Solution of ECE 315 Test 2 F09

1. Find the numerical values of the constants in these Laplace transform pairs.

(a) $10e^{2t}\,\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{A}{s-a}$

What is the ROC? ROC is _____

$10e^{2t}\,\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{10}{s-2}$, $\sigma > 2$

(b) $5\delta(3t-1) \overset{\mathscr{L}}{\longleftrightarrow} Ae^{-as}$

What is the ROC? ROC is _____

$5\delta(3t-1) = 5\delta\big(3(t-1/3)\big) = (5/3)\delta(t-1/3) \overset{\mathscr{L}}{\longleftrightarrow} (5/3)e^{-s/3}$, ROC is all s.

(c) $Ae^{at}\,\mathrm{u}(bt) + Ce^{ct}\,\mathrm{u}(dt) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{s-1}{s(s+2)}$, $\sigma > 0$

$\dfrac{s-1}{s(s+2)} = \dfrac{-1/2}{s} + \dfrac{3/2}{s+2}$, $\sigma > 0$

$\left[-(1/2) + (3/2)e^{-2t}\right]\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{-1/2}{s} + \dfrac{3/2}{s+2}$, $\sigma > 0$

(d) $Ae^{at}\,\mathrm{u}(bt) + Ce^{ct}\,\mathrm{u}(dt) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{s-1}{s(s+2)}$, $-2 < \sigma < 0$

$(1/2)\mathrm{u}(-t) + (3/2)e^{-2t}\,\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{s-1}{s(s+2)}$, $-2 < \sigma < 0$

2. Find the numerical values of the constants in these Fourier transform pairs.

(a) $-2\,\mathrm{tri}(t-4) \xleftrightarrow{\mathcal{F}} A\mathrm{sinc}^2(af)e^{bf}$

$-2\,\mathrm{tri}(t-4) \xleftrightarrow{\mathcal{F}} -2\mathrm{sinc}^2(f)e^{-j8\pi f}$

(b) $A\sin(at)\mathrm{sinc}(bt) \xleftrightarrow{\mathcal{F}} j\left[\delta(f-3)-\delta(f+3)\right] * 4\,\mathrm{rect}(2f)$

$-4\sin(6\pi t)\mathrm{sinc}(t/2) \xleftrightarrow{\mathcal{F}} j\left[\delta(f-3)-\delta(f+3)\right] * 4\,\mathrm{rect}(2f)$

or

$4\sin(-6\pi t)\mathrm{sinc}(t/2) \xleftrightarrow{\mathcal{F}} j\left[\delta(f-3)-\delta(f+3)\right] * 4\,\mathrm{rect}(2f)$

(c) $A\,\mathrm{rect}(at) * \mathrm{rect}(bt) \xleftrightarrow{\mathcal{F}} (14/3)\mathrm{sinc}(f/3)\mathrm{sinc}(2f)$

$7\,\mathrm{rect}(3t) * \mathrm{rect}(t/2) \xleftrightarrow{\mathcal{F}} (14/3)\mathrm{sinc}(f/3)\mathrm{sinc}(2f)$

3. If a CTFT in the *f* form is $24\delta_3(f)$ and in the ω form it is $A\delta_b(c\omega)$, what are the numerical values of *A*, *b* and *c*?

$$\left[24\delta_3(f)\right]_{f\to\omega/2\pi} = 24\delta_3(\omega/2\pi) = 24\sum_{k=-\infty}^{\infty}\delta(\omega/2\pi-3k) = 48\pi\sum_{k=-\infty}^{\infty}\delta(\omega-6\pi k)$$

