AUTOMATIC CALCULATOR PLOTTING

with the HP system 9100

HEWLETT PACKARD

CAN AUTOMATIC PLOTTING MAKE YOUR OPERATION MORE PROFITABLE ?

Compare to find out. Use these prices and the enclosed sample plots to determine if automatic plotting can increase your computing efficiency.

PURCHASE PLANS

The prices and plans shown are for the United States; check with one of the 141 worldwide sales and service offices for specific prices and plans in your area.

MODEL	PRICE	RENT/MO.	LEASE/MO. (4-Year Term)	SERVICE CHG/MO. (within local service area)
9125B Plotter	$2,675.00	$200.00	$69.50	$20.00

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COVER

The cover illustration is a three dimensional plot of an estimate of the Joint Gaussian Probability Density Function:

$$\rho\ (x,\ y) = \frac{\partial}{\partial y}\left(\frac{\partial P\ (x,\ y)}{\partial x}\right)$$

where P(x, y) is the joint probability distribution function.

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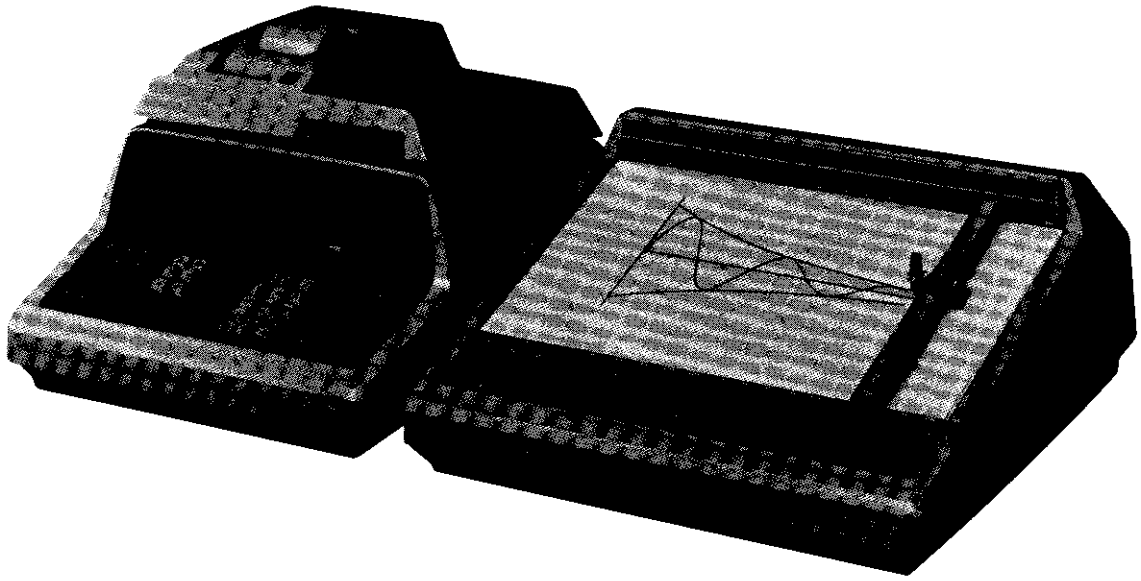


Whether you are an engineer, scientist, or businessman, a graph is often the quickest and most reliable method of translating "raw data" into "useful information."

Now, using the HP 9100 Calculator and the HP 9125B X-Y Plotter you receive automatically-drawn graphs at a fraction of the previous cost. You no longer need a large central computer and expensive peripherals.

Automatic plotting with the HP System 9100 also eliminates the tedium and inaccuracies of hand-plotting. You get all the benefits of fast, automatic data reduction and concise graphical solutions.

What's more, once the HP 9125B has given you the initial graphic solution, you can modify the input data, plot again, and immediately see the results of changes you've made. Optimum solutions in areas of critical importance can be readily obtained because of the pin-point resolution of the HP System 9100.

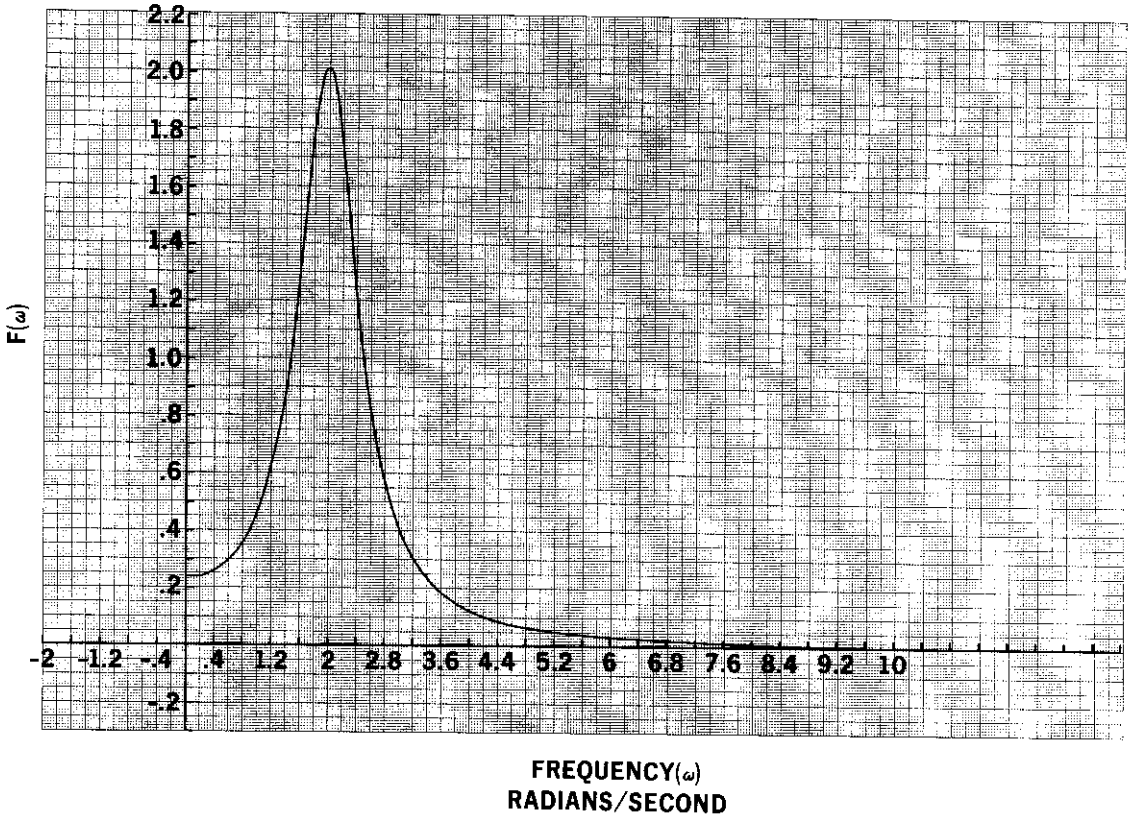
Completely documented programs for use with this personal computing system are supplied. Using some of these library programs the following graphs were plotted in minutes. They demonstrate the type of output you can expect from this versatile system. Check these examples to determine how much time you can save when solving similar problems.

