

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECTION 1.4

Math 1000 Worksheet

FALL 2025

For practice only. Not to be submitted.

1. Use analytical methods to find the following limits. If a limit does not exist, explain why. Assign ∞ or $-\infty$ to the limit where appropriate.

(a) $\lim_{x \rightarrow 4} \frac{2x^2 - 7x - 4}{3x^2 - 14x + 8}$

(b) $\lim_{x \rightarrow -1} \frac{3x^2 - 9x - 12}{x^3 + 7x^2 + 15x + 9}$

(c) $\lim_{t \rightarrow 2} \frac{t^2 + t - 6}{t^3 - 6t^2 + 12t - 8}$

(d) $\lim_{x \rightarrow \frac{1}{2}} \frac{3x}{2x - 1}$

(e) $\lim_{x \rightarrow -4} \frac{\sqrt{x+8} - 2}{x+4}$

(f) $\lim_{h \rightarrow 0} \frac{h^2 - h}{\sqrt{h+3} - \sqrt{3}}$

(g) $\lim_{x \rightarrow 3} \frac{x-5}{\sqrt{2x+3}+1}$

(h) $\lim_{x \rightarrow 5} \frac{12(x+1)^{-1} - 2}{x^2 - 6x + 5}$

(i) $\lim_{h \rightarrow 0} \frac{\frac{1}{h^2+9} - \frac{1}{9}}{h}$

(j) $\lim_{x \rightarrow 0} \frac{\sin(8x)}{\sin(2x)}$

(k) $\lim_{x \rightarrow 0} \frac{1 - \cos^2(x)}{x}$

(l) $\lim_{x \rightarrow 0} \frac{\sin(3x^2)}{x \sin(x)}$

(m) $\lim_{x \rightarrow \pi} \frac{\tan\left(\frac{x}{4}\right)}{1 - \cos(x)}$

(n) $\lim_{\theta \rightarrow 0} \frac{1 - \sec(\theta)}{\theta \sec(\theta)}$

(o) $\lim_{x \rightarrow 2} \frac{|x-2| - 2}{x}$

(p) $\lim_{x \rightarrow -2} \frac{|x-2| - 2}{x}$

(q) $\lim_{x \rightarrow 0} \frac{x^2 - 4x}{7x - |x|}$

2. (a) Evaluate $\lim_{x \rightarrow 1} f(x)$ where

$$f(x) = \begin{cases} x^2 + 3x + 5, & \text{for } x \leq 1 \\ 7x - 2, & \text{for } x > 1 \end{cases}$$

- (b) Evaluate $\lim_{x \rightarrow 1} g(x)$ where

$$g(x) = \begin{cases} x^2 + 3x + 5, & \text{for } x \leq 1 \\ 7x + 2, & \text{for } x > 1 \end{cases}$$

- (c) Evaluate $\lim_{x \rightarrow 1} h(x)$ where

$$h(x) = \begin{cases} x^2 + 3x + 5, & \text{for } x \leq -3 \\ 7x - 2, & \text{for } x > -3 \end{cases}$$

3. Find the vertical asymptotes (if any) of the following functions. Justify your answers. For every vertical asymptote, use the lefthand and righthand limits to investigate whether $f(x)$ tends towards ∞ or $-\infty$ on either side of the asymptote.

(a) $f(x) = \frac{5x - 4 - x^2}{x^3 + 3x^2 - 9x + 5}$

(b) $f(x) = \frac{x^3 + 3x^2 - 9x + 5}{5x - 4 - x^2}$

4. Evaluate $\lim_{x \rightarrow \frac{\pi}{2}} \cot(x) \sin\left(\frac{1}{x}\right)$ using the Squeeze Theorem and the fact that

$$-1 \leq \sin\left(\frac{1}{x}\right) \leq 1.$$

5. Use the Squeeze Theorem to find $\lim_{x \rightarrow 0} x \cos\left(\frac{\pi}{2x}\right)$.