Texcad32 Version 4.3

Peter Furlan

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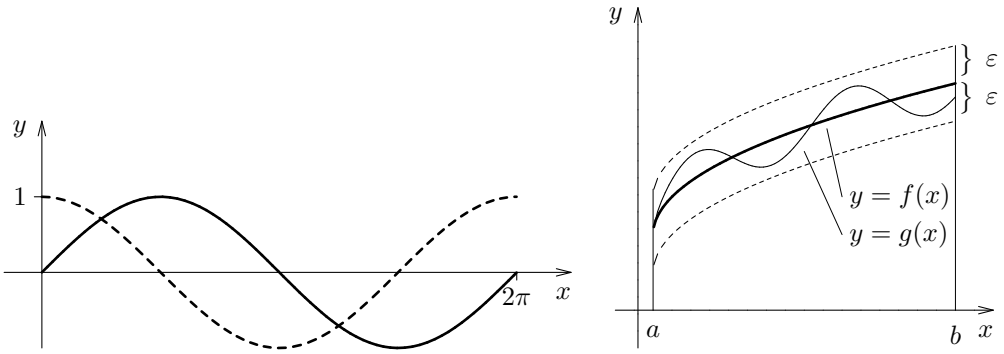
`www.das-gelbe-rechenbuch.de/Texcad32`

1 Introduction

1.1 What's all about?

TeXCad32 is a clone of the DOS-program TeXCad of G. Horn and J. Winkelmann. It helps in the making of mathematical pictures with LaTeX.

Texcad32 is a tool to make pictures like the following ones in short time.



1.2 What one needs

TeXCad32 runs under windows from Win95 – better on faster computers, but you can use a slow ones, too, if you have some time.

In case of colored pictures `color.sty` has to be present.

For `postscript`-pictures of for `pdflatex` `ifpdf.sty` has to be present, for `pdflatex` in addition `graphics.sty` or `graphicx.sty`.

1.3 What's the result?

These types of files can be created:

`.tcs` This filetype contains all data form the drawing and is used to save the drawings.

`.tec` This is in basically the `.pic`-format of the original texcad-version. Because Quicktime steals this extension each time it it started, the wiser one gives in. The picture consist of a `\begin{picture} ... \end{picture}` environment with EmTeX-specials. These are recognised from all established dvi-viewers like DVIWIN, Yap (from the Miktex distribution) and dviscr (from the EmTeX distribution). The pictures can be read in simply with `\input{file.tec}`.

`.tcp` These files contain a `\begin{picture} ...\end{picture}` environment that contains text commands and an `\input` command that reads the `.ps`-file in the LaTeX case and the `.pdf`-file in the `pdflatex` case.

`.ps` All line elements and cirles in postscript. This filetype is saved together with the `.tcp`-file.

`.dvi`-files with pictures can be converted with `dvips` to postscript, and then into pdf. The `-Ppdf` option should be used in this step.

A alternative method for producing `pdf` is to convert the `.ps` picture files with `ps2pdf` into `pdf`. Then compile the document with `pdflatex`. In this case in the `tcp`-file automatically the `pdf`-picture is read (instead of the `ps`-picture).

1.4 What not?

This is not a complete manual for TeXCad32. Some reasons are:

i) actually I wrote this program for myself

ii) If you make mathematical pictures with TeX you have to be a little cute

iii) the program is not yet finished (and will never be)

1.5 How to start?

Best: start the program and try out. Alternatively follow the example at the end of this manual.

2 The symbol bar

The left part of the symbol bar contains commands for drawing, the middle part for color and linethickness, and the right part for editing.

2.1 Upper left: Drawing of simple objects

In this group are the standard (em)TEXelements:

Lines

Circles up to 27mm (≈ 1 in) of diameter

Filled circles up to 6mm (≈ $\frac{1}{4}$in)of diameter

Text will be placed with alignment (in a `\makebox` environment)

2.2 Lower left: Drawing of composed objects

This second group composes the drawing out of many little dashes. This is done by the curve drawing machinery (explained later). The advantage is that one cannot only draw solid lines but patterns, too. Moreover parts of the objects may be deleted.

The pattern and drawing controls (which are activated only in this modes) are explained in the section about curves.

Straight lines

These lines are (like the circles) generated by the curve drawing machinery.

