My First Document

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1 Introduction

1.1 Lines of Text

this is a text. but entering a new line does not create a new line
this will create new line

this creates a new line 5.75 millimetres below

this is a new paragraph this is a new paragraph

1.2 Text Formatting

Some formatting techniques:

this is bold-faced text

this is italicised text

this is underlined text

this is interesting

this is centralised **bold-faced**

1.3 Some Special Characters

Some special characters are:

$ % & { } \ ˆ

Here are some ways of writing accents:

L'Hôpital, Marché, Hölder's Inequality... for other accents just Google.

"This is a bad quote"...

Remark. Never use "

“This is a good quote”
‘This is also a good quote’

2 Mathematics

In this section, we will discuss essential features of the mathematics environment.

2.1 Basic Mathematics

The most basic mathematical environment is this $x + y - z = 1$. Compare this with x + y - z = 1.
Here's a list of basic math features:

1. Greek Symbols: Let $\varepsilon > 0$, or $\epsilon > 0$. $\alpha, \beta, \gamma, \delta, \pi, \xi, \phi, \varphi, \psi, \sigma, \Sigma, \Gamma$.
2. Common Symbols: $1 \in \{1, 2, 3, 4, 5\}$
3. More Common Symbols: $\infty \notin \{1, 2, 3\}$.
4. Elementary Functions: $\sin(x), \cos(x), \exp(x), \log(x), \ln(x), \tan, \arctan(x), \ldots$ remember not to write $sin(x)$ etc.
5. Some more: $f : A \to B, g : B \to C$
6. Even more: $g \circ f : A \to C$

Let's talk about fractions, subscripts and superscripts...

1. Fractions: $\frac{1}{2}$, $\frac{1}{1+\frac{1}{2}} = \frac{2}{3}$
2. Subscripts: $x_1, x_2, x_3, \ldots, x_{2017}$
3. Superscripts: $x^1, x^2, \ldots, x^{2017}$
4. Combinations: $(1 + \frac{1}{n})^n \to e$ as $n \to \infty$... Always remember, subscripts first followed by superscripts, e.g. x_n^2, $w_{1_2}^{3^4}$. α^ϵ

2.2 Mathematical Fonts

Here are some useful fonts:

1. Default: a, b, c, d, e
2. These are not default fonts:
   (i) Blackboard Bold: $\mathbb{Q} \subset \mathbb{R}$
   (ii) Bold-faced: $\mathbf{P}(X = k) = 0.4$
   (iii) Caligraphy: $A \in \mathcal{A} \cup \mathcal{B}$, $(\Omega, \mathcal{F}, \mu)$
   (iv) Fraktur: $\mathfrak{ABCDEFG}$.

2.3 Equations

- An example of an numbered equation is
$$e^{i\pi} + 1 = 0. \tag{1}$$
- An example of an unnumbered equation is
$$1 + 1 = 2.$$
- This is how we split equations:
$$\begin{aligned} (1 + 2) + 3 &= 3 + 3 \\ &= 6 \\ &= 6.0 \end{aligned} \tag{2}$$

2.4 Integrals, Limits, Summation

- This is an integral: $\int_0^1 f(x)\,dx$.
- This is a limit $\lim_{n\to\infty}(1+\frac{1}{n})^n = e$.
- This is a summation $\sum_{n=0}^{\infty}\frac{1}{n!} = e$.

Some fancy stuff:

$$\begin{aligned}\iint f(x,y)\,dxdy &\leq \frac{\pi^2}{6}\\ &\geq \frac{1}{1^2}+\frac{1}{2^2}+\dots\\ &\neq 1+\sum_{n=1}^{\infty}\frac{1}{n^2}.\end{aligned}$$

Partial Derivative example: $\frac{\partial f}{\partial x}$

2.5 Matrices, Vectors

A Matrix:

$$\begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 6\\ 7 & 8 & 9\end{pmatrix} \tag{3}$$

$$\begin{bmatrix}1 & 2 & 3\\ 4 & 5 & 6\\ 7 & 8 & 9\end{bmatrix} \tag{4}$$

A Vector:

$$\vec{v} = \begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} \tag{5}$$

2.6 Theorems, Lemma, Definitions, Corollaries

Definition 2.1. *Let $(x_n)_{n=1}^{\infty}$ be a real-valued sequence. A sequence is said to converge to a limit $x \in \mathbb{R}$ if for any given $\varepsilon > 0$, there exists $N \in \mathbb{N}$ such that $n \geq N$ implies $|x_n - x| < \varepsilon$.*

Based on Definition 2.1 we can prove the following lemma.

Lemma 2.2. *If $x_n \to x$, then $|x_n| \to |x|$.*

Proof. The proof is left as an exercise to readers. □

Remark 2.3. *The converse of Lemma 2.2 is not true in general!*

Refer to [1]

Theorem 2.4 (Central Limit Theorem)**.** *Let $X_1, X_2, X_3, \dots$ be a sequence of IID random variables, with finite mean μ and variance σ^2. Then*

$$\frac{\bar{X}-\mu}{\sqrt{\sigma^2/n}} \tag{6}$$

can be approximated by the standard normal distribution.

3 Others

3.1 Tables

Name	Age	Favourite Food
Mark	25	Burgers
John	18	Hotdogs

3.2 Figures

This is a figure:

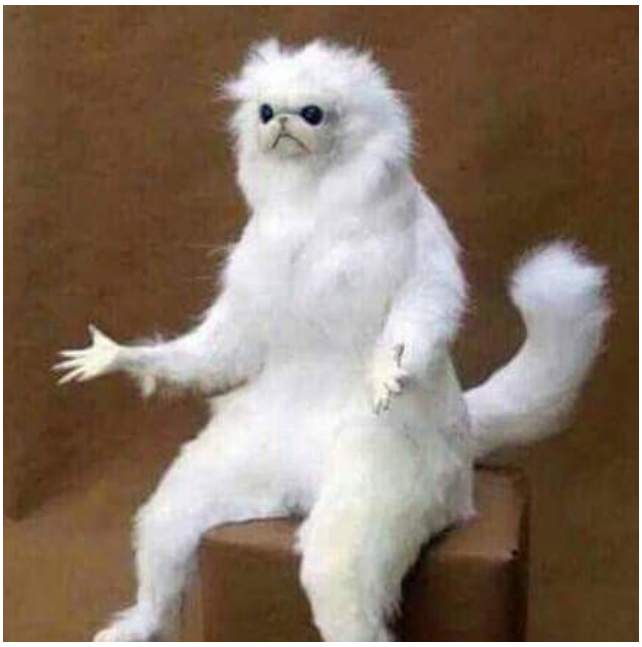

Figure 1: My Favourite Photo

References

[1] Mark Ng (2017), *"A First Course in LaTeX"*. NUS Mathematics Society.