1. (a) [7 points] Find a unit vector that has the same direction as \( \langle 1, -2 \rangle \).

(b) [7] Determine whether the following vectors parallel, perpendicular, or neither:

\[ 2\mathbf{i} - 3\mathbf{j}, \quad 6\mathbf{i} + 4\mathbf{j} \]

(c) [7] Given the vector equation \( \mathbf{r}(t) = \langle 1-t, 2t^2+1 \rangle \), find the corresponding Cartesian equation (i.e. involving only \( x \) and \( y \)).
2. (a) [5] State the definition of limit, that is \( \lim_{x \to a} f(x) = L \) means

(b) [14] Prove \( \lim_{x \to -2} (1 - 4x) = 9 \) using the definition of limit.
3. Find the following limits. (You need not give proofs.)

(a) \[ \lim_{x \to 1} \left( 4 - \frac{8x}{x + 1} \right) \]

(b) \[ \lim_{x \to \frac{1}{2}} \frac{2 - 4x}{\sqrt{2x - 1}} \]
3. (continued)

(c) \[10\] \[\lim_{x \to \infty} \frac{1 - 2x + 3x^2}{1 - \sqrt{2x^4 + 1}}\]

4. [10] Use the Squeeze Theorem to find \[\lim_{x \to 0} x^4 \cos \left(\frac{1}{x}\right)\]. Justify your answer.
5. (a) [5] State the definition of continuity at a number \( a \), that is, a function \( f \) is continuous at \( a \) means

(b) [5] Sketch the graph of \( f(x) = \begin{cases} 
    x^2 - 1, & \text{if } x \leq 0 \\
    1, & \text{if } 0 < x \leq 1 \\
    2 - x, & \text{if } x > 1 
\end{cases} \)

(c) [5] Let \( f \) be the function from part (b). Is \( f \) continuous at 0? Explain why or why not.

(d) [5] Let \( f \) be the function from part (b). Is \( f \) continuous at 1? Explain why or why not.