1. The following problems are not related.

(a)(10pts) Suppose \( f(x) = \sqrt{x} \) and \( g(x) = \sqrt{4-x^2} \). Find \((g \circ f)(x)\) and express the domain of this function in interval notation.

(b)(10pts) Suppose we know that the function \( p(x) \) is an even function. Show that the function \( q(x) = x^3 + \sin(x) + xp(x) \) is an odd function. Justify your answer.

(c)(5pts) Which choice below would result in shifting the graph of \( y = s(t) \) one unit to the right and then reflecting it about the \( y \)-axis? (No justification necessary - Choose only one answer, copy down the entire answer.)

(A) \( y = -s(t) - 1 \) (B) \( y = s(-(t+1)) \) (C) \( y = s(-(t-1)) \) (D) \( y = -s(t+1) \) (E) \( y = s(-t) - 1 \)

2. The following problems are not related.

(a)(10pts) Use the Squeeze Theorem to evaluate the following limit: \( \lim_{x \to 1} (x-1)^2 \sin \left( \frac{1}{x-1} \right) \). Show all work, explain your answer.

(b)(12pts) Suppose that \( f(x) = \begin{cases} \frac{4x+1}{2-x}, & \text{if } x \leq 0 \\ x + \frac{1}{x}, & \text{if } x > 0 \end{cases} \), use limits to find all horizontal and vertical asymptotes of \( f(x) \). Show all work.
3. The following problems are not related.
   
   (a)(12pts) Find the real number \(a\) so that the function
   \[
   f(x) = \begin{cases}
   3 \sin(1 + x), & \text{if } x \neq -1 \\
   \frac{1 + x}{ax + 8}, & \text{if } x = -1
   \end{cases}
   \]
   is continuous for all real numbers. Be sure to show that all three conditions of continuity have been satisfied.

   (b)(12pts) The function \(g(x) = \frac{x + 10}{|x| + 2}\) has two horizontal asymptotes. They are \(y = 1\) and \(y = -1\). Use a theorem from class to show that \(g(x)\) crosses one of it’s horizontal asymptotes on the interval \([-10, 0]\). Clearly explain your answer.

   (c)(5pts) For which one of the 4 choices below is the following true: \(\lim_{x \to 3} f(x) = -2\). (No justification necessary - Choose only one answer, copy down the entire answer.)
   
   (A) \(f(x) = \frac{-6 \sin(\pi x/6)}{x}\)
   (B) \(f(x) = \frac{-2(x - 3)}{|x - 3|}\)
   (C) \(f(x) = \frac{-2x^2 - 3x + 4}{x^2 - 1}\)
   (D) \(f(x) = \begin{cases}
   \cos(\pi x/6) - 2, & \text{if } x \leq 3 \\
   2, & \text{if } x > 3
   \end{cases}\)

4. The following problems are not related.
   
   (a)(12pts) For this problem, use the limit definition of the derivative to find the derivative of \(f(x) = \frac{1}{\sqrt{x}}\), show all work.

   (b) Consider the function \(g(x) = \sqrt{x^2 - 1}\) with derivative \(g'(x) = \frac{2x}{3(x^2 - 1)^{2/3}}\).

   (i)(6pts) Find the equation of the tangent line to \(g(x) = \sqrt{x^2 - 1}\) at the point \(x = 3\). Simplify your answer.

   (ii)(6pts) For what values of \(x\) is the function \(g(x) = \sqrt{x^2 - 1}\) differentiable? Justify your answer.

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**The list of Appm 1350 Lecture Numbers/Instructor Names for the front of your blue book:**

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