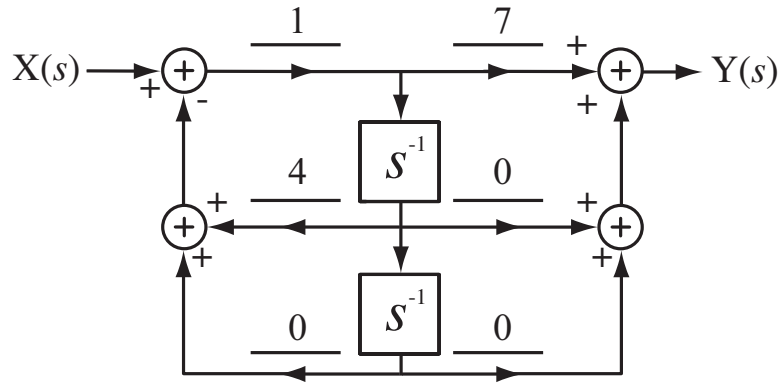# Solution of ECE 316 Test 1 S11

1. Find the numerical region of convergence of the bilateral Laplace transform of
    $x(t) = -5e^{2t} u(t) + 7e^{-t} u(t)$.

    ROC is $\sigma = \text{Re}(s) > 2$

2. Fill in the blanks in the block diagram below with numbers for a system whose transfer function is
    $H(s) = \dfrac{7s^2}{s(s+4)} = \dfrac{7s^2}{s^2 + 4s}$. (Put a number in each blank even if it is a zero or a one.)

3.   (5 pts) Fill in the blanks with numbers.

$$A\delta(t) + Be^{bt}\,\mathrm{u}(t) + Ce^{ct}\,\mathrm{u}(t) \xleftrightarrow{\ \mathscr{L}\ } \frac{10s^2}{6s^2 + 51s + 99} \quad,\quad \sigma = \mathrm{Re}(s) > -3$$

$$1.667\delta(t) - 20.17e^{-5.5t}\,\mathrm{u}(t) + 6e^{-3t}\,\mathrm{u}(t) \xleftrightarrow{\ \mathscr{L}\ } \frac{10s^2}{6s^2 + 51s + 99} = 1.667 - \frac{20.17}{s + 5.5} + \frac{6}{s + 3} \quad,\quad \sigma = \mathrm{Re}(s) > -3$$

$A = 1.667$, $B = -20.17$, $b = -5.5$, $C = 6$, $c = -3$

4. Write in each blank space above each pole-zero diagram the letter designation of the frequency response magnitude corresponding to it. (In each case the transfer function is of the form

