PLOT-50

**Software for the
4051 BASIC Graphic
Computing System**

TEKTRONIX

Mathematics Program Library

Fast, interactive, state-of-the-art.
The 4051 Math software Library is the first such package to combine the newest problem-solving codes and time-saving algorithms with real user-oriented versatility.

State-of-the-art software isn't always usable software: some software libraries lock you into inflexible programs that commit you to the menu as-written. But the PLOT-50 Mathematics Library offers a high degree of interactivity via modularized algorithms that permit their extraction and use as separate programs.

The algorithms themselves are faster, more stable, with better convergence properties than any previously available. The linear programming package, for example, can solve a problem with 40 variables in less than 10 minutes.

Step-saving, user-definable overlay keys, internal cartridge tape storage and detailed program documentation combine to offer unusual problem-solving ease and flexibility —with the unique Graphics capability to present solutions in the most comprehensible form.

PLOT-50 Mathematics: unequalled accuracy and accessibility. Because many Plot-50 math routines are designed to be subroutines accessed by user programs, remarks are generously included to indicate what the program segment is, what parameters are passed to subroutines, and the purpose of code segments within each routine. Variables are clearly indicated within the programming manual . . . most are prefixed P or Q to keep ambiguity to a minimum.

In several programs, it is possible to specify the degree of accuracy desired in the solution, and the program will adjust its internal parameters accordingly.
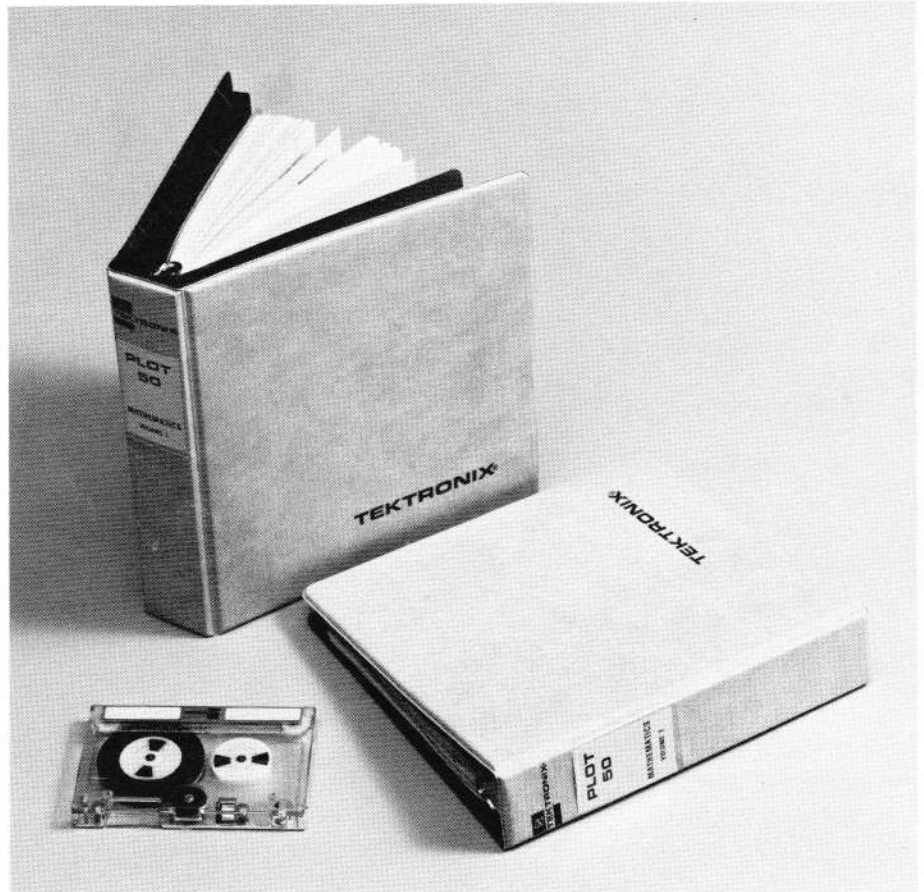
The PLOT-50 Mathematics Library is contained within two volumes. All programs in Math 1 may be run on the 4051 with just 8K bytes of workspace. In Math 2, all but two programs can be run on 16K, with the two programs in differential equations requiring 24K and 32K. Of course, since the efficiency of PLOT-50 software is restricted only by your system's workspace, the larger the workspace, the larger the problems you can solve.

PLOT-50 Mathematics Volume 1
English/Metric Conversion. Function keys provide 36 conversions, including squared and cubic conversions.

Number Base Conversion. Will convert any number bases up to and including 36, to any other base up to 36.

Coordinate System Conversion. Based on rectangular coordinate system. Proceeds from rectangular to polar, spherical, or cylindrical, and back.

Gamma Function and Factorial Bessel Functions. Produces accurate results for N and X up to 50.

