Graphics

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Contents

Abstract

This document provides an in-depth discussion on various LaTeX features. The abstract summarizes the contents of the document, giving readers an overview of what to expect. We explore the use of images, mathematical proofs, theorems, and multicolumn layouts. The aim is to demonstrate the versatility and power of LaTeX for typesetting complex documents.

1 Exploring Cubes with TikZ

Cubes are one of the most fundamental shapes in both geometry and everyday life. Characterized by their six square faces, eight vertices, and twelve edges, cubes are a prime example of a three-dimensional square. They can be found in various contexts, from architecture and design to natural formations. In mathematics, cubes are studied not only for their geometric properties but also for their applications in algebra, where the cube of a number is its third power.

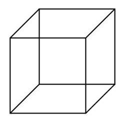

Figure 1: A simple 3D cube drawn with TikZ.

The cube illustrated above is created using TikZ, a powerful tool for generating vector graphics directly in LaTeX documents. Through simple commands, TikZ allows for precise control over the drawing, enabling the creation of both simple diagrams like this cube and more complex figures. The cube's representation here, while simple, serves as a foundational example for more intricate geometric constructions and visualizations in LaTeX. Learning to draw with TikZ not only enhances your documents visually but also provides a deeper understanding of the geometric concepts being presented.

2 An Essay on Apples

Apples are among the most popular and beloved fruits worldwide. Known scientifically as Malus domestica, apples have been cultivated by humans for thousands of years. Originating in Central Asia, these fruits have spread to every corner of the globe and have been embraced in various cultures, cuisines, and traditions.

Apples come in a wide variety of flavors, colors, and textures, ranging from sweet to tart and from crisp to soft. This diversity has allowed apples to be incredibly versatile in cooking and baking, featuring in dishes from simple snacks like raw apple slices to complex recipes like apple pies and tarts.

Beyond their culinary uses, apples have significant cultural and symbolic meanings. They can represent knowledge, as seen in the story of Adam and Eve, or temptation and desire. In many cultures, apples are a symbol of health and vitality, encapsulated in the saying, "An apple a day keeps the doctor away."

Nutritionally, apples are a rich source of fiber, vitamin C, and various antioxidants. These nutrients contribute to various health benefits, such as improving digestion, enhancing heart health, and potentially reducing the risk of chronic diseases.

The cultivation of apples is a significant industry in many countries, with China, the United States, and Poland being among the top producers. The process of growing apples, from planting and pruning to harvesting and storage, requires careful management to ensure the quality and yield of the fruit.

In conclusion, apples are not just a staple in diets around the world but also carry deep cultural and symbolic significances. Their widespread popularity is a testament to their versatility, nutritional value, and the joy they bring to people's lives.

Type	Color	Taste
Granny Smith	Green	Tart
Gala	Red	Sweet
Honeycrisp	Red/Yellow	Crisp

Table 1: Types of Apples and Their Characteristics

3 A New Chapter on Equations

This chapter introduces some fundamental equations in physics.

The first equation is Newton's second law, which states that the force applied to an object is equal to the mass of the object multiplied by its acceleration.

$$F = ma \tag{1}$$

This law is a cornerstone in classical mechanics.

Next, we consider the equation for gravitational force, which describes the attraction between two masses.

$$\boxed{F = G\frac{m_1 m_2}{r^2} \qquad (2)}$$

Where G is the gravitational constant, m_1 and m_2 are the masses of the two objects, and r is the distance between their centers.

Lastly, we look at the equation for kinetic energy, which represents the energy that an object possesses due to its motion.

$$KE = \frac{1}{2}mv^2 \tag{3}$$

Where m is the mass of the object and v is its velocity.

Inserting a new equation between these will automatically update the numbering without any additional adjustments needed.

4 Understanding Footnotes

Footnotes are an essential part of academic and research writing, offering a convenient way to provide additional information, clarifications, or references without cluttering the main text. They allow authors to elaborate on specific points without interrupting the flow of their arguments or narrative[1].

The use of footnotes is not limited to academic writing; it is also prevalent in books, reports, and other documents where detailed explanations or citations are necessary. They contribute significantly to the depth and richness of a document, enabling writers to substantiate their claims and readers to explore topics further.

In LaTeX, the \footnote command simplifies the process of adding footnotes, automatically handling numbering and placement, thus maintaining the document's integrity and readability.

[1] Footnotes appear at the bottom of the page on which they are referenced, making it easy for readers to find supplementary information without losing their place in the text.

5 RGB image example

In this section, we include an external graphic into our document. This can be an image file such as a JPEG, PNG, or PDF. The figure below demonstrates how an image is included using LaTeX.

Figure 2: The included image.

As shown in Figure 2, you can reference figures easily in your text.

6 Mathematical Proofs and Theorems

Mathematical proofs and theorems are the core components of any mathematical text. They provide the logical foundation upon which mathematical theory is built. LaTeX, with the help of packages like ‘amsthm‘, provides an excellent way to typeset these structures.

6.1 Sample Theorem

Theorem 6.1. *If $f : A \to B$ is bijective, then there exists an inverse function $f^{-1} : B \to A$.*

Theorem 6.2. *Let $f : A \to B$ be a function from set A to set B. If f is bijective, then there exists an inverse function $f^{-1} : B \to A$.*

Proof. Since f is bijective, for each $b \in B$, there exists a unique $a \in A$ such that $f(a) = b$. We define $f^{-1}(b) = a$. To show that f^{-1} is the inverse of f, we must demonstrate that $f(f^{-1}(b)) = b$ for all $b \in B$ and $f^{-1}(f(a)) = a$ for all $a \in A$.

First, we show that $f(f^{-1}(b)) = b$ for all $b \in B$. Since $f^{-1}(b) = a$, it follows that $f(f^{-1}(b)) = f(a) = b$.

Next, we show that $f^{-1}(f(a)) = a$ for all $a \in A$. Since $f(a) = b$, and $f^{-1}(b) = a$, it follows that $f^{-1}(f(a)) = f^{-1}(b) = a$.

Therefore, f^{-1} is the inverse function of f. □

6.2 Sample Lemma

Lemma 6.3. *For every non-empty set S, if $f : S \to S$ is injective, then f is surjective.*

Proof. (Sketch) Since S is non-empty and f is injective, every element of S maps to a distinct element of S. Given the finiteness of S, this implies that f must cover all elements of S, hence it is surjective. □

6.3 Sample Corollary

Corollary 6.4. *If $f : A \to B$ and $g : B \to C$ are bijective functions, then the composition $g \circ f : A \to C$ is also bijective.*

Proof. Omitted for brevity. □

6.4 Sample Definition

Definition 6.5. A function $f : A \to B$ is said to be *injective* if for every $a_1, a_2 \in A$, $f(a_1) = f(a_2)$ implies that $a_1 = a_2$.

6.5 Sample Remark

Remark 6.6. This is a remark that provides additional information or context about the material presented above.

A Newton

Sir Isaac Newton was a key figure in the scientific revolution, known for his laws of motion and universal gravitation. His work laid the foundation for classical mechanics and has influenced many areas of mathematics, physics, and astronomy. Newton's contributions extend beyond the well-known apple anecdote, profoundly shaping our understanding of the natural world.

B Nikola Tesla

Nikola Tesla was a pioneering inventor and engineer known for his groundbreaking work on alternating current (AC) electrical systems. He developed the AC motor and contributed to the establishment of AC as the standard for electric power transmission worldwide. Tesla's passion for discovery led to numerous innovations in the fields of electrical and radio engineering, leaving a lasting legacy.