Problem 1: (10 points) Find the limit if it exists. If it does not exist, show why. Use the symbols $\infty$ or $-\infty$ as appropriate.

(i) \[ \lim_{x \to 3^+} \frac{x^2 + x - 12}{\sqrt{x} - 3} \]

(ii) \[ \lim_{x \to \infty} \sqrt{x^2 + x} - x \]

Problem 2: (5 points) Find all values of $C$ which will make the following function continuous.

\[ f(x) = \begin{cases} 
Ax - x^2 & \text{if } x \leq 1, \\
2x + 3 & \text{if } x > 1.
\end{cases} \]

Problem 3: (5 points) Use the definition of the derivative to find $f'(2)$ for the function $f(x) = x^2 - x$.
Problem 4: (15 points) Find $f'(x)$ for each function:

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

(b) $f(x) = \frac{2x + 1}{x^2 - x^3}$

(c) $f(x) = (x^2 - x)^5$

Problem 5: (5 points) Find the equation of the tangent line to the curve $y = \frac{4}{\sqrt{9x^2 + 1}}$ at $x = 1$. 