\cdots-sf^{(n-2)}(0)-f^{(n-1)}(0)$			

```
exp(-2*t)/4 - 2*exp(-t) - (3*t)/2 + t^2/2 + 7/4
```

B)what is the final value for y(s) in part y(s)= $\frac{1}{s^2+2s+3}$ (2 points)

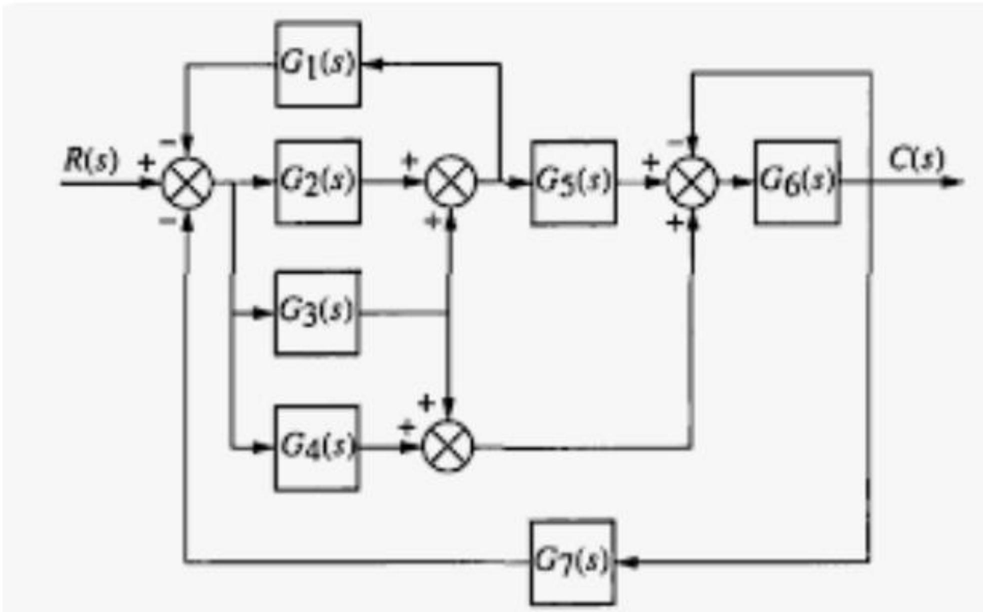
0

Q2) find the transfer function for the following a) Uut/Uin (4 points)



$= \frac{8000}{1.3s+10000}$

Q3) Find the equivalent transfer function for (5 points)