$$\left[24\delta_3(f)\right]_{f\to\omega/2\pi} = 48\pi\delta_{6\pi}(\omega)$$

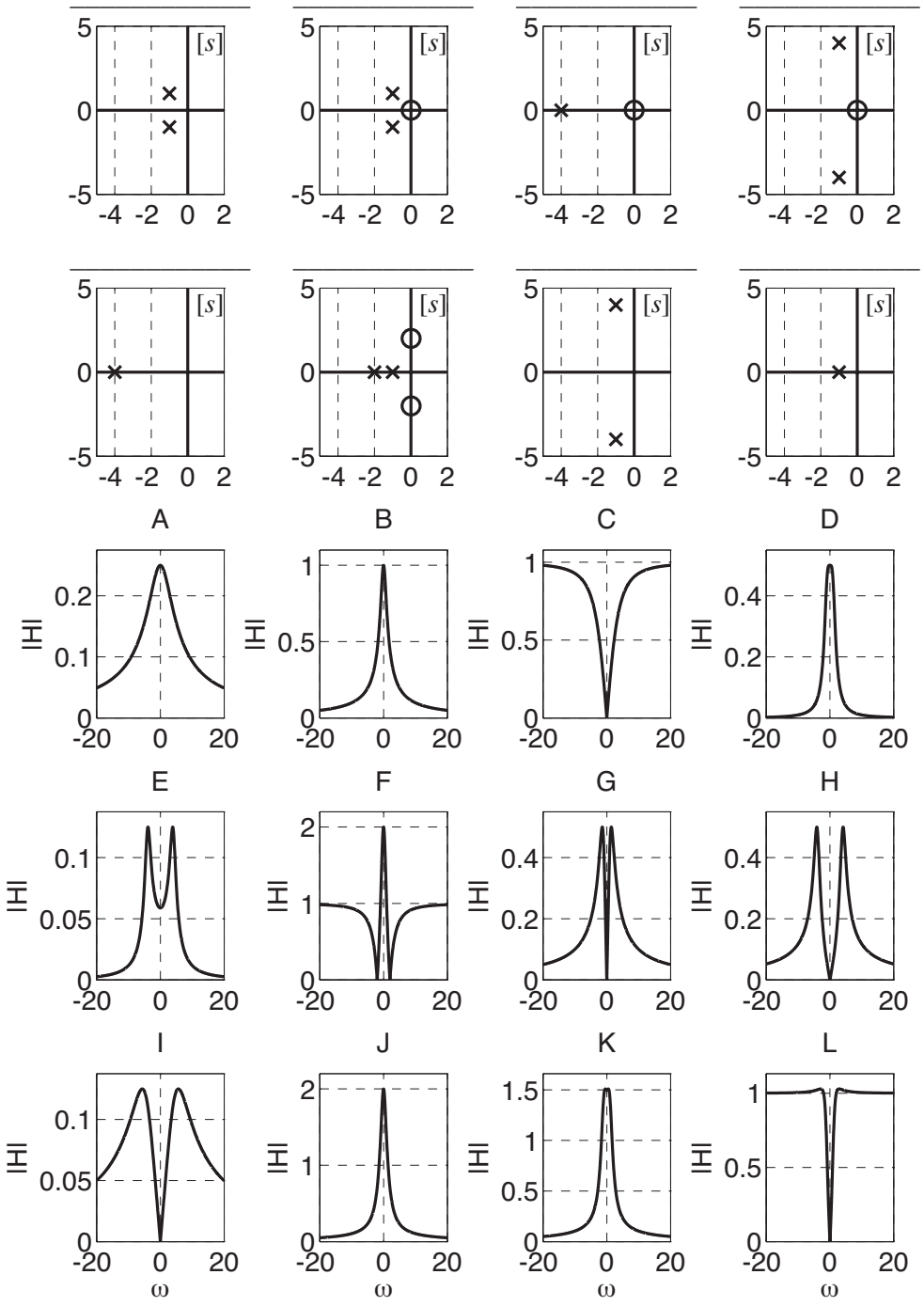
Because of the way the problem was worded, I also accepted the solution

$$24\delta_3(\omega/2\pi)$$

even though that was not what I intended.

4. Below are some pole-zero diagrams and some magnitude frequency responses. Match the frequency responses to the pole-zero diagrams by writing the letter designation of the frequency response in the blank space provided above the pole-zero diagram. If there is no match, just write "None".

