You are allowed to use Mathematica or equivalent to do integrals.

3.1) Griffiths Problem 2.1. (8 points)

3.2) Griffiths Problem 1.16. (4 points)

3.3) Consider the set of coupled differential equations

\[
i \dot{\psi}_1 = -3 \psi_1 + 2 \psi_2
\]
\[
i \dot{\psi}_2 = 2 \psi_1 - 3 \psi_2.
\]

Find \( \psi_1(t) \) and \( \psi_2(t) \) in terms of the initial conditions \( \psi_1(0) \) and \( \psi_2(0) \) following the method outlined in class. The dot denotes the differentiation with respect to \( t \) and note the factor of \( i \equiv \sqrt{-1} \). Please explain the steps clearly. (8 points)

*Do not submit:* If you want a slightly more challenging problem try

\[
i \dot{\psi}_1 = -2 \psi_1 + i \psi_2
\]
\[
i \dot{\psi}_2 = -i \psi_1 - 2 \psi_2.
\]

If you write the equation in matrix form what kind of matrix do you obtain on the right-hand side?