Homework 1 – Linear ODEs and Allometric Due Fri. 9/10

Work all problems in **WeBWorK**. The written portion of the **WeBWorK Problem 4** and the two problems below are submitted in **Gradescope** (due by **Fri. Sep 10 by noon**).

1. Solve

$$\frac{dy}{dx} + 2xy = f(x),\ y(0) = 2$$

where

$$f(x) = \begin{cases} x, & 0 \le x < 1 \\ 0, & x \ge 1 \end{cases}$$

2. Consider the equation

$$\dot{x} + p(t)x = 0.$$

Suppose that $p(t)$ is periodic with period T, *i.e.*, $p(t+T) = p(t)$. Show that the solution $x(t)$ for any initial condition is periodic if and only if

$$\int_0^T p(s)ds = 0.$$

Said another way, you are showing that if $p(t)$ has zero average in time, then the solution will be periodic.