$$H(s) = A \frac{(s - z_1)(s - z_2)\cdots(s - z_M)}{(s - p_1)(s - p_2)\cdots(s - p_N)} \quad \text{with } A = 1.)$$
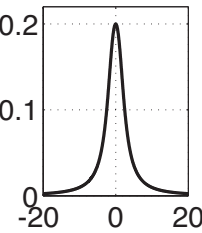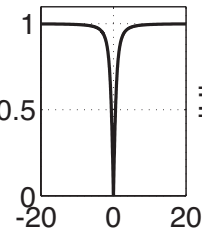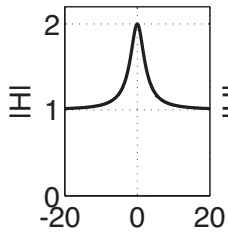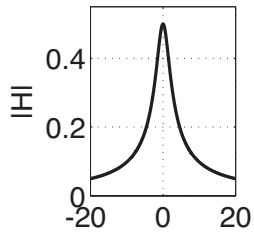
F   C   G   E
D   A   B   H
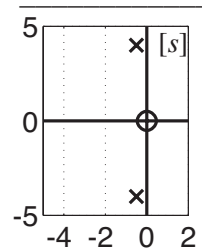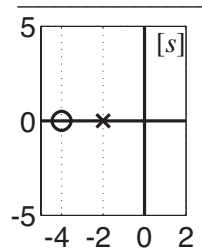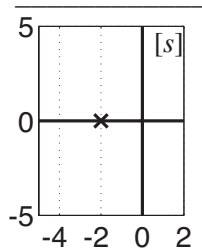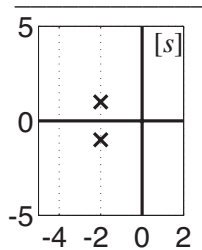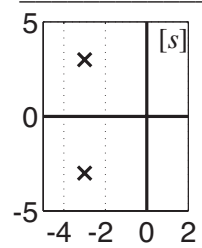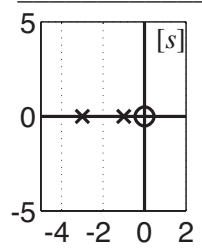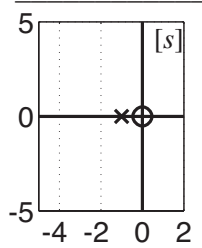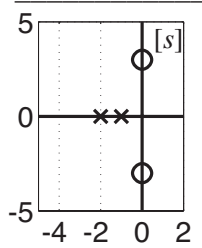
A   B   C   D
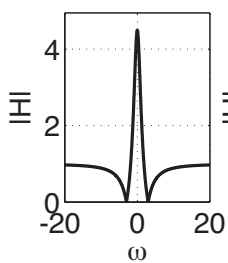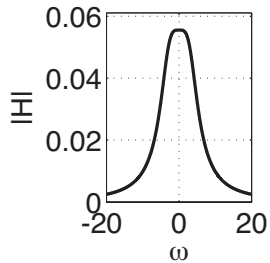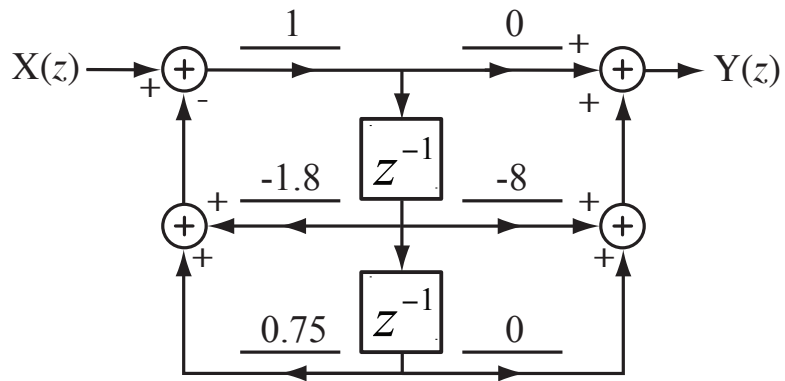
E   F   G   H
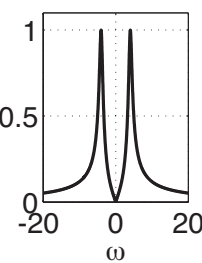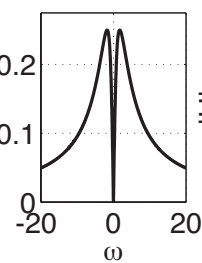
5.   (6 pts) Fill in the blanks in the block diagram below with numbers for a system whose transfer function is

$H(z) = \dfrac{-8z}{z^2 - 1.8z + 0.75}$. (Put a number in each blank even if it is a zero or a one.)

