Midterm III

MATH 151

Due: Friday, May 23, 2008 11:00 – 12:20 **Founders 2107**

Instructions: **Show *all* work.** Failure to show work may result in loss of credit. Write your solutions in the space provided on the *answer sheets*. Do *not* hand in scratch paper. There are ten questions worth ten points each. You may use computers and graphing calculators for all questions, but decimal approximations are acceptable only in *7) and 10)* and the solutions obtained must *not* in any way depend on the computer. Please remember to circle your final answers. Some partial credit ***may*** be given. Numerical answers must be accurate to at least five decimal places. **Good Luck!**

1) Show that the equation $2x^4 + 4x^3 + 6x^2 - 6x + 1 = 0$ has exactly two real roots.

2) Suppose that g is a four times differentiable function such that $g(-1) = 3$, $g(0) = 0$, $g'(0) = -1$, $g(1) = 1$ and $\frac{d^4g}{dx^4} \le 24$ for all x. How large can $g(2)$ possibly be?

3) Find a cubic function $f(x) = ax^3 + bx^2 + cx + d$ that has a local maximum value of 9 at 6 and a local minimum value of -3 at 3.

4) Sketch the graph of $f(x) = (x^2 - x - 2)e^x$. Use the guidelines in your book. Any conclusions based solely on graphing utilities or computers are not acceptable.

5) Sketch the graph of $g(x) = e^{-2x}(\sin x - \cos 2x)$. Use the guidelines in your book. Any conclusions based solely on graphing utilities or computers are not acceptable.

6) Find the points on the curve $x^2 - 2xy + y^2 - 3x + 2y + 2 = 0$ that are closest to the origin.

7) Find, correct to five decimal places, the radius of the largest circle that can be inscribed in the curve $2x^2 + 3y^2 = 5$.

8) Find the maxima and minima of the function $f(x) = e^x(\cos x + \cos 3x)$ on the interval $[-\pi, \pi]$.

9) Let $g(x) = \frac{x + 12}{x^2 + 11x - 11}$. **(a)** Find the intervals on which g is increasing or decreasing. **(b)** Find the intervals of concavity and the inflection points.

10) Find the inflection points of the curve $y = x^5 + x^4 - 2x^2 + 5$ correct to five decimal places

You are welcome to keep this *Questions sheet* for your files.