Name:_____

Student ID:_____

Section:_____

Instructor:_____

Math 2413 (Calculus I)
Practice Exam 3

Instructions:

- Work on scratch paper will not be graded.
- No partial credit will be given for the multiple choice part and the short answer part.
- Show all your work in the space provided. Full credit will be given only if the necessary work is shown justifying your answer.
- **Please write neatly. If I cannot read your handwriting, you will not receive credit.**
- Simplify your answers as much as possible. Expressions such as $\ln(1)$, e^0, $\sin(\pi/2)$, etc. must be simplified for full credit.

Show all work in the space provided. Full credit will be given only if all steps are shown justifying your answer. Please write neatly and carefully, if I cannot read your handwriting, you will receive NO credit.

1. (10 points) Find the domain and find the x-values of all critical points of the function

$$f(x) = 2x^3 + \frac{3}{x}.$$

2. (10 points) Find the absolute maximum and minimum of the function on the interval $[-2, 1]$

$$f(x) = \frac{4x^2}{x-2}.$$

3. (10 points) Find the open intervals on which the given function is increasing or decreasing:

$$f(x) = x - 2\cos(x), 0 < x < 2\pi.$$

4. (10 points) Suppose a function f has second derivative

$$f''(x) = x^2(x-5)^4(x+4)^3(x^2-1).$$

(a) Find the x-values of the inflection(s) points of f. Give the reason why those correspond to inflection points.

(b) Suppose f has horizontal tangent lines at $x = -5, 1/2, 0, 4, -2$. Which correspond to a local max? local min? Which cannot be determined by the second derivative test.

5. (10 points) A rectangular box which is open at the top can be made from an 6-by-18-inch piece of metal by cutting a square from each corner and bending up the sides. Find the dimensions of the box with greatest volume, where h = height, l = length, and w = width. (Note: let the width be determined by the 6-inch side and the length by the 18-inch side.)

6. (10 points) A rectangle is bounded by the x-axis and the semicircle $y = \sqrt{9 - x^2}$. What length and width should the rectangle have so that its area is a maximum?

7. (10 points) Find the limit

$$\lim_{x \to 0} \frac{4x + e^x - e^{5x}}{1 - \cos(4x)}.$$

8. (10 points) Find the limit

$$\lim_{x \to 0^+} (1 + x)^{3/x}.$$

9. (10 points) Find the horizontal asymptotes of the given function

   (a) $f(x) = \dfrac{x^4 - 8x^3 + 1}{7 - 7x^2 - 9x^4}$.

   (b) $g(x) = \dfrac{\sqrt{x^2 - 2}}{2x - 7}$.

10. (10 points)

    (a) Use Newton's method and the function $f(x) = x^2 - a$ to find a formula for x_{n+1} in terms of x_n

    (b) Use the previous part to approximate $\sqrt{10}$ to three decimal places.

END OF EXAM