6. (5 pts) Fill in the blanks with numbers.

$$A\delta[n-1] + B\left(Cc^{n-1}u[n-1] + d^{n-1}u[n-1]\right) \xleftrightarrow{\ \mathcal{Z}\ } \frac{4}{z(z+0.2)(z-0.8)} \ , \ |z| > 0.8$$
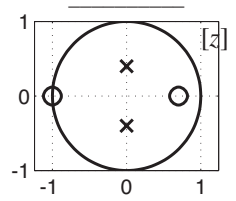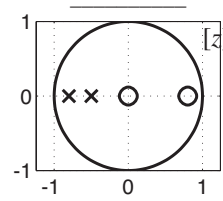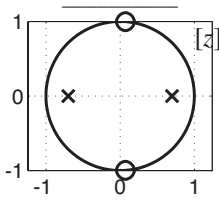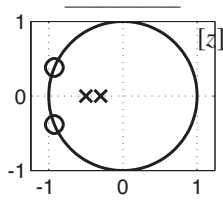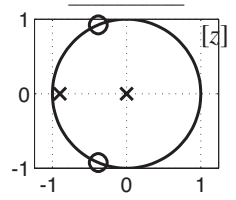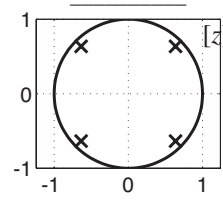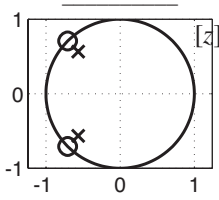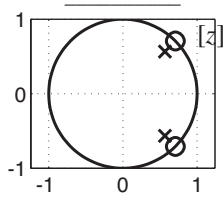
$$-25\delta[n-1] + 5\left(4(-0.2)^{n-1}u[n-1] + (0.8)^{n-1}u[n-1]\right) \xleftrightarrow{\ \mathcal{Z}\ } \frac{4}{z(z+0.2)(z-0.8)} = \frac{-25}{z} + \frac{20}{z+0.2} + \frac{5}{z-0.8} \ , \ |z| > 0.8$$

$$A = \text{-25} \ , \ B = 5 \ , \ C = 4 \ , \ c = \text{-0.2} \ , \ d = 0.8$$

7. Write in each blank space above each pole-zero diagram the letter designation of the frequency response magnitude corresponding to it. (In each case the transfer function is of the form

$$H(z) = A\frac{(z-z_1)(z-z_2)\cdots(z-z_M)}{(z-p_1)(z-p_2)\cdots(z-p_N)} \quad \text{with } A=1.)$$

C   H   G   D
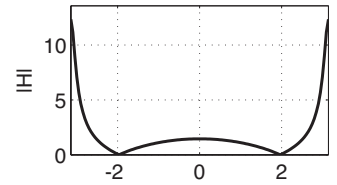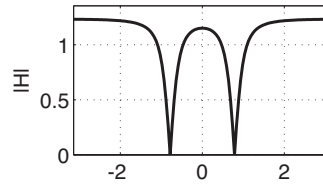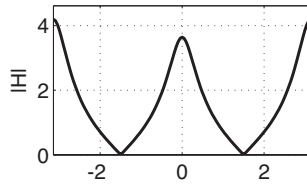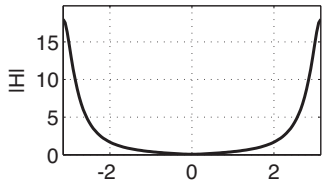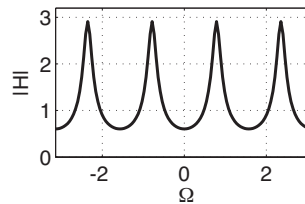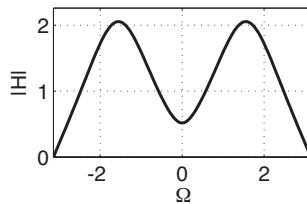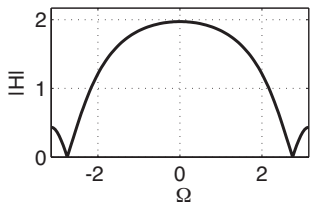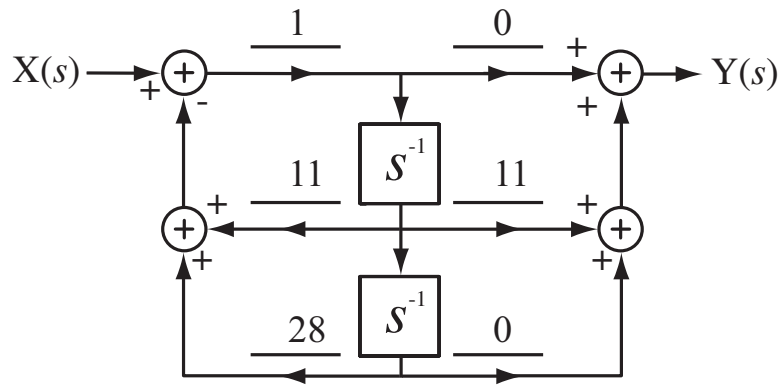E   B   A   F
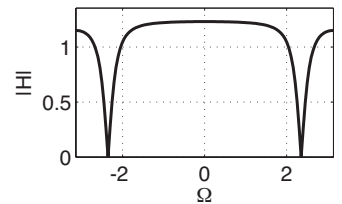
Solution of ECE 316 Test 1 S11