D G C H
A F E B



Solution of ECE 315 Test 3 F09

1. Find the numerical values of the constants in these Laplace transform pairs.

(a) $7e^{3t}\,\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{A}{s-a}$

What is the ROC? ROC is _____

$7e^{3t}\,\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{7}{s-3}$, $\sigma > 3$

(b) $3\delta(5t-1) \overset{\mathscr{L}}{\longleftrightarrow} Ae^{-as}$

What is the ROC? ROC is _____

$3\delta(5t-1) = 3\delta\big(5(t-1/5)\big) = (3/5)\delta(t-1/5) \overset{\mathscr{L}}{\longleftrightarrow} (3/5)e^{-s/5}$, ROC is all s.

(c) $Ae^{at}\,\mathrm{u}(bt) + Ce^{ct}\,\mathrm{u}(dt) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{s-2}{s(s+1)}$, $\sigma > 0$

$\dfrac{s-2}{s(s+1)} = \dfrac{-2}{s} + \dfrac{3}{s+1}$, $\sigma > 0$

$\left[-2 + 3e^{-t}\right]\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} -\dfrac{2}{s} + \dfrac{3}{s+1}$, $\sigma > 0$

(d) $Ae^{at}\,\mathrm{u}(bt) + Ce^{ct}\,\mathrm{u}(dt) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{s-2}{s(s+1)}$, $-1 < \sigma < 0$

$2\,\mathrm{u}(-t) + 3e^{-t}\,\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{s-2}{s(s+1)}$, $-1 < \sigma < 0$

2. Find the numerical values of the constants in these Fourier transform pairs.

(a) $-4\,\mathrm{tri}(t-2) \overset{\mathcal{F}}{\longleftrightarrow} A\mathrm{sinc}^2(af)e^{bf}$

$-4\,\mathrm{tri}(t-2) \overset{\mathcal{F}}{\longleftrightarrow} -4\mathrm{sinc}^2(f)e^{-j4\pi f}$

(b) $A\sin(at)\mathrm{sinc}(bt) \overset{\mathcal{F}}{\longleftrightarrow} j\left[\delta(f-5)-\delta(f+5)\right] * 6\,\mathrm{rect}(3f)$

$-4\sin(10\pi t)\mathrm{sinc}(t/3) \overset{\mathcal{F}}{\longleftrightarrow} \overset{\mathcal{F}}{\longleftrightarrow} j\left[\delta(f-5)-\delta(f+5)\right] * 6\,\mathrm{rect}(3f)$

or

$4\sin(-10\pi t)\mathrm{sinc}(t/3) \overset{\mathcal{F}}{\longleftrightarrow} \overset{\mathcal{F}}{\longleftrightarrow} j\left[\delta(f-5)-\delta(f+5)\right] * 6\,\mathrm{rect}(3f)$

(c) $A\,\mathrm{rect}(at) * \mathrm{rect}(bt) \overset{\mathcal{F}}{\longleftrightarrow} (24/5)\mathrm{sinc}(f/5)\mathrm{sinc}(3f)$

$8\,\mathrm{rect}(5t) * \mathrm{rect}(t/3) \overset{\mathcal{F}}{\longleftrightarrow} (24/5)\mathrm{sinc}(f/5)\mathrm{sinc}(3f)$

3. If a CTFT in the f form is $18\delta_5(f)$ and in the ω form it is $A\delta_b(c\omega)$, what are the numerical values of A, b and c?

$$\left[18\delta_5(f)\right]_{f\to\omega/2\pi} = 18\delta_5(\omega/2\pi) = 18\sum_{k=-\infty}^{\infty}\delta(\omega/2\pi - 5k) = 36\pi\sum_{k=-\infty}^{\infty}\delta(\omega - 10\pi k)$$