Lease/rental plans on an HP 9100 Calculator and HP 9125B X-Y Plotter start as low as $2.10/hour (based on average usage of 4 hours/day). Compare the cost of "going graphic" against manual plotting . . . or the cost of obtaining the same results on large computing systems. Now, with the HP System 9100, you can get the graphs you want at a price you can afford.

For a personal demonstration of the HP 9100 Calculator and the HP 9125B Plotter, please complete the enclosed reply card. Our calculator salesman from your nearest Hewlett-Packard sales office will be happy to arrange a demonstration and answer your specific questions and requests.

MATHEMATICS

PLOT A: Fourier Transform of $f(t) = e^{(-.5|t|)}\cos 2t$



Equation: $F(j\omega) = \int_{-\infty}^{\infty} f(t)e^{(-j\omega t)}dt$

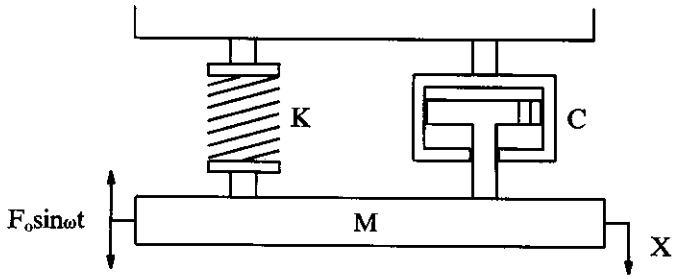
Method: Numerical Integration using Simpson's Rule

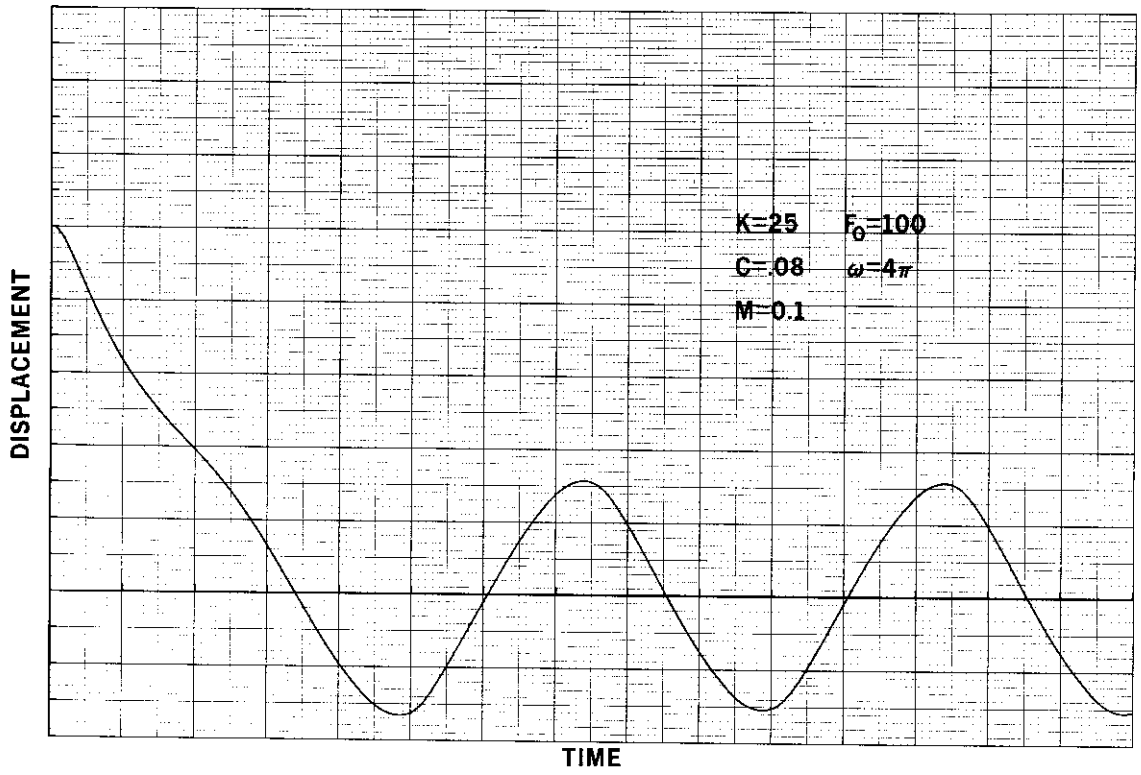
Comments: The general program will calculate and plot the Fourier Transforms of a wide range of real transient functions. The user specifies the program steps which generate f(t) and also the sampling interval Δt.