1. Find the numerical region of convergence of the bilateral Laplace transform of
   $x(t) = -5e^{5t} u(t) + 7e^{2t} u(t)$.

   ROC is $\sigma = \text{Re}(s) > 5$

2. Fill in the blanks in the block diagram below with numbers for a system whose transfer function is
   $H(s) = \dfrac{11s}{(s+7)(s+4)} = \dfrac{11s}{s^2 + 11s + 28}$. (Put a number in each blank even if it is a zero or a one.)

3.   (5 pts) Fill in the blanks with numbers.

$$A\delta(t) + Be^{bt}\,\mathrm{u}(t) + Ce^{ct}\,\mathrm{u}(t) \xleftrightarrow{\mathscr{L}} \frac{4s^2}{16s^2 + 62s + 21} \;,\; \sigma = \mathrm{Re}(s) > -0.375$$

$$0.25\delta(t) - 0.98e^{-3.5t}\,\mathrm{u}(t) + 0.01125e^{-0.375t}\,\mathrm{u}(t) \xleftrightarrow{\mathscr{L}} \frac{4s^2}{16s^2 + 62s + 21} = 0.25 - \frac{0.98}{s + 3.5} + \frac{0.01125}{s + 0.375} \;,\; \sigma = \mathrm{Re}(s) > -0.375$$
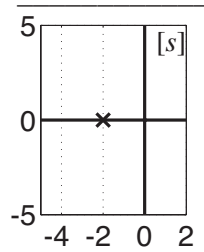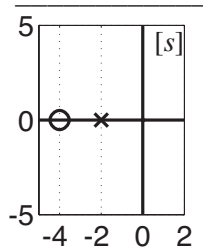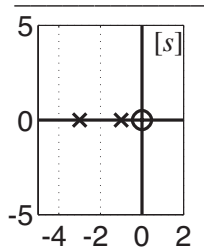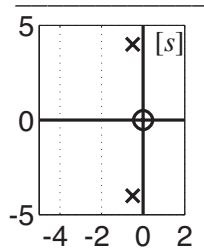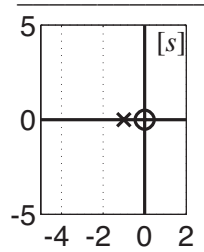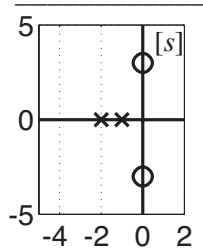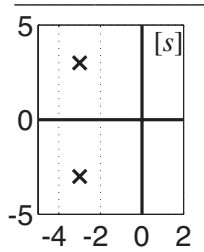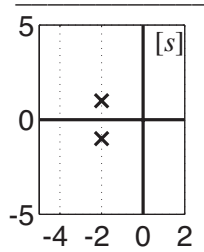
$A = 0.25, B = -0.98, b = -3.5, C = 0.01125, c = -0.375$

