# Homework 13

1. a) Find $\mathcal{L}\{tu(t-3)e^{-4t}\}$.

   b) Find $\mathcal{L}\left\{\int_0^t e^{-6\tau}\cos(7\tau)d\tau\right\}$.

2. a) Find $f(t)$ if $F(s)=\dfrac{5s-62}{s^2+6s+58}-\dfrac{8}{s}$.

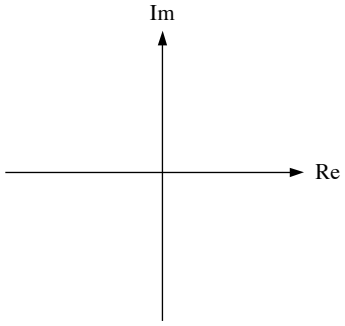
   b) Find $v(t)$ if $V(s)=\dfrac{18s+148}{s^2+12s+11}$.

3. a) Find $\lim\limits_{t\to 0^+} f(t)$ if $F(s)=\dfrac{s(9s-6)}{3(s^2+4)(s+2)}$.

   b) Find $\lim\limits_{t\to\infty} v(t)$ if $V(s)=\dfrac{s^2+4}{(s+3)^3}$.

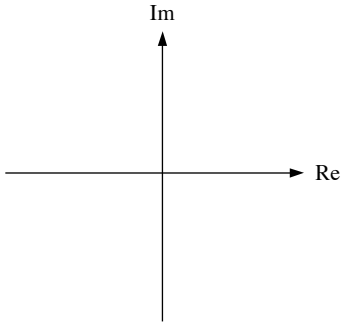
4. Plot and label the values of the poles and zeros of $F(s)$ in the $s$ plane.

$$F(s)=\frac{s^2-9}{s[(s+1)^2+4]}$$




5. Plot the poles and zeros of $V(s)$ in the $s$ plane.

$$V(s)=\frac{s^2+5s+6}{(s+1)\left[(s+4)^2+5^2\right]}$$



Answers:

1.a) $\mathcal{L}\left\{tu(t-3)e^{-4t}\right\} = e^{-3s}\left[e^{-12}\frac{1}{(s+4)^2} + 3e^{-12}\frac{1}{s+4}\right]$

b) $\mathcal{L}\left\{\int_0^t e^{-6\tau}\cos(7\tau)\,d\tau\right\} = \frac{s+6}{s[(s+6)^2+7^2]}$

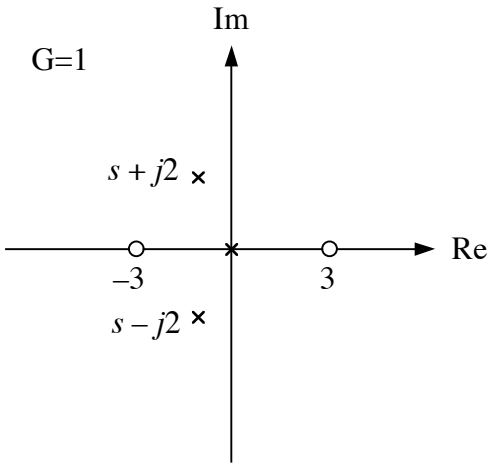
2.a) $f(t) = 5e^{-3t}\cos(7t) - 11e^{-3t}\sin(7t) - 8u(t)$

b) $\mathcal{L}^{-1}\left\{\frac{13}{s+1} + \frac{5}{s+11}\right\} = \left[13e^{-t} + 5e^{-11t}\right]u(t)$

3.a) $\lim_{t\to 0^+} f(t) = 3$

b) $\lim_{t\to\infty} v(t) = 0$

4.




5. Zeros are plotted as o's at $s = -2$ and at $s = -3$.
Poles are plotted as x's at $s = -1$, $s = -4 - j5$, and at $s = -4 + j5$.