graphs it creates directly on worksheets. Second, for all its advanced functionality, *Wingz* contains sloppy implementations of several features. Therein lies the crux of the issue. Do you want added features, or a (subjectively) more comfortable work experience?

Both programs are installed for you by *Windows* in typically easy routines, and occupy about 1.5 megabytes of disk space. *Excel*, however, because it was written for earlier *Windows* implementations and has only been updated (so far) for *Windows 3.0* memory compliance, stops short of putting a program icon in one of your program groups. Documentation is similar, as well. The thick, alphabetically arranged reference manuals are probably all you'll need once you learn the basics, accomplished via an on-line tutorial in *Excel*, and by following examples in the "user's guide" that accompanies *Wingz*. A volume devoted to the two programs' powerful macro languages is included with each, and *Excel* also includes a sturdy template for the *1-2-3*-mimicking function key assignments, plus a getting started/quick reference booklet, while *Wingz* comes with a reference card for navigation; the program virtually ignores function keys. We give the nod for clarity to *Excel*, in spite of the differences between operations under prior versions of *Windows* (for which its books were written) and the current one. Even in the tutorial, *Wingz*'s is full of prose such as this: "To enter numbers into your worksheet, select the cell or range of cells that you want to use for the numeric data. To enter a positive number, simply type the number and press <Enter>, <Shift/Enter>, <Tab>, <Shift-Tab>, <Up>, <Down>, <Right>, <Left>, click the accept entry icon, or click the mouse on the worksheet." **Got that?**

Wingz's packaging is a bit quirky, using a box much larger than necessary, and excluding sleeves for the cellophane-wrapped program diskettes. These oddities are more then compensated for by a most welcome occurrence: if you ever migrate to OS/2, the upgrade is even better then free; disks for that operating system are included in the package. ***BRAVO!*** The practice of expecting users to buy a new program, even when presented as a relatively inexpensive upgrade, is unconscionable, and hopefully Informix Software starts a new trend with the move here.

The advantages of using a *Windows*-based spreadsheet over one that is character-based are present in both products. Actions such as resizing the width of a column are reduced to simple point, drag, and click operations, and graphs are created by highlighting the appropriate data ranges (also point and click), and issuing the "graph" command. In *Excel*, this is done by creating a new graph file, and *Wingz* does it by selecting the graph icon and pointing to the spot on the worksheet where you want to place the graph. *1-2-3*-entrenched users, take a look at this.

Excel uses a 256 column by 16,384 row matrix, for a total potential data space of 4.1 million cells. *Wingz* provides 32,768 by 32,768 (over one billion). Sound impressive, but there aren't too many PCs capable of loading and working on a document of either size, so the advantage is immaterial. Both can perform recalculations either automatically or on command, but *Excel* beats *Wingz* in one very important regard: Switching away from *Excel* to work in other programs during the number crunching is virtually instantaneous, while internal workings of *Wingz* delay execution of a switch command considerably. In one of our tests, a delay of nearly twenty seconds was encountered.

Printing with either program yielded similar results in terms of time and quality of output, but this is determined more by *Window*'s Print Manager then by features internal to the spreadsheets. In a byte for byte comparison, however, *Wingz* wins out, because the files it creates are only about half the size of those from *Excel*, and are processed more quickly. Database features are similar, as well, but the nod here goes to *Excel* for it's form based entry and query-by-example (QBE) abilities. Miscellaneous niceties found in both include file and data protection features such as passwords and assignment of read-only status, the ability to create notes that explain the basis of your work (although the methods of implementation are very different), and usually bi-directional data exchange abilities with a range of other spreadsheets, ASCII file formats, and in *Excel* only, facilities for transfer of information to and from *dBASE II* or *III* files.

Wingz has a few features not found in *Excel*. You can have *Wingz* automatically save your work for you after one to 999 minutes (yup, over sixteen hours), and inputting dates to worksheets is smarter in *Wingz*; it automatically recognizes date text that is spelled out alphabetically, as well as the numeric formats understood by *Excel*. Then, there's graphing. While both programs do admirable jobs of displaying many variations of business-style chart formats, only *Wingz* includes support of scientific layouts such as two and three-dimensional polar, contour, surface, and wireframe. *Wingz* also includes drawing and object-manipulating tools for further customization. Compared to those found in programs designed specifically for such purposes they're primitive, but this is a spreadsheet, remember?

There are two questions to answer here. Is a *Windows* spreadsheet inherently better then one running under character based DOS, and which of the *Windows* choices is superior to the other. To the first question, we respond with an emphatic yes. Easier formatting and publishing capabilities, and a much higher (memory-based rather than program-