Quiz 8, Math 246, Professor David Levermore
Tuesday, 5 November 2019

Your Name:

Discussion Instructor (circle one):   Sam Potter   Nathan Yu   David Russell
Discussion Time (circle one):   9:00   11:00   12:00

No books, notes, calculators, or any electronic devices.
Show your reasoning for full credit. Good luck!

Short Table: $\mathcal{L}[t^n e^{at}](s) = \dfrac{n!}{(s-a)^{n+1}}$ for $s > a$, $\mathcal{L}[u(t-c)j(t-c)](s) = e^{-cs}\mathcal{L}[j](s)$.

(1) [5] Find $F(s) = \mathcal{L}[f](s)$ where $f(t) = u(t-4)e^{-3t} + 5\delta(t-2)$.

(2) [2] Recast the equation $x'''' - e^{t+x''}x' + \sin(x) = 0$ as a first-order system of ordinary differential equations.

(3) [3] Consider the matrix-valued function $\mathbf{\Psi}(t) = \begin{pmatrix} 1 & 2t^4 \\ -t^2 & 4 - t^6 \end{pmatrix}$.

    (a) Compute $\det(\mathbf{\Psi}(t))$.
    (b) Compute $\mathbf{\Psi}(t)^{-1}$.
    (c) Compute $\mathbf{\Psi}'(t)$.