Program: Fourier Transform Plot; -hp- Library No. 09100-70045

Paper: 25 cm. x 38 cm. metric plot area; -hp- Part No. 9270-1024

PLOT B: Solution of the Second Order Differential Equation for





Equation: $M\ddot{X} + C|\dot{X}|\dot{X} + KX = F_o \sin \omega t$

Method: Taylor Series about the solution point

Comments: The general program may be used to solve and simultaneously plot a wide variety of second order nonlinear differential equations of the form $X'' = f(t, X, X')$. The user specifies the initial conditions and the program steps which generate $f(t, X, X')$.

Program: Second Order Differential Equation Solution and Plot -hp- Library No. 09100-70046

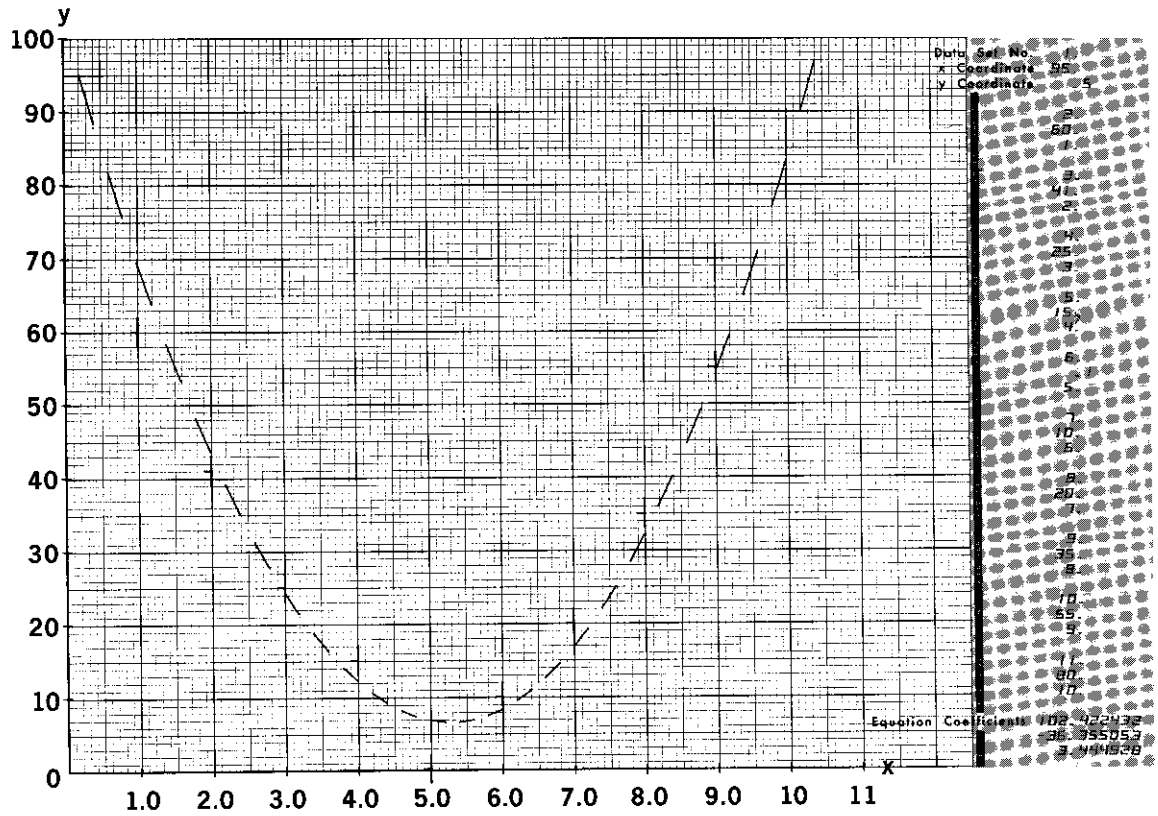
Paper: 10 in. x 15 in. plot area; -hp- Part No. 9270-1004

OTHER APPLICATIONS:

1. Plots of functions in rectangular or polar coordinates on linear, semi-log, or log-log paper.
2. Plot of the derivative of a function.
3. Plot of the integral of a function.

