Math 344 Sample Midterm 1

These are questions that may be similar to the ones on the first midterm exam. The actual midterm has only 5 questions.

1. Find a function $f(t)$ such that $f(t) = t - 4\int_0^t xf(t-x)\,dx$.

2. Solve $y'' + 2y' + 5y = \delta(t-3)$ if $y(0) = 0$ and $y'(0) = 1$. What is a physical interpretation for this differential equation?

3. Solve $xy'' - xy' + 2y = 0$.

4. Solve $y'' + y = f(t)$ where $f(t)$ is t on $[0,1]$, $2-t$ on $[1,2]$, and 0 elsewhere.

5. Solve $y'' + ty' + y = 0$.

6. Solve $tf(t) = \int_0^t f(x)f(t-x)\,dx$.

7. Find $\mathcal{L}^{-1}\left[1 + \dfrac{s}{(s-a)^2+b^2} + e^{-2s}\arctan\left(\dfrac{\pi}{s}\right)\right]$.

8. If $\mathcal{L}[f(t)] = F(s)$, write $\mathcal{L}[f(at)]$ in terms of F.

9. Solve $x^2y'' + xy' = 4$.