

## Math 301 — Functional limits

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**Problem 1.** Using your intuition and past experience, determine the value of  $L = \lim_{x \rightarrow 0} f(x)$  for each example below.

a.  $f : \mathbb{R} \rightarrow \mathbb{R}, f(x) = x^2$

b.  $f : \mathbb{R} \setminus \{0\} \rightarrow \mathbb{R}, f(x) = x^2$

c.  $f : \mathbb{R} \rightarrow \mathbb{R}, f(x) = \begin{cases} 2x + 1 & x \neq 0 \\ 2 & x = 0 \end{cases}$

**Problem 2.** For each example below, give an  $\epsilon$ - $\delta$  proof that  $\lim_{x \rightarrow a} f(x) = L$ .

a.  $f(x) = x^2, a = 0, L = 0$

b.  $f(x) = \begin{cases} x^2 \sin(1/x) & x \neq 0 \\ 0 & x = 0 \end{cases}, a = 0, L = 0$

c.  $f(x) = x^2, a = -3, L = 9$