MAT 2410 Writing Project #1 Name_____
100 Points Midterm Exam Prep NO GRAPHING CALCULATORS!!!

1. (10 pts) Evaluate $\lim_{x\to 3}\dfrac{x^2-9}{x^3-27}$ by any (convincing) method.

2. (10 pts) Evaluate each of the following by factoring and simplifying. One exists. The other doesn't.

   a. $\lim_{x\to -3}\dfrac{2x^2+x-15}{x^2+5x+6}$

   b. $\lim_{x\to -3}\dfrac{2x^2-x-15}{x^2+5x+6}$

3. (10 pts) Prove that $\lim_{x\to 5}(2x-7)=3$ (This is the $\varepsilon-\delta$ proof you're dying to do.)

4. (10 pts) Compute the derivative of $f(x)=x^2+5x+6$ by the definition of derivative. This means taking the limit of a difference quotient.

5. (5 pts each) Compute the derivatives of each of the following. Do not simplify your answer.

   a. $y=x^2+5x+\dfrac{6}{x^2}$

   b. $y=(x^2+5x)(7x-1)$

   c. $y=\dfrac{x^2+5x}{7x-1}$

   d. $y=(x^2+5x)^3(7x-1)^5$

   e. $y=\cot(\sec(x^2-5))$

6. (10 pts) Find an equation of the tangent line to $f(x)=\sin(x)$ at $x=\dfrac{\pi}{3}$. Then sketch the graph of this situation, with the function and its tangent line, together on the same set of axes.

7. (5 pts) Use your result from the previous problem to approximate $\sin(65^0)$

8. (10 pts) Find all values of x such that $f(x)=1+2\cos(x)$ has a horizontal tangent.

9. (10 pts) Find $\dfrac{dy}{dx}$, given that $\sec x+\sin y=2xy-3x^2y^2$

BONUS SECTION:

B1 (5 pts) Find the derivative of $f(x)=\frac{1}{\sqrt{x}}$, by the definition of the derivative.

B2 (5 pts) Prove that $\lim_{x\to 3}\left(x^2+5x+2\right)=26$