

April 28, 2009

MAE 105 Homework #5

Due: Tuesday, 05/5/09

PROBLEM 1 (3 Points):

Consider the following ODE:

$$\frac{d^2\phi}{dx^2} + \tan(x) \frac{d\phi}{dx} + [\lambda \sigma(x) + \gamma(x)] \phi = 0, \quad (1)$$

where $\sigma(x) > 0$ and $\gamma(x)$ are given functions. Multiply through by the yet unknown function $H(x)$, and then find an expression for $H(x)$ such that (1) become a Sturm-Liouville DE.

PROBLEM 2 (3 Points):

Do problem 5.3.8 in your text, page 169.

PROBLEM 3 (3 Points):

Consider the following ODE:

$$\frac{d}{dx} [\cos(x) \frac{d\phi}{dx}] + \lambda \phi = 0, \quad 0 < x < \pi,$$

with boundary conditions

$$\phi(0) = \phi(\pi) = 0.$$

Use the Rayleigh quotient with $\phi_t = \sin x$ to estimate the first eigenvalue of this problem.

Note 1: To receive full credit, *all steps must be neatly shown*. Writing down the final results will receive no credit.

Note 2: Homeworks must be turned in at the start of due-date class. Late homeworks will be graded but *will receive zero credit*.