# Evaluating Limits

1. Evaluate the following limits for these piecewise functions.

   (i) Let

   $$f(x) = \begin{cases} 1+x, & x < -1 \\ x^2, & -1 \leq x < 1 \\ 2-x & x \geq 1 \end{cases}$$

   ,

   find $\lim_{x\to -1^-} f(x), \lim_{x\to -1^+} f(x), \lim_{x\to 1^-} f(x), \lim_{x\to 1^+} f(x)$. Using what you found what can you say about $\lim_{x\to -1} f(x)$ and $\lim_{x\to 1} f(x)$?

   $$\begin{aligned} \lim_{x\to -1^-} f(x) &= \lim_{x\to -1^-} 1 + x2 \\ \lim_{x\to -1^+} f(x) &= \lim_{x\to -1^+} x^2 = 1 \\ \lim_{x\to 1^-} f(x) &= \lim_{x\to 1^-} x^2 = 1 \\ \lim_{x\to 1^+} f(x) &= \lim_{x\to 1^+} 2 - x = 1 \end{aligned}$$

   (ii) Let

   $$f(x) = \begin{cases} 1+\sin x, & x < 0 \\ \cos x, & 0 \leq x < \pi \\ \sin x & x \geq \pi \end{cases}$$

   .

   Find $\lim_{x\to 0} f(x)$ and $\lim_{x\to \pi} f(x)$ if they exist. If they do not exist explain why.

   $\lim_{x\to 0} f(x)$ exists and is 1. $\lim_{x\to \pi} f(x)$ does not exist as from the left it is -1 but from the right it is 0.

2. Evaluate the following limits or explain why they do not exist

   (i)

   $$\lim_{h\to 0} \frac{(2+h)^3 - 8}{h}$$

   *Answer*: 12

   (ii)

   $$\lim_{t\to 2} \frac{4-t^2}{t-2}$$

*Answer*: -4

(iii)

$$\lim_{x \to 3} \frac{x+3}{x^2-9}$$

*Answer*: Does not exist

(iv)

$$\lim_{h \to 0} \frac{\sqrt{25+h}-5}{h}$$

*Answer*: 1/10