# Math 120 Practice Midterm 2

This midterm is 50 minutes, closed book. Solve each problem using the paper provided, and put your full name and student ID at the top of each sheet of paper.

No clarification will be given for any problems; if you believe a problem is ambiguous, interpret it as best you can and write down any assumptions you feel are necessary.

If you need more paper, there is are blank sheets at the front of the class. Be sure to put your name and student # on each sheet of paper.

Name: _____

Student #: _____

| Problem | Score |
|---------|-------|
| 1: | /10 |
| 2: | /10 |
| 3: | /10 |
| Total: | /30 |

1. Let $f(x) = \sin(x) + 2\cos(x)$. Compute $f'(x)$, $f''(x)$, $f'''(x)$ and $f''''(x)$. Use Taylor's theorem with remainder to expand $f(x)$ around the point $c = 0$ as a degree three polynomial plus an error term (i.e. when applying Taylor's theorem, $n = 4$ ).

(scratch space for problem 1)

2. Let $P = a_n x^n + a_{n-1} x^{n-1} + \ldots + a_0$ and $Q = b_m x^m + b_{m-1} x^{m-1} + \ldots + b_0$ be polynomials. Suppose that $a_n > 0$ and $n > m$. Prove that $\lim_{x \to \infty} \frac{e^{P(x)}}{e^{Q(x)}} = \infty$. Be sure to carefully state any rules or theorems that you use about limits, exponential functions, etc.

(scratch space for problem 2)

3. Let $f(x) = e^{x^3}$.

a. What is the domain and range of $f$?

b. Prove that $f$ has an inverse, i.e. there exists a function $g(x)$ with $D(g) = R(f)$ and $R(g) = D(f)$, so that $f(x) = y$ if and only if $g(y) = x$.

(scratch space for problem 3)