Part I Problems and Solutions

Problem 1: *For each of the following functions $f(t)$, find the pole diagram of $F(s)$.*

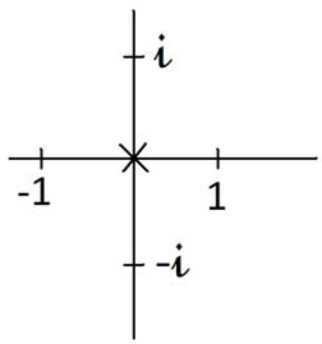
a) $f(t) = 1$

b) $f(t) = e^{-t} + 3e^{-3t}$

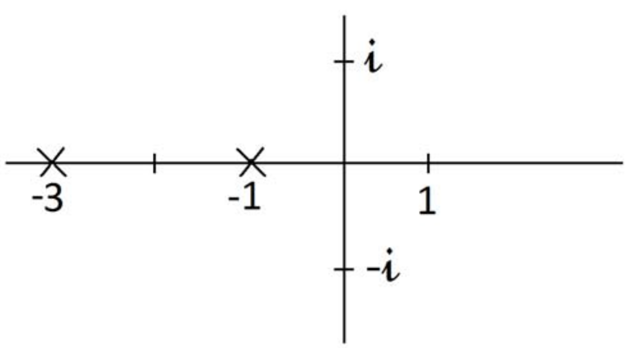
c) $f(t) = \cos(2t) + e^{-t}\sin(t)$

Solution:

a) $f(t) = 1 \to \mathcal{L}(f) = \frac{1}{s}$ which has one pole at $s = 0$.



b) $f(t) = e^{-t} + 3e^{-3t} \to \mathcal{L}(f) = \frac{1}{s+1} + \frac{3}{s+3}$. This has poles at $s = -1$ and $s = -3$.



c) $f(t) = \cos(2t) + e^{-t}\sin t \rightarrow \mathcal{L}(f) = \frac{s}{s^2+4} + \frac{1}{(s+1)^2+1}$. This has poles when $s^2 + 4 = 0$, so at $s = \pm 2i$; and when $(s+1)^2 + 1 = 0$, so also at $s = -1 \pm i$.