1. (10 pts) Use the limit process to find the derivative of the function

\[ f(x) = 3x^2 + 5x - 8. \]

2. (50 pts) Use the differentiation rules to find the derivatives of the following functions.
   (a) \( f(x) = 3x^2 + 5x - 8 + \frac{2}{x^2}. \)
   (b) \( f(x) = (\sqrt{x} + \sqrt{x}) (x^3 + 2). \)
   (c) \( f(x) = \frac{x^2 - 1}{x^2 + 1}. \)
   (d) \( f(x) = \cot x. \)
   (e) \( f(x) = (x + \cos 3x)^4. \)

3. (12 pts) Given the equation \( 2x^3 + y^3 = 5xy \) in which \( y \) is a function of \( x \),
   (a) Find \( \frac{dy}{dx} \) in terms of \( x \) and \( y \).
   (b) Find the equation of the line tangent to the curve at the point \( (1, 2) \).

4. (12 pts) Let \( \theta \) be the upper angle of an isosceles triangle inscribed in a circle of \textit{constant} radius \( r \), as shown in the following diagram.

The area of the triangle is given by

\[ A = r^2 \sin \theta (1 + \cos \theta). \]

(a) (8 pts) Find a formula for \( dA/dt \).
(b) (4 pts) If \( \theta \) is changing at a rate of 0.5 radians/sec, then how fast is the area changing (in terms of \( r \)) when \( \theta = \pi/4 \)?
5. (16 pts) An object is dropped from rest from a height of 80 feet.

(a) Write a function $s(t)$ for the position of the object (in feet above the ground) as a function of time.

(b) Find a function $v(t)$ for the velocity of the object at time $t$, in feet/sec.

(c) Find a function $a(t)$ for the acceleration of the object at time $t$, in feet/sec$^2$.

(d) At what time will the object hit the ground?

(e) How fast is the object going at the moment when it hits the ground?

(f) What is the object’s average velocity over the time interval from when it was released to the moment it hits the ground?