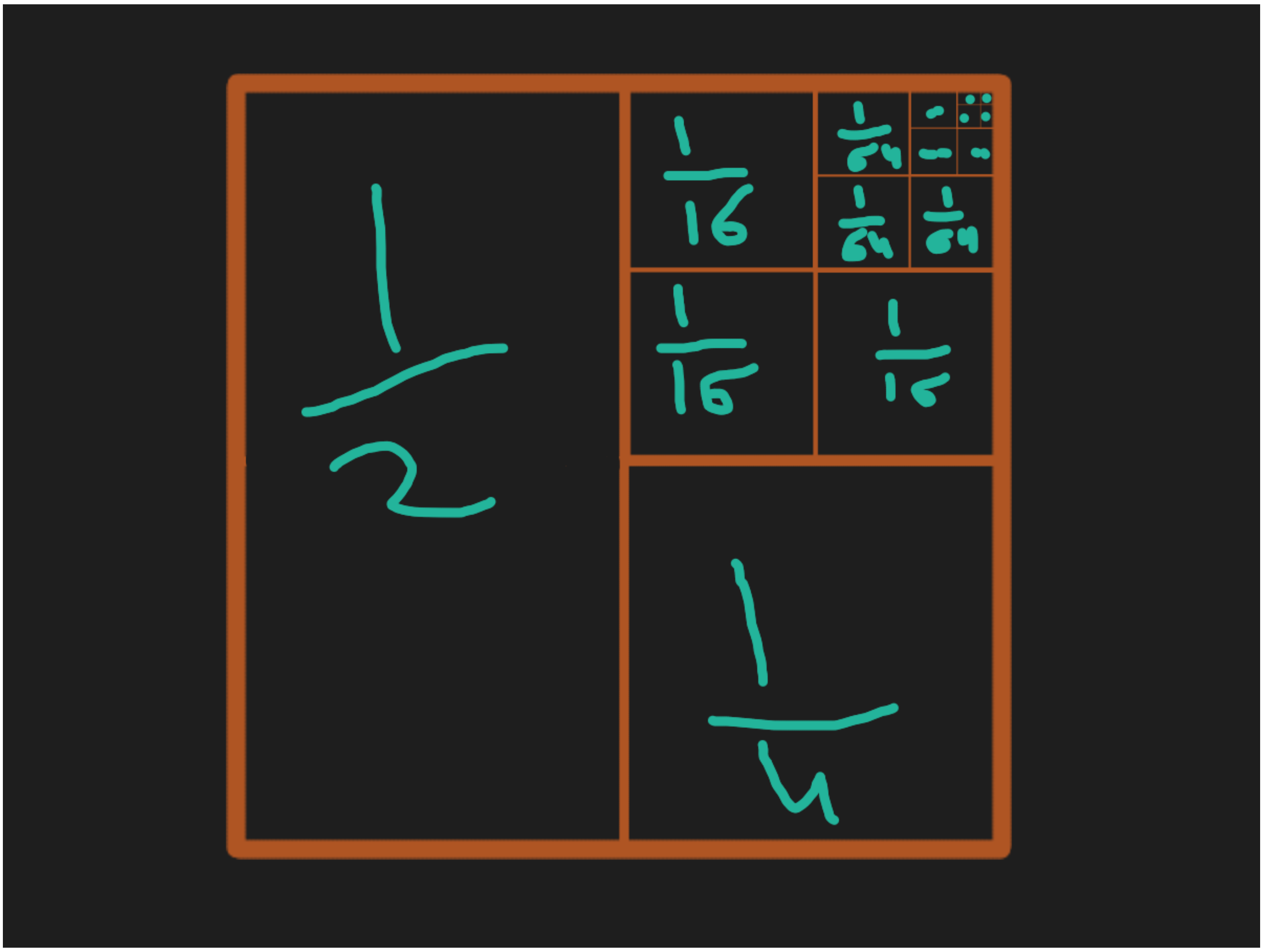
Chapter 1.1 - Limits (of Skill Issue)

The Concept of The Limit:

Understanding the **idea** of a limit of extremely important to having a solid grasp on Calculus as a whole. And for this, we turn to the epic square:



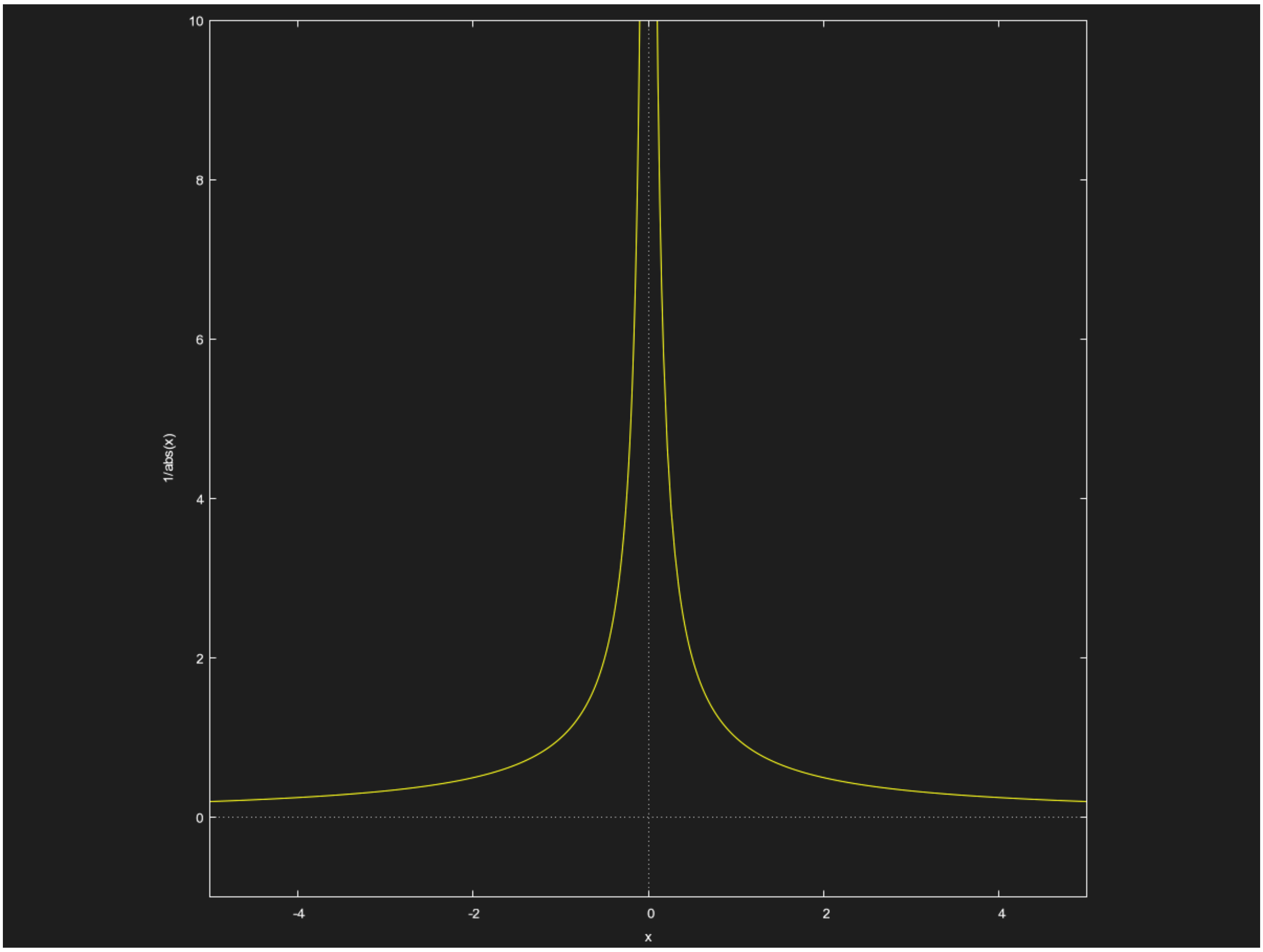
This square has an area of 1, but we have divided it into halves, quarters, 16'ths. and more. It is an infinite sum expressed as:

$$\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\frac{1}{64}+\ldots$$

If we compute this with a calculator, we see that we get closer and closer to 1, but we never quite *reach* it, as that would require infinite additions. Hence, we can say that the **limit** of the sum is 1. Just as we know that the square is infinitely divided, but still has a finite area, we can say the limit of its area is 1. Meaning:

$$\sum_{x=1}^{+\infty}\frac{1}{2^x}=\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\frac{1}{64}+\ldots=1$$

Another example: the graph of $|\frac{1}{x}|$



We see that as x approaches 0, the value of y explodes. At 0, the function becomes $\frac{1}{0}$, which is undefined. *However, the limit of the function is* $+\infty$. Since the limit does not require us to *reach* a certain value, but only **approach** it, we can properly define the limit like so:

$$\lim_{x \to 0} f(x) = |\frac{1}{x}| = +\infty$$