1. (a) Determine
\[ \lim_{{x \to 0}} \frac{2x}{\tan(x)} \]
(b) What is the domain of \( f(x) = \sqrt{x^2 - 9} \)?
(c) Simplify \( \log_2(64) \).
(d) Let \( f(x) = 4x^2 \). Find \( f'(x) \) using the definition of the derivative.

2. Consider the equation
\[ 1 - x^2 = \frac{1}{x} \]
Show that this equation has a negative solution.

3. Find a point on the curve \( y = \sqrt{x} \) such that the tangent line to the curve at this point also passes through the point \((-1, 0)\). Illustrate your answer with a sketch.

4. Show that the following function is differentiable at \( x = 0 \):
\[ f(x) = \begin{cases} \sin^2(2x) & \text{if } x \neq 0, \\ 0 & \text{if } x = 0. \end{cases} \]

5. Let
\[ f(x) = \begin{cases} c + \cos(x) & \text{if } x \leq 0 \\ xg(x) & \text{if } x > 0, \end{cases} \]
where \( c \) is a constant and \( g(x) \) is a continuous function on the interval \( x > 0 \) such that \( 0 \leq g(x) \leq 1 \) for all \( x > 0 \). Find the value of \( c \) that makes \( f(x) \) continuous everywhere.