4. Write in each blank space above each pole-zero diagram the letter designation of the frequency response magnitude corresponding to it. (In each case the transfer function is of the form

$$H(s) = A\frac{(s - z_1)(s - z_2)\cdots(s - z_M)}{(s - p_1)(s - p_2)\cdots(s - p_N)} \quad \text{with } A = 1.)$$
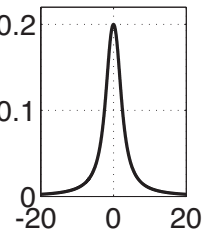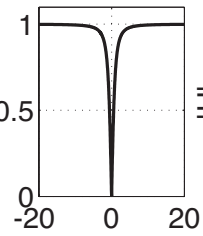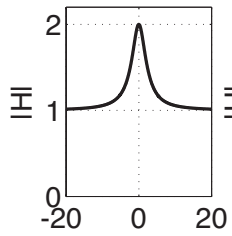
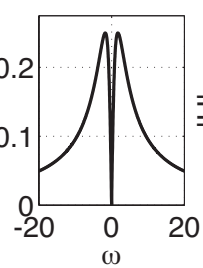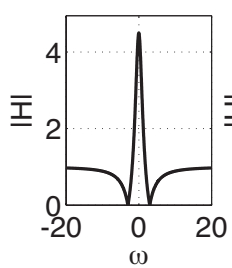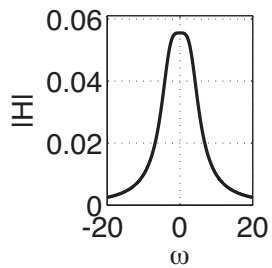| D	E	F	C
H	G	B	A

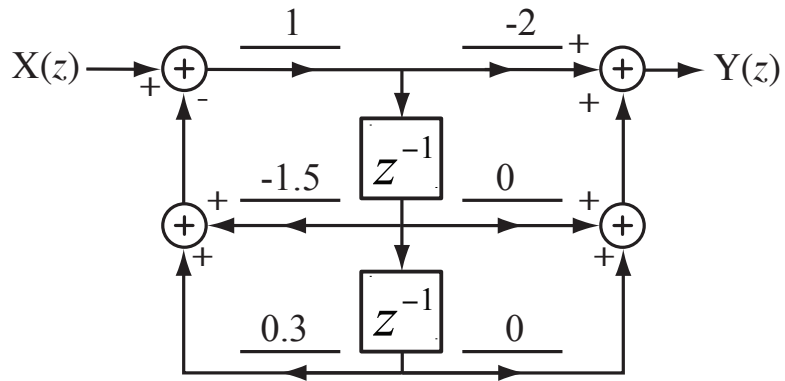A   B   C   D
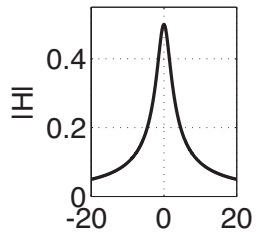
E   F   G   H
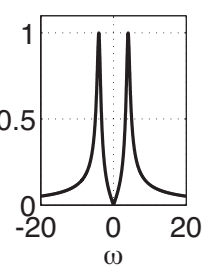
5. (6 pts) Fill in the blanks in the block diagram below with numbers for a system whose transfer function is $H(z) = \dfrac{-2z^2}{z^2 - 1.5z + 0.3}$. (Put a number in each blank even if it is a zero or a one.)

6. (5 pts) Fill in the blanks with numbers.

