Environments:

An environment in \LaTeX{} is a way to make specialized paragraphs. That is, you can make paragraphs that hold mathematics like arrays or equation arrays which you saw in the last \TeXnique{} or you can make paragraphs that hold quotations and even poetry although I have no idea why someone would write poetry in \LaTeX{}. A list of environments can be found on the \LaTeX{}2e help system. They can also be found throughout the on-line \LaTeX{} manual but a short description starts on page 26. For a listing you should go to page 82 of the index. We will not look at all of the environments available in \LaTeX{} but we will look those that will probably be the most useful to you. First of all environments all have the same syntax,

\begin{environment-name}
< environment body (usually text or mathematics) >
\end{environment-name}

Centering Text, the center Environment:

\begin{center}
This paragraph is centered.
\end{center}

produces

This paragraph is centered.

Lists, the enumerate Environment:

\begin{enumerate}
\item This is the first item.
\item This is the second item.
\item This is the third item.
\end{enumerate}

produces

1. This is the first item.
2. This is the second item.
3. This is the third item.
1. This is the first item.
   (a) This is the first subitem.
   (b) This is the second subitem.

2. This is the second item.
   (a) This is the first subitem.
   (b) This is the second subitem.
   (c) This is the third subitem.

3. This is the third item.
   (a) This is the first subitem.
   (b) This is the second subitem.

and

\begin{enumerate}
\item This is the first item.
\begin{enumerate}
\item This is the first subitem.
\begin{enumerate}
\item This is the first subsubitem.
\item This is the second subsubitem.
\end{enumerate}
\end{enumerate}
\item This is the second subitem.
\begin{enumerate}
\item This is the first subitem.
\begin{enumerate}
\item This is the first subsubitem.
\item This is the second subsubitem.
\end{enumerate}
\end{enumerate}
\end{enumerate}
1. This is the first item.
   
   (a) This is the first subitem.
       
       i. This is the first subsubitem.
       
       ii. This is the second subsubitem.
   
   (b) This is the second subitem.
   
2. This is the second item.
   
   (a) This is the first subitem.
   
   (b) This is the second subitem.
       
       i. This is the first subsubitem.
       
       ii. This is the second subsubitem.
       
       A. This is the first subsubsubitem.
       
       B. This is the second subsubsubitem.
   
   (c) This is the third subitem.
   
3. This is the third item.
(a) This is the first subitem.
(b) This is the second subitem.

but I digress.

More Lists, the itemize Environment:

\begin{itemize}
\item This is the first item.
\item This is the second item.
\item This is the third item.
\end{itemize}

produces

• This is the first item.
• This is the second item.
• This is the third item.

\begin{itemize}
\item This is the first item.
\begin{itemize}
\item This is the first subitem.
\item This is the second subitem.
\end{itemize}
\item This is the second item.
\begin{itemize}
\item This is the first subitem.
\item This is the second subitem.
\item This is the third subitem.
\end{itemize}
\item This is the third item.
\begin{enumerate}
\item This is the first subitem.
\item This is the second subitem.
\end{enumerate}
\end{itemize}

produces

• This is the first item.
  – This is the first subitem.
  – This is the second subitem.
• This is the second item.
  – This is the first subitem.
  – This is the second subitem.
  – This is the third subitem.

• This is the third item.
  – This is the first subitem.
  – This is the second subitem.

and

\begin{itemize}
  \item This is the first item.
  \begin{itemize}
    \item This is the first subitem.
    \begin{itemize}
      \item This is the first subsubitem.
      \item This is the second subsubitem.
    \end{itemize}
    \item This is the second subitem.
  \end{itemize}
  \item This is the second item.
  \begin{itemize}
    \item This is the first subitem.
    \begin{itemize}
      \item This is the first subsubitem.
      \item This is the second subsubitem.
    \end{itemize}
    \item This is the second subitem.
  \end{itemize}
  \item This is the third item.
  \begin{itemize}
    \item This is the first subitem.
    \begin{itemize}
      \item This is the first subsubitem.
      \item This is the second subsubitem.
    \end{itemize}
    \item This is the second subitem.
  \end{itemize}
\end{itemize}

produces
• This is the first item.
  – This is the first subitem.
    * This is the first subsubitem.
    * This is the second subsubitem.
  – This is the second subitem.

• This is the second item.
  – This is the first subitem.
  – This is the second subitem.
    * This is the first subsubitem.
    * This is the second subsubitem.
      · This is the first subsubsubitem.
      · This is the second subsubsubitem.
  – This is the third subitem.

• This is the third item.
  – This is the first subitem.
  – This is the second subitem.

but I digress, again.

