Name:\_\_\_\_\_

1. Compute the limits

(a) 
$$\lim_{x \to 0} \frac{\sin(x)}{3x}$$

(b) 
$$\lim_{n \to \infty} \frac{n^3 + 5n}{4n^2 - 5}$$

(c) 
$$\lim_{n \to \infty} \frac{7n^2}{4n^5 + 1}$$

(d) 
$$\lim_{n \to \infty} \frac{-8n^3}{2n^2 + 4n^3 + 1}$$

(e) 
$$\lim_{x \to 0^{-}} \frac{1}{3x^3}$$

(f) 
$$\lim_{x \to 0} \frac{1}{3x^3}$$

2. Compute the derivative using the **definition** of the derivative

$$f(x) = 3x^2 + x$$

3. Compute the following derivatives

(a)  $f(x) = 3x + 5\sqrt{x} - \sin(x)$ 

(b)  $f(x) = \ln(x) \sec(x)$ 

(c) 
$$f(x) = \ln(x^2 + 1)$$

(d) 
$$f(x) = (2x - 1)^4 (x + 2)^3$$

4. Compute the derivative using implicit differentiation.

$$y^2 + \cos(y+3) = 2x + 5$$

5. Find the derivative of

$$y = x^{x^2 + 1}$$

6. Find the equation of the line tangent to  $f(x) = 2e^x - 1 + x^2 - 3x$  when x = 0.

7. Let  $f(x) = x^3 - 12x + 1$ . Find the points where f(x) has a zero derivative.

- 8. Let  $s(t) = -5t^2 + 10t + 30$  represent the height of a ball we throw up in the air at time t = 0.
  - (a) Write out the velocity and acceleration equations.
  - (b) When does the ball have a velocity of zero?
  - (c) When does the ball hit the ground?
  - (d) Waht is the velocity of the ball when it hits the ground?