This Lecture Activity is designed 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 **Mon. Sep 27 by noon**). There are 3 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 the initial value problem:

$$\frac{dy}{dt} = \frac{3+2t}{2y}, \qquad y(0) = -4.$$

Solve this initial value problem. (Slides Separable 5–12)

2. A nice Riesling should be served at 45°F. At 11 AM, you grab a bottle of Riesling that has been sitting in a warm garage (88°F) and plunge it into a bucket of ice water (32°F). At 11:30 AM, you find the temperature of the wine to be 72°F.

a. (6pts) If $H(t)$ is the temperature of the wine, then Newton's Law of Cooling gives:

$$\frac{dH}{dt} = -k(H - T_e),$$

where T_e is the temperature of the ice water, t is in min after 11 AM, H is the temperature in °F, and k is the coefficient of heat transfer. Solve this differential equation, and use the information at 11:30 AM ($t = 30$) to find the value of k (at least **4** sig. figs). Estimate how many min before you should serve the wine. (Slides Intro 7–11)

b. (6pts) Suppose that an experimental study of the cooling for this bottle of Riesling gives a model, which satisfies the differential equation:

$$\frac{dH_b}{dt} = -k_b(H_b - T_e)^{3/4},$$

where again T_e is the temperature of the ice water, H_b is the temperature in °F, and k_b is the coefficient of heat transfer. Solve this differential equation, and use the information at 11:30 AM ($t = 30$) to find the value of k_b (at least **4** sig. figs). Estimate how many min before you should serve the wine with this model. (Slides Separable 39–41)