MAT 3-119 Calculus of a Single Variable
Take home exam   November 13, 2015

This exam is completely open book and open notes; you may use any reference you like. However, the work should be your own, without substantial help on these actual problems from others including students, tutors, or faculty. **Work neatly and clearly label your problems.** 25 points possible. Due Monday, November 16 by 5 p.m.

1. (5 pts) A fungus grows at a rate proportional to its current size. Suppose that the fungus weighs 12 grams at time t = 0 and 15 grams at time t = 6 hours. At what time does the fungus weigh 24 grams?

2. (8 pts.) Let f(x) = x + cos x. Use calculus techniques to answer the following questions.
   a. Does f have any stationary points in [0, 2π]? If so, where?
   b. Where in the interval [0, 2π] is f increasing?
   c. Find the absolute maximum and minimum values of f in the interval [0, π].
   d. Where in the interval [0, 2π] is f concave down?

3. (5 pts) A rectangular box with square base and vertical sides is to be made to contain 1000 cubic feet. The material for the base costs 50 cents per square foot, for the top costs 20 cents per square foot, and for the sides costs 30 cents per square foot. Find the dimensions of the box that will minimize cost.

4. (4 pts.) Calculate the anti-derivative of the following function:
   $f(x) = e + 2\ e^x + \sin(x+2) - 3\cos(x)$

5. (3 pts.) Find the equation of the tangent line to $2^x \cos x$ at x = π.