This Lecture Activity has you actively work with the lecture notes presented in class and available on my website. This activity is due by **Thur. Oct 14 by noon**. The problems below require written answers, which are entered into **Gradescope**.

Note: For full credit you must show intermediate steps in your calculations.

1. (3pts) Consider the homogeneous ODE:

$$\dot{\mathbf{x}} = \begin{pmatrix} -2 & 0 & 0 \\ 0 & -1 & 1 \\ 0 & -1 & -1 \end{pmatrix} \mathbf{x}.$$

Find a fundamental solution to this ODE. Use the Corollary of Abel's formula to show that you have a fundamental solution. (Slide Fundamental 49–67)

2. (5pts) Consider the nonhomogeneous ODE:

$$\dot{\mathbf{x}} = \begin{pmatrix} -2 & 0 & 0 \\ 0 & -1 & 1 \\ 0 & -1 & -1 \end{pmatrix} \mathbf{x} + \begin{pmatrix} e^{-2t} \\ 1 \\ t \end{pmatrix}, \qquad x(0) = \begin{pmatrix} x_{10} \\ x_{20} \\ x_{30} \end{pmatrix}.$$

Using your fundamental solution, solve this ODE. It is recommended that something like Maple is used to solve the integrals. (Slide Fundamental 49–67)

3. (3pts) Consider the homogeneous ODE:

$$\dot{\mathbf{x}} = \begin{pmatrix} 0 & 1 \\ 2t^{-2} & -2t^{-1} \end{pmatrix} \mathbf{x}, \qquad t > 0.$$

Find a fundamental solution to this ODE. Use the Corollary of Abel's formula to show that you have a fundamental solution. (Slide Fundamental 49–67)

4. (5pts) Consider the nonhomogeneous ODE:

$$\dot{\mathbf{x}} = \begin{pmatrix} 0 & 1 \\ 2t^{-2} & -2t^{-1} \end{pmatrix} \mathbf{x} + \begin{pmatrix} 6t \\ 9t^{-4} \end{pmatrix}, \qquad x(1) = \begin{pmatrix} x_{10} \\ x_{20} \end{pmatrix}, \qquad t > 0.$$

Using your fundamental solution, solve this ODE. It is recommended that something like Maple is used to solve the integrals. (Slide Fundamental 49–67)