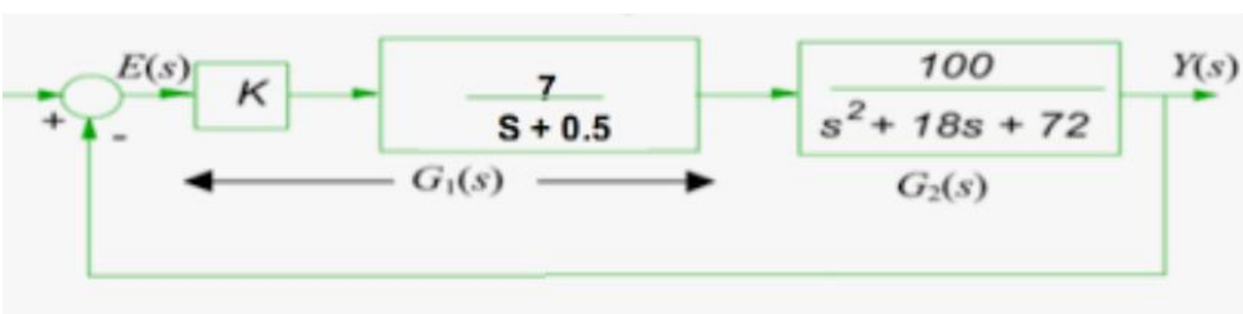


4 path

7 loop

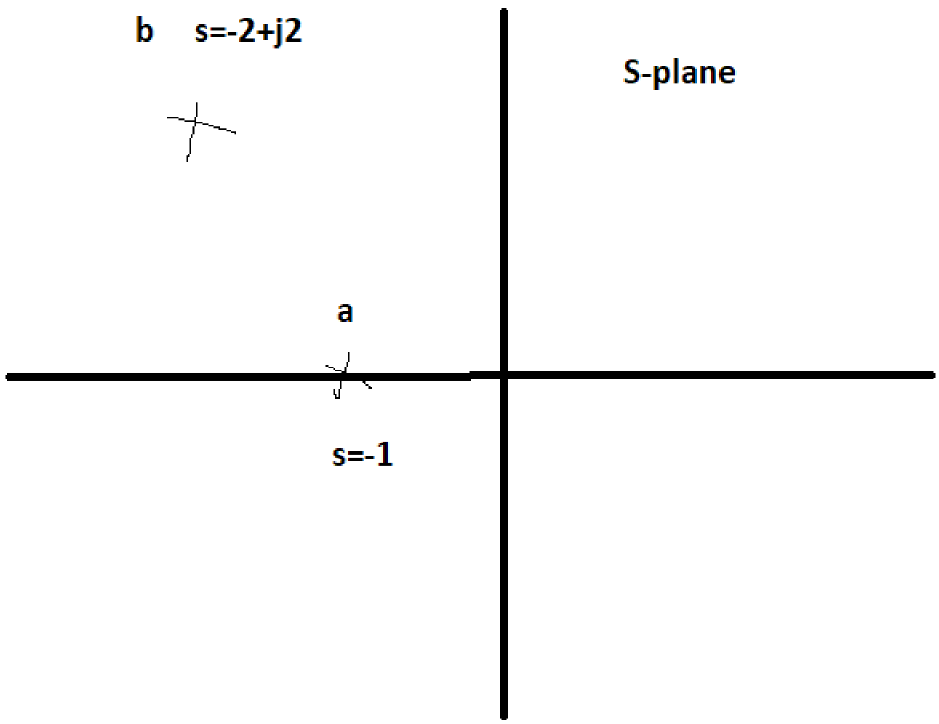
2 non touching

Q4) Find the steady state error for a step input (5 points)



0.05

Q5) a) For a and b poles in the following fins the associated damping ratio and percent opevershoot   (5 points)



For a

Damping ratio =1

Mp=0

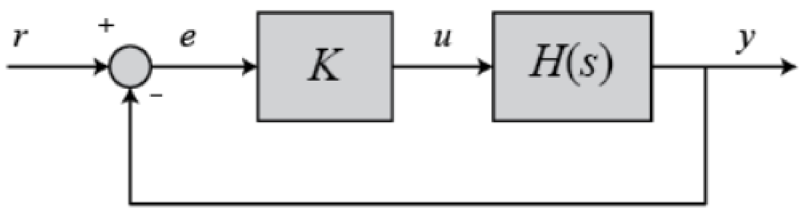
For b

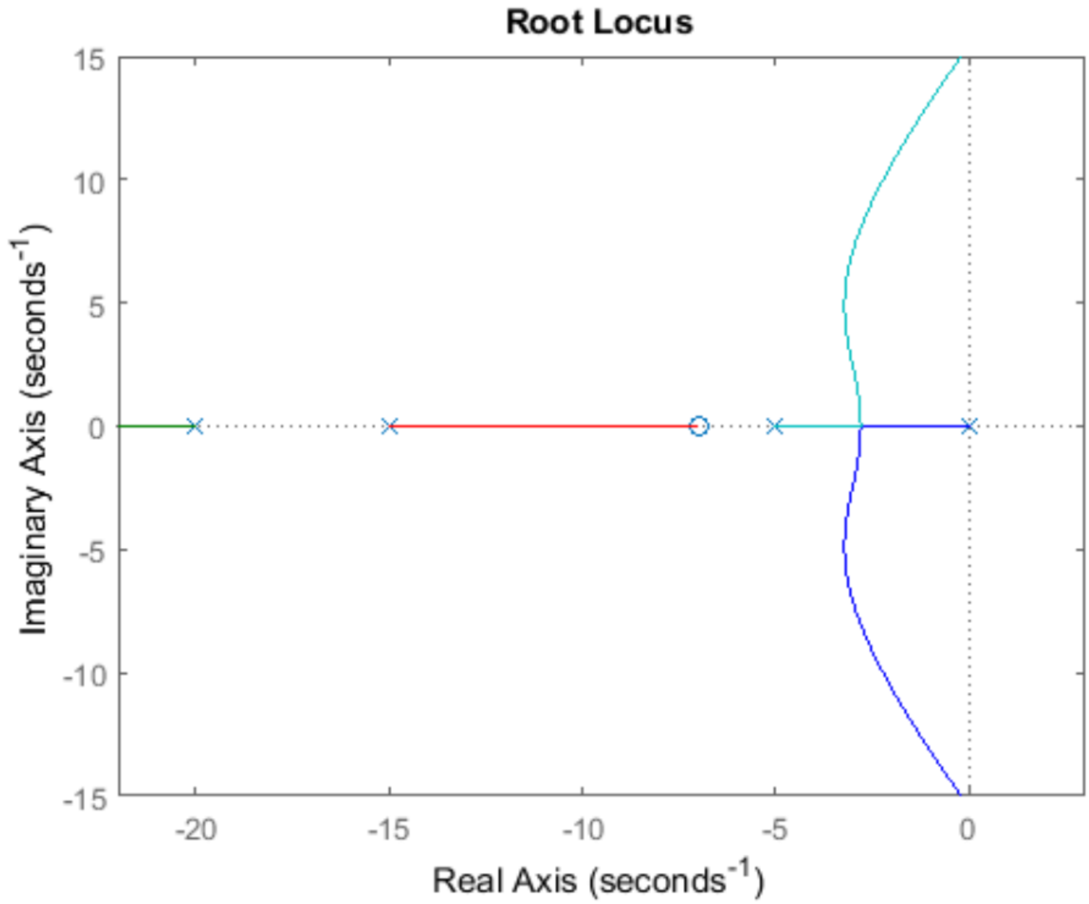
Damping ratio=0.7071

Mp=4.33

$$H(s) = \frac{Y(s)}{U(s)} = \frac{s+7}{s(s+5)(s+15)(s+20)}$$

Q6)What is the) a) For the following system design the feedback controller k to achieve a damping ratio of > 0.6. (you must use the root locus figure below) (5 points)




Root Locus
15
10
5
0
-5
-10
-15
Imaginary Axis (seconds^-1)
-20
-15
-10
-5
0
Real Axis (seconds^-1)

S=-3+5j

K=1130