Math 207C
Homework 3
Due Friday, April 22nd

1. In class we constructed the leading order composite expansion to the initial value problem

$$\epsilon\ddot{u} + \dot{u} + u = 0,$$
$$u(0) = 0, \quad \epsilon\dot{u}(0) = 1.$$

   (a) Find the terms at order ϵ for the inner and outer expansions, perform matching at this order using the intermediate scale, and give the composite expansion.

   (b) Compute the exact solution to this problem. Use it to assess the accuracy of the leading order composite expansion and the expansion from part (a) for different values of ϵ.

2. Compute the leading order composite expansion to the problem

$$\epsilon u'' + \sqrt{x}u' - u = 0,$$
$$u(0) = 0, \quad u(1) = \mathrm{e}^2.$$