1. Evaluate the limit, if it exists.

   (a) \( \lim_{x \to -2} \left[ \frac{1}{x + 2} + \frac{4}{x^2 - 4} \right] = \)

   (b) \( \lim_{x \to 0} \frac{(x - 4)^2 - 16}{x} = \)

   (c) \( \lim_{x \to 4} \frac{x - 4}{\sqrt{x} - 2} = \)

   (d) \( \lim_{x \to -3} \frac{2x^2 - 5x - 3}{x^2 + 2x - 15} = \)

   (e) \( \lim_{x \to 1} \frac{x^2 + x - 2}{x + 7} = \)

   (f) \( \lim_{x \to -3} \frac{4 - \sqrt{x^2 + 7}}{x - 3} = \)

   (g) \( \lim_{x \to -3} \frac{|x - 3|}{x - 3} = \)

2. Use the Intermediate Value Theorem to show that there is a root of the equation

\[ x^5 + 2x^2 - x + 2 = \sqrt{x^2 + 8} \]

on the interval (0, 1). Be specific.

3. Determine if the following functions are continuous or discontinuous at the given point \( a \). If it is discontinuous at \( a \), state which condition fails.

   (a) \( f(x) = \begin{cases} 7x - 5 & \text{if } x \geq 3 \\ 2x & \text{if } x < 3 \end{cases} \quad a = 3 \)

   (b) \( g(x) = \begin{cases} x^3 + 2 & \text{if } x \leq -1 \\ x^2 + x + 1 & \text{if } x > -1 \end{cases} \quad a = -1 \)

   (c) \( h(x) = \frac{2x^2 + 3x - 5}{4x^2 - x - 3} \quad a = 1 \)

4. Find the equation of the tangent line to the curve \( y = 2x^2 - 3x \) at the point (3, 9).

5. Locate the discontinuities for \( f(x) = \frac{2}{1 + \cos x} \)

6. Given a graph of \( f \), be able to find limits, function values, points at which \( f \) is discontinuous, points at which \( f \) is continuous from the left or from the right.
1. (a) \(-\frac{1}{4}\)

(b) \(-8\)

(c) \(4\)

(d) \(\frac{7}{8}\)

(e) \(0\)

(f) \(-\frac{3}{4}\)

(g) \(-1\)

2. Let \(f(x) = x^5 + 2x^2 - x + 2 - \sqrt{x^2 + 8}\). Now, \(f\) is continuous on \([0, 1]\) and \(f(0) = 2 - \sqrt{8} < 0\) whereas \(f(1) = 1 > 0\). Therefore, by the Intermediate Value Theorem, there is a root \(c \in (0, 1)\) such that \(f(c) = 0\).

3. (a) \(f\) is discontinuous at \(x = 3\) since the \(\lim_{x \to 3} f(x) = \text{dne}\).

(b) \(g\) is continuous at \(x = -1\).

(c) \(h\) is discontinuous at \(x = 1\) since \(h\) is not defined at \(x = 1\).

4. \(y = 9x - 18\)

5. \(f\) is discontinuous whenever \(1 + \cos x = 0\). Therefore, \(f\) is discontinuous at \(x = \pi + 2k\pi\) where \(k\) is any integer.

6. See instructor for details.