1. This exam has 5 pages including this cover.
2. No books, no calculators and no talking. Cheating is punished severely.
3. The correct answer is worth no points without any argumentation. For full credit we must be able to see how you got your answer.

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1. [40 pts] Evaluate the following limits.

a) \( \lim_{x \to -3} \left( x^4 - x \sin(\pi x^2) - 5 \right) \)

b) \( \lim_{x \to 0^+} \frac{\sqrt{x}}{\cos x} \)

c) \( \lim_{x \to 0} \frac{x^2}{\sin^2(x) + x^3} \)

d) \( \lim_{h \to 0} \frac{\sqrt{16 + h} - 2}{h} \)
2. [20 pts] Determine the (equation of the) tangent lines to the parabola \( y = \frac{x^2}{4} + 1 \) that pass through the origin \((0, 0)\). At which points do these tangent lines touch the parabola?
3. [20 pts] Determine whether the following statements are true or false. Justify your answer.

a) If \( \lim_{x \to 5} f(x) = 2 \) and \( \lim_{x \to 5} g(x) = 0 \), then \( \lim_{x \to 5} \frac{f(x)}{g(x)} \) does not exist.

b) If \( 0 \in \text{Domain}(f) \), then \( \lim_{x \to 0} xf(x) = 0 \).
4. [20 pts] Let

\[ f(x) = \begin{cases} 
  x^2 \cos(1/x), & x \neq 0 \\
  0, & x = 0 
\end{cases} \]

a) Find \( f'(0) \).
b) Is \( f' \) continuous?