\LaTeX\ Workshop

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# Font Size

<table>
<thead>
<tr>
<th>Command</th>
<th>Nominal Point Size</th>
<th>Exact Point Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>\tiny</code></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><code>\scriptsize</code></td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td><code>\footnotesize</code></td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td><code>\small</code></td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td><code>\normalsize</code></td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><code>\large</code></td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td><code>\Large</code></td>
<td>14</td>
<td>14.40</td>
</tr>
<tr>
<td><code>\LARGE</code></td>
<td>18</td>
<td>17.28</td>
</tr>
<tr>
<td><code>\huge</code></td>
<td>20</td>
<td>20.74</td>
</tr>
<tr>
<td><code>\Huge</code></td>
<td>24</td>
<td>24.88</td>
</tr>
</tbody>
</table>
changing fontsize

hello
\begin{tiny}
wow
\end{tiny}

hello  wow
fonts

Italic \textit{words in italics} puts the words in the brackets in italics

Slanted \textsl{words to be slanted} puts a few words in slanted type.

Small Capitals \textsc{words to be in small capitals} puts the words in the brackets in small capitals

Bold \textbf{words to be in bold} puts the words in brackets in bold

Sans-serif \textsf{words to be in sans-serif} puts the words into sans-serif type

Monospace \texttt{words to be in monospace} puts a few words in typewriter type

Emphasis \texttt{\emph{word}} italicizes word(s). When the surrounding text is in italics, \LaTeX{} knows to read \texttt{words} as emphasized and so it will unitalicize words when used within surrounding text already in italics.

Monospace \texttt{\tt words} Monospaces all words within the curly braces.

Italics \texttt{\it words} Italicizes all words within the curly braces.

Hello \textbf{wow}

Hello \texttt{wow}
math mode

$ \text{ initiates the math mode}$

$[ \text{ initiates a math mode (centered with displaystyle)}$
\]

$\text{ turns off this mode}$

$\text{If } \ f(x_1,x_2) = 3x_1 + 9x_2 + 7$ $\text{and } \ g(x) = x_1 + 4 \text{ then}$

$\ [ \text{ } f(x) + g(x) = 4x_1 + 9x_2 + 11 \ [ ]$

$\text{and}$

$\ [ \text{ } f(x)g(x) = 3x_1^2 + 9x_1x_2 + 19x_1 + 28. \ [ ]$

$(\text{Here the character } ^{\text} \text{ is used to obtain a superscript.})$
If \( f(x_1, x_2) = 3x_1 + 9x_2 + 7 \) and \( g(x) = x_1 + 4 \) then

\[
f(x) + g(x) = 4x_1 + 9x_2 + 11
\]

and

\[
f(x)g(x) = 3x_1^2 + 9x_1x_2 + 19x_1 + 28.
\]

you can also use $$ for both \[ and \]

For example $$f(x)=3x+5$$ produces

\[
f(x) = 3x + 1
\]
\LaTeX provides facilities for the automatic numbering of displayed equations. If you want an numbered equation then you use \begin{equation} \text{and} \end{equation} instead of using \[ \text{and} \]
Thus

If \( f(x_1, x_2) = 3x_1 + 9x_2 + 7 \) and \( g(x) = x_1 + 4 \) then
\begin{equation}
   f(x) + g(x) = 4x_1 + 9x_2 + 11
\end{equation}
and
\begin{equation}
   f(x)g(x) = 3x_1^2 + 9x_1x_2 + 19x_1 + 28.
\end{equation}
If $f(x_1, x_2) = 3x_1 + 9x_2 + 7$ and $g(x) = x_1 + 4$ then

$$f(x) + g(x) = 4x_1 + 9x_2 + 11 \tag{1}$$

and

$$f(x)g(x) = 3x_1^2 + 9x_1x_2 + 19x_1 + 28. \tag{2}$$
\[ ds^2 = dx_1^2 + dx_2^2 + dx_3^2 - c^2 dt^2 \]

\[ ds^2 = dx_1^2 + dx_2^2 + dx_3^2 - c^2 dt^2 \]
Labeling and references

If $f(x_1,x_2) = 3x_1 + 9x_2 + 7$ and $g(x) = x_1 + 4$ then
\begin{equation}
\label{one}
f(x) + g(x) = 4x_1 + 9x_2 + 11
\end{equation}
and
\begin{equation}
\label{two}
f(x)g(x) = 3x_1^2 + 9x_1x_2 + 19x_1 + 28.
\end{equation}

In Eq(\ref{one}) we see.....rather than in Eq. (\ref{two}).....
If \( f(x_1, x_2) = 3x_1 + 9x_2 + 7 \) and \( g(x) = x_1 + 4 \) then

\[
f(x) + g(x) = 4x_1 + 9x_2 + 11 \tag{3}
\]

and

\[
f(x)g(x) = 3x_1^2 + 9x_1x_2 + 19x_1 + 28. \tag{4}
\]

In Eq\((3)\) we see.....rather than in Eq. \((4)\).....
Note some of the mathematics representation will depend on the math mode you are in just math mode or math mode displaystyle.

