Math 1A Midterm 2 2005-11-3 11:00-12:30pm.

You are allowed 1 sheet of notes. Calculators are not allowed. Each question is worth 3 marks, which will only be given for a clear and correct answer.

1. For what values of x does the graph of $f(x) = x - 2\sin(x)$ have a horizontal tangent?

2. Find an equation of the tangent line to the curve $y = (1 + 3x)^{10}$ at the point $(0, 1)$.

3. Find dy/dx by implicit differentiation if $\sqrt{xy} = 1 + x^2 y$.

4. Find y''', where $y = x/(2x - 1)$.

5. Differentiate $\ln(\ln(\ln(\ln(x))))$.

6. Find the derivative of $\sinh(x)\tanh(x)$.

7. Use differentials or a linear approximation to estimate $\sqrt{99.8}$

8. Find the absolute maximum and absolute minimum values of $f(x) = x^3 - 3x + 1$ on the interval $[0, 3]$.

9. Find all critical numbers of the function $f(x) = x^{1/3} - x^{2/3}$.

10. Verify that $f(x) = x^2 - 4x + 1$ satisfies the three hypotheses of Rolle's theorem on the interval $[0, 4]$. Then find all numbers c that satisfy the conclusion of Rolle's theorem.

11. Find the intervals on which f is increasing or decreasing and all local maximum and minimum values of $f(x) = x^2 e^x$.

12. Find the limit $\lim_{x \to 0}(e^x - 1 - x)/x^2$.

13. Find the limit $\lim_{x \to 0}\sin(x)/(\sinh(x) + 1)$.

In questions 14 and 15 your sketch should show the domain of the function, local maxima and minima, where the function is increasing or decreasing, any zeros of the function, the behavior for large values of $|x|$, and the behavior near $x = 0$. You need not show convexity or points of inflection.

14. Sketch the curve $y = \sin(x)/(1 + \cos(x))$.

15. Sketch the curve $y = x^{1/x}$ for $x > 0$.