STATISTICS

PLOT A: Second Degree Regression



Equation: $Y = 3.445X^2 - 36.355X + 102.422$

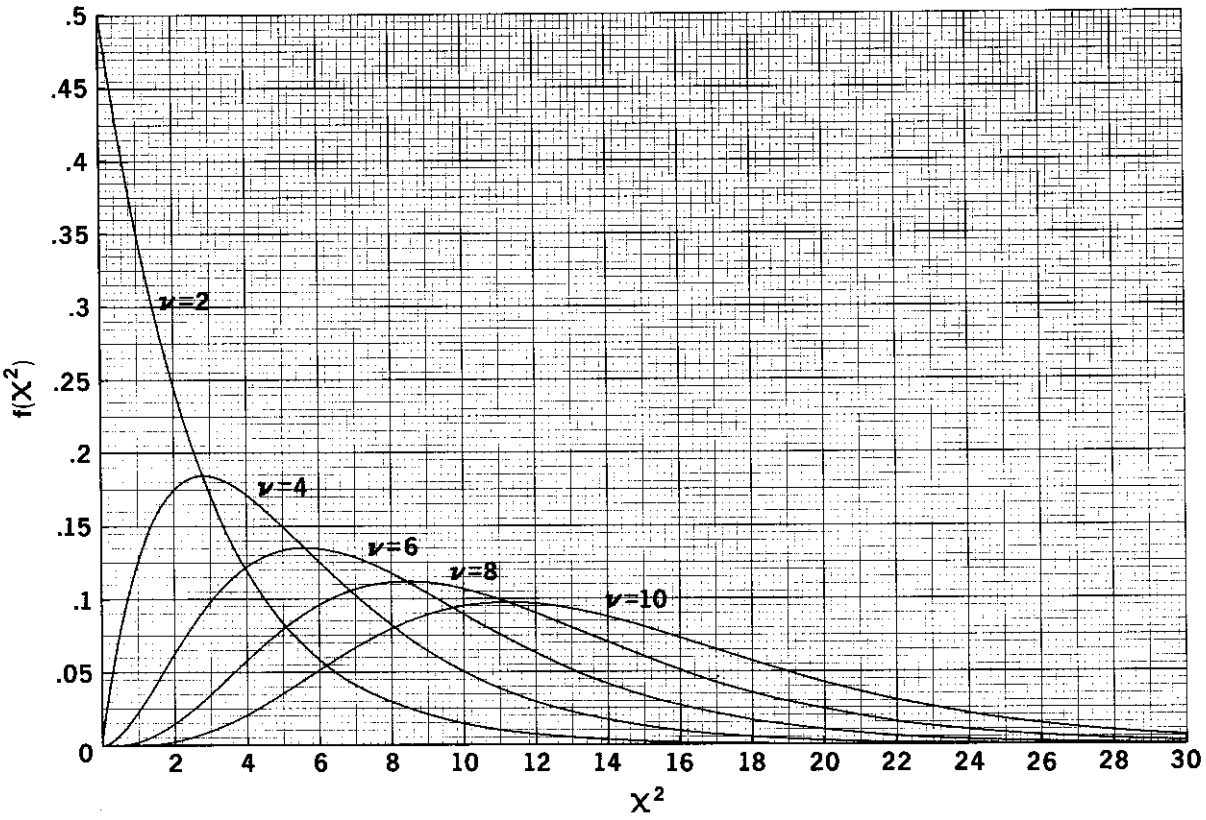
Method: Least-Squares Curve Fit

Comments: The regression program plots each data point as its coordinates are entered into the calculator. After all the data has been entered, the coefficients of the equation are computed and the curve is then plotted.

Program: Parabolic Regression and Plot; -hp- Library No. 09100-70911

Paper: 10 in. x 15 in. plot area; -hp- Part No. 9270-1004

PLOT B: Chi Square Distributions



Equation: $$P\ (\chi^2, \nu) = \frac{1}{2^{\frac{\nu}{2}}\ \Gamma(\frac{\nu}{2})} (\chi^2)^{\frac{\nu}{2}-1}\ e^{-\frac{\chi^2}{2}}$$

where ν = Degrees of Freedom

Method: The distribution is evaluated and plotted at incremented values of the independent variable, χ^2.

Comments: The only entry required for the execution ot this program is a specified value of ν (degrees of freedom). The Chi Square distribution approaches a normal curve as ν becomes large.

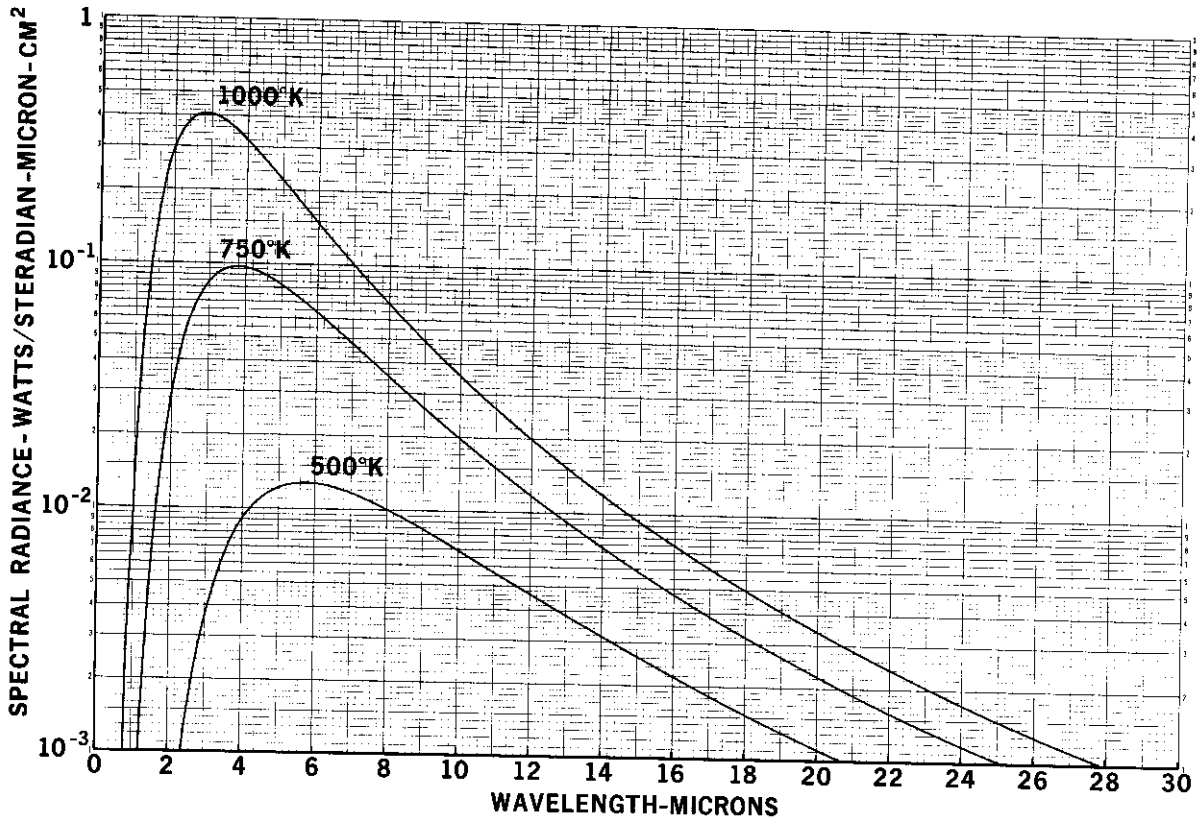
Program: Chi Square Distribution Plot; -hp- Library No. 09100-70826

Paper: 10 in. x 15 in. plot area; -hp- Part No. 9270-1004

OTHER APPLICATIONS:

1. Probability Integral Plots
2. Histogram Plots
3. Frequency Curves

PLOT: Blackbody Radiation Curves



Equation: Planck's Function

$$W_\lambda = \frac{C_1 \lambda^{-5}}{\pi \left[\exp \left[\frac{C_2}{\lambda T} \right] - 1 \right]}$$

where λ = wavelength

T = temperature of the radiating blackbody, °K

Method: Planck's function is evaluated and plotted for incremented values of the wavelength.

Comments: This program plots the spectral radiant intensity of a blackbody for a wide range of temperatures and wavelengths. The program also integrates the function between specified limits of the wavelength. The user inputs these limits, the incremental wavelength, and the temperature of the body.

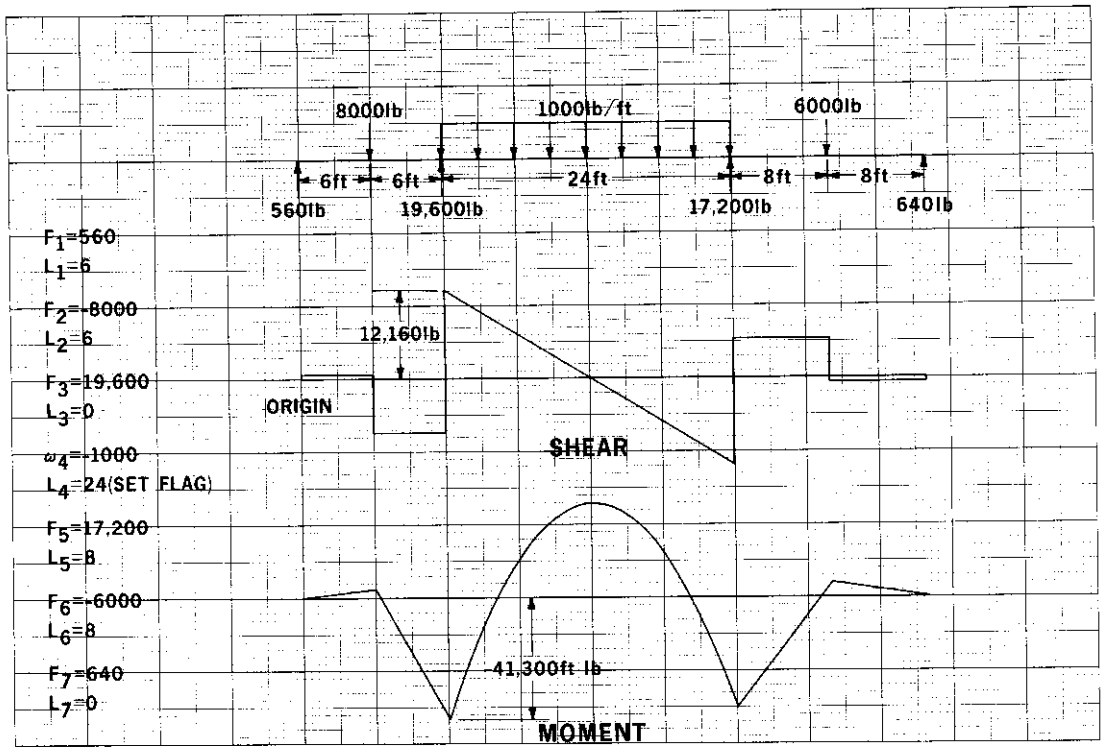
Program: Blackbody Radiation Plot -hp- Library No. 09100-73205

Paper: 3 cycle x 15 in. plot area; -hp- Part No. 9280-0168

OTHER APPLICATION:

Trajectories of Particles

PLOT: Shear and Moment Diagrams



Force diagram is not part of the program.

Method: The program determines the equation of the line and plots the Shear Diagram and integrates and plots the Moment Diagram.

Comments: The general program plots the shear and moment diagram for a beam subjected to *any* combination of concentrated loads, uniformly distributed loads and uniformly varying loads. Inputs are the force and length of distribution of each load, and all reactions.

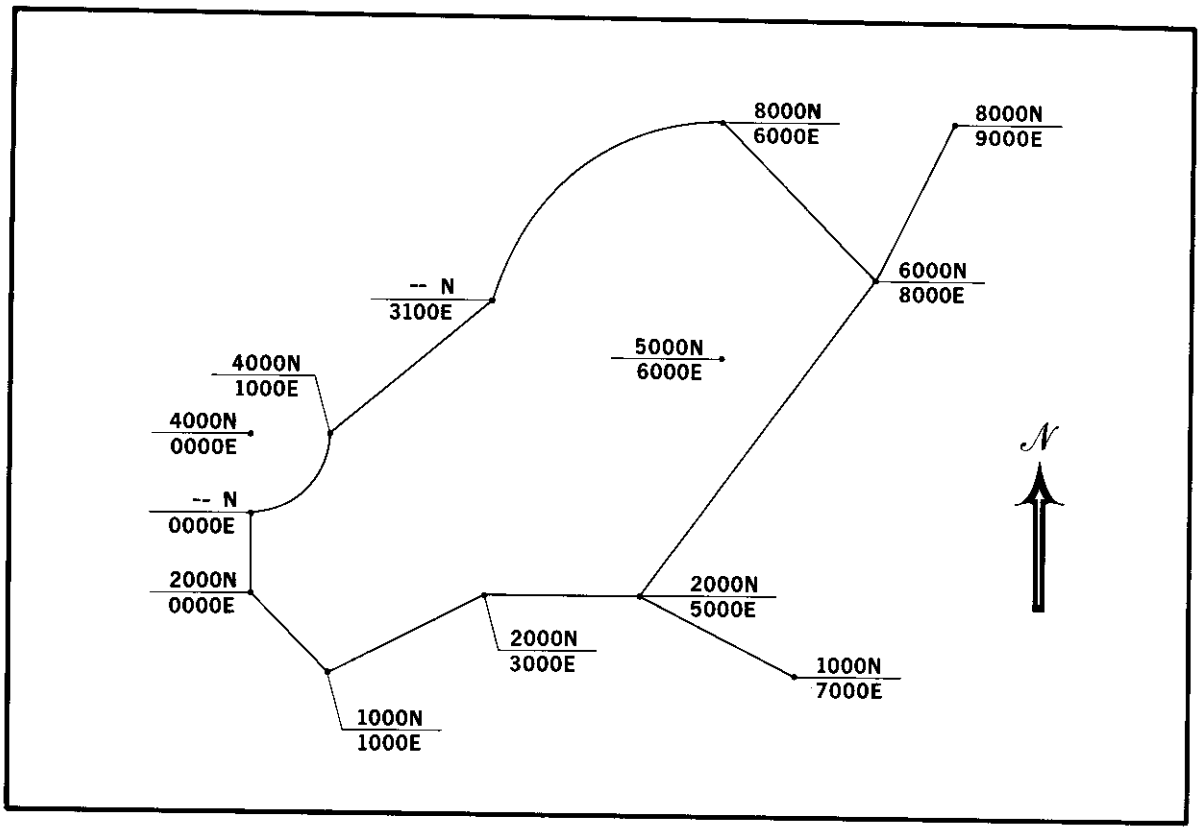
Program: Shear and Moment Diagram -hp- Library No. 09100-74801

