Math 391 — **EXAM #2** — April 11, 2005

Please PRINT your name and ID# on the cover of your exam booklet and indicate if you are handing-in more than one booklet. Write clearly and cross-out work not to be graded.

ALL ANSWERS GO IN THE EXAM BOOK. SHOW ALL WORK.
NO CALCULATORS OR NOTES ALLOWED.

1. Find the general solution of: (30 pts.)

$$y'' + y = \tan x, \ 0 < x < \pi/2.$$

   You might find the following useful:

$$\int \sin(x) \tan(x) \ dx = \ln(\sec x + \tan x) - \sin x.$$

2. Using the method of your choosing, find the general solution of: (30 pts.)

$$y'' - y' - 2y = e^x + x.$$

3. Find a second, linearly independent solution $y_2(x)$, given that $y_1(x) = \frac{1}{x}$ is a solution (30 pts.) to the differential equation:

$$x^2 y'' + 3xy' + y = 0, \ x > 0.$$

4. A mass of 5 kg stretches a spring 10 cm. The mass is acted on by an extrernal force of (10 pts.) $10 \sin(t/2)$ Newtons and moves in a medium that imparts a viscous force of 2 Newtons when the speed of the mass is 4 cm/sec. If the mass is set in motion from its equilibrium position with an initial velocity of 3 cm/sec, formulate (**but DO NOT solve**) the initial value problem describing the motion of the mass.