

Math 111 EXAM I, February 19, 2003

Read each problem carefully. Show all your work for each problem! Use only those methods discussed thus far in class. No Calculators!

1. (15) Find dy/dx for the following functions:

$$(a) y = 2x + \frac{1}{2}x^2, \quad (b) y = (7x^2 + x)^4x, \quad (c) y = \frac{6x + 2}{3x - 4}.$$

2. (10) Find the points on the curve $y = 3\sqrt{x} - x^{3/2}$, $0 \leq x \leq 4$, where the tangent line is either horizontal or vertical.

3. (15) Evaluate the following limits:

$$(a) \lim_{\theta \rightarrow 0} \frac{\theta}{\tan(\pi\theta)}, \quad (b) \lim_{x \rightarrow 4} \frac{x^2 - 16}{2 - \sqrt{x}}, \quad (c) \lim_{t \rightarrow 1} \frac{t - 1}{t^2 + 2t + 1}.$$

4. (10) Find dy/dx for the following functions:

$$(a) y = \sqrt{x + \sqrt{2 + x^2}}, \quad (b) y = [x - x^{3/2}]^{2/5}.$$

5. (10) The radius of a circle is decreasing at a rate of 2 in/s. At what rate is its area decreasing when the area is 9π ?

6. (10) Use the definition of the derivative to find $f'(x)$:

$$f(x) = x + \sqrt{x}.$$

7. (10) Find the maximum and minimum values attained by the given functions on the indicated closed intervals:

$$(a) f(x) = \frac{1}{x} - \frac{1}{x^2}, \quad x \in [1, 3], \quad (b) f(x) = 1 - |x - 1|, \quad x \in [-2, 2].$$

8. (10) The *position*, $x = f(t)$, of a particle moving in a straight line is given below. Find the particle's *velocity* when its *acceleration* is zero.

$$x(t) = \frac{1}{6}t^3 - t^2 + 3t + 1.$$

9. (10) Find the constant c such that the function given below is continuous for all x :

$$f(x) = \begin{cases} \cos x - c, & x \leq 0 \\ c \left\{ \frac{1 - \sqrt{1+x}}{x} \right\} + 3, & x > 0. \end{cases}$$