Paper: 10 in. x 15 in. plot area; -hp- Part No. 9270-1004

OTHER APPLICATIONS:

1. Principal Stress Analysis
2. Pressure Distribution on a Retaining Wall

PLOT: Traverse by Coordinates



Method: Straight line segments are plotted directly. Arcs are computed in polar coordinates for plotting.

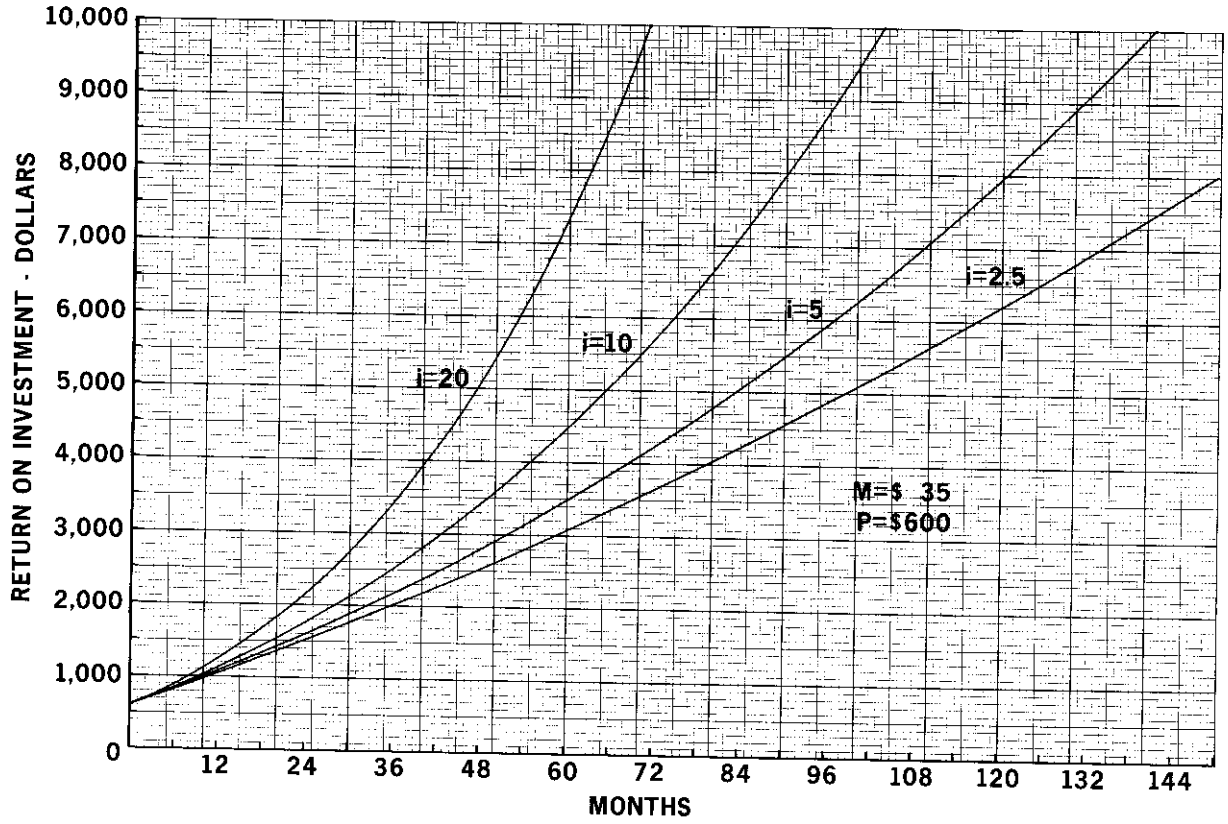
Comments: The general traverse program will plot straight line segments, sideshots, and concave or convex arcs. Any straight line segment may be used for which the end point coordinates are known. The arcs are plotted from a known radius length and included angle.

Program: Plot of Traverse with Sideshots and Arc; -hp- Library No. 09100-74029

OTHER APPLICATIONS:

1. Cut and Fill Plots
2. Traverse by Bearings and Distances

PLOT: Return on Investment



Equation: Present Value $= (P + nM)\left(1 + \frac{i}{1200}\right)^n$

M = Monthly Investment
P = Initial Investment
i = Interest Rate

Method: The present value of the investment is determined and plotted at each successive future month.

Comments: This program plots a family of curves corresponding to different specified interest rates acting upon an initial investment linked with successive monthly investments. The interest rates are interpreted as annual interest rates compounded monthly.

