

COMMON L^AT_EX ERRORS (AND HOW TO AVOID THEM)

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1. USE BUILT-IN L^AT_EX COMMANDS

Whenever available. They take care of proper fonts and spacing. Do not invent new ones or manually craft ones.

1.1. **Theorems and proofs.** Begin your file with

```
\documentclass{amsart}
\usepackage{amsmath,amssymb,amsfonts,amsthm}
\theoremstyle{plain}
\newtheorem{theorem}{Theorem}
\newtheorem{corollary}[theorem]{Corollary}
\newtheorem{lemma}[theorem]{Lemma}
\newtheorem{proposition}[theorem]{Proposition}
\theoremstyle{definition}
\newtheorem{definition}[theorem]{Definition}
\newtheorem{example}[theorem]{Example}
\newtheorem{conjecture}[theorem]{Conjecture}
\theoremstyle{remark}
\newtheorem{remark}[theorem]{Remark}
```

Then, add theorems as follows:

```
\begin{theorem}[Pythagoras]
Let \dotso
\end{theorem}
\begin{proof}
Let \dotso
\end{proof}
```

Theorem 1 (Pythagoras). *Let ...*

Proof. Let ...

□

When a proof ends with a `displaymath` environment, use `\qedhere`:

```
\begin{proof}
\dotso, and thus
\[
c^2=a^2+b^2.\qedhere
\]
\end{proof}
```

Proof. ..., and thus

$$c^2 = a^2 + b^2.$$

□

Without the `\qedhere` command, you get

Proof. ... , and thus

$$c^2 = a^2 + b^2.$$

□

Tip. Do not number theorems, propositions, etc., separately; this makes it difficult to locate the place of these items when referred. The above code provides joint numbering. In a long document with many theorems, use `\newtheorem{theorem}{Theorem}[section]` to have the numbers indicate the section:

Theorem 1.1. ...

Tip. `\documentclass[12pt]{amsart}` gives a globally larger font that is easier to read. I also add, especially in this case, `\usepackage[top=2in, bottom=1.5in, left=1in, right=1in]{geometry}` to get more—but not too much—text to the page.

1.2. Use labels for reference. E.g.,

```
\begin{theorem}[Pythagoras]
\label{thm:Pyt}
Let \dotso
\end{theorem}
By Theorem~\ref{thm:Pyt}, \dotso
```

Theorem 2 (Pythagoras). *Let* ...

By Theorem 2, ...

Do not insert reference numbers manually, since the numbers are likely to change as the paper develops and gets reorganized.

2. MATH MODE ISSUES

2.1. Mathematical operators.

Wish to type. $\ker(T)$

Wrong way. $\$ker(T)\$ \mapsto \ker(T)$. Here, “ker” looks like a product of three variables k , e , r (\LaTeX adds an extra bit of space among the letters).

Right way. $\$\ker(T)\$$

If an operator is not defined by default, define it, e.g.:

```
\DeclareMathOperator{\domain}{domain}
```

Then $\$\domain(f)\$ \mapsto \text{domain}(f)$.

Tip. For operators with subscripts, use `\DeclareMathOperator*{\mylim}{mylim}`

$\$\mylim_n a_n\$ \mapsto \text{mylim}_n a_n$

To type an operator without defining it first: $\$\operatorname{rank}(A)\$ \mapsto \text{rank}(A)$.

2.2. Italics in text.

Wish to type. This *is* correct

Wrong way. This $\$is\$$ correct \mapsto This *is* correct

Right way. This `\emph{is}` correct
See Section 2.1.

2.3. Angle brackets.

Wish to type. $\langle g, h \rangle$

Wrong way. `$\langle g,h \rangle$` $\mapsto \langle g, h \rangle$

Right way. `$\langle g,h \rangle$`
Binary relations are spaced as such.

2.4. Large numbers.

Wish to type. 1,000,000

Wrong way. `$1,000,000$` $\mapsto 1,000,000$

Right way. `$1{,}000{,}000$`
L^AT_EX, rightfully, adds space after a comma.

2.5. Functions.

Wish to type. $f: A \rightarrow B$

Wrong way. `f:A\to B` $\mapsto f: A \rightarrow B$

Right way. `$f\colon A\to B$`
`\colon` gets the spacing right for this purpose.

2.6. Space set brackets.

Wish to type. $\{x \in X : f(x) = y\}$

Wrong way. `{x \in X : f(x) = y}`

Right way. `${\, x \in X : f(x)=y\,}$`
The `\,` adds the needed small space.

2.7. Displaymath delimiters.

Wish to type.

$$a = b.$$

Wrong way. `$$a=b.$ $` \mapsto

$$a = b.$$

Right way. `\[a=b. \]`

`$$` is unofficial and might conflict with other things. Some claim it gets the spacing wrong.

2.8. **Use displaymath for tall mathematical objects.** Tall mathematical objects, such as $\begin{pmatrix} a & 0 \\ 0 & b \end{pmatrix}$ (`\begin{pmatrix}a & 0 \\ 0 & b\end{pmatrix}`) distort the line spacing. Put them into a displaymath environment:

$$\begin{pmatrix} a & 0 \\ 0 & b \end{pmatrix}$$

or find a short substitute, such as `\diagonal(a,b)`—see Section 2.1).