Real Hyperbolic Trigonometric Functions.
Polynomial Roots.
Real Roots.
Plot of $Y = F(x)$ for user function, F.
Plot of $Y = F(x)$ for user data, (X_i, Y_i).
Plot of a parametric function.
All Graphic plotting functions in the PLOT-50 Math Library include plots of the derivative and/or integral of the function. By changing the value of one variable any plot may be drawn on the 4662 Plotter.

Linear Equations.
Interpolation.
Complex number operations.
Functions of a complex number.
Complex trigonometric functions.
Inverse complex trigonometric functions.

All subroutines for complex number operations are designed to be extracted for use in larger user programs.

Trapezoidal quadrature.
Simpson quadrature.
Gaussian quadrature.
Gauss-Laguerre quadrature.
Gauss-Hermite quadrature.
Differential equations.

Degree of error in quadrature functions is automatically controlled; operator simply specifies degree of accuracy desired.

PLOT-50 Mathematics Volume 2

Linear programming.
Data fitting.
  Cubic spline (least squares smoothing)
  Polynomial regression (least squares)
  Chebychev fit (by polynomial, min/max sense)
  Planar curve fit (by splines under tension)

Linear equations.
  Real symmetric matrix.
  Complex matrix.
  Lu decomposition of real matrix.

Eigenvalues and eigenvectors.
  Real symmetric matrix.
  Hermetian matrix.
  General real matrix.

All three programs use variants of the QR algorithm, the newest, fastest, and most accurate method available.

Integration.
  Newton-Cotes quadrature.
  Clenshaw-Curtis quadrature.

Ordinary differential equations.
 Rational extrapolation.
  Predictor corrector.

Step size in integration and differential equation programs is adjusted automatically to produce results to the desired accuracy.

FFT—Fast Fourier Transform.
For many problems, as in integration, PLOT-50 offers the operator a choice of several routines for problem-solving—so he can select the one that best applies, or with which he is most familiar. In all cases, the intention behind the Mathematics Library has been to make programs as
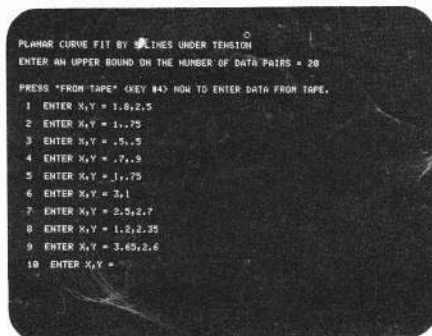
These 9 data pairs specify a curve in the x-y plane. We want a *smooth* curve going through these points, in the order that the points were entered. (Vol. 2)
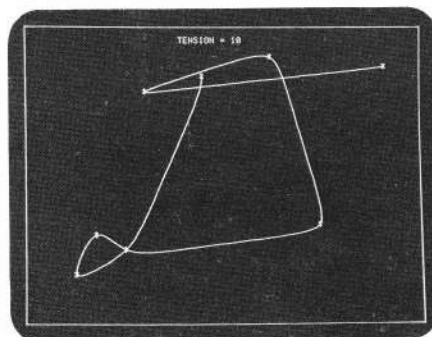
This curve is through the same data points, but a larger tension is used. It is very easy to try different tension factors until you find one you like. (Vol. 2)

modularized and versatile as possible, while offering a degree of accuracy unique to a desktop computational device.

Package Components include tape cartridges for program storage and storage of data, analysis and results of analysis; labeled user-definable overlays; manual and binder.

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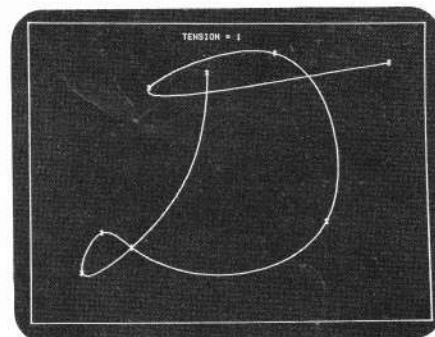9-31 Kitashinagawa-5
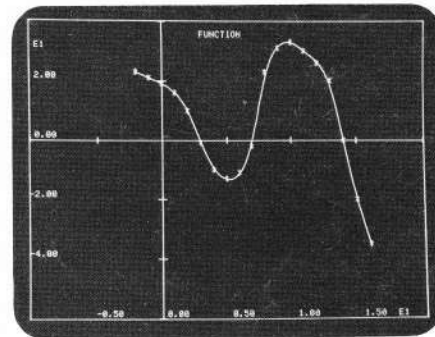Shinagawa-Ku
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The curvature of the curve is controlled by a user-entered parameter called *tension*. This graph has a fairly low tension. (Vol. 2)

Smoothing and/or interpolation is possible with this cubic spline program. This particular graph is a least squares cubic spline approximation to the data. (Vol. 2)

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