Common mistakes with limit notation.

Here is a correctly written limit computation:

\[
\lim_{x \to 2} \frac{x^2 - 4}{x - 2} = \lim_{x \to 2} \frac{(x-2)(x+2)}{x - 2} = \lim_{x \to 2} (x+2) = 2+2 = 4.
\]

The following versions all have major notation mistakes:

\[
\lim_{x \to 2} \frac{x^2 - 4}{x - 2} = \lim_{x \to 2} \frac{(x-2)(x+2)}{x - 2} = \lim_{x \to 2} (x+2) = 2+2 = 4.
\]

(Parantheses missing; what is written means \(\lim_{x \to 2} (x+2)\))

\[
\lim_{x \to 2} \frac{x^2 - 4}{x - 2} = \lim_{x \to 2} \frac{(x-2)(x+2)}{x - 2} = \lim_{x \to 2} x+2 = 2+2 = 4
\]

(you can't put \(\lim\) in front of \(2+2\), because you have already let \(x\) approach 2)

\[
\lim_{x \to 2} \frac{x^2 - 4}{x - 2} = (x-2)(x+2) = 2+2 = 4
\]

(you can't put \(\lim\) in \(x \to 2\) when you have not yet let \(x\) approach 2)

\[
\lim_{x \to 2} \frac{x^2 - 4}{x - 2} \neq \lim_{x \to 2} \frac{(x-2)(x+2)}{x - 2}
\]

(never put anything between \(\lim\) and the expression you are taking the limit of)

\[
\lim_{x \to 2} \frac{x^2 - 4}{x^2} = \frac{0}{0}, \text{ so we factor the numerator }---
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\]
(you can say "the limit has the form 0/0")

\[
\lim_{x \to 2} \frac{x^2-4}{x-2} \\
\lim_{x \to 2} (x-2)(x+2) \\
\lim_{x \to 2} (x+2) \\
2+2 \\
4
\]

(without "=" signs, you have told me nothing about how the formulas are supposed to be related to each other)

Here is another correctly written calculation, assuming \(f(x) = -x^2\) for all real \(x\):

\[
\lim_{x \to 3} f(x) = \lim_{x \to 3} (-x^2) = (-3^2) = 9.
\]

The following versions all have major notational mistakes:

\[
\lim_{x \to 3} f(x) = \lim_{x \to 3} -x^2 = -3^2 = 9
\]

(paratheses are essential)

\[
\lim_{x \to 3} f(x) = -x^2 = -3^2 = 9
\]

("\(\lim_{x \to 3}\) missing in 2nd expression")

\[
\lim_{x \to 3} f(x) = \lim_{x \to 3} (-x^2) = \lim_{x \to 3} (-3^2) = 9
\]

(at the third expression, you already let \(x\) approach 3)