

### Formulas

If you're writing a technical document, it's likely to contain mathematical formulas. A formula appearing in the middle of a sentence is enclosed by `\(` and `\)` commands.

The formula  $x - 3y = 7$  is easy to type.      The formula `\( x-3y = 7 \)` is easy to type.

Any spaces that you type in the formula are ignored.

Does  $x + y$  always equal  $y + x$ ?      Does `\( x + y \)` always equal `\(y+x\)`?

$\TeX$  regards a formula as a word, which may be broken across lines at certain points, and space before the `\(` (or after the `\)`) is treated as an ordinary interword separation.

Subscripts are produced by the `_` command and superscripts by the `^` command.

$a_1 > x^{2n}/y^{2n}$       `\( a_{1} > x^{2n} / y^{2n} \)`

These two commands can be used only inside a mathematical formula.

When used in a formula, the right-quote character `'` produces a prime ( $'$ ), two in a row produce a double prime, and so on.

This proves that  $x' < x'' - y_3' < 10x'''z$ .      ... `\( x' < x'' - y'_{3} < 10 x''' z \)`.

Mathematical formulas can get very complex; Section 3.3 describes many additional commands for producing them. Here, I consider the use of formulas in the text. A formula is a grammatical unit; it should be treated as such in the sentence structure.

The formula  $a < 7$  is a noun in this sentence. It is sometimes used as a clause by writing that  $a < 7$ .      The formula `\( a<7 \)` is a noun in this sentence. It is sometimes used ...

Beginning a sentence with a formula makes it hard to find the start of the sentence; don't do it. It is best to use a formula as a noun; it should certainly never appear as a complete sentence in the running text.

A variable like  $x$  is a formula. To save you some typing,  $\LaTeX$  treats `$. . . $` the same as `\( . . . \)`.

Let  $x$  be a prime such that  $y > 2x$ .      Let `$x$` be a prime such that `$y>2x$`.

Use `$. . . $` only for a short formula, such as a single variable. It's easy to forget one of the `$` characters that surrounds a long formula. You can also type

`\begin{math} . . . \end{math}`

instead of `\( . . . \)`. You might want to use this form for very long formulas.

broken across pages in a distracting way. The commands `\` and `\*` are used in all environments in which you tell  $\LaTeX$  where to break lines; several such environments are described in the next chapter. The `\*` command is called the *\*-form* of the `\` command. Several other commands also have *\*-forms*—versions of the command that are slightly different from the ordinary one—that are obtained by typing *\** after the command name.

The `\` and `\*` commands have a little-used optional argument described in Section C.1.6, so putting a `[` after them presents the same problem as for the `\item` command. Moreover, the *\** in the `\*` command is somewhat like an optional argument for the `\` command, so following a `\` with a *\** in the text poses a similar problem. See Section C.1.1 for the solutions to these unlikely problems. Almost every command that has a *\*-form* is fragile, and its *\*-form* is also fragile.

### Displayed Formulas

A mathematical formula is displayed when either it is too long to fit comfortably in the running text, it is so important that you want it to stand out, or it is to be numbered for future reference.  $\LaTeX$  provides the `displaymath` and `equation` environments for displaying formulas; they are the same except that `equation` numbers the formula and `displaymath` doesn't. Because displayed equations are used so frequently in mathematics,  $\LaTeX$  allows you to type `\[...]` instead of

```
\begin{displaymath} ... \end{displaymath}
```

Here is an example of an unnumbered displayed equation:

$$x' + y^2 = z_i^2$$

and here is the same equation numbered:

$$x' + y^2 = z_i^2 \quad (8)$$

Here is an example of an unnumbered displayed equation:

```
\[ x' + y^{2} = z_{i}^{2} \]
```

and here is the same equation numbered:

```
\begin{equation}
  x' + y^{2} = z_{i}^{2}
\end{equation}
```

The document class determines how equations are numbered. Section 4.2 describes how  $\LaTeX$  can automatically handle references to equation numbers so you don't have to keep track of the numbers.

A displayed formula, like any displayed text, should not begin a paragraph. Moreover, it should not form a complete paragraph by itself. These two observations are summed up in a simple rule: in the input, never leave a blank line before a displayed formula.

$\TeX$  will not break the formula in a `displaymath` or `equation` environment across lines. See Section 3.3.5 for commands to create a single multiple-line formula or a sequence of displayed formulas.