1.5 Problems

Question 1. If you are given the table of values below for $f(x) = x^3 + \dfrac{\cos 5x}{10,000}$.

What would you guess is the value for $\lim_{x \to 0^+} \left(x^3 + \dfrac{\cos 5x}{10,000} \right)$?

Are there multiple correct answers?

looking at numerical values can be tricky.

From the table it seems like the limit is 0

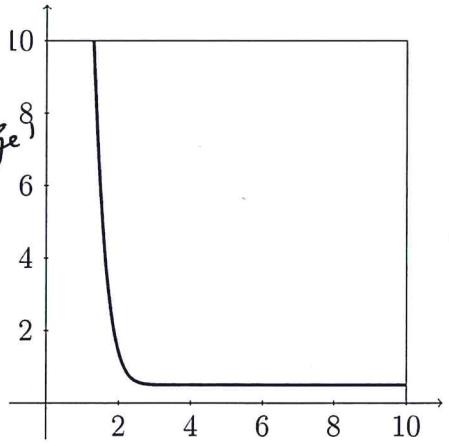
But actual limit is $\frac{1}{10,000}$

x	$f(x)$
1	1.000028
0.5	0.124920
.1	0.001088
.05	0.000222
.01	0.000101

Question 2. Given the graph of $f(x)$ below guess the value for $\lim_{x \to 0^+} f(x)$. Are there multiple correct answers?

impossible

It would be ~~hard~~ to guess from the picture but the limit being "very large" or ∞ might be good guesses.



Question 3. Consider the graph of the function f below. Evaluate the following

(a) $\lim_{x\to 2^-} f(x)$ $= 2$

(b) $\lim_{x\to 2^+} f(x)$ $= 2$

(c) $\lim_{x\to 2} f(x)$ $= 2$

(d) $\lim_{x\to 3^-} f(x)$ $= -1$

(e) $\lim_{x\to 3^+} f(x)$ $= 3$

(f) $\lim_{x\to 3} f(x)$ $=$ DNE

(g) $\lim_{x\to 5^-} f(x)$ $= 1$

(h) $\lim_{x\to 5^+} f(x)$ $= 4$

(i) $\lim_{x\to 5} f(x)$ $=$ DNE

(j) $\lim_{x\to 7^-} f(x)$ $= 4$

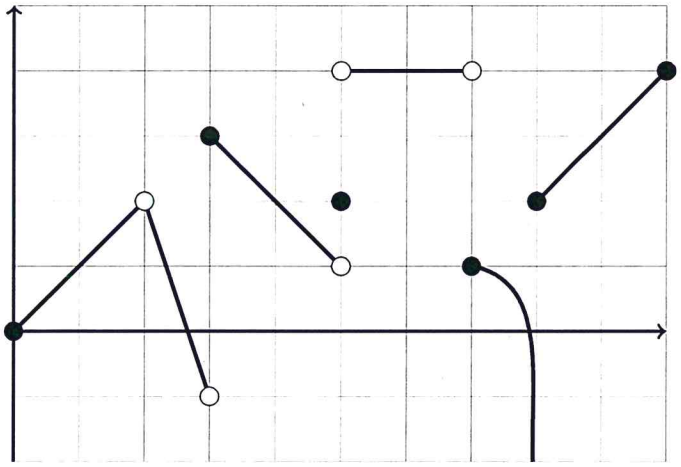
(k) $\lim_{x\to 7^+} f(x)$ $= 1$

(l) $\lim_{x\to 7} f(x)$ $=$ DNE

(m) $\lim_{x\to 8^-} f(x)$ $= -\infty$

(n) $\lim_{x\to 8^+} f(x)$ $= 2$

(o) $\lim_{x\to 8} f(x)$ $=$ DNE



Question 4 (@ home bonus fun). Try to write down the function's ~~equation~~ limit from the graph in Question 3. (Hint: It should be piecewise defined)

Question 5. Determine the infinite limits. Your final answer should be one of: $\infty, -\infty$, or DNE.

(a) $\lim_{x\to -3^+} \dfrac{x+2}{x+3}$

for $x = -3+\delta$ But denom $\to 0$ $\therefore$ limit $= -\infty$.

numerator < 0

denominator > 0

$\therefore \infty$

(b) $\lim_{x\to 1^+} \dfrac{-2}{(x-1)^3}$

denominator > 0

numerator < 0

$\therefore$ limit $= -\infty$

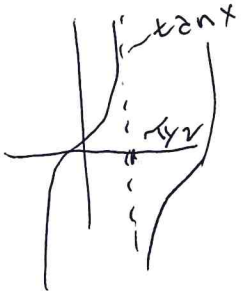
(c) $\lim_{x\to 2^-} \dfrac{3(x+4)}{x^2+2x-8}$

denominator < 0

numerator > 0

$\therefore$ limit $= -\infty$

(d) $\lim_{x\to(\pi/10)^+} x^5 \tan(5x) \quad = -\infty$



Question 6. Given the functions below

$$f(x)=\begin{cases}1+x & \text{if } x<-1\\ x^2 & \text{if } -1\le x<1\\ 2-x & \text{if } x\ge 1\end{cases}\qquad g(x)=\begin{cases}1+\sin x & \text{if } x<0\\ \cos x & \text{if } 0\le x\le \pi\\ \sin x & \text{if } x>\pi\end{cases}\qquad h(x)=\begin{cases}0 & \text{if } x \text{ is rational}\\ 1 & \text{if } x \text{ is irrational}\end{cases}$$

Evaluate the following limits:

(a) $\lim_{x\to 1^+} f(x)$ 1

(b) $\lim_{x\to 1} f(x)$ 1

(c) $\lim_{x\to 0^-} g(x)$ 1

(d) $\lim_{x\to 0} g(x)$ 1 DNE

(e) $\lim_{x\to \pi^-} g(x)$ -1

(f) $\lim_{x\to 0} h(x)$ DNE