

## Building Pictures in L<sup>A</sup>T<sub>E</sub>X

Simple pictures are quite easy to assemble in L<sup>A</sup>T<sub>E</sub>X, and have the advantage of making the document more portable than if separate files need to be imported.

A picture is built on a grid of integer coordinates. If you would like your grid to have position (0,0) at the bottom left and position (100,100) at the top right, then the picture environment is defined within:

```
\begin{picture}(100,100)(0,0) ... \end{picture}
```

The main command that you will use within the picture environment is the `\put(X,Y){ object }` command. This will put the specified object at position (X,Y) on the grid.

Here are examples of some basic objects that you can “put” in a picture.

- Text or a math expression will be placed with the bottom left corner of its bounding box at the “put position”
- `\line(a,b){L}`  
This creates a line beginning at the “put position”, with over:up ratio a:b, and with horizontal length L. (If the line is vertical, then use the vertical measure.)
- `\vector(a,b){L}`  
Same as a line, but with an arrow at the end.
- `\circle{R}`  
Creates a circle with radius R at the “put position”.
- `\circle*{R}`  
Fills in the circle.

Another handy command is `\multiput(X,Y)(dX,dY){n}{ object }`. This puts n identical objects in the picture, the first put at (X,Y) and each subsequent one displaced by (dX,dY).

To scale the size of the picture by a factor of N, use the command

```
\setlength{\unitlength}{N pt}
```

before the picture, then rescale afterwards.

For example, the following code...

```
\setlength{\unitlength}{1.3 pt}
\begin{picture}(100,100)(0,0)
\put(0,10){\vector(1,0){100}} %
\put(10,0){\vector(0,1){100}} %
\multiput(20,8)(10,0){8}{\line(0,1){4}} %
\multiput(8,20)(0,10){8}{\line(1,0){4}} %
\put(30,20){\circle*{4}} %
\put(80,40){\circle*{4}} %
\put(40,80){\circle*{4}} %
\put(30,20){\line(5,2){50}} %
\put(80,40){\line(-1,1){40}} %
\put(40,80){\line(-1,-6){10}} %
\put(58,2){\$$} %
\put(2,58){\$$} %
\put(95,12){\x$} %
\put(12,95){\y$} %
\end{picture}
\setlength{\unitlength}{1 pt}
```

...produces the following picture:

