

**Math 100C – WORKSHEET 2**  
**LIMITS AND ASYMPTOTES**

- (1) Review of asymptotics: analyze the expression  $\frac{e^x + A \sin x}{e^x - x^2}$  as  $x \rightarrow \infty$ ,  $x \rightarrow 0$ ,  $x \rightarrow -\infty$ .

1. LIMITS

- (2) Either evaluate the limit or explain why it does not exist. Sketching a graph might be helpful.  
(a)  $\lim_{x \rightarrow 5} (x^3 - x)$

(b)  $\lim_{x \rightarrow 1} f(x)$  where  $f(x) = \begin{cases} \sqrt{x} & 0 \leq x < 1 \\ 3 & x = 1 \\ 2 - x^2 & x > 1 \end{cases}$ .

(c)  $\lim_{x \rightarrow 1} f(x)$  where  $f(x) = \begin{cases} \sqrt{x} & 0 \leq x < 1 \\ 1 & x = 1 \\ 4 - x^2 & x > 1 \end{cases}$ .

- (3) Let  $f(x) = \frac{x-3}{x^2+x-12}$ .  
(a) (Final 2014) What is  $\lim_{x \rightarrow 3} f(x)$ ?

- (b) What about  $\lim_{x \rightarrow -4} f(x)$ ?

(4) Evaluate

(a)  $\lim_{x \rightarrow \infty} \frac{e^x + A \sin x}{e^x - x^2}$

(b)  $\lim_{x \rightarrow 0} \frac{e^x + A \sin x}{e^x - x^2}$

(c)  $\lim_{x \rightarrow -\infty} \frac{e^x + A \sin x}{e^x - x^2}$

(5) Evaluate

(a)  $\lim_{x \rightarrow 2} \frac{x+1}{4x^2-1}$

(b) (Final, 2014)  $\lim_{x \rightarrow -3^+} \frac{x+2}{x+3}$ .

(c)  $\lim_{x \rightarrow 1} \frac{e^x(x-1)}{x^2+x-2}$

(d)  $\lim_{x \rightarrow -2^-} \frac{e^x(x-1)}{x^2+x-2}$

(e)  $\lim_{x \rightarrow 1} \frac{1}{(x-1)^2}$

(f)  $\lim_{x \rightarrow 4} \frac{\sin x}{|x-4|}$

(g)  $\lim_{x \rightarrow \frac{\pi}{2}^+} \tan x, \lim_{x \rightarrow \frac{\pi}{2}^-} \tan x$ .

## 2. LIMITS AT INFINITY

(6) Evaluate

(a)  $\lim_{x \rightarrow \infty} \frac{x^2+1}{x-3}$

(b) (Final, 2015)  $\lim_{x \rightarrow -\infty} \frac{x+1}{x^2+2x-8}$

(c) (Quiz, 2015)  $\lim_{x \rightarrow -\infty} \frac{3x}{\sqrt{4x^2+x}-2x}$