Circles of any size

If only a part of the circle is used, this is tunable in degree and in radian.

Arrows

The parameters may be changed in the options menu.

Curves. Look below.

2.3 The middle

Color The current color can be changed by clicking.

Snap If snap is active a points can only be choosen if the coordinates are divisible by the snap factor without remainder.

Linenwidth Choose the linewidth. The widths for the screen and export can be changed in the options menu.

The width 'invisible' is included for future expansions (border of areas). Dashes in pattern that are not drawn are invisible. Invisible dashes are drawn in brown.

2.4 Right part of the symbol bar: editing

Delete
Delete picked objects.

Text edit
The nearest text is chosen.

Move
Move picked objects. The displacement is determined by clicking start- and endpoint.

Pick
Pick elements.

If you click in this mode, all elements with one end (or, in case of circles, the center) near to the point are questioned by coloring them green. You accept by clicking left and you refuse by clicking right. What is 'near' can be tuned in the options menu.

Picked elements are in violet.

Pick area
All elements in this area will be picked.

Unpick

This is rarely used because the ESC-key does the same.

Zoom
Choose an area with the mouse and display it enlarged.

Unzoom
Undo last zoom.

Refresh
The drawing is refreshed.

Gotozero
While zooming it is possible to loose the orientation. This brings the origin back to the lower left corner.

3 Drawing curves

This is this the heart of the program. The idea is to draw on graph paper with the origin of the paper is the origin of the drawing. The scaling can be adjusted in the edit field `scale`. The given scale 10 means that a point with coordinates (x, y) has the coordinaates $(10x, 10y)$ in the drawing. Exporting this into a `.tec`- or `.ps`-file these values will be written into the file and will appear in the document multiplied by `\unitlength`.

3.1 Basics

The output is a set of parametrised curves $(x_n(t), y_n(t))$ for $t_{n,0} \le t \le t_{n,1}$ and $n_0 \le n \le n_1$. To plot simple graphs choose `n0` and `n1` be `1`, `x(t)` as `t` and `y` as a function of `t`.

The interpreter understands expressions with

Operators: +, -, *, /, ^

Functions: sin, cos, tan, cot, arcsin, arccos, arctan, arccot, sinh, cosh, tanh, coth, arsinh, arcosh, artanh, arcoth, exp, ln, lgt, sqrt, int, frac, abs

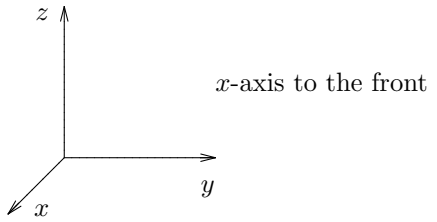
Constants: Integer- and real numbers in floating point or exponential form, (e.g. -5, 461.5 or -43.1e-12) and the predefined constants `pi` and `e`

Offset

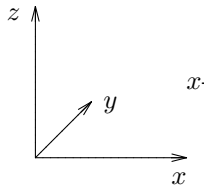
In the starting configuration the point $(0, 0)$ will be plotted at $(0, 0)$. With `x-offset` and `y-offset` this can be changed.

3D-Drawings

To plot three-dimensional objects it is possible to set a function for the z-coordinate by activating the appropriate switch. The result will be look like this (depending on the choosen direction of the x-axix):



x-axis to the front



x-axis to the right

The mapping from the point (x, y, z) to the plotted point (x', y') depends on whether the x-axis is to be drawn to the front or to the right:

$$x' = y - factor \cdot \cos\alpha \cdot x \qquad y' = z - factor \cdot \sin\alpha \cdot x \qquad \text{to the front}$$

$$x' = x + factor \cdot \cos\alpha \cdot y \qquad y' = z + factor \cdot \sin\alpha \cdot y \qquad \text{to the right}$$

Here $factor := 0.5$ and $\alpha = 42°$, so $\cos\alpha = 0.743$.

3.2 Scaling units

The numbers on the border are millimeters. In this size the picture will be included in a `picture`-environment into the TEX-document. This unit may be changed in the generated files with an editor by changing the line containing `\unitlength 1mm`. The postscript output has to be scaled accordingly.

In curve drawing it is assumed that a lenght unit corresponds to 10 millimeters. This is editable as `scale`.

