DEPARTMENT OF MATHEMATICS
BROOKLYN COLLEGE

FINAL EXAMINATION–Spring 2008
MATHEMATICS 3.3

PART I: ANSWER <u>ALL</u> 3 QUESTIONS (*44 pts*).
SHOW ALL YOUR WORK.

(*16 pts*) 1. Find dy/dx for each of the following:

    (a) $y = (1 + x^2)^4 (2 - x^3)^5$ (b) $\sin(x + y) = x - y$

    (c) $y = \dfrac{1 + \tan x}{\sec x}$ (d) $y = (\cos 2x)^{5x}$

(*16pts*) 2. Find each of the following:

    (a) $\displaystyle\int \sin^3(5x + 2)\cos(5x + 2)\, dx$

    (b) $\displaystyle\int \frac{(1 + x)^2}{\sqrt{x}}\, dx$

    (c) $\displaystyle\int_1^3 \frac{e^{(3/x)}}{x^2}\, dx$

    (d) $\displaystyle\int_0^4 (9 + x^2)^{1/2}\, 2x\, dx$

(*12pts*) 3. Let $f(x) = 2x^3 + 3x^2 - 12x$.

    (a) Find the intervals of increase or decrease.
    (b) Find the local maximum and local minimum values, if they
         exist.
    (c) Find all points of inflection and indicate when the graph
         is concave up and when it is concave down.
    (d) Carefully sketch the graph of the function f and indicate
         the points identified in parts (b) and (c) on the graph.

Please turn over

PART II: ANSWER <u>FOUR</u> OF THE FIVE QUESTIONS
(*56 pts*). SHOW ALL YOUR WORK.

(*14pts*) 4. (a) A particle moves along the x-axis with an acceleration
according to the formula $a(t) = 6t - 12$, where t is
measured in seconds and s (displacement) is measured in
meters. If at time t= 0 the position of the particle is 5
meters (i.e., s(0)=5) and the velocity is 9 meters per second
(i.e., v(0)=9). Find the displacement when the accelera-
tion is zero.

(b) Find

$$\lim_{x \to \infty} \frac{\sqrt{4x^2 - 3x + 5}}{3x - 1}$$

(*14pts*) 5. (a) Suppose that $f''(x) = x^{-3/2}$, $f'(4) = 2$,
and $f(16) = 20$. Find $f(x)$.

(b) Two automobiles start from point A at the same time.
One travels west at 30 miles per hour and the other travels
north at 40 miles per hour. How fast is the distance
between them increasing 3 hours later?

(*14pts*) 6. (a) Use the *definition* of the derivative to find $f'(x)$ for
$f(x) = \frac{1}{1+2x}$.

(b) Find the area under the curve $y = \frac{x}{x^2+1}$

(above the x-axis) between $x = 0$ and $x = 3$.

Please turn over

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(*14pts*) 7. (a) A rectangular poster is to have an area of 200 square inches with a 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) Evaluate:

$$\lim_{x \to 0} \frac{1 - \cos x}{x}$$

(*14pts*) 8. (a) Find the absolute maximum and absolute minimum of $f(x) = \frac{x^2}{1+x^2}$ on the interval $[-1, 2]$.

(b) Find an equation of the tangent line to the graph $x^3 + y^3 - \frac{9}{2}xy = 0$ at the point $(2, 1)$.

Kindly indicate on the cover of your examination booklet the number of the problem in Part II that you omitted.

End of Examination