

Mathematics 1050
Problem Set
Due April 15, 2009

Print Name: _____

Signature: _____

Your signature is your pledge that you have adhered to the guidelines for problem sets and take-home examinations.

This problem set will be graded on the basis of 100 points but will be worth 50 points.

Make sure that you check the course website for instructions, available from the *General Policies* portion of the web site. Remember that your paper may be handed in before the deadline but that no late papers will be accepted regardless of the reason. The course website also includes an explanation of how your average will be calculated if you fail to complete this assignment.

Note that, since most of the calculations involved can be done routinely using either a calculator or a symbolic manipulation program such as Maple or Mathematica, it will obviously be necessary to show, through your work, exactly how you came up with your solutions.

Regardless of the instructions above, this is the first portion of the April 15 exam and will count for half the exam. It should be submitted at the start of class April 15, at which time the in-class portion is to be taken.

1. Consider a one-dimensional diffusion situation where a gas of mass 20 grams is released in the center of a thin tube. Assume a diffusion constant $D = 0.15$ centimeters per second. Calculate the concentration of the gas at the center and at locations 0.5, 1, 1.5, 2, 5 and 10 centimeters from the center at times 1, 2, 5 and 10 seconds after the gas is released.
2. Suppose 125 kilograms of a soluble material are spilled into the center of a large shallow lake and gradually diffuses out into the lake. Suppose the diffusion constant in the north/south directions is 0.5 square meters per minute while the diffusion constant in the east/west directions is 0.7 square meters per minute.
 - (a) Find the concentrations at a point 10 meters north and 15 meters east of the center 10, 20, 30 and 60 minutes after the material is spilled.
 - (b) Find the concentrations at a point 15 meters north and 10 meters east of the center 10, 20, 30 and 60 minutes after the material is spilled.

3. A chemical plant emits a volatile organic compound into the air at the rate of 150 grams