

# MATH 271 – “Final Exam”

due 14 May 2009 at 0840

**This “Final Exam” is optional. If you choose to submit your work, I will count it as being equivalent to two homeworks and average it into the 14 homework assignments already submitted. If you submit nothing, then your grade will be determined by the 14 previous homeworks.**

For each of these problems, you may use either Maple or Matlab or a combination of the two. Please send your work to the appropriate email address: `brill@math.boisestate.edu` for Maple and `stephenbrill@yahoo.com` for Matlab. GOOD LUCK!

1) Consider the surface

$$x^2 + 3y^2 + 2z^2 = 20. \tag{1}$$

- a) Find an equation of the plane tangent to (1) at the point  $(3, -1, 2)$ .
- b) Find an equation of the plane tangent to (1) at the point  $(0, 2, -2)$ .
- c) Find an equation of the curve that is the intersection of these two planes.

2)

- a) Find the greatest and smallest values that the function

$$f(x, y) = xy$$

takes on the ellipse

$$\frac{x^2}{8} + \frac{y^2}{2} = 1.$$

- b) Plot the ellipse in the  $x$ - $y$  plane and plot some well-chosen level curves of  $f$  in the same picture. Describe how this picture relates to your answer to part a).

3) Consider the curve given by

$$x^2 - y^2 = 1. \quad (2)$$

Plot this curve in the  $x$ - $y$  plane in two substantially different ways:

- a) Solve (2) for  $y$  and then graph  $y$  using an appropriate vector  $x$ .
- b) Choose a parameter  $t$  and then define both  $x$  and  $y$  in terms of  $t$ . (Hint: use hyperbolic functions.)

4) Write both a Maple proc and a Matlab function to implement the trapezoid method for approximating

$$\int_a^b f(x) dx.$$

The inputs for your proc/function should be only the function/expression  $f$ , the number of subintervals  $n$ , and the endpoints  $a$  and  $b$ .

5) Consider approximating the integral

$$\int_{-2}^2 (3x^5 - 5x^4 - 60x^3 + 300x^2) dx$$

via the trapezoid method with an error no larger than 0.00001. How many subintervals must we use? After you have found your answer, use your proc/function from the previous exercise to do the necessary computations that shows that the error is indeed not larger than 0.00001.

6) Let an input file called `paragraph.txt` contain a paragraph of text. Your task is to write code to read the paragraph, count the number of sentences, words, and the number of times each letter and punctuation mark appears. These counts should then be reported to a file called `counts.out`. Remember, sentences need not end in only a period and such things like hyphenated words and contractions do exist. The file `paragraph.txt` does not contain information about how many words or sentences are in it; your code cannot assume that this knowledge is available without it reading and then analyzing the paragraph.