1. Given that
\[ \lim_{x \to a} f(x) = -3 \quad \lim_{x \to a} g(x) = 0 \quad \lim_{x \to a} h(x) = 8 \]
find the limits that exist.
(a) \[ \lim_{x \to a} [f(x) + h(x)] \]
(b) \[ \lim_{x \to a} [f(x)]^2 \]
(c) \[ \lim_{x \to a} \sqrt[3]{h(x)} \]
(d) \[ \lim_{x \to a} \frac{1}{f(x)} \]
(e) \[ \lim_{x \to a} \frac{f(x)}{h(x)} \]
(f) \[ \lim_{x \to a} \frac{g(x)}{f(x)} \]
(g) \[ \lim_{x \to a} \frac{f(x)}{g(x)} \]
(h) \[ \lim_{x \to a} \frac{2f(x)}{h(x) - f(x)} \]

2. Find the infinite limit for the following:
   a. \[ \lim_{x \to 0^-} \frac{x-1}{x^2(x+2)} \]
   b. \[ \lim_{x \to 0^+} \frac{x-1}{x^2(x+2)} \]
   c. \[ \lim_{x \to 0^-} \frac{x-1}{x(x+2)} \]
   d. \[ \lim_{x \to 0^+} \frac{x-1}{x(x+2)} \]

3. What is wrong with the equation \( \frac{x^2 + x - 6}{x-2} = x + 3 \)?

4. Evaluate each of the following limits if it exists:
   a. \[ \lim_{x \to 0} \frac{(2+x)^3 - 8}{x} \]
   b. \[ \lim_{x \to 1} \frac{x^2 + x - 2}{x^2 - 3x + 2} \]
   c. \[ \lim_{x \to 1} \frac{1}{x-1} - \frac{2}{x^2-1} \]
   d. \[ \lim_{x \to 1.5} \frac{2x^2 - 3x}{|2x-3|} \]
   e. \[ \lim_{x \to 2^-} \sqrt{x^2 + x - 2} \]

5. The position of a moving particle at time \( t \), \( 0 \leq t < 5 \) is given by the vector
\[ r(t) = \left( \frac{2t-10}{t-5}, \frac{t-5}{t^2-4t-5} \right) \]. What is the anticipated position of the particle at time \( t = 5 \)?

6. Use the Squeeze theorem to show that \[ \lim_{x \to 0} \sqrt{x^3 + x^2} \sin \frac{\pi}{x} = 0 \]

7. Find the values of \( c \) and \( d \) that make the function \( f \) continuous everywhere
\[ f(x) = \begin{cases} 2x, & x < 1 \\ cx^2 + d, & 1 \leq x \leq 2 \\ 4x, & x > 2 \end{cases} \]
8. Given that

\[ h(x) = \begin{cases} 
  x & \text{if } x < 0 \\
  x^2 & \text{if } 0 < x \leq 2 \\
  8 - x & \text{if } x > 2 
\end{cases} \]

(a) Evaluate each of the following limits if it exists.

(i) \( \lim_{x \to 0^+} h(x) \)  
(ii) \( \lim_{x \to 0} h(x) \)  
(iii) \( \lim_{x \to 1} h(x) \)

(iv) \( \lim_{x \to 2^-} h(x) \)  
(v) \( \lim_{x \to 2^+} h(x) \)  
(vi) \( \lim_{x \to 2} h(x) \)

(b) Sketch the graph of \( h \).

9. Which of the following functions \( f \) has a removable discontinuity at \( a \)?

(a) \[ f(x) = \frac{x^2 - 2x - 8}{x + 2}, \quad a = -2 \]

(b) \[ f(x) = \frac{x - 7}{|x - 7|}, \quad a = 7 \]

(c) \[ f(x) = \frac{x^3 + 64}{x + 4}, \quad a = -4 \]

(d) \[ f(x) = \frac{3 - \sqrt{x}}{9 - x}, \quad a = 9 \]

10. If \( f(x) = x^3 - x^2 - 10 \), show that a number \( c \) exists such that \( f(c) = 10 \)

11. Test the following functions for continuity. If not continuous, explain why.

a. \[ f(x) = \frac{x^2 - 1}{x + 1}, \quad a = -1 \]

b. \[ f(x) = \begin{cases} 
  3, & x = 4 \\
  x^2 - 2x - 8, & x \neq 4 
\end{cases}, \quad a = 4 \]

12. At what values of \( x \) is the following piece-wise function discontinuous?

\[ f(x) = \begin{cases} 
  5, & x \leq -1 \\
  -3x, & -1 < x \leq 1 \\
  \frac{2x}{x-5}, & x > 1 
\end{cases} \]

13. What are the horizontal and vertical asymptote(s) of the function \( f(x) = \frac{x^2 - 2x - 3}{x^4 - 3x^3 - 4x^2} \)?