

Limits Question Bank

Topic 1 — experiments

1. Compute $\frac{1 - \cos mx}{x^2}$ for $x = 0.1, 0.01, \text{ and } 0.001$.
Use these values to guess the exact value of $\lim_{x \rightarrow 0} \frac{1 - \cos mx}{x^2}$.
 $m = 2..9$
2. Estimate $\lim_{x \rightarrow 0} \frac{n^x - 1}{x}$. Report your answer to the nearest 0.001.
 $n = 2..8$

Topic 2 — computing limits by factoring

1. (a) Let $f(x) = (x^2 - ax)/(x - a)$. What is $f(a)$? (multiple choice)
(b) Compute $\lim_{x \rightarrow a} \frac{x^2 - ax}{x - a}$.
 $a = 1..9$
2. Compute $\lim_{x \rightarrow a} \frac{x^2 - (a + b)x + ab}{x^2 - (a + c)x + ac}$.
 $a, b, c = -5..5 \quad abc(a - b)(a - c)(b - c) \neq 0$

Topic 3 — continuity

All of these questions have the same parts:

- Compute $\lim_{x \rightarrow a^-} f(x)$.
- Compute $\lim_{x \rightarrow a^+} f(x)$.
- What can you say about the continuity of f ? (multiple selection)
 - f is continuous at a .
 - f has a removable discontinuity at a .
 - f has a non-removable discontinuity at a .
 - f is continuous at all points other than a .

1. Let

$$f(x) = \begin{cases} mx + b & x \leq a \\ nx + c & x > a \end{cases} .$$

$$a = \pm 1 \quad b = 1..4 \quad m, n = -3, -2, 2, 3 \quad m \neq n \quad c = ma + b - na > 0$$

2. Let

$$f(x) = \begin{cases} mx + b & x \leq a \\ \frac{nx+c}{px-d} & x > a \end{cases} .$$

$$a = \pm 1 \quad b, c, d = 1..4 \quad m, n, p = -3, -2, 2, 3 \quad na + c \neq (ma + b)(pa - d) \quad pa \neq d$$

3. Let

$$f(x) = \begin{cases} mx + b & x \leq a \\ \frac{nx+c}{px-d} & x > a \end{cases} .$$

$$a = \pm 1 \quad b, d = 1..4 \quad m, n, p = -3, -2, 2, 3 \quad c = (ma + b)(pa - d) - na > 0 \quad a > d/p$$

4. Let

$$f(x) = \begin{cases} mx + b & x \leq a \\ \frac{nx+c}{px-d} & x > a \end{cases} .$$

$$a = \pm 1 \quad b, d = 1..4 \quad m, n = -3, -2, 2, 3 \quad p = 2, 3 \quad c = (ma + b)(pa - d) - na > 0 \quad a < d/p$$

Topic 4 — limits at infinity

1. Compute $\lim_{x \rightarrow \infty} \frac{ax^p + b}{cx^p + d}$.

$$p = 2..5 \quad a, c = 1..5 \quad b, d = -5..5 \quad d \neq 0$$

2. Compute $\lim_{x \rightarrow \infty} \frac{ax^p + b}{cx^{p+1} + d}$.

$$p = 2..4 \quad a, c = 1..5 \quad b, d = -5..5 \quad d \neq 0$$

3. Compute $\lim_{x \rightarrow \infty} \frac{ax}{\sqrt{c^2x^2 + d}}$.

$$c = 1..5 \quad a, d = -5..5 \quad ad \neq 0$$