This assignment is your first Lecture Activity to have you actively work with the lecture notes presented in class and available on my website. This activity is meant to keep you engaged and current with the class, so there is a fairly rapid turn around (due by **Fri. Aug 27 by noon**). There are 4 problems that require written answers, which are entered into **Gradescope**.

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

1. (4pts) Consider a population of animals, $P(t)$, growing according to the differential equation model of *Malthusian growth*. Assume that the initial population is given by $P(0) = 75$ and that 10 weeks later the population is $P(10) = 120$. Let r be the growth rate and write the ordinary differential equation describing this population. Find the value of r and the doubling time for this population. Determine $P(50)$. (Slides Intro 18-21)

2. (4pts) Consider the damped harmonic oscillator given by the differential equation:

$$y'' + 4y' + 5y = 0.$$

What order of differential equation is this? Is it linear? Is it homogeneous? Determine if

$$y(t) = 3e^{-2t}\cos(t),$$

is a solution, showing your work to prove or disprove it being a solution. (Slides Intro 31-34)

3. (4pts) Assume the function $y(t) = 3e^{-2t}\cos(t)$ in the previous problem represents the distance of a mass from equilibrium, where y is in cm and t is in sec. Create a graph in MatLab showing the position, y, as a function of time, t, where $t \in [0, 10]$. Be sure to add a title and properly label the axes. Show your MatLab program. (Modify the MatLab program graph_plot.m linked on the HW Assignment or Lecture page.)

4. (4pts) Consider the differential equation (ODE):

$$\frac{dy}{dt} = \frac{y}{5}, \quad \text{with} \quad y(8) = 20.$$

Determine the order of this ODE, whether it is linear, and whether it is homogeneous. Solve the initial value problem (IVP). Use MatLab to create a graph of the solution for $t \in [0, 10]$. Include a clear data point (circle) showing the initial value above. (Slides Qual Methods 3-4)