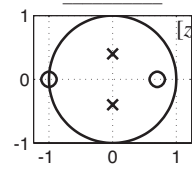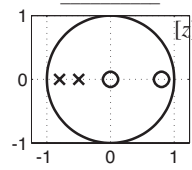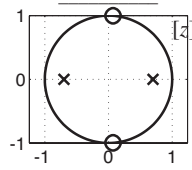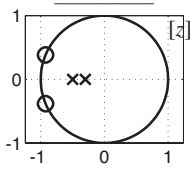$$A\delta[n-1] + B\left(Cc^{n-1}u[n-1] + d^{n-1}u[n-1]\right) \xleftrightarrow{\ \mathcal{Z}\ } \frac{18}{z(z+0.1)(z-0.5)} \ , \ |z| > 0.5$$
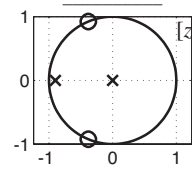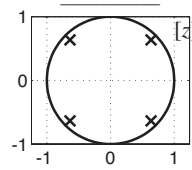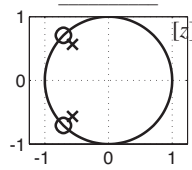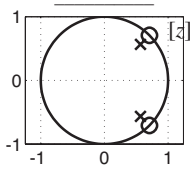
$$-360\delta[n-1] + 60\left(5(-0.1)^{n-1}u[n-1] + (0.5)^{n-1}u[n-1]\right) \xleftrightarrow{\ \mathcal{Z}\ } \frac{18}{z(z+0.1)(z-0.5)} = \frac{-360}{z} + \frac{300}{z+0.1} + \frac{60}{z-0.5} \ , \ |z| > 0.5$$

$$A = \text{-360} \ , \ B = 60 \ , \ C = 5 \ , \ c = \text{-0.1} \ , \ d = 0.5$$

7. Write in each blank space above each pole-zero diagram the letter designation of the frequency response magnitude corresponding to it. (In each case the transfer function is of the form

$$H(z) = A\frac{(z - z_1)(z - z_2)\cdots(z - z_M)}{(z - p_1)(z - p_2)\cdots(z - p_N)} \quad \text{with } A = 1.)$$
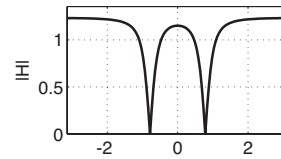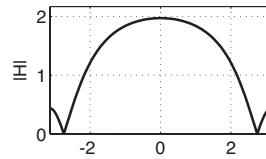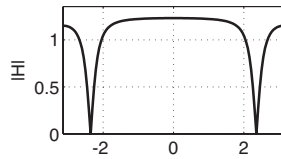
D	B	H	A
C	E	F	G

A

B

C

D

E

F

G

H

Solution of ECE 316 Test 1 S11

1. Find the numerical region of convergence of the bilateral Laplace transform of
    $x(t) = -5e^{2t} u(t) + 7e^{-t} u(t)$.

    ROC is $\sigma = \text{Re}(s) > 7$

2. Fill in the blanks in the block diagram below with numbers for a system whose transfer function is
    $H(s) = \dfrac{13}{(s+11)(s+4)} = \dfrac{13}{s^2 + 15s + 44}$. (Put a number in each blank even if it is a zero or a one.)
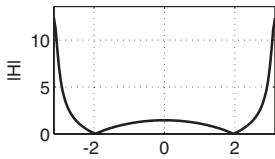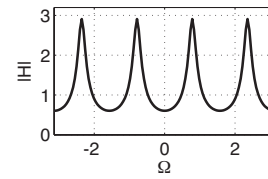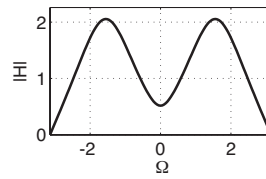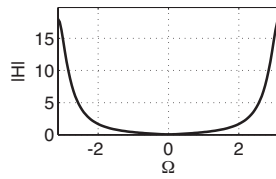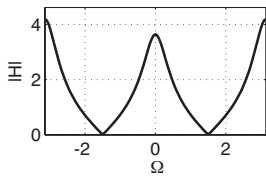
3.   (5 pts) Fill in the blanks with numbers.