$$\left[18\delta_5(f)\right]_{f\to\omega/2\pi} = 36\pi\delta_{10\pi}(\omega)$$

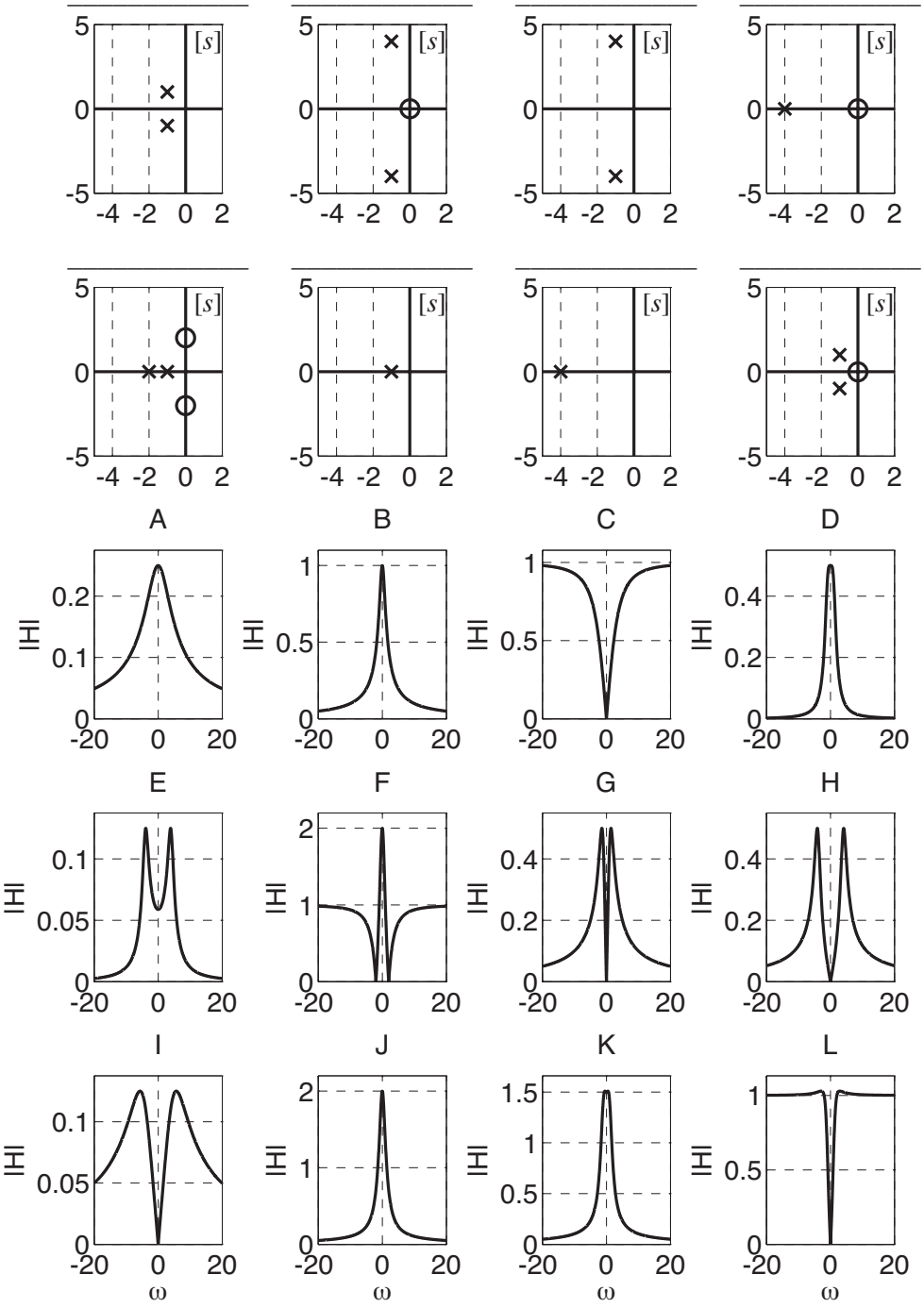
Because of the way the problem was worded, I also accepted the solution

$$18\delta_5(\omega/2\pi)$$

even though that was not what I intended.

4. Below are some pole-zero diagrams and some magnitude frequency responses. Match the frequency responses to the pole-zero diagrams by writing the letter designation of the frequency response in the blank space provided above the pole-zero diagram. If there is no match, just write "None".

