Homework 3

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Problem 1

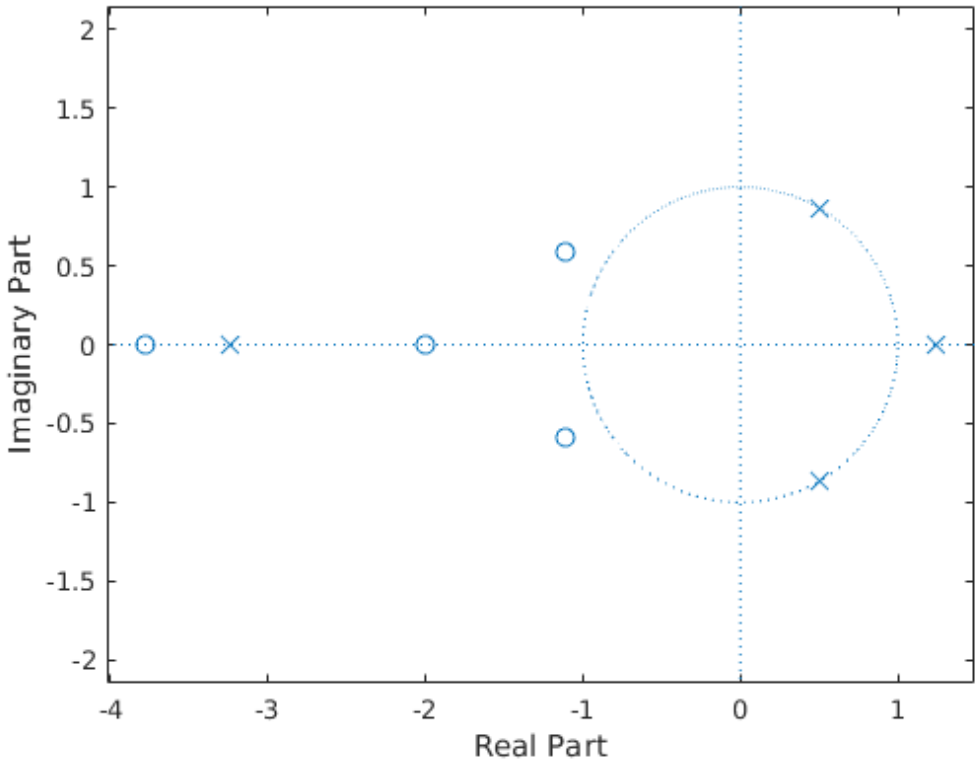
The factored form is made up of the zeroes zfrom H in the numerator And the poles p in the denomenator Multiplied by the coefficient k

```
num = [2 16 44 52 24]
den = [3 3 -15 18 -12]
[z,p,k] = tf2zp(num,den)
```

```
num =

     2    16    44    52    24


den =

     3     3   -15    18   -12


z =

  -3.7693 + 0.0000i
  -2.0000 + 0.0000i
  -1.1154 + 0.5897i
  -1.1154 - 0.5897i


p =

  -3.2361 + 0.0000i
   1.2361 + 0.0000i
   0.5000 + 0.8660i
   0.5000 - 0.8660i


k =

    0.6667
```

The plot of H(z) is

```
zplane(z,p)
```



And become ROC = infinity > z > 3.2361, 3.2361 > z > 1.2361, 1.2361 > z > 1, and 1 > z > 0. Taken from

```
abs(p)


ans =

    3.2361
    1.2361
    1.0000
    1.0000
```

Problem 2

The rational z transform will have

```
z = [.21; 3.14; -.3 + 0.5i;-0.3 - .5i];
p = [-.45; 0.67; 0.81 + 0.72i; 0.81 - 0.72i];
k = 2.2;
[num, den] = zp2tf(z,p,k)
```

```
num =

    2.2000   -6.0500   -2.2233   -1.6354    0.4932


den =

    1.0000   -1.8400    1.2294    0.2300   -0.3541
```

Problem 3

r and p form the residues, poles and direct terms of the expansion

```
[r,p,k] = residuez([18 0 0 0],[18 3 -4 -1])


r =

    0.3600
    0.2400
    0.4000


p =

    0.5000
   -0.3333
   -0.3333


k =

     0
```

