

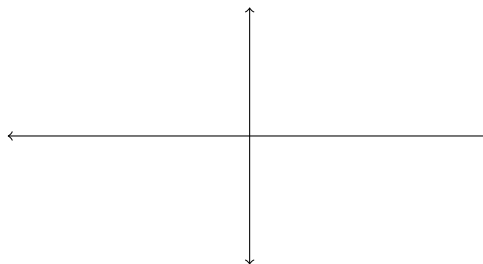
3 September 2015

1. **Warm up:** Fill in the blank to the following questions with one of the answers *0*, *1*, *2*, *finitely many*, or *infinitely many*.

- (a) A function can have at most _____ vertical asymptotes.
 (b) A function can have at most _____ horizontal asymptotes.
 (c) A function can have at most _____ zeros.

2. Draw the graphs of the following important functions. Make sure to label your axes.

$$\begin{aligned} f(x) &= \sin(x) \\ g(x) &= \cos(x) \\ h(x) &= e^x \\ k(x) &= \ln(x) \\ \ell(x) &= 1/e^x \end{aligned}$$



3. Find the following limits, if they exist.

- (a) $\lim_{x \rightarrow 0} \left[\frac{1}{x^2} \right]$ (c) $\lim_{t \rightarrow 2} \left[\frac{t-2}{|t-2|} \right]$ (e) $\lim_{x \rightarrow 0} \left[\frac{e^x + 1}{e^{2x} - 1} \right]$
 (b) $\lim_{x \rightarrow 0} \left[\frac{1}{x^3} \right]$ (d) $\lim_{w \rightarrow 0} [\cos(w)|w|/w]$ (f) $\lim_{t \rightarrow 16} \left[\frac{\sqrt{t} - \frac{t}{4}}{t - 16} + \frac{1}{4} \right]$

4. Find constants k such that the following limits exist.

- (a) $\lim_{y \rightarrow \pi} [\csc(2y) \sin(ky)]$ (d) $\lim_{x \rightarrow 0} \left[\frac{k}{x} - \frac{4}{kx} \right]$
 (b) $\lim_{x \rightarrow 1} \left[\frac{x^2 - k}{x - 1} \right]$
 (c) $\lim_{z \rightarrow \infty} [kz - 5]$ (e) $\lim_{t \rightarrow 3} \left[\frac{4t^2 + kt + 7k - 6}{2t^2 - 5t - 3} \right]$

5. Let $f(x)$ be the function that is 1 on every rational number and 0 on every irrational number.

- (a) Graph $f(x)$.
 (b) Where is $f(x)$ continuous?
 (c) Calculate $\lim_{x \rightarrow 0} [xf(x)]$.