

**Break-Ground:**

## Could it be anything?

*Two young mathematicians investigate the arithmetic of large and small numbers.*

Check out this dialogue between two calculus students (based on a true story):

**Devyn:** Hey Riley, remember

$$\lim_{\theta \rightarrow 0} \frac{\sin(\theta)}{\theta}?$$

**Riley:** It is equal to 1!

**Devyn:** But was that crazy proof with all the triangles really necessary? I mean, just plug in zero.

$$\left[ \frac{\sin(\theta)}{\theta} \right]_{\theta=0} = \frac{\sin(0)}{0} = \frac{0}{0} \dots$$

**Riley:** You were going to say “1,” right?

**Devyn:** Yeah, but now I’m not sure I was right.

**Riley:** Dividing by zero is usually a bad idea.

**Devyn:** You are right. I will never do it again! Also, don’t tell anyone about this conversation.

**Riley:** What conversation?

**Devyn:** Exactly.

**Problem 1** Consider the function

$$f(x) = \frac{x}{x}.$$

$$f(0) = \boxed{DNE} \quad \lim_{x \rightarrow 0} f(x) = \boxed{1}.$$

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Learning outcomes: Calculate limits of the form zero over zero.  
Author(s):

Could it be anything?

**Problem 2** Consider the function

$$f(x) = \frac{4x}{x}.$$

$$f(0) = \boxed{DNE} \quad \lim_{x \rightarrow 0} f(x) = \boxed{4}.$$

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**Problem 3** Consider the function

$$f(x) = \frac{x}{-3x}.$$

$$f(0) = \boxed{DNE} \quad \lim_{x \rightarrow 0} f(x) = \boxed{-1/3}.$$

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