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前言

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Example 12

$$\frac{a}{b} = c$$

Example 2

$$\frac{a}{b} = c$$

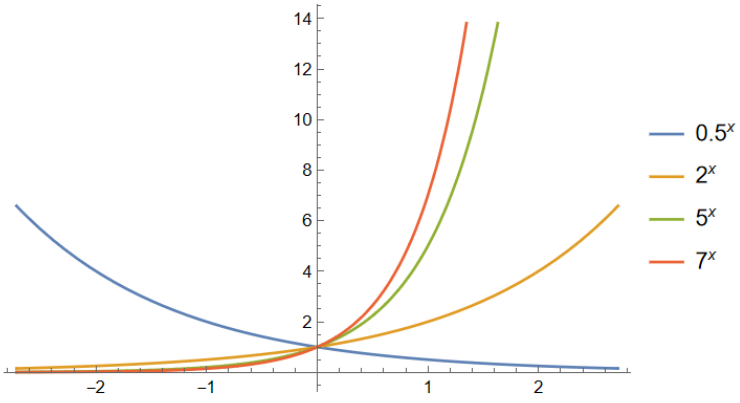

图 1: Figure referenced from the figure folder

Preparatory Chapter
Background Knowledge

This chapter prepares for the course study. We first introduce some terminology and notation widely used in mathematics, and then present several typical problems that inspire basic concepts in calculus.

§1 Sets and Logical Notation

The concept of a set is described as follows: **a set is a collection of well-defined and distinct objects**. The objects that make up a set are called **elements** of the set.

The statement that x is an element of a set E is denoted as:

$$x \in E \quad \text{(read as: "}x \text{ belongs to } E\text{")};$$

The statement that y is not an element of a set E is denoted as:

$$y \notin E \quad \text{(read as: "}y \text{ does not belong to } E\text{")}.$$

If every element of a set E is also an element of a set F, then we say that E is a **subset** of F, denoted as:

$$E \subseteq F \quad \text{(read as: "}E \text{ is contained in } F\text{")},$$

or equivalently:

$$F \supseteq E \quad \text{(read as: "}F \text{ contains } E\text{")}.$$

If every element of a set E is also an element of a set F, and every element of F is also an element of E (i.e., $E \subseteq F$ and $F \subseteq E$), then we say that sets E and F are **equal**, denoted as:

$$E = F.$$

For convenience, we introduce a set that contains no elements—the **empty set** $\varnothing$. We also adopt the convention that the empty set is a subset of any set E, i.e.,

$$\varnothing \subseteq E.$$

The sets of natural numbers $\mathbb{N}$, integers $\mathbb{Z}$, rational numbers $\mathbb{Q}$, real numbers $\mathbb{R}$, and complex numbers $\mathbb{C}$ are the most commonly encountered sets.