# Baby Rudin Chapter 1 Notes

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## 1 Motivation for Writing Notes

*The reason I'm writing these notes is to better understand certain aspects of Rudin's book on real analysis. By writing things in my own words and going through concepts that I don't fully understand in a systemic fashion, I'm confident my understanding of the material will be much deeper by the time I'm done reading this book.*

## 2 Introduction

**Theorem 1.** *The number $\sqrt{2}$ is irational.*

*Proof.* By definition, $\sqrt{2}$ is the number $p$ that satisfies the equation:

$$p^2 = 2$$

Assume that $p$ is rational, so it can be written as an irreducable quotient of integers $p = m/n$. It follows that:

$$m^2 = 2n^2$$

This implies that $m^2$ is even, so $m$ must be even (an odd times and odd is equal to an odd). Let us write $m$ as $2a$. We thus have:

$$4a^2 = 2n^2 \Rightarrow n^2 = 2a^2$$

it follows that $n$ is also even. Let us write $n$ as $2b$. Thus, we have:

$$p = \frac{m}{n} = \frac{2a}{2b} = \frac{a}{b}$$

Thus, $m$ and $n$ do not form a irreducable fraction, contrary to our initial assumption. This implies that $p$ cannot be written as such a fraction and is thus irrational. ■

**Remark 1.** *There is a decent bit to be said about how Rudin went about choosing the formula used to demonstrate that the sets of rationals with $p^2 < 2$ and $p^2 > 2$ have no greatest and smallest element. However, I'll probably circle back and fill this section in when I have two to draw some graphs to really build visual intuition.*