1. (30 pts.) Find the following limits (show work):

   (a) \[ \lim_{x \to 0} \frac{x}{\tan(x)} \]  
   (b) \[ \lim_{x \to 0} \frac{2x + |x|}{|x|} \]  
   (c) \[ \lim_{x \to 0} x \cos \left( \frac{1}{x^2} \right) \]

2. (30 pts.) Differentiate each of the following functions:

   (a) \[ x^2 \sin^2(x^2) \]  
   (b) \[ \frac{3x}{x^2 + 1} \]  
   (c) \[ \sqrt{\cos(x)} \]

3. (20 pts.) Find an equation for the line that is perpendicular to the graph of \( y = x^2 \) and passes through the point \((-3, 0)\).

4. (30 pts.) Find the critical points of the function \( f(x) = 3x^4 + 8x^3 - 18x^2 + 100 \). Find the minimum and maximum values of this function in the interval \([0,2]\)。

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