Instructions: This is a closed book, closed notes exam. Use of calculators is not permitted. You have one hour and fifteen minutes. Do all 8 problems. Please do all your work on the paper provided.
Please print your name clearly here.

Print name: ________________________________

Upon finishing please sign the pledge below:
On my honor I have neither given nor received any aid on this exam.

Grader’s use only:

1. ______ /15
2. ______ /10
3. ______ /10
4. ______ /10
5. ______ /20
6. ______ /15
7. ______ /10
8. ______ /10
1. [15 points] Find the following limits, if they exist.

(a) \[ \lim_{x \to -2} \frac{x^2 - x - 6}{x + 2} \]

(b) \[ \lim_{x \to 0} \frac{\tan 5x}{x} \]
2. [10 points] Let \( f \) be the function defined by

\[
f(x) = \begin{cases} 
3 - x & \text{if } x < 2 \\
0 & \text{if } x = 2 \\
2x^2 - 7 & \text{if } x > 2 
\end{cases}
\]

Find \( \lim_{x \to 2^+} f(x) \), \( \lim_{x \to 2^-} f(x) \), and \( \lim_{x \to 2} f(x) \) (if they exist). Is \( f \) continuous at \( x = 2 \)?
3. [10 points] (a) Give the formal, mathematical definition of the derivative of a function \( f \).

(b) Find the derivative of \( f(x) = \frac{1}{x+2} \) using the definition of the derivative. (No credit will be given for finding the derivative by other means.)
4. [10 points] Find the equation of the tangent line to the graph of $y = \sqrt[3]{x}$ at $x = 8$. 
5. [20 points] Find the derivatives of the following functions.

(a) \( f(x) = 1 + 3\sqrt{x} + 2x^2 - 6x^{-3} \)

(b) \( g(t) = \frac{e^{2t+1}}{t+3t^2} \)

(c) \( F(t) = \sqrt{t} \sin(t^4) \)

(d) \( f(x) = (2\ln(2 + 3x^{-2}) + 7)^8 \)
6. [15 points] A sector is removed from a circular piece of cardboard of radius 10 cm. The remaining cardboard is folded so the ends of the sector join to form a cone. What is the maximum possible volume of the resulting cone? (The volume of a cone with height $h$ and radius of the base $r$, is $V = \frac{1}{3}\pi r^2 h$.)
7. [10 points] Use implicit differentiation to find $\frac{dy}{dx}$ if $x \tan y = \cos(x + y)$. 

8. [10 points] A baseball diamond is a square with side length 90 ft. A batter hits the ball and runs towards first base with a velocity of 24 ft/sec. At what rate is his distance from 3rd base increasing when he is halfway to first base?