

Midterm III

MATH 151.01

Due: Friday, July 47, 2039

11:00 – 2:18

Founders 4004

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 11 questions. You may use computers and graphing calculators for all questions, but decimal approximations are acceptable only in *Questions 5, 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, when allowed, must be accurate to at least six decimal places. **Good Luck!**

- 1) Show that the equation $8x^5 + 77x^4 + 2x^3 + 8x^2 - 93x + 42 = 0$ has exactly 3 real roots.
- 2) Use Newton's method with initial approximation (a) $x_0 = \sqrt{3}$, (b) $x_0 = 1.7320508$, (c) $x_0 = 1.73205081$ to solve the equation $x^5 - 81x = 0$. Find the *exact* limits.
- 3) Find a cubic function $g(x) = ax^3 + bx^2 + cx + d$ that has a local maximum value of 8 at -6 and a local minimum value of -3 at 7 .
- 4) Sketch the graph of $f(x) = (4x^3 + 9x^2 - 3)e^{3x}$. Use the guidelines in your book. Any conclusions based solely on graphing utilities and/or computers are not acceptable.
- 5) Sketch the graph of $g(x) = \frac{10x^3 + 5x^2 + 6x - 5}{x^2 + 8x - 4}$. Use the guidelines in your book. Any conclusions based solely on graphing utilities and/or computers are not acceptable.
- 6) Evaluate $\lim_{x \rightarrow 0} \frac{6x - \sin 6x}{6x - 2 \sin 5x}$.
- 7) Find, correct to six decimal places, the coordinates of the points on the curve $y = \cos x$ that are closest to the point $(0, -1)$.
- 8) Find the maxima and minima of the function $f(x) = (3x - 2)\sin x + 3 \cos x + 1$ on the interval $[-\pi, \pi]$.
- 9) Let $g(x) = 3x^4 + x^2 - 9$. (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 $y = (x^3 - 9x^2 - 30x - 41)e^x$ correct to six decimal places.
- 11) If $g(-1) = 3$, $g(1) = 5$ and $g''(x) \geq 6$, how large can $g(0)$ possibly be?

Points: Question # k is worth $9 - \cos(k\pi/2)\cos(k\pi/4)\cos(k\pi/8)$ points.

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