

# L<sup>A</sup>T<sub>E</sub>X Tutorial for Math Majors

Here are some typesetting features you may want to use when writing up your classwork, or the mathematics in your class summary. If you want to type a paragraph of text, simply start typing.

To start a new paragraph, leave a blank line before the new paragraph.

Here's a bullet list of some of the math symbols you may need. Note that any math formulas must be surrounded by dollar signs, like so:  $H(s, t) = F(\alpha(s), t)$ . If you surround a math formula by double dollar signs, your formula will be centered on a line by itself, like so:

$$H(s, t) = F(\alpha(s), t).$$

Whatever you type afterwards will begin again on a separate line.

- Greek letters:  $\alpha, \gamma, \pi, \tau$
- product of two sets  $X \times Y$
- Intersections  $\cap$ , unions  $\cup$ , and disjoint unions  $\sqcup$
- *italics* and **bold**
- related to:  $\sim$ , homotopic to  $\simeq$ , and isomorphic to  $\cong$
- Fractions which fit inside a paragraph of text:  $\frac{az+b}{cz+d}$ , and bigger fractions:  $\frac{az + b}{cz + d}$
- Subscripts and exponents:  $z_1, w^2, z_2^3, f_*(x), p^{-1}(b)$
- Derivatives:  $f'(x)$ , integrals  $\int_a^b f(x) dx$ , and limits  $\lim_{n \rightarrow \infty} a_n$  or  $\lim_{n \rightarrow \infty} a_n$
- Not equals:  $c \neq 0$ , or greater than / less than or equal:  $c \geq 0, x \leq 17$
- functions defined in pieces:

$$p(x) = \begin{cases} x & \text{for } x \in [0, 1] \\ x - 1 & \text{for } x \in [2, 3] \end{cases}$$

- Left quotes “ and right quotes ”
- Composition:  $g \circ f$ , and multiplication:  $g \cdot f$
- Left and Right Set Brackets need a backslash:  $\{x : p(x) = b\}$
- Is an element of:  $b \in B$
- $\mathbb{R}, \mathbb{S}^2, \mathbb{T}^2, \mathbb{Z}$
- To put a word in with a string of math symbols, use mbox:  $f \sim g \text{ rel } A$ , otherwise, it looks like:  $f \sim grelA$ .

- $p|\tilde{v}$
- group presentation:  $\langle a, b : ab\bar{a} \rangle$
- A lot of symbols you might want to know are just what you think they might be, preceded by a backslash:  $\cos \theta, \notin, \rightarrow, \mapsto, \Leftrightarrow, \longrightarrow, \subset, \subseteq$

There are nice, pre-written environments for Theorems and Proofs, as below:

**Theorem (Unique Path Lifting Property)** Here's where you type in the text of the theorem.

**Proof:** And this is where you type in the proof! □

**Lemma** Here's where you put the body of a lemma.

You might also want to write up the following things:

1. A numbered list,
2. or a sequence of equations, lined up at the equals sign, with comments...

$$\begin{aligned}
 d(z_1, z_2) &= \int_{z_1}^{z_2} \frac{1}{t} dt \\
 &= \ln(z_2) - \ln(z_1) && \text{by the Fund Thm of Calc} \\
 &= \ln\left(\frac{z_2}{z_1}\right)
 \end{aligned}$$

3. or numbered equations, so you can refer to them later, like equation 2

$$\frac{dI}{dt} = \alpha SI - \beta I \tag{1}$$

$$= \alpha I \left( S - \frac{\beta}{\alpha} \right) \tag{2}$$

$$= \alpha I \left( N - I - \frac{\beta}{\alpha} \right) \tag{3}$$

$$\tag{4}$$

4. or some Commutative Diagrams...

$$\begin{array}{ccc}
 \mathbb{S}^2 & \xrightarrow{g} & \mathbb{S}^2 \\
 \mathbb{S} \downarrow & & \downarrow \mathbb{S} \\
 \mathbb{R}^2 & \xrightarrow{f} & \mathbb{R}^2
 \end{array}$$

5. or a Table...

Column A	Column B
$T^2 \# S^2$	$P^2 \# P^2$
$K^2$	$K^2 \# P^2$
$S^2 \# S^2 \# S^2$	$S^2 \# S^2$
$P^2 \# T^2$	$P^2 \# P^2 \# P^2 \# K^2$
$K^2 \# T^2 \# P^2$	$T^2$

6. or a picture, such as in Figure 1 (you will need to use a .eps graphics file for Windows, and a .pdf graphics file for Mac).

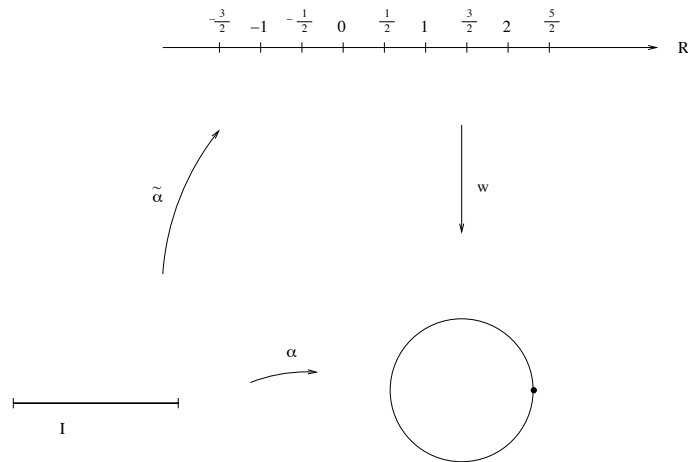


Figure 1: Lifting the circle to its universal cover

Maybe you want a big vertical skip

Or maybe you want a more specialized list....like letters in parentheses, or roman numbers with a slash: the following two require adding the word `enumerate` as a package in the header (see the top of this file)

(a) first thing

(b) second thing

or

I/ first thing

II/ second thing

...and you can always ask me if you need to typeset something that I haven't included here.