For example the geometric series

\[
\sum_{i=0}^{\infty} \frac{1}{x^k} = \frac{1}{1-x}
\]

\[
\sum_{i=0}^{\infty} \frac{1}{x^k} = \frac{1}{1-x}
\]
we can achieve math mode displaystyle without a new line and centering using \displaystyle

\$\displaystyle\sum_{i=0}^{\infty}\frac{1}{x^k}= \frac{1}{1-x}\$

He was soon disturbed by Lord Cornwallis, who, early on the morning of the 20th of November, 1776 crossed the Hudson from Dobb’s Ferry to Closter’s Landing, five miles above Fort Lee, \[ \sum_{i=0}^{\infty} \frac{1}{x^k} = \frac{1}{1-x} \] and with artillery climbed a steep, rocky road to the top of the Palisades, unobserved by Greene. That officer was told of his danger by a farmer, who awoke him from slumber.
If $h \leq \frac{1}{2} |\zeta - z|$ then
\[ |\zeta - z - h| \geq \frac{1}{2} |\zeta - z|\]
and hence
\[
\begin{eqnarray*}
\left| \frac{1}{\zeta - z - h} - \frac{1}{\zeta - z} \right| & = & \left| \frac{(\zeta - z) - (\zeta - z - h)}{(\zeta - z - h)(\zeta - z)} \right| \\
& = & \left| \frac{h}{(\zeta - z - h)(\zeta - z)} \right| \\
& \leq & \frac{2|h|}{|\zeta - z|^2}.
\end{eqnarray*}
\]

If $h \leq \frac{1}{2} |\zeta - z|$ then

$$|\zeta - z - h| \geq \frac{1}{2} |\zeta - z|$$

and hence

\[
\left| \frac{1}{\zeta - z - h} - \frac{1}{\zeta - z} \right| = \left| \frac{(\zeta - z) - (\zeta - z - h)}{(\zeta - z - h)(\zeta - z)} \right| \\
= \left| \frac{h}{(\zeta - z - h)(\zeta - z)} \right| \\
\leq \frac{2|h|}{|\zeta - z|^2}.
\]
If $h \leq \frac{1}{2} |\zeta - z|$ then

\[ |\zeta - z - h| \geq \frac{1}{2} |\zeta - z| \]

and hence

\[
\begin{eqnarray}
& & \left| \frac{1}{\zeta - z - h} - \frac{1}{\zeta - z} \right| \\
& = & \left| \frac{(\zeta - z) - (\zeta - z - h)}{(\zeta - z - h)(\zeta - z)} \right| \\
& \leq & \frac{2 |h|}{|\zeta - z|^2}.
\end{eqnarray}
\]

If $h \leq \frac{1}{2} |\zeta - z|$ then

\[ |\zeta - z - h| \geq \frac{1}{2} |\zeta - z| \]

and hence

\[
\begin{align}
\left| \frac{1}{\zeta - z - h} - \frac{1}{\zeta - z} \right| &= \left| \frac{(\zeta - z) - (\zeta - z - h)}{(\zeta - z - h)(\zeta - z)} \right| \\
&= \left| \frac{h}{(\zeta - z - h)(\zeta - z)} \right| \\
&\leq \frac{2|h|}{|\zeta - z|^2}.
\end{align}
\]
Let $\mathbf{u}, \mathbf{v}$ and $\mathbf{w}$ be three vectors in $\mathbb{R}^3$. The volume $V$ of the parallelepiped with corners at the points $\mathbf{0}$, $\mathbf{u}$, $\mathbf{v}$, $\mathbf{w}$, $\mathbf{u} + \mathbf{v}$, $\mathbf{u} + \mathbf{w}$, $\mathbf{v} + \mathbf{w}$ and $\mathbf{u} + \mathbf{v} + \mathbf{w}$ is given by the formula

\[ V = (\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}. \]
This passage is produced by the following input:

\begin{verbatim}
\textbf{array}

The \textit{characteristic polynomial} $\chi(\lambda)$ of the $3 \times 3$-matrix

$$\left(\begin{array}{ccc}
a & b & c \\
d & e & f \\
g & h & i \end{array}\right)$$

is given by the formula

$$\chi(\lambda) = \left| \begin{array}{ccc}
\lambda - a & -b & -c \\
-d & \lambda - e & -f \\
-g & -h & \lambda - i \end{array} \right|.$$  
\end{verbatim}
The characteristic polynomial $\chi(\lambda)$ of the $3 \times 3$ matrix

$$
\begin{pmatrix}
a & b & c \\
d & e & f \\
g & h & i \\
\end{pmatrix}
$$

is given by the formula

$$
\chi(\lambda) = \begin{vmatrix} 
\lambda - a & -b & -c \\
-d & \lambda - e & -f \\
-g & -h & \lambda - i \\
\end{vmatrix}.
$$
note the use of \texttt{\textbackslash left} and \texttt{\textbackslash right} to produce the large delimiters around the arrays. As we have already seen, if we use \texttt{\textbackslash left( ... \textbackslash right)} then the size of the parentheses is chosen to match the subformula that they enclose.