3.3 Structure of the curves

The curves are assemblied out of single pieces. In this process four phases appear: in phase one and three elements are plotted, in phase two and four not. Each phase has a given value that corresponds to number of elements that are contained in it. If a phase has the value zero, it is skipped. Sounds complicated, doesn't it? In reality it's quite simple:

Phase	1	2	3	4	
————————	1	0	0	0	you are always in phase 1, everything is plotted
- - - - - - - - - - - - - - - - - -	1	1	0	0	Alternately one element is plotted and one not
— - — - — - — - — - — - —	3	1	1	1	Three elements are plotted, one not, then one again and one not

3.4 Length of elements

There are three different strategies for determining the length of an element:

Length

The program tries to build the curve out of elements of the length `linelength` with a relative error less than 10%. The appropriate parameter value is found with the secant method. As a starting value the last parameter difference is used. This leads to success only if the derivative of the parametrisation has neither zeroes nor strong variations.

Direction

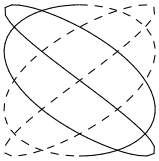
In each step first the current direction is found by the direction of the secant between the points with the actual parameter value and that one increased by `Start step`. This increment will be multiplied by `factor` until the direction differs more than the assigned value.

This mode is well adapted to curves with large variations in curvature.

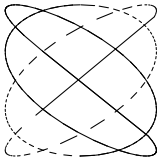
No control

This mode is active when neither directional nor length control are active. Here an equidistant parametrisation is used. In each step the parameter is increased by `delta`.

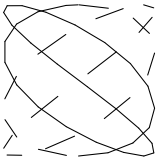
Length 1mm



Direction 5°



No control $\Delta t = 0.1$



These pictures are dashed in the half of the parameter interval, so that one can see the lengths of the dashes. If you print this page, you will see the advantages of the directional control near the corners.

4 The menu

4.1 File

In general the entries do what one expects from the names.

`Tcp-Pic-Import` doesn't support dashboxes or Bezier curves. Dashboxes are imported as frameboxes.

`Export` of elements is done in the following order: first line elements are written, after that circles, at last texts. This is done to enable the placement of texts in dense sets of curves by placing a white circle and a text into this circle.

`Yap` (sometimes) and `Dviwin` don't manage to diplay or print the `.tec`-version. If you generate `.ps` or `.pdf` files everything is diplayed in the right way.

4.2 Edit

Copy All picked elements are copied into a buffer.

Cut All picked elements are copied into a buffer and then deleted.

Paste The content of the buffer is inserted into the drawing. The elements then are picked an can be moved or edited.

Scale All picked elements are stretched with respect to the center with the x-and y-factors. Negative factors result in mirroring. Please note that the size of TEX-circles is limited. The size of the text is not changed.

Clean up Deleted elements are not removed but only marked as deleted. This removes them definitely. This is important because there can be at most 32000 elements.

4.3 View

Grid Toggles the grid.

4.4 Options

Text visible is self-explanatory.

Linenwidth is the width of the lines on the screen and in the generated picture. Invisible lines will be useful in version 5 to define areas.

Arrows: Angle and lenght of arrowhead define the parameters for the arrows. The angle is measured between one arrowhead and the shaft.

x- and y-origin are the coordinates of the lower left corner of the screen. `Gotozero` will set them both to -2.

Pickdistance is the maximal distance in pixel, in which elements are regarded als 'near' in the pick operation.

4.5 Clip

If this is active only elements between the borders are drawn. Lines will be cut, circles not. This can be invoked by clicking the corresponding part of the status bar, too.

4.6 Zoom

Adjusts the zoom level. The zoom symbol in the symbol bar does this better, so this will be used rarely.

4.7 Info

Guess what!

5 Keys

These functions are available with the keys:

Esc	unpick
Del	deletes the picked elements (what else?)
Crtl A	picks all
Ctrl C	copies the picked elements into a buffer
Ctrl X	copies the picked elements into a buffer and deletes them.
Ctrl V	inserts the elements in the buffer into the drawing. These are picked and can be moved or edited.
Ctrl 0	invisible lines
Ctrl 1	thin lines
Ctrl 2	normal lines
Ctrl 3	thick lines
Ctrl G	toggles the grid
Ctrl +	advances the zoom level
Ctrl -	decreases the zoom level

6 Known bugs

In some modes like linedrawing the menu is not available by keys while the cursor is in the drawing area. It's uncertain whether this ever will be changed.

