

1. (7 points) Solve $y''(t) + 4y'(t) + 3y(t) = 5H(t - 2) + \cos(t)\delta(t - \pi)$ if $y(0) = 0$ and $y'(0) = 0$.

2. (6 points) Solve $q(t) + \int_0^t (t - \tau)q(\tau)d\tau = \sin(2t)$.

3. (6 points) Assume $\mathcal{L}\{f(t)\}$ exists for $s > a \geq 0$. Use the definition of Laplace transform to show that

if c is a positive constant, then $\mathcal{L}\{f(ct)\} = \frac{1}{c}F\left(\frac{s}{c}\right)$ for $s > ca$.

4. (6 points) Find the Laplace transform of $f(t) = (t^2 - 4t + \delta(t - 3))H(t - 2)$. Show work.