$$A\delta(t) + Be^{bt}\,u(t) + Ce^{ct}\,u(t) \xleftrightarrow{\;\mathscr{L}\;} \frac{3s^2}{36s^2 + 58s + 6} \quad , \quad \sigma = \mathrm{Re}(s) > -0.1111$$
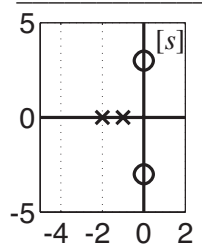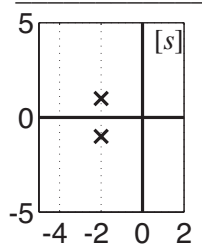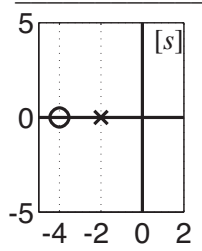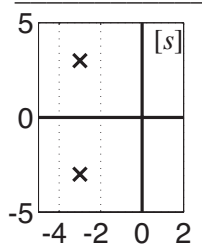
$$0.08333\delta(t) - 0.135e^{-1.5t}\,u(t) + 0.000741e^{-0.1111t}\,u(t) \xleftrightarrow{\;\mathscr{L}\;} \frac{3s^2}{36s^2 + 58s + 6} = 0.08333 - \frac{0.135}{s + 1.5} + \frac{0.0007407}{s + 0.1111} \quad , \quad \sigma = \mathrm{Re}(s) > -0.1111$$

$A = 0.0833, B = -0.135 , b = -1.5 , C = 0.000741 , c = -0.1111$

4. Write in each blank space above each pole-zero diagram the letter designation of the frequency response magnitude corresponding to it. (In each case the transfer function is of the form

$$H(s) = A\frac{(s-z_1)(s-z_2)\cdots(s-z_M)}{(s-p_1)(s-p_2)\cdots(s-p_N)} \quad \text{with } A = 1.)$$
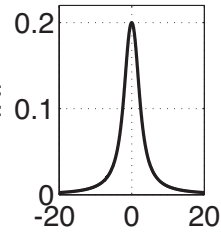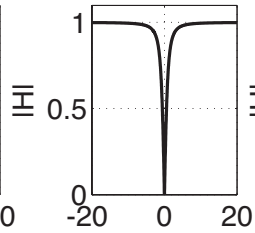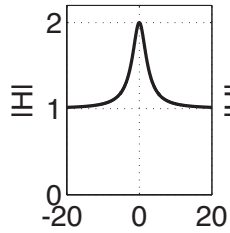
E   B   D   F
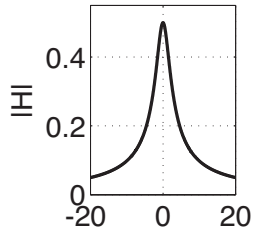H   G   A   C
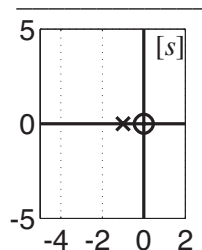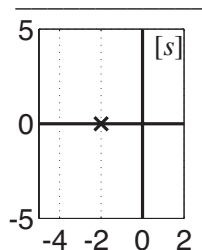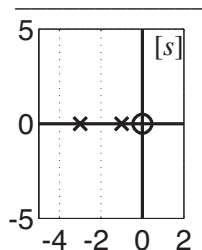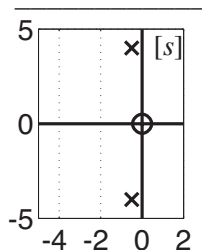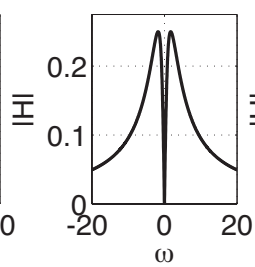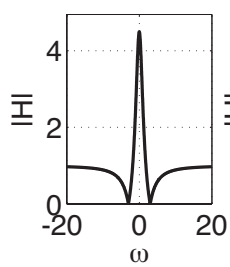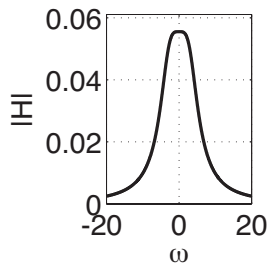

