



En eering
UNIVERSITY OF COLORADO BOULDER

STRATEGIC VISION

ENGINEERING SOLUTIONS TO DRIVE THE ECONOMY, SECURITY
AND QUALITY OF LIFE OF OUR STATE AND NATION

ENGINEERING LEADERSHIP

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Math 101

The first part of the problem asks us to determine whether the function $f(x) = \frac{1}{x}$ is continuous at $x = 1$. To do this, we need to check if the limit of $f(x)$ as x approaches 1 is equal to $f(1)$. Since $f(1) = 1$, we need to see if $\lim_{x \rightarrow 1} \frac{1}{x} = 1$.

Using the epsilon-delta definition of a limit, let $\epsilon > 0$ be given. We want to find a $\delta > 0$ such that whenever $0 < |x - 1| < \delta$, it follows that $|\frac{1}{x} - 1| < \epsilon$. We start by manipulating the inequality $|\frac{1}{x} - 1| < \epsilon$:

$$|\frac{1}{x} - 1| = |\frac{1 - x}{x}| = \frac{|1 - x|}{|x|} = \frac{|x - 1|}{|x|} < \epsilon$$

We want to bound this expression by $\epsilon|x - 1| < \delta$. To do this, we need to bound $\frac{1}{|x|}$. If we choose $\delta < 1$, then $|x - 1| < \delta < 1$ implies $x > 1 - \delta > 0$. Therefore, $\frac{1}{|x|} < \frac{1}{1 - \delta}$. We can choose δ such that $\frac{1}{1 - \delta} = \epsilon$, which means $1 - \delta = \frac{1}{\epsilon}$, or $\delta = 1 - \frac{1}{\epsilon}$. However, this δ might be negative if $\epsilon > 1$. To handle this, we choose $\delta = \min\{1, \frac{\epsilon}{2}\}$. Then, $\delta < 1$ and $\delta \leq \frac{\epsilon}{2}$.

Now, if $0 < |x - 1| < \delta$, then $x > 1 - \delta > 1 - \frac{\epsilon}{2}$. Thus, $\frac{1}{|x|} < \frac{1}{1 - \frac{\epsilon}{2}} < \frac{1}{1 - \frac{\epsilon}{2}} < 1 + \epsilon$. Therefore,

$$|\frac{1}{x} - 1| = \frac{|x - 1|}{|x|} < \delta \cdot (1 + \epsilon) < \frac{\epsilon}{2} \cdot (1 + \epsilon) < \frac{\epsilon}{2} \cdot \frac{3}{2} = \frac{3\epsilon}{4} < \epsilon$$

Hence, we have shown that $\lim_{x \rightarrow 1} \frac{1}{x} = 1$. Since $f(1) = 1$, the function $f(x) = \frac{1}{x}$ is continuous at $x = 1$.

VISION



ACCELERATE OUR RESEARCH IMPACT

1. The first step is to identify the key areas of research that have the potential for the greatest impact. This involves a thorough review of the current state of the field and identifying the most pressing challenges and opportunities.

2. Once the key areas have been identified, the next step is to develop a clear and concise research strategy. This strategy should outline the specific research questions, the methods to be used, and the expected outcomes.

3. The third step is to secure the necessary resources to support the research. This includes funding, personnel, and equipment. It is important to ensure that the resources are allocated effectively and that the research team has the expertise and skills needed to carry out the work.

4. The fourth step is to implement the research strategy. This involves setting up the research infrastructure, recruiting and training the research team, and carrying out the experiments and data analysis.

5. The final step is to disseminate the research findings. This involves publishing the results in peer-reviewed journals, presenting at conferences, and engaging with the public and policy makers. It is important to ensure that the research is accessible and understandable to a wide range of audiences.

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In ENGINEERING