Rutgers University
Math 151

Section 2.2: Calculating Limits - Worksheet

1. Evaluate the following limits. If a limit does not exist, explain why.

   (a) $\lim\limits_{x \to 3} \dfrac{x^2 - x - 6}{9x^{-2} - 1}$.

   (b) $\lim\limits_{t \to 2} \dfrac{\sqrt{t^2 + 12} - 2t}{2 - t}$.

   (c) $\lim\limits_{y \to 0} y \cot(5y)$.

   (d) $\lim\limits_{x \to 0} \dfrac{(x-2)^3 + 8 - 12x}{x^2}$.

   (e) $\lim\limits_{u \to 4} \dfrac{u - 4}{\sqrt{2u+1} - \sqrt{u+5}}$.

   (f) $\lim\limits_{x \to 0} \dfrac{\sin^2(4x)}{x \sin(3x)}$.

   (g) $\lim\limits_{x \to 1} \dfrac{\sqrt{4x^2 + 7} - \sqrt{x + 10}}{x^2 + 4x - 5}$

   (h) $\lim\limits_{h \to 0} \dfrac{\frac{6}{3+7h} - 2}{h}$

   (i) $\lim\limits_{x \to 0} \dfrac{x \sin(5x)}{\tan^2(3x)}$

   [Advanced]

   (j) $\lim\limits_{\theta \to 0} \dfrac{\sin^2(3\theta)}{\cos(5\theta) - 1}$.

   (k) $\lim\limits_{x \to 0} x \sin\left(\ln |x|\right)$.

   (l) $\lim\limits_{h \to 1} \dfrac{\sqrt[3]{h} - 1}{h - 1}$.

2. Suppose that f is a function such that for any number x, we have

   $$x - 8 \leqslant f(x) \leqslant x^2 - 3x - 4.$$

   For which values of a can you determine $\lim\limits_{x \to a} f(x)$? For these values of a, evaluate $\lim\limits_{x \to a} f(x)$.

3. **[Advanced]** Suppose that f is a function such that

   $$\lim_{x \to 0} \frac{f(x)}{\sin(3x)} = 2.$$

   Evaluate the following limits.

   (a) $\lim\limits_{x \to 0} f(x)$.

   (b) $\lim\limits_{x \to 0} \dfrac{f(x)}{x}$.

   (c) $\lim\limits_{x \to 0} \dfrac{1 - \cos(x)}{f(2x)^2}$.