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Exercise 1

Use the squeeze Theorem to evaluate

$$\lim_{x \rightarrow 0} x^4 \sin\left(\frac{2x^3 + \cos(x)}{|x + \ln|x||}\right).$$

Exercise 2

Use the $\epsilon - \delta$ definition to show that the function $f(x) = x^2 + 2x$ is continuous at 0.

Exercise 3

Let a, b two positive real numbers and f a function given by

$$f(x) = \begin{cases} 1 - x & \text{if } x \leq 0 \\ \frac{1}{ax+b} & \text{if } x > 0. \end{cases}$$

1. Find a condition on b so that f be a continuous on \mathbb{R} .
2. Determine a and b so that f be differentiable on \mathbb{R} , and give the value of $f'(0)$.