Of course you can combine these:

\begin{itemize}
\item This is the first item.
\begin{enumerate}
\item This is the first subitem.
\begin{itemize}
\item This is the first subsubitem.
\end{itemize}
\item This is the second subitem.
\begin{itemize}
\item This is the second subsubitem.
\end{itemize}
\end{enumerate}
\item This is the second item.
\begin{enumerate}
\item This is the first subitem.
\begin{itemize}
\item This is the second subitem.
\end{itemize}
\end{enumerate}
\item This is the third item.
\begin{enumerate}
\item This is the first subitem.
\begin{itemize}
\item This is the second subitem.
\end{itemize}
\end{enumerate}
\end{itemize}
This is the first item.

1. This is the first subitem.
   – This is the first subsubitem.
   – This is the second subsubitem.

2. This is the second subitem.

This is the second item.

– This is the first subitem.
– This is the second subitem.

1. This is the first subsubitem.
2. This is the second subsubitem.
   (a) This is the first subsubsubitem.
   (b) This is the second subsubsubitem.

– This is the third subitem.

This is the third item.

– This is the first subitem.
– This is the second subitem.

Even More Lists, the description Environment:

\begin{description}
\item [Integer] --- any number from the set $\{ 0, \pm 1, \pm 2, \ldots \}$.
\item [Rational] --- any number of the form $\frac{a}{b}$ where $a$ and $b$ are integers with $b \neq 0$.
\item [Group] --- Let $G$ be a nonempty set together with a binary operation (usually called multiplication) that assigns to each pair...
$(a,b)$ of elements of $G$ an element of $G$ denoted $ab$. We say $G$ is a \emph{group} under this operation if the following three properties are satisfied.

\begin{enumerate}
\item \emph{Associativity.} The operation is associative; that is, $(ab)c = a(bc)$ for all $a, b, c$ in $G$.
\item \emph{Identity.} There is an element $e$ (called the \emph{identity}) in $G$ such that $ae = ea = a$ for all $a$ in $G$.
\item \emph{Inverses.} For each element $a$ in $G$, there is an element $b$ in $G$ (called an \emph{inverse} of $a$) such that $ab = ba = e$.
\end{enumerate}

produces

\begin{description}
\item[Integer] — any number from the set \{0, \pm 1, \pm 2, \ldots \}.
\item[Rational] — any number of the form $\frac{a}{b}$ where $a$ and $b$ are integers with $b \neq 0$.
\item[Group] — Let $G$ be a nonempty set together with a binary operation (usually called multiplication) that assigns to each pair $(a, b)$ of elements of $G$ an element of $G$ denoted $ab$. We say $G$ is a \emph{group} under this operation if the following three properties are satisfied.
\begin{enumerate}
\item \emph{Associativity.} The operation is associative; that is, $(ab)c = a(bc)$ for all $a, b, c$ in $G$.
\item \emph{Identity.} There is an element $e$ (called the \emph{identity}) in $G$ such that $ae = ea = a$ for all $a$ in $G$.
\item \emph{Inverses.} For each element $a$ in $G$, there is an element $b$ in $G$ (called an \emph{inverse} of $a$) such that $ab = ba = e$.
\end{enumerate}
\end{description}

Figures, the figure Environment:

\begin{figure}[htbp]
The body of the figure would go here.
\caption{Not really a figure, more like text.}
\end{figure}

produces

The body of the figure would go here.

\begin{figure}
\centering
\caption{Not really a figure, more like text.}
\end{figure}

The figure environment, as with a few others, are floating environments. This means that if there is not enough room for the figure’s contents, \LaTeX will automatically move it to another position. The optional placement argument (in \{\}) determines where \LaTeX will try to place your figure. There are four places where \LaTeX can possibly put a float:
The body of the second figure. This figure was placed before the sentence. “The optional placement argument (in \[]) determines where \LaTeX{} will try to place your figure.” above.

Figure 2: Look where I am.

1. h — (Here) at the position in the text where the figure environment appears.
2. t — (Top) at the top of a text page.
3. b — (Bottom) at the bottom of a text page.
4. p — (Page of floats) on a separate float page, which is a page containing no text, only floats.

\LaTeX{} will try to place the figure in your order of preference. That is, the list [htbp] means place the figure here if there is enough room, like it did with Figure 1. If there is not enough room, place it at the top of a text page (usually the next page), as it did with Figure 2. If there is not enough room for that, place it at the bottom of a text page (usually the next page). Finally, if there is not enough room for any of those place the figure on a page that contains only floating structures (like figures).

