

## Mathematics Literacy Exam – Spring Semester 2007

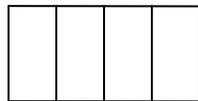
Answer two of the following four questions (only two will be scored).

Calculators are permitted.

Responses will be scored based on the following criteria:

- Communication of mathematical understanding of the question
  - Correct use of mathematical procedures
  - A clear presentation of an appropriate solution strategy
  - A valid interpretation of a solution
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1. For residential electric consumption, the local power company charges a fixed monthly service charge (the same each month) plus a cost for each kilowatt hour (kwh) of electricity used. In August, your electric bill was \$57.65 for 900 kwh. In September, the bill was \$81.17 for 1320 kwh.
  - a. Assuming the same rate schedule, what will your October bill be if you use 1790 kwh of electricity? How is that determined?
  - b. After deregulation, a competing power company offers you a rate of  $6\frac{1}{4}$  cents per kwh with no monthly service charge. Which power company is offering the better rate? Explain how you determined this.
2. Suppose 100 meters of fence is being used to build a rectangular dog kennel that is divided into four sections like this:



- a. Use an equation to express the relationship between the “long” and “short” dimensions of the kennel.
- b. Graph the area of the kennel as a function of one of its dimensions. Then, from the graph, determine the dimensions of the kennel that has maximum area.
- c. Describe a more general method for finding the dimensions of the kennel with maximum area when  $L$  meters of fencing are used to make a rectangular kennel divided into  $N$  sections.

3. According to a newspaper report, the trees in a certain land area are being cut at a rate of 15% per year. The lumber company that manages the land claims that it replants 2000 tree starts in this area every year. Discuss the future tree production in this land area if this plan continues.
  
4. A test for a specific type of cancer has been found to have the following reliability. The test correctly detects 85 percent of the people who have this cancer and fails to detect 15 percent of the people who have this cancer. Among those who don't have this cancer, the test erroneously identifies 8 percent as having cancer and correctly identifies 92 percent as not having this cancer. Statistics show that 1.8 percent of the population has this cancer.
  - a. Suppose a randomly chosen person is given the test and it indicates that he has this cancer. What is the probability that he actually has this cancer?
  - b. Suppose a randomly chosen person is given the test and it indicates that he does not have this cancer. What is the probability that he actually has this cancer?
  - c. Suppose that the test works by looking at the level of a certain hormone in the blood. If the hormone is above a specific threshold, then the test is determined to be a "positive" result, indicating cancer, while if the hormone is below the threshold, the test is considered to be a "negative" result, not indicating cancer. One could adjust the test by changing the threshold at which a test is considered positive. Discuss the implications of raising or lowering this threshold and what factors should enter into the decision about an appropriate threshold.