7 An example

We want to draw the graphs of sine and cosine in the interval $[0, 2\pi]$; i.e. the left half of the picture in the beginning.

(1) Start the program

(2) Select thick lines in the middle of the symbol bar

(3) Select curves. 

(4) The `x`-function remains `t`, the `y`-function is `sin(t)`.

(5) As the origin shall be at (5,10), set `x-offset` to `5` and `y-offset` to `10`.

(6) The field `t1(n)` gets the value `6.28` (or `2*Pi`). Press `OK`.

(7) Unpick with `ESC` or 

(8) Select curves.  This time the `y-function` is `cos(t)`.

(9) In `Pattern` the second phase is set to `1`, so the curve will be drawn dashed.

(10) `OK`

(11) Unpick with `ESC`.

(12) Select linewidth `normal` and arrows.

(13) Draw the first arrow from (0,10) to (75,10), then the next from (5,0) to (5,30).

(14) Unpick with `ESC`.

(15) Select text  .

(16) At (3,29) insert `$y$` with alignment `cr`.

(17) At (74,8) insert `$x$` with alignment `tc`.

(18) Draw a (simple) line from (4,20) to (5,20). 

(19) At (3,20) insert the text `1` with alignment `cr`.

(20) Zoom a small region containing (68,10). 

(21) Uncheck `Snap`.

(22) Draw a line (as vertical as possible) from the endpoint of the graph downwards 1 unit.

(23) One unit below insert the text `$2\pi$` with alignment `tc`.

(24) Unzoom  and look proudly at the drawing.

(25) With `File - Save as` save the drawing as `sin`. The file `sin.tcs` is created that contains all information about the currect drawing.

(26) `File - Tec export` creates `sin.tec`.

(27) `File - Tcp/Ps export` creates `sin.tcp` and `sin.ps`.

(28) Exit the programm.

The next steps depend on what type of file you want to create:

Dvi-Format use a test file `test_tec.tex`:

```
% test_tec.tex
\documentclass{article}
\begin{document}
\usepackage{color}
Some text.

\input{sin.tec}

Some more text.
\end{document}
```

Run `latex test_tec` to generate `test_tec.dvi`

Ps-Format use a test file `test_tcp.tex`:

```
% test_tcp.tex
\documentclass{article}
\usepackage{color}
\usepackage{graphics}
%\usepackage{graphicx}   % alternativly
\usepackage{ifpdf}
\begin{document}
Some text.
```

```
\input{sin.tcp}

Some more text.
\end{document}
```

Run `latex test_tcp` to generate `test_tcp.dvi`, and
`dvips test_tcp` to generate `test_tcp.ps`.

Pdf-Format use the same file `test_tcp.tex` as in the `ps`-case.

Via Postscript (e.g. if you want to include bitmaps that you don't want to convert).
`latex test_tcp` generates `test_tcp.dvi`
`dvips -Ppdf test_tcp` generates `test_tcp.ps`
`ps2pdf test_tcp.ps test_tcp.pdf` generates `test_tcp.pdf`

With pdflatex `ps2pdf sin.ps sin.pdf` converts the picture to the`pdf`-format.
`pdflatex test_tcp` generates `test_tcp.pdf`

Hint: It's nicer if you include pictures with

`{\small\input{sin.tec}}` or `{\small\input{sin.tcp}}`

because the size of the labels fits better.

8 Installation

n

i) Copy Texcad32.exe into a directory, e.g. `C:\Program Files\TeXCad32`

ii) Start the programm, draw a line, save it as `1.tcs` and export as `1.tec`.

iii) Open the explorer, click with the right mouse at `1.tec` and choose `Open with...` and select `Other...`

iv) Select `C:\Program Files\TeXCad32\Texcad32.exe` and `Open`.

v) The same with `1.tcs`.

vi) That's all.

9 Plans for the next subversions of version 4

Installation program to prepare the registry.

Increase the maximal numer of 32000 elements.

Curves through given points as splines

Macros - recycable parts of drawings can be inserted (as resistors or capacities in electrical circuits)