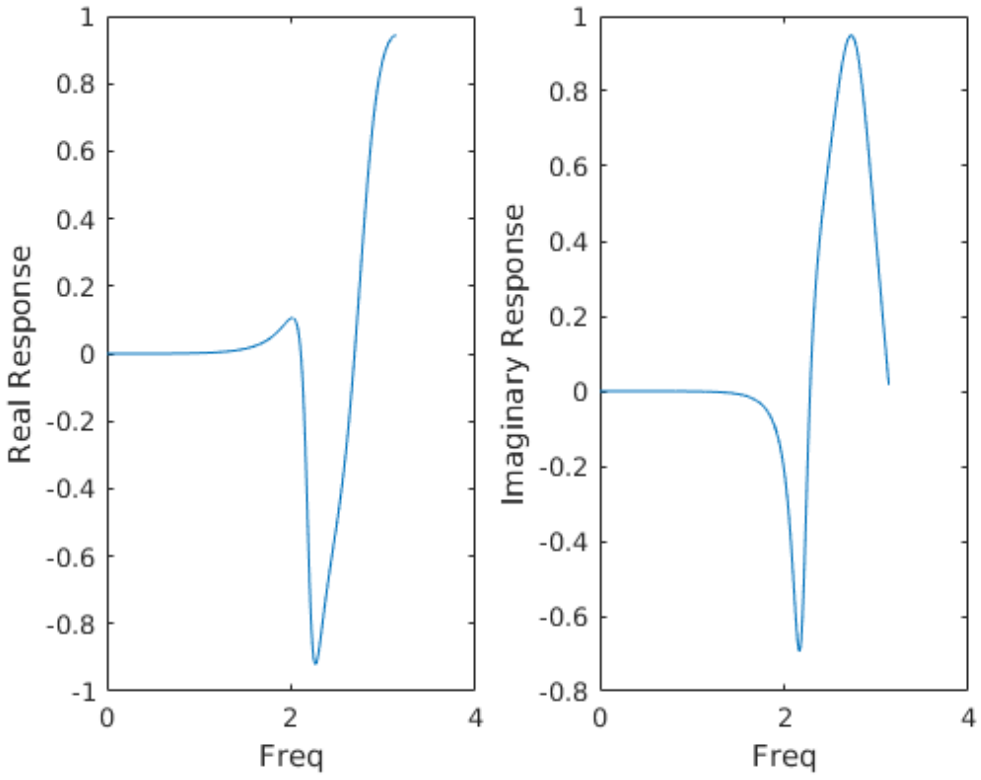
Problem 4

```
syms z;
sos = zp2sos([1 2 0],[1 .4 -.12]);
coefficients = impz(sos, 11)
H = (z * (z + 2))/((z - .2) * (z + .6));
pretty(iztrans(H))


coefficients =

    1.0000
   -1.7200
   -0.4336
   -0.2040
   -0.0779
   -0.0316
```

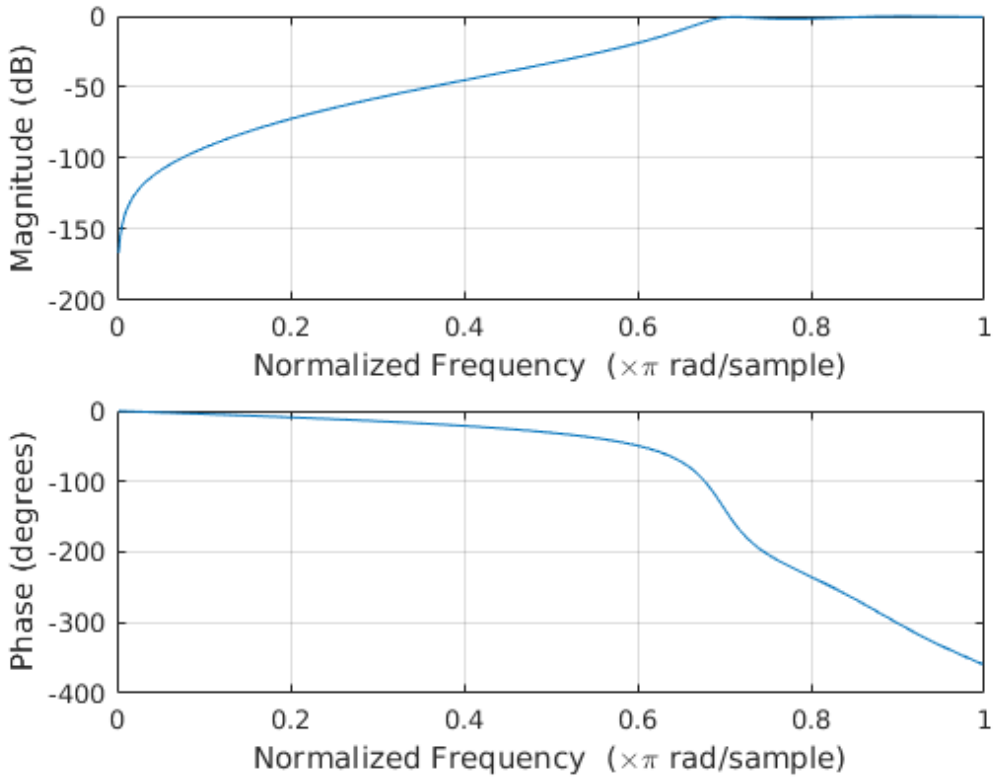
```
   -0.0126
   -0.0050
   -0.0020
   -0.0008
   -0.0003

   / 1 \n      /   3 \n
11 | - |    7 | - - |
   \ 5 /      \   5 /
--------- - ----------
    4            4
```

Problem 5

```
B = [.008 -.033 .05 -.033 .008];
A = [ 1 2.37 2.7 1.6 .41];
[H,W] = freqz(B,A);
subplot(121)
plot(W,real(H))
xlabel('Freq')
ylabel('Real Response')
subplot(122)
plot(W,imag(H))
xlabel('Freq')
ylabel('Imaginary Response')
```



```
freqz(B,A)
```



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