MATH 170 – Section 004 – Quiz 11

You may work with other class members on this quiz, but you may not receive assistance from people not in MATH 170 (Section 004). You must show all of your work to receive full credit. Do all your work on other sheets of paper and be sure to staple all the pieces of paper together or YOU WILL GET A ‘ZERO’ ON THE QUIZ. Do not use decimal approximations unless asked to do so. Your work on this quiz must be handed in by Monday, 21 April 2003 at 11:40 a.m. GOOD LUCK!

1) We cut a length of wire 100 cm long into two pieces. From one piece we make a square; from the other we make an equilateral triangle. Determine where we make the cut and describe the square and triangle if we wish to
   a) maximize the total area of the square and triangle.
   b) minimize the total area of the square and triangle.

2) A zoo manager wants to enclose a rectangular area of 16,000 square meters into three cages of equal size (see Figure 1). The fencing along the perimeter of the 16,000 square meter area costs $10 per meter while the fencing that separates adjacent cages costs $15 per meter. How much of each type of fencing should be purchased to minimize the cost? In this case, what are the dimensions for each of the three cages?

3) Use Newton’s method to find all solutions of the equation

\[ x^2 - 2 = \ln x. \]

Stop when you are certain your answers are accurate to six places to the right of the decimal point.

4) Find the most general antiderivative of

\[ f(x) = x^3 - \frac{2}{\sqrt{x}} + e^{-5x} - 8 \sin 4x + \frac{6}{x} + 3. \]

5) Show that

\[ \frac{d}{d\theta} (\tan^2 \theta) = \frac{d}{d\theta} (\sec^2 \theta). \]

Does this mean that \( \tan^2 \theta = \sec^2 \theta \)? Explain your answer fully.

6) A ball is dropped from the top a building and hits the ground 5 seconds later. Find the height of the building. Assume that air resistance is neglected; thus a constant acceleration due to gravity of 32 ft/sec^2 acts on the ball. (Hint: what is the mathematical meaning of the word “dropped?”)
Figure 1: Cages for Exercise 2)