

Math 3.3 Final Examination Fall 2004

Department of Mathematics, Brooklyn College

Name _____ Section _____

Show all work and justify all your answers

PART I (55 points) : Answer all questions in this part.

1. (20 points)

(a) Find $\lim_{x \rightarrow \infty} \frac{3x^2 + 4x - 1}{2x^2 - 3}$.

(b) Find dy/dx for each of the following:

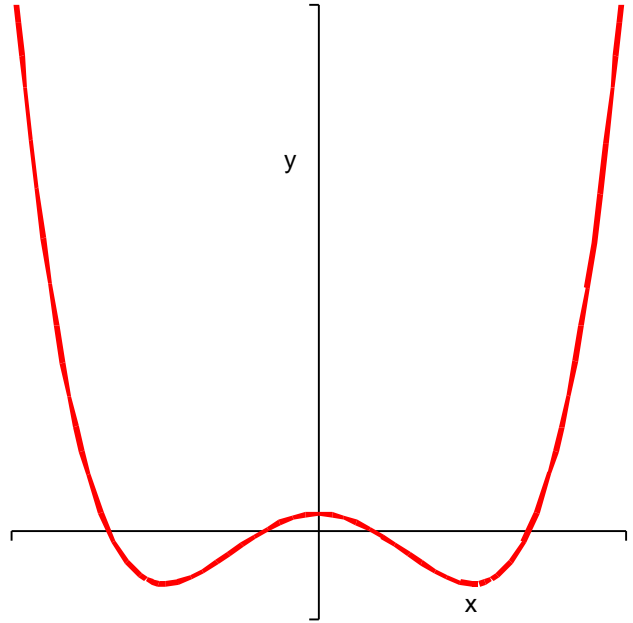
i. $y = (e^x + 4)\sqrt{3x + 2}$,

ii. $y = \frac{\ln(2x)}{x^2 + 3}$,

iii. $y = \cos^x(x)$,

iv. $y = \sec^4(x)$.

2. (20 points) Shown is the graph of
 $f(x) = x^4/4 - 2x^2 + 1$.



- (a) Determine and show on your graph all relative minima, relative maxima and points of inflection.
- (b) Find intervals where the function is increasing, decreasing, concave up and concave down.

- (c) Find the absolute maximum and the absolute minimum values of f on the interval $[-1, 3]$.

3. (15 points) Find each of the following integrals:

(a) $\int (x^2 - x + 5)\sqrt{x^3} dx,$

(b) $\int \sqrt{2x + 3} dx,$

(c) $\int_0^{\pi/6} \cos^4(2x) \sin(2x) dx.$

PART II (45 points) : Answer any three (3) of the four (4) questions in this part.

1. (15 points)

(a) Let $f(x) = 1/(3x - 1)$. Use the definition of derivative to find $f'(1)$.

(b) Let A be the area of a rectangle whose length u and width v are functions of time. At a certain time, the length is 15 feet and growing at the rate of 3 feet per second while the width is 7 feet and decreasing at the rate of 2 feet per second. Find the rate at which A is changing at that time. Is the area increasing or decreasing at that time?

2. (15 points)

(a) Find the area between the curve $y = \sin(2x)$ and the x -axis from $x = \pi/6$ to $x = \pi/3$.

(b) Find an equation of the tangent line to the curve $x^2 + 4xy - y^3 = 1$ at the point $(1, 2)$.

3. (15 points)

- (a) A rectangular poster is to have an area of 200 square inches with 1 inch margin on the sides and a 2 inch margin at the top and at the bottom. Find the dimensions of the poster with the largest printed area.

(b) Find $\lim_{x \rightarrow 0} \frac{\sin(4x)}{\tan(7x)}$.

4. (15 points) An object moves along a straight line. At time t seconds its position (distance from the origin) is s feet. Its acceleration a at time t is given by

$$a(t) = 6t - 7, \quad t \geq 0.$$

- (a) Find its velocity v at time t given that $v(0) = 2$.

- (b) At what times is the velocity of the object 0? What is the velocity of the object at $t = 3$ seconds?

- (c) Find the position s at time t , given that $s(0) = 3$.