D H E C
F B A G



Solution of ECE 315 Test 2 F09

1. Find the numerical values of the constants in these Laplace transform pairs.

(a) $3e^{5t}\,\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{A}{s-a}$

What is the ROC? ROC is _____

$3e^{5t}\,\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{3}{s-5}$, $\sigma > 5$

(b) $4\delta(6t-1) \overset{\mathscr{L}}{\longleftrightarrow} Ae^{-as}$

What is the ROC? ROC is _____

$4\delta(6t-1) = 4\delta\big(6(t-1/6)\big) = (2/3)\delta(t-1/6) \overset{\mathscr{L}}{\longleftrightarrow} (2/3)e^{-s/6}$, ROC is all s.

(c) $Ae^{at}\,\mathrm{u}(bt) + Ce^{ct}\,\mathrm{u}(dt) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{s-3}{s(s+5)}$, $\sigma > 0$

$\dfrac{s-3}{s(s+5)} = \dfrac{-3/5}{s} + \dfrac{8/5}{s+5}$, $\sigma > 0$

$\left[-3/5 + (8/5)e^{-5t}\right]\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{-3/5}{s} + \dfrac{8/5}{s+5}$, $\sigma > 0$

(d) $Ae^{at}\,\mathrm{u}(bt) + Ce^{ct}\,\mathrm{u}(dt) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{s-3}{s(s+5)}$, $-5 < \sigma < 0$

$(3/5)\mathrm{u}(-t) + (8/5)e^{-5t}\,\mathrm{u}(t) \overset{\mathscr{L}}{\longleftrightarrow} \dfrac{s-3}{s(s+5)}$, $-5 < \sigma < 0$

2. Find the numerical values of the constants in these Fourier transform pairs.

(a) $-7\,\mathrm{tri}(t-3) \overset{\mathcal{F}}{\longleftrightarrow} A\mathrm{sinc}^2(af)e^{bf}$

$-7\,\mathrm{tri}(t-3) \overset{\mathcal{F}}{\longleftrightarrow} -7\mathrm{sinc}^2(f)e^{-j6\pi f}$

(b) $A\sin(at)\mathrm{sinc}(bt) \overset{\mathcal{F}}{\longleftrightarrow} j\left[\delta(f-8)-\delta(f+8)\right] * 9\,\mathrm{rect}(5f)$

$-(18/5)\sin(16\pi t)\mathrm{sinc}(t/5) \overset{\mathcal{F}}{\longleftrightarrow} j\left[\delta(f-8)-\delta(f+8)\right] * 9\,\mathrm{rect}(5f)$

or

$(18/5)\sin(-16\pi t)\mathrm{sinc}(t/5) \overset{\mathcal{F}}{\longleftrightarrow} j\left[\delta(f-8)-\delta(f+8)\right] * 9\,\mathrm{rect}(5f)$

(c) $A\,\mathrm{rect}(at) * \mathrm{rect}(bt) \overset{\mathcal{F}}{\longleftrightarrow} 9\,\mathrm{sinc}(2f)\mathrm{sinc}(5f)$

$(9/10)\mathrm{rect}(t/2) * \mathrm{rect}(t/5) \overset{\mathcal{F}}{\longleftrightarrow} 9\,\mathrm{sinc}(2f)\mathrm{sinc}(5f)$

3. If a CTFT in the f form is $30\delta_4(f)$ and in the ω form it is $A\delta_b(c\omega)$, what are the numerical values of A, b and c?

$$\left[30\delta_4(f)\right]_{f\to\omega/2\pi} = 30\delta_4(\omega/2\pi) = 30\sum_{k=-\infty}^{\infty}\delta(\omega/2\pi-4k) = 60\pi\sum_{k=-\infty}^{\infty}\delta(\omega-8\pi k)$$

$$\left[30\delta_4(f)\right]_{f\to\omega/2\pi} = 60\pi\delta_{8\pi}(\omega)$$

Because of the way the problem was worded, I also accepted the solution

$$30\delta_4(\omega/2\pi)$$

even though that was not what I intended.

4. Below are some pole-zero diagrams and some magnitude frequency responses. Match the frequency responses to the pole-zero diagrams by writing the letter designation of the frequency response in the blank space provided above the pole-zero diagram. If there is no match, just write "None".

H D A F
E B G C