Math 19. Mathematical Modeling
Reviewing for Midterm II

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1. The exam will be the on Chapters 13–20 and will be in class on Monday, November 25, 2002. You may bring a 3×5 index card of notes. No calculators will be permitted, but the problems should only require a minimum of numerical computation.

2. Go over the extra problems and solutions for Chapters 13–23 (pp. 489–493 in the textbook).

3. You should understand and be able to apply the advection equation (pp. 192–197),
$$\frac{\partial u}{\partial t} = -c\frac{\partial u}{\partial x} + f(u).$$

4. You should understand and be able to apply the diffusion equation (pp. 216–219),
$$\frac{\partial u}{\partial t} = \mu\frac{\partial^2 u}{\partial x^2} + f(u).$$

5. You should understand and be able to apply Laplace's equation (pp. 260–263),
$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0.$$

6. You should understand and be able to apply initial conditions and boundary conditions to the advection equation, the diffusion equation, and Laplace's equation.

7. You should understand and be able to apply the separation of variables technique to solve advection equation, the diffusion equation, and Laplace's equation (pp. 259–263).

8. You should be able to solve the differential equation

$$\frac{d^2u}{dx^2} = cu$$

for $c > 0$, $c = 0$, and $c < 0$ (pp. 261–262).

9. You should understand and be able to apply the Principle of Superposition (pp. 227–229).

10. You should understand and be able to apply stability criterion for equilibrium solutions (p. 271).

11. You should understand the difference between advection and diffusion. That is, the advection equation is used when particle motion is due the motion of the ambient fluid. On the other hand, the diffusion equation is used when the particles move by random drift.