

Exam #3
Math 273
November 22, 2005

Name _____

All questions are worth an equal number of points. All work is to be done on the blank paper provided. At the end of the exam, please hand in this sheet, together with all of your work.

§1 Calculation

1. Find the (exact) maximum and minimum values of $f(x) = x - 2 \sin x$ on the interval $[0, 2\pi]$.

2. Let $f(x) = x^3 - 4x$.

- a. Find the intervals on which f is increasing or decreasing.
- b. Find the local maxima and minima of f .
- c. Find the intervals on which f is concave up or concave down.
- d. Find the inflection points of f .
- e. Sketch the curve.

3. Evaluate the following limits.

- a. $\lim_{x \rightarrow 0^+} \frac{\sqrt{x}}{\ln x}$.
- b. $\lim_{x \rightarrow 0} \frac{\sin x - x}{x^3}$.
- c. $\lim_{x \rightarrow 0} \frac{e^x - 1}{\sin x - 1}$.
- d. $\lim_{x \rightarrow 0^+} (\tan 2x)^x$.

4. Find an antiderivative for each of the following functions.

- a. $f(x) = x - \sqrt{x} + 1/x$.
- b. $g(\theta) = \sin \theta + \cos \theta$.
- c. $h(x) = 4e^x + \frac{2x^4 - \sqrt{x}}{x}$.

§2 Comprehension

5. State and prove Rolle's Theorem.
6. What is the definition of the definite integral? Give the precise meaning of the limit.
7. Use the definition of area to find the area between the curve $y = x^2$ and the axis $y = 0$ for $0 \leq x \leq 2$.

§3 Application

8. Find the rectangle of largest area that can be inscribed in a semicircle of radius r .
9. A right circular cylinder is inscribed in a cone of height h and base radius r . Find the largest possible volume of the cylinder.
10. A small rocket launched from the ground has acceleration $a(t) = -32 + 40(2 - t)$ ft/s². Find the height of the rocket t seconds after liftoff. When does the rocket hit the ground?