Review for test 1 Below are a selection of problems to help prepare you for exam 1. In addition to these problems, you should understand all of the (non-starred) homework problems.

- Describe how to transform the graph of \( f(x) = x^2 \) into the graph of \( g(x) = x^2 + 2x + 2 \).
- If \( f \) and \( g \) are odd functions, determine if the following functions are odd or even: \( f \circ g \), \( f + g \) and \( fg \).
- If \( f(x) \) is even and \( f(x) = x^3 \) for \( x \leq 0 \), sketch the graph of \( f \).
- Find the limits, or explain why they do not exist.
  
  1. \( \lim_{x \to 2} \frac{x^2 - 2}{x^2 + 2} \)
  
  2. \( \lim_{x \to 2} \frac{x^2 + 4}{x^2 - 4} \)
  
  3. \( \lim_{x \to 2} \frac{x^2 - 4x + 4}{x^2 - 4} \)
  
  4. \( \lim_{x \to 2} \frac{x^2 + 2}{(x - 2)^2} \)
  
  5. \( \lim_{x \to 2} \frac{|x|}{x} \)
  
  6. \( \lim_{x \to 0^+} \frac{|x|}{x} \)
  
  7. \( \lim_{x \to 0} \frac{|x|}{x} \)

- State the squeeze theorem.
- Use the squeeze theorem to find the limit:
  
  \( \lim_{x \to 0} x^4 \cos(1/x^2) \).

- State the definition of continuity.
- Find \( c \) so that
  
  \[ f(x) = \begin{cases} 
  x + 1 & x > c \\
  x^2 & x \leq c 
  \end{cases} \]

  is continuous everywhere.

- State the intermediate value theorem.
- Use the intermediate value theorem to show \( f(x) = x^3 + \sqrt{1 + x^2} \) has a root.
- State the definition of derivative.
• Be able to compute the derivatives of

\[ x^2 + 2x, \quad \frac{1}{(x+1)^2}, \quad \sqrt{x}, \quad x^3 \]

using the definition.

• Find the tangent line(s) to \( y = x^2 \) which pass through \((-3, 0)\)

• Be able to prove the product rule, the quotient rule and the reciprocal rule for differentiation.