

MATH 211  
EXAM 2  
SPRING 2005

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Name \_\_\_\_\_  
Section \_\_\_\_\_

1. **(20 pts.)** Find the following derivatives

(a)  $f(x) = (2x^3 + x^2 + 2)^{10}$

(b)  $f(x) = \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)(x^3 + 3x^2)^5$

(c)  $f(x) = \frac{(x^2 + 1)^3}{(x^2 - 1)^2}$

(d)  $f(x) = \left(5x^3 + x^{1/2} + \frac{2}{x}\right)^{1/2}$

2. (15 pts.) Find the limit if exists:

$$(a) \lim_{x \rightarrow \infty} \left( \frac{x^4 + 3x^2}{2x^5 + x + 7} \right)$$

$$(b) \lim_{x \rightarrow \infty} \frac{4x^3 + 4x}{2x^3 - 3x}$$

$$(c) \lim_{x \rightarrow \infty} \frac{x}{x + 4}$$

$$(d) \lim_{x \rightarrow 2^+} \frac{1}{x - 2}$$

3. **(15 pts.)** Let  $f(x) = \frac{x-1}{x-2}$ ,  $f'(x) = \frac{-1}{(x-2)^2}$  and  $f''(x) = \frac{2}{(x-2)^3}$

(a) Find the vertical asymptote

(b) Find the horizontal asymptote

(c) Find the interval where  $f(x)$  is increasing or decreasing (using first derivative test).

(d) Find the interval where  $f(x)$  is concave up or down.

(e) Draw a rough sketch of the graph using (a) - (d).

4. **(15 pts.)** Find the absolute maximum and minimum values of the function

$$f(x) = 4x^3 - 6x^2 - 24x$$

over  $[0, 3]$  (if they exist).

5. **(20 pts.)** Let  $f(x) = x^3 - 6x^2 + 9x + 1$

(a) Find the critical point(s).

(b) Find the relative max/min.

(c) Find the inflection point(s) by using 2nd derivative test.

(d) Using (a) - (c) draw a rough sketch of  $f(x) = x^3 - 6x^2 + 9x + 1$

6. (15 pts.) A T-shirt company is planning to expand its business. It estimates the number of T-shirts produced by hiring  $x$  workers if given by

$$T(x) = -.25x^4 + 5x^3, \quad 0 \leq x \leq 20$$

When is the rate of change of T-shirt production increasing and when is it decreasing?  
What is maximum value of  $T(x)$  in the interval  $[0, 20]$ .