Basic Mathematical Elements

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1 Fractions

To create a fraction, you must use the \( \frac{\text{numerator}}{\text{denominator}} \) command. (For those who need their memories refreshed, that’s the top and bottom respectively!) You can also embed fractions within fractions, as shown in the examples below:

\[
\frac{x+y}{y-z}
\]

To illustrate nested fractions:

\[
\frac{\frac{1}{x} + \frac{1}{y}}{y-z}
\]

2 Powers and Indices

Powers and indices are mathematically equivalent to superscripts and subscripts in normal text mode. The carat (^) character is used to raise something, and the underscore (_) is for lowering. How to use them is best shown by example:

<table>
<thead>
<tr>
<th>Powers</th>
<th>$x^{-n}$</th>
<th>$x^{n}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$x^{-2n}$</td>
<td>$x^{2n}$</td>
</tr>
<tr>
<td>Indices</td>
<td>$n_{i}$</td>
<td>$n_{ij}$</td>
</tr>
</tbody>
</table>

3 Roots

The typical square root can be achieved with \( \sqrt{x} \):

\[
\sqrt{x}
\]

Regardless of the size of root you want, you still use the \( \sqrt{} \) command, even if you want the cube-root. You simply pass an additional option to the command if you want to change the default behaviour. E.g., \( \sqrt[3]{8} \)

\[
\sqrt[3]{\frac{x^2}{4xy + \pi}}
\]

Note how the length and height of the root notation automatically resizes to the size of the equation within it.
4 Brackets

You may recall that you already have the ( ) [ ] symbols at your disposal, which should be more than adequate for most peoples' needs. So why the need for a dedicated section? Well, I think that can be shown by example:

\[
\left( \frac{x^2}{y^3} \right)
\]

(1)

As you can see, equation 1 looks odd, because the brackets do not scale to contain the entire fraction. What we wanted is illustrated in equation 2:

\[
\left( \frac{x^2}{y^3} \right)
\]

(2)

This was achieved using special bracket commands. You tell \LaTeX that you want a left bracket, rather than the literal '(' symbol, and then it will determine the appropriate size for it once it processes the internal contents.

<table>
<thead>
<tr>
<th>Left</th>
<th>Right</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>\left(</td>
<td>\right)</td>
<td>(...)</td>
</tr>
<tr>
<td>\left[</td>
<td>\right]</td>
<td>[...]</td>
</tr>
<tr>
<td>\left{</td>
<td>\right}</td>
<td>{...}</td>
</tr>
<tr>
<td>\left</td>
<td>\right</td>
<td></td>
</tr>
</tbody>
</table>