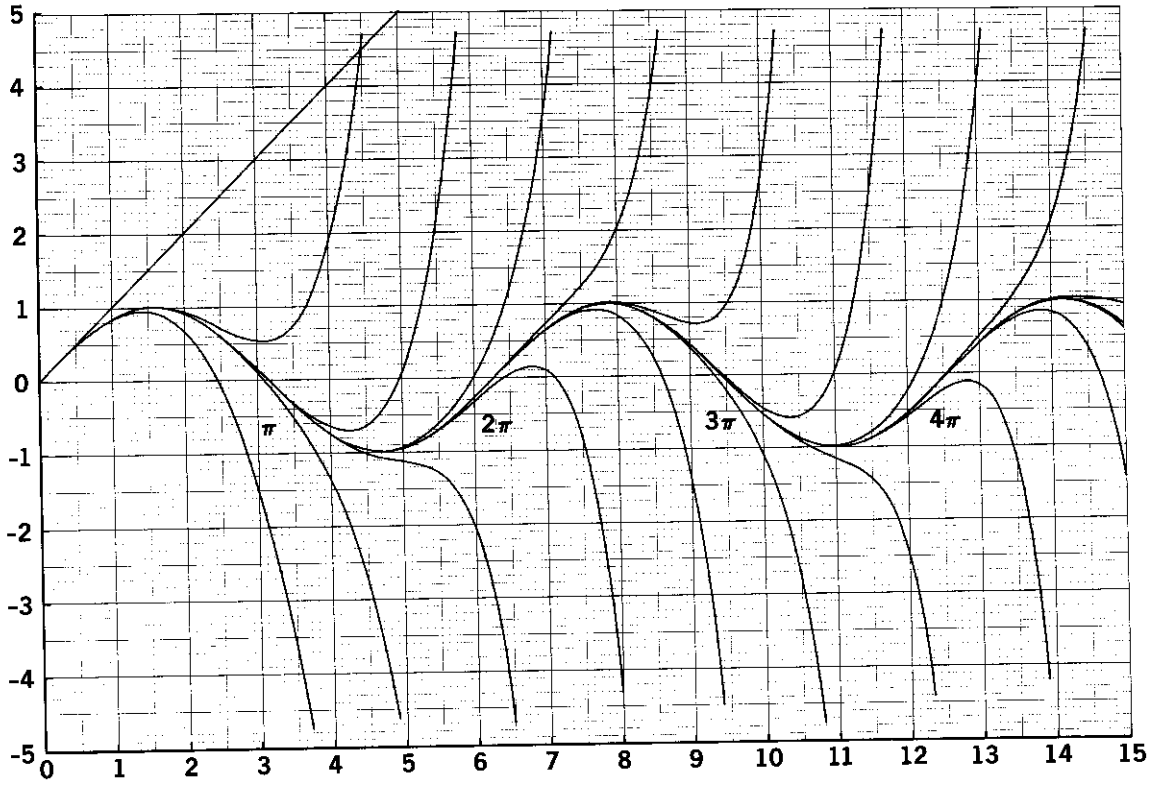
Program: Return on Investment Plot; -hp- Library No. 09100-73011

Paper: 10 in. x 15 in. plot area; -hp- Part No. 9270-1004

OTHER APPLICATIONS:

1. Exponential Smoothing and Forecasting
2. Depreciation Schedule Plots

PLOT A: Approximation of SIN X



Equation: $\text{SIN } X = \frac{X}{1!}$

$$\text{SIN } X = \frac{X}{1!} - \frac{X^3}{3!}$$

$$\text{SIN } X = \frac{X}{1!} - \frac{X^3}{3!} + \frac{X^5}{5!}$$

etc.

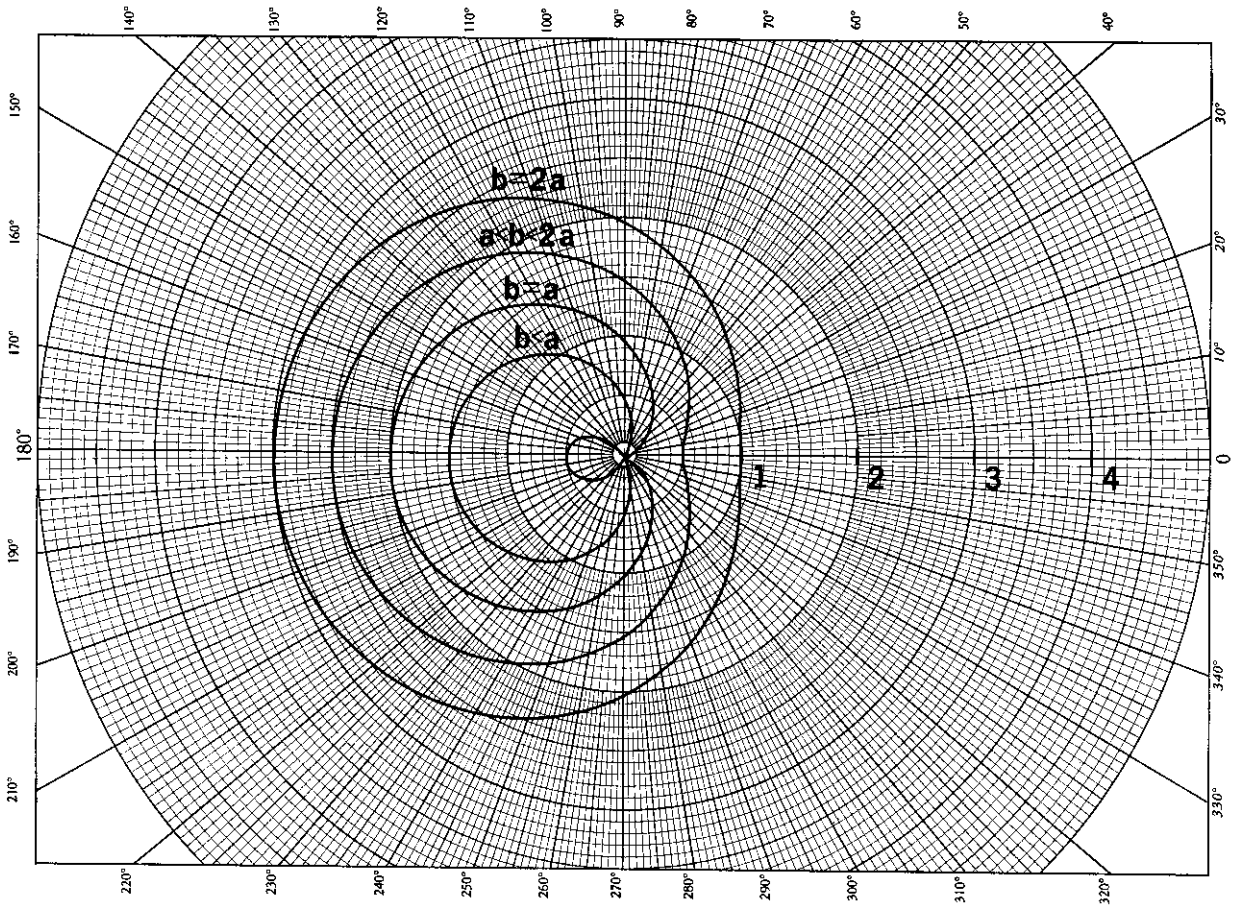
Method: Truncated Maclaurins Series for $X \geq 0$

