Math 105 Quiz 3
§2.1-§2.3.
Name: [Key]
Show all work for credit. As discussed in class, please re-write any negative or fractional exponents appropriately.

1. Determine the following limits using the graph of \( g(x) \).

   (a) \( \lim_{x \to -2} g(x) = 1 \)
   (b) \( \lim_{x \to 1^+} g(x) = 2 \)
   (c) \( \lim_{x \to 3^-} g(x) = 3 \)
   (d) \( \lim_{x \to 4^-} g(x) = -2 \)
   (e) \( \lim_{x \to 1} g(x) = 0 \NE \)

2. Find the derivative of \( f(x) = \frac{2}{x^3} \) using the limit definition of the derivative.

\[
f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \to 0} \frac{\frac{2}{x+h^3} - \frac{2}{x^3}}{h} = \lim_{h \to 0} \frac{2(x+h^3) - 2(x^3)}{(x+h^3)(x^3)} = \lim_{h \to 0} \frac{2x^6 + 2x^3 - 2x^6 - 6x^3}{(x+h^3)(x^3)} = \lim_{h \to 0} \frac{-2x^3}{(x+h^3)(x^3)} = -\frac{2}{(x^3)^2}
\]

3. Use the sum/difference, constant multiple, and power rules to evaluate the following.

   (a) \( f(x) = 2\sqrt{x^2} + \frac{2}{5x^2} - \frac{x}{4} + x^{3/5} \). Find \( f'(x) \).

\[
f(x) = 2x^{1/2} + \frac{2}{5}x^{-2} - \frac{1}{4}x + x^{3/5}
\]

\[
f'(x) = \frac{4}{5}x^{-3/2} - \frac{4}{5}x^{-3} - \frac{1}{4} + \frac{3}{5}x^{-3/5} = \frac{4}{5\sqrt{x^3}} - \frac{4}{5x^3} - \frac{1}{4} + \frac{3}{5\sqrt{x^2}}
\]

   (b) Find the equation of the tangent line at \( x = 4 \) for \( f(x) = 3x^2 + 4x - 1 \).

\[
f'(x) = 6x + 4 \quad f'(4) = 28
\]

\[
f'(4) = 28 \quad f(4) = 3(4)^2 + 4(4) - 1 = 48 + 16 - 1 = 63
\]

\[
y = 63 = 28(x - 4)
\]

\[
y = 28x - 49
\]