Next note the use of the alignment tab character \& to separate the entries of the matrix and the use of }\texttt{\textbackslash \} to separate the rows of the matrix, exactly as in the construction of multiline formulae described above.

We begin the array with \texttt{\textbackslash begin\{array\}} and end it with \texttt{\textbackslash end\{array\}}.

The only thing left to explain is \texttt{\{ccc\}} which occurs immediately after \texttt{\textbackslash begin\{array\}}.

Now each of the c’s in \texttt{\{ccc\}} represents a column of the matrix and indicates that the entries of the column should be centered.

If the c were replaced by l then the corresponding column would be typeset with all the entries left-justified, and r would produce a column with all entries right-justified.
Thus

\[
\begin{array}{lcr}
\mbox{First number} & x & 8 \\
\mbox{Second number} & y & 15 \\
\mbox{Sum} & x + y & 23 \\
\mbox{Difference} & x - y & -7 \\
\mbox{Product} & xy & 120
\end{array}
\]
produces

<table>
<thead>
<tr>
<th>Description</th>
<th>Expression</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>First number</td>
<td>$x$</td>
<td>8</td>
</tr>
<tr>
<td>Second number</td>
<td>$y$</td>
<td>15</td>
</tr>
<tr>
<td>Sum</td>
<td>$x + y$</td>
<td>23</td>
</tr>
<tr>
<td>Difference</td>
<td>$x - y$</td>
<td>-7</td>
</tr>
<tr>
<td>Product</td>
<td>$xy$</td>
<td>120</td>
</tr>
</tbody>
</table>
We can use the array environment to produce formulae such as

\[
|x| = \left\{ \begin{array}{ll}
x & \text{if } x \geq 0; \\
-x & \text{if } x < 0.
\end{array} \right.
\]

\[
|x| = \left\{ \begin{array}{ll}
x & \text{if } x \geq 0; \\
-x & \text{if } x < 0.
\end{array} \right.
\]
tablular

The first five International Congresses of Mathematicians were held in the following cities:
\begin{quote}
\begin{tabular}{lll}
Chicago&U.S.A.&1893\ \ \\
Z"{u}rich&Switzerland&1897\ \\
Paris&France&1900\ \\
Heidelberg&Germany&1904\ \\
Rome&Italy&1908
\end{tabular}
\end{quote}
\end{quote}
The first five International Congresses of Mathematicians were held in the following cities:

- Chicago, U.S.A., 1893
- Zürich, Switzerland, 1897
- Paris, France, 1900
- Heidelberg, Germany, 1904
- Rome, Italy, 1908
In a tabular environment, the format specification after 
\begin{tabular}
should consist of one or more of the following, enclosed within braces and :

l specifies a column of left-justified text
c specifies a column of centered text
r specifies a column of right-justified text
p{width} specifies a left-justified column of the given width
| inserts a vertical line between columns
@{text} inserts the given text between columns
Table 1: Performance at peak F-measure

\begin{table}[h]
\caption{Performance at peak F-measure}
\begin{tabular}{| r | r || c | c | c |}
\hline
2 & 2 & 3 & 4 & 5 \\
\hline
2 & 2 & 3 & 4 & 5 \\
\hline
2 & 2 & 3 & 4 & 5 \\
\hline
\end{tabular}
\end{table}

Theorem Environments

In \LaTeX{}, one can create ‘environments’ for statements of theorems, lemmas, propositions, corollaries, etc., and also for proofs, definitions, examples and remarks. These can be established using appropriate \texttt{\newtheorem} and \texttt{\newenvironment} commands: these commands are best included in the \LaTeX{} input file before \texttt{\begin{document}}.

The following code will create theorem, lemma, proposition, corollary, proof, definition, example and remark environments, together with a control sequence \texttt{\qed} which produces ‘tombstones’ for the ends of proofs:
\newtheorem{theorem}{Theorem}[subsection]
\newtheorem{lemma}{Theorem}[Lemma]
\newtheorem{proposition}{Theorem}[Proposition]
\newtheorem{corollary}{Theorem}[Corollary]

\newenvironment{proof}{\noindent\bf Proof.}{\hspace*{\fill} \Box}
\begin{theorem}
In Euclidean Geometry, for any triangle the sum of the three angles is $180^\circ$.
\end{theorem}

\begin{proposition}
This is a proposition.
\end{proposition}

\begin{proof}
This is my proof, my brain hurts so I will stop, but the theorem is correct anyway.
\end{proof}
Theorem 0.0.1. In Euclidean Geometry, for any triangle the sum of the three angles is 180°

Proposition 0.1. This is a proposition

Proof. This is my proof, my brain hurts so I will stop, but the e Theorem is correct anyway

□