2.9. Modulo.

Wish to type. $a = b \pmod{c}$; $a \bmod c = b$

Wrong way. `\a = b (\bmod c)`; `\a \text{ mod } c = b` $\mapsto a = b(\bmod c)$; $a \bmod c = b$.

Right way. `\a = b \pmod c`; `\a\bmod c = b`

`\pmod` denotes a property. `\bmod` is a binary operator. Do not invent new commands when ones already exist.

2.10. Use proper parentheses sizes.

Wish to type.

$$\left\{ \sum_{n<7} a_n, \sum_{n<7} b_n \right\}, \left\{ \begin{pmatrix} a \\ b \end{pmatrix} \right\}$$

Wrong way. `\left\{\, \sum_{n<7} a_n, \sum_{n<7} b_n \, \right\}`,
`\{\, \binom{a}{b} \, \}` \mapsto

$$\left\{ \sum_{n<7} a_n, \sum_{n<7} b_n \right\}, \left\{ \begin{pmatrix} a \\ b \end{pmatrix} \right\}$$

Right way. `\Bigl\{\, \sum_{n<7} a_n, \sum_{n<7} b_n \, \Bigr\}`,
`\left\{\, \binom{a}{b} \, \right\}`

The automatic parentheses scaling such as `\left\{` sometimes gives too large parentheses.

2.11. Don't use eqnarray.

Wish to type.

$$\begin{aligned} a &= b + c \\ c &= a + b. \end{aligned}$$

Wrong way.

```
\begin{eqnarray*}
a &=&b+c\\
c &=&a+b.
\end{eqnarray*}
```

\mapsto

$$\begin{aligned} a &= b + c \\ c &= a + b. \end{aligned}$$

Right way.

```
\begin{align}
a &=b+c\\
c &=a+b.
\end{align}
```

`eqnarray` is obsolete, and gets the spacing wrong.

You may also wish to check the environment `split`.

2.12. Use the right kind of ellipsis dots.

Wish to type. The numbers 1, 2, 3, ..., the sum $1 + 2 + \dots$, the product $1 \cdot 2 \cdot \dots$, the integral $\int \dots$, and ...

Wrong way.

The numbers `$1,2,3,\dots$`, the sum `$1+2+\dots$`,
the product `$1\cdot 2\dots$`, the integral `$\int\dots$`, and ...

↪ The numbers 1, 2, 3, ..., the sum $1 + 2 + \dots$, the product $1 \cdot 2 \dots$, the integral $\int \dots$, and ...

Right way.

The numbers `$1,2,3,\dotsc$`, the sum `$1+2+\dotsb$`,
the product `$1\cdot 2\dotsm$`, the integral `$\int\dotsi$`, and `\dotso`

`\dotsc` for dots with commas, `\dotsb` for dots with binary operators/relations, `\dotsm` for multiplication dots, `\dotsi` for dots with integrals, and `\dotso` for other dots.

3. SPACING

3.1. Do not put a space before a period, a comma, etc.

3.2. Space after dot.

Wish to type. James et al. suggest;
James scored an A. He is ...

Wrong way. James et al. suggest ↪ James et al. suggest;
James scored an A. He is ↪ James scored an A. He is ...

Right way. James et al.\ suggest
James scored an A\@. He is \dotso

L^AT_EX thinks the period ends a sentence, and adds extra space. Unless it is after an uppercase (e.g., James E. Jones is correct).

3.3. Manual spacing and formatting. Avoid—entirely, if possible—manual spacing. Never end a paragraph with a `\\`. Minimize use of manual spacing commands like `\medskip`.

4. BIBLIOGRAPHY AND CITATIONS

4.1. Sort your bibliography. Bibliographic items must be sorted according to author's last name.

4.2. **All bibitems must follow the same style.** E.g., if some items have initial first names, all items should. If some items must have issue number within a journal volume, all must. Similarly for fonts of various bibitem fields.

4.3. **Use hard space before citations and references.**

Wish to type. ... James [15]

Wrong way. James `\cite{James96}` \mapsto James
[15]

Right way. James`~\cite{James96}`
Similarly, use: Lemma`~\ref{lem:main}`, Equation`~\eqref{eq:main}`, etc.

4.4. **Multiple citation.**

Wish to type. [15, 17]

Wrong way. `\cite{JJ98}`, `\cite{JJ00}` \mapsto [15], [17]

Right way. `\cite{JJ98, JJ00}`

4.5. **Detailed citation.**

Wish to type. [15, Theorem 17]

Wrong way. `\cite{JJ98}`, Theorem`~17` \mapsto [15], Theorem 17

Right way. `\cite[Theorem~17]{JJ98}`

4.6. **Citations are not names.** Citations are like footnote numbers. For footnotes, you will not write “see¹.”, but “see the footnote.¹” is ok. Similarly for citations. This may be tricky, but try to follow this rule as much as possible.

Wrong way. In [5], Jones proved ...
See [5].
In [5] we show ...
... is available in [5].

