

## Existence of limits.

1. Explain why  $\lim_{x \rightarrow 0} 1/x$  does not exist.
2. Explain why  $\lim_{x \rightarrow \pi/2} \tan x$  does not exist.
3. Explain why  $\lim_{x \rightarrow \pi/2} \sec x$  does not exist.
4. Explain why  $\lim_{x \rightarrow 0} \csc x$  does not exist.
5. Explain why  $\lim_{x \rightarrow -1} \ln x$  does not exist.
6. Explain why  $\lim_{x \rightarrow 0} \sin(1/x)$  does not exist.
7. Explain why  $\lim_{x \rightarrow \infty} \cos x$  does not exist.
8. Let  $\operatorname{sgn}(x)$  be the sign function. This function is given by  $\operatorname{sgn}(x) = \begin{cases} 1, & \text{if } x > 0, \\ 0, & \text{if } x = 0, \\ -1, & \text{if } x < 0. \end{cases}$  Explain why  $\lim_{x \rightarrow \infty} \operatorname{sgn}(x)$  does not exist.
9. Explain why  $\lim_{x \rightarrow 0} 2^{1/x}$  does not exist.
10. Explain why  $\lim_{x \rightarrow 1} 2^{1/(x-1)}$  does not exist.