Tables, the tabular Environment:

There are several environments that can be used for making tables, one of the easier ones to set up is the tabular environment. With this environment we select a layout by columns. We use an l for a column of left-justify the text, r for right-justified text, c for centered text and — for a vertical line. There is another tag, pwidth, for a column containing justified text with line breaks. To place a horizontal line in the table we use the command \hline. When you are creating your table, place & between the entries of the table (just like arrays and equation arrays). Also place \ at the end of each line. For example,

\begin{tabular}{|r|l|}
\hline
7C0 & hexadecimal \\
3700 & octal \\
11111000000 & binary \\
\hline
1984 & decimal \\
\hline
\end{tabular}

produces

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7C0</td>
<td>hexadecimal</td>
</tr>
<tr>
<td>3700</td>
<td>octal</td>
</tr>
<tr>
<td>11111000000</td>
<td>binary</td>
</tr>
<tr>
<td>1984</td>
<td>decimal</td>
</tr>
</tbody>
</table>
There are a couple other tags that can be used in the tabular environment. The two we will look at are @{\cdot} and \multicolumn. The @{\cdot} is used in the layout portion of the table and it is used to put a specific character or symbol as the divider between the two columns. It would be used in place of the vertical line, but unlike the vertical line it kills the inner-column spacing. For example,

\begin{tabular}{c | c @{$\vdots$} c}
\hline
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 & 9 \\
\hline
\end{tabular}

produces

<table>
<thead>
<tr>
<th>1</th>
<th>2:3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5:6</td>
</tr>
<tr>
<td>7</td>
<td>8:9</td>
</tr>
</tbody>
</table>

The \multicolumn command is used to merge columns together. For example,

\begin{tabular}{c r @{$\cdot$} l}
Pi expression & \multicolumn{2}{c}{Value} \\
\hline
$\pi$ & 3&1416 \\
$\pi^\pi$ & 36&46 \\
$(\pi^\pi)^\pi$ & 80662&7 \\
\hline
\end{tabular}

produces

<table>
<thead>
<tr>
<th>Pi expression</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\pi$</td>
<td>3.1416</td>
</tr>
<tr>
<td>$\pi^\pi$</td>
<td>36.46</td>
</tr>
<tr>
<td>$(\pi^\pi)^\pi$</td>
<td>80662.7</td>
</tr>
</tbody>
</table>

Notice how the heading Value is centered over two columns of the table.

**A Few Miscellaneous \LaTeX Things:**

**Dashes:**

There are four types of dashes in \LaTeX. The hyphen, numeric range dash, em-dash and the negative sign. The hyphen is done with a single -, the numeric range dash is done with two --, em-dash with three ---, and the negative sign is done with one and is printed only in math mode. For example,
Quotation Marks:

Quotation marks are a little different in \LaTeX you must specify which way they go. For a single quote you must use the graves quote to begin the quote and a regular single quote to end. The graves quote is below the tilde in the upper left of the keyboard. For example, ‘This is a quote.’ produces ‘This is a quote.’ Double quotations are done using two single quotes. Again the graves quotes start and the regular ones finish. For example, ‘‘This is a quote.’’ produces “This is a quote.”

Dots, Dots and More Dots:

In math mode we have vertical dots, horizontal dots (both low and middle) and diagonal dots. The lower horizontal dots can also be used outside of math mode. For example,

\[
\begin{array}{cccc}
  a_{11} & a_{12} & \cdots & a_{1n} \\
  a_{21} & a_{22} & \cdots & a_{2n} \\
  \vdots & \vdots & \ddots & \vdots \\
  a_{m1} & a_{m2} & \cdots & a_{mn} \\
\end{array}
\]

\[
\begin{array}{cccc}
  a_{11} & a_{12} & \cdots & a_{1n} \\
  a_{21} & a_{22} & \cdots & a_{2n} \\
  \vdots & \vdots & \ddots & \vdots \\
  a_{m1} & a_{m2} & \cdots & a_{mn} \\
\end{array}
\]

\[
\begin{array}{cccc}
  a_{11} & a_{12} & \cdots & a_{1n} \\
  a_{21} & a_{22} & \cdots & a_{2n} \\
  \vdots & \vdots & \ddots & \vdots \\
  a_{m1} & a_{m2} & \cdots & a_{mn} \\
\end{array}
\]
produces

\[
\begin{bmatrix}
a_{11} & a_{12} & \cdots & a_{1n} \\
a_{21} & a_{22} & \cdots & a_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
a_{m1} & a_{m2} & \cdots & a_{mn}
\end{bmatrix}
\]

and

and so on \ldots

produces

and so on . . .

**Footnotes:**

Footnotes are easy\footnote{The last footnote was produced by}

Footnotes are easy\footnote{They are practically automatic!}

Note that the footnote number is produced automatically as well as the line and footnote at the bottom of the page.

\footnote{They are practically automatic!}