Right way. Jones [5] proved ...
Is available in our earlier paper [5].
We have shown [5] ...
... is available in a paper of Jones [5].

5. STYLE ISSUES

5.1. **Hyphenation and dashes.**

Wish to type. non-commutative;
Hardy–Littlewood;
pp. 13–19;
L^AT_EX—and other processors—should be used correctly.

Wrong way. non commutative; Hardy-Littlewood \mapsto Hardy-Littlewood;
 pp.~13-19 \mapsto pp. 13-19;
`\LaTeX{}` - and other processors - should be used correctly
 \mapsto L^AT_EX - and other processors - should be used correctly.

Right way. non-commutative;
 Hardy--Littlewood;
 pp.~13--19;
`\LaTeX{}`---and other processors---should be used correctly.

5.2. Caption tables before the tables, and figures after the figures.

5.3. Quotes.

Wish to type. The answer is “No.”

Wrong way. The answer is "No." \mapsto The answer is "No.”

Right way. The answer is ‘‘No.’’
 Type ‘ twice for “, and ’ twice for ”.

5.4. Latin abbreviations.

Wish to type.
 et al.
 ... , e.g., ...
 ... , i.e., ...

Wrong way.
 et. al.
et al.
 ... , e.g. ...
 ... , *e.g.*, ...
 ... , i.e. ...
 ... , *i.e.*, ...

Right way.
 et al. \mapsto et al.
 ... , e.g., ... \mapsto ... , e.g., ...
 ... , i.e., ... \mapsto ... , i.e., ...

The term *et al.* abbreviates *et alters*. Do *not* use slanted/italized text for these words.

5.5. Prefer words to mathematical symbols.

Wish to type. For every natural number n , we have ...

Wrong way. $\forall n \in \mathbb{N}$, we have ...

5.6. Defer definitions to where they are necessary. Do not begin your paper by making all definitions ever used in it, or many of them. Few can memorize many definitions. Seeing a Lemma after a definition helps learning it. Thus, chose some lemma or theorem to begin with, and provide before it just the definitions necessary for understanding its statement. Consider even rewording the statement to make the needed number of definitions smaller. Then proceed in a similar manner to the next Lemma, providing just the needed definitions for it, and so on.

5.7. A mathematical symbol is not a name.

Wrong way. r is irrational.

Right way. The real number r is irrational.

5.8. Never end a paragraph with a Theorem.

Wrong way. We obtain the following

Theorem 3. ...

Right way. We obtain the following result.

Theorem 4. ...

5.9. Do not use abbreviations.

Wish to type. Also known as; without loss of generality; if and only if; such that

Wrong way. aka; WLOG; iff; s.t.

Similarly, do not use `\bysame` in the bibliography. Write the author names in each bibliographic entry.

5.10. Use the short title option.

Wrong way. `\title{Reasons why one should not use much too long titles in running headers}`

The running header becomes longer than the available space, or just not aesthetic. Provide a short title for the running head when the full title is long.

Right way. `\title[Long running headers]{Reasons why one should not use much too long titles in running headers}`

5.11. Do not overuse the Remark environment. Comments that are not needed later on, or that are not of particular importance (e.g., ones added for didactic reasons) should be written as a usual paragraph, not in a Remark environment. Similarly, to some extent, for the Lemma environment.

6. AUTOMATIC CHECKS

These cannot substitute manual checking, but you will be surprised how much errors that you missed they detect.

6.1. Spellcheck. Run a good spellchecker before submitting your writeup anywhere, including after every revision!

6.2. Verify that the bibliography is used. Use `\includepackage{refcheck}` to verify that you use all bibliographic items correctly. When compiling, a problem with an item will be indicated by a question mark on the margin. Remember to comment out the package inclusion and recompile before submission.

6.3. Comment out the showkeys package. This package shows you the labels on the pdf file, and saves you searches in the source when writing your paper. However, it is embarrassing to have all labels shown on the submitted version.

6.4. More sophisticated autochecks. Some common errors may be detected by some programs. I haven't yet checked any, but <https://github.com/devd/Academic-Writing-Check> looks interesting.

7. ADDITIONAL READING

Jerzy Trzeciak, a professional editor in top mathematics journals, prepared excellent resources that will help you improve your mathematical writing style. In particular, you can check how to use specific words correctly, using his mathematical dictionary.

- (1) Mathematical English Usage — a Dictionary,
<https://www.impan.pl/en/publishing-house/for-authors/dictionary>
- (2) Common English errors in mathematical papers,
<https://www.impan.pl/wydawnictwa/dla-autorow/errors.pdf>
- (3) Writing Mathematical Papers — a Few Tips,
<https://www.impan.pl/wydawnictwa/dla-autorow/writing.pdf>

8. EMAIL ME COMMENTS AND CORRECTIONS

None of the above is my own invention. I collected everything from other sources. To make this document more useful for others, please email me corrections and important additions. Preference goes to *common* L^AT_EX errors.

Acknowledgments. I thank Jose Ignacio Royo Prieto for corrections, and Jerzy Trzeciak for very useful discussions on mathematical writing.

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