A   B   C   D
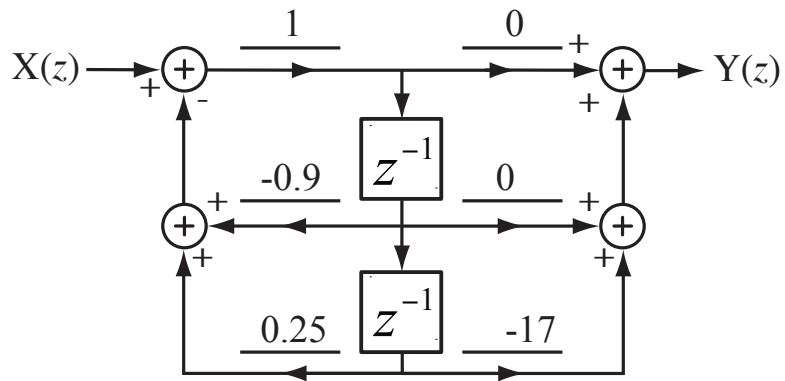

E   F   G   H
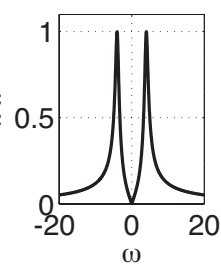
5.   (6 pts) Fill in the blanks in the block diagram below with numbers for a system whose transfer function is

$H(z) = \dfrac{-17}{z^2 - 0.9z + 0.25}$.   (Put a number in each blank even if it is a zero or a one.)

6. (5 pts) Fill in the blanks with numbers.

$$A\delta[n-1] + B\left(Cc^{n-1}\mathrm{u}[n-1] + d^{n-1}\mathrm{u}[n-1]\right) \xleftrightarrow{\ \mathcal{Z}\ } \frac{-8}{z(z+0.9)(z-0.3)} \ , \ |z| > 0.9$$

$$29.63\delta[n-1] - 7.407\left(3(0.3)^{n-1}\mathrm{u}[n-1] + (-0.9)^{n-1}\mathrm{u}[n-1]\right) \xleftrightarrow{\ \mathcal{Z}\ } \frac{-8}{z(z+0.9)(z-0.3)} = \frac{29.63}{z} - \frac{7.407}{z+0.9} - \frac{22.22}{z-0.3} \ , \ |z| > 0.9$$

$A = 29.63$, $B = $ -7.407 , $C = 3$, $c = 0.3$, $d = $ -0.9

7. Write in each blank space above each pole-zero diagram the letter designation of the frequency response magnitude corresponding to it. (In each case the transfer function is of the form

$$H(z) = A \frac{(z-z_1)(z-z_2)\cdots(z-z_M)}{(z-p_1)(z-p_2)\cdots(z-p_N)} \quad \text{with } A = 1.)$$

C   H   D   A
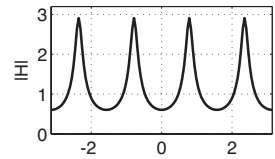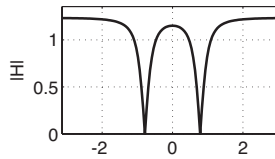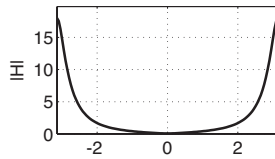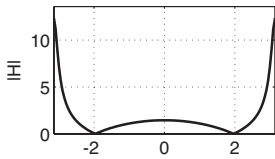G   F   B   E

A   B   C   D

E   F   G   H

Ω