1. Let \( f(x) = x^2 + 3x + 1 \). Using the definition of derivative, compute \( f'(x) \).

2. Give an example of a function that is continuous from the left at \( x = 0 \) but that is not continuous from the right. Justify your work. An example is: 
\[
 f(x) = \begin{cases} 
 x & \text{if } x \leq 0 \\
 2 & \text{if } x > 0
\end{cases}
\]
(Why is this continuous from the left and not the right?)

3. Compute \( \lim_{x \to \infty} \frac{\sqrt{x} + x^3}{x^4 + 1} = 0 \)

4. Given \( f(x) = (x^3 + 5x^2 + 3x - 1)^8 \), compute the derivative \( f'(x) \).
\[
f'(x) = 8(x^3 + 5x^2 + 3x - 1)^7(3x^2 + 10x + 3)
\]

5. Given \( f(x) = (e^{3x} + 4x^2 - 1)^5 \), compute \( f'(x) \).
\[
f'(x) = 5(e^{3x} + 4x^2 - 1)^4(3e^{3x} + 8x)
\]

6. Given \( f(x) = (\frac{x^2 - 2}{x+1})^3 \), find the derivative \( f'(x) \).
\[
f'(x) = 3\left(\frac{x^2 - 2}{x+1}\right)^2 \frac{2x + 2}{(x+1)^2}
\]

7. Given \( f(x) = x^3 + 3x - 1 \), show that there is a number \( c \) in the interval \((0, 1)\), for which \( f(c) = 0 \). Explain your work carefully. First we know that \( f \) is continuous since it is a polynomial. Now \( f(0) = -1 < 0 \) and \( f(1) = 3 > 0 \). So by the Intermediate Value Theorem, there is a number \( c \) in the interval \((0, 1)\) such that \( f(c) = 0 \).

8. Find an equation of the tangent line to the curve \( y = \frac{2x + 1}{x + 2} \) at the point \((2, 3)\).
\[
y - 3 = \frac{3}{16}(x - 2)
\]

9. Find the following limits:
(a) \( \lim_{x \to -3} \frac{x^2 - 9}{x^2 + 2x - 3} = \frac{3}{2} \)
(b) \( \lim_{x \to 3} \frac{\sqrt{x + 6} - x}{x^3 - 3x^2} = 0 \)
(c) \( \lim_{h \to 4^+} \frac{4 - h}{|4 - h|} = -1 \)
(d) \( \lim_{x \to 1^+} \sin(\pi \ln(x)) = 0 \)
(e) \( \lim_{x \to 0} \frac{\sin(2x)}{5x} = \frac{2}{5} \)

10. Find all horizontal asymptotes of the graph \( y = \frac{\sqrt{x^6 + 2x}}{x^3 + 3x^2 - 1} \).
There are two horizontal asymptotes. They are at \( y = -3 \) and \( y = 3 \)

11. Given \( f(x) = \tan(2x^4e^x) \) compute \( f'(x) \).
\[
f'(x) = \sec^2(2x^4e^x)(8x^3e^x + 2x^4e^x)
\]