Comments: This program demonstrates how the function f(X)= SIN X is approximated by successive expansions of the Maclaurin Series. No entries are required of the user.

Program: Successive Approximations to SIN X. -hp- Library No. 09100-75803

Paper: 10 in. x 15 in. plot area; -hp- Part No. 9370-1004

PLOT B: Limacon of Pascal



Equation: $r = b - a \cos \theta$

Method: The angle θ is successively incremented by 2 degrees in polar coordinates and the polar form of the function (r, θ) is then converted to rectangular form for plotting.

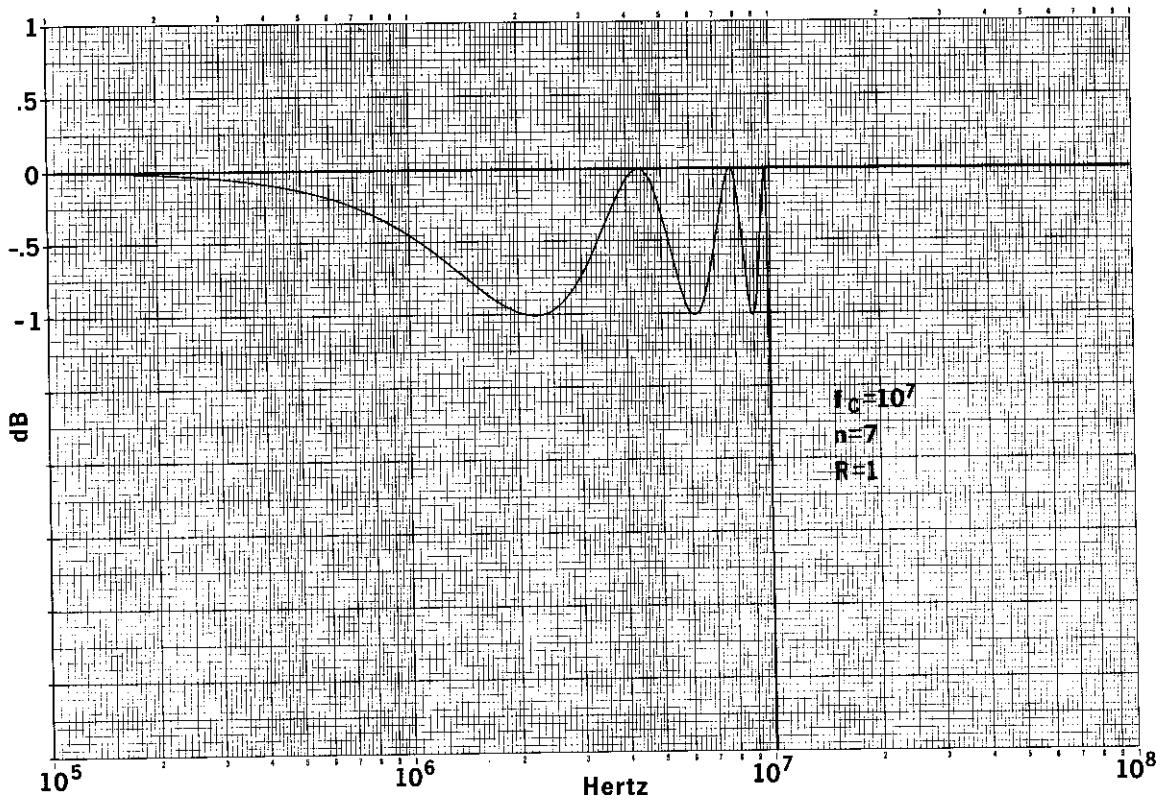
Comments: The general program will plot any function of the form $r = f(\theta)$ in polar coordinates. The user specifies the range of the function as well as the program steps which generate $f(\theta)$.

Program: Plot of $r = f(\theta)$; -hp- Library No. 09100-70030

OTHER APPLICATIONS:

1. Study of Functions
2. Analytic Geometry Plots

PLOT A: Tchebysheff Filter Response



Equation: $|G(\omega)|_{dB} = -\log_{10}[1 + \epsilon^2 T_n^2(\omega)]$

where $\omega = \frac{f_i}{f_c}$

f_c = CORNER FREQUENCY

$\epsilon^2 = (10^{.1R})-1$

R = BAND PASS RIPPLE in dB

n = FILTER ORDER

$T_n = \cos(n \cos^{-1}(\omega)) \quad \omega \leq 1$

$\cosh(n \cosh^{-1}(\omega)) \quad \omega > 1$

Method: The attenuation, $G(\omega)_{dB}$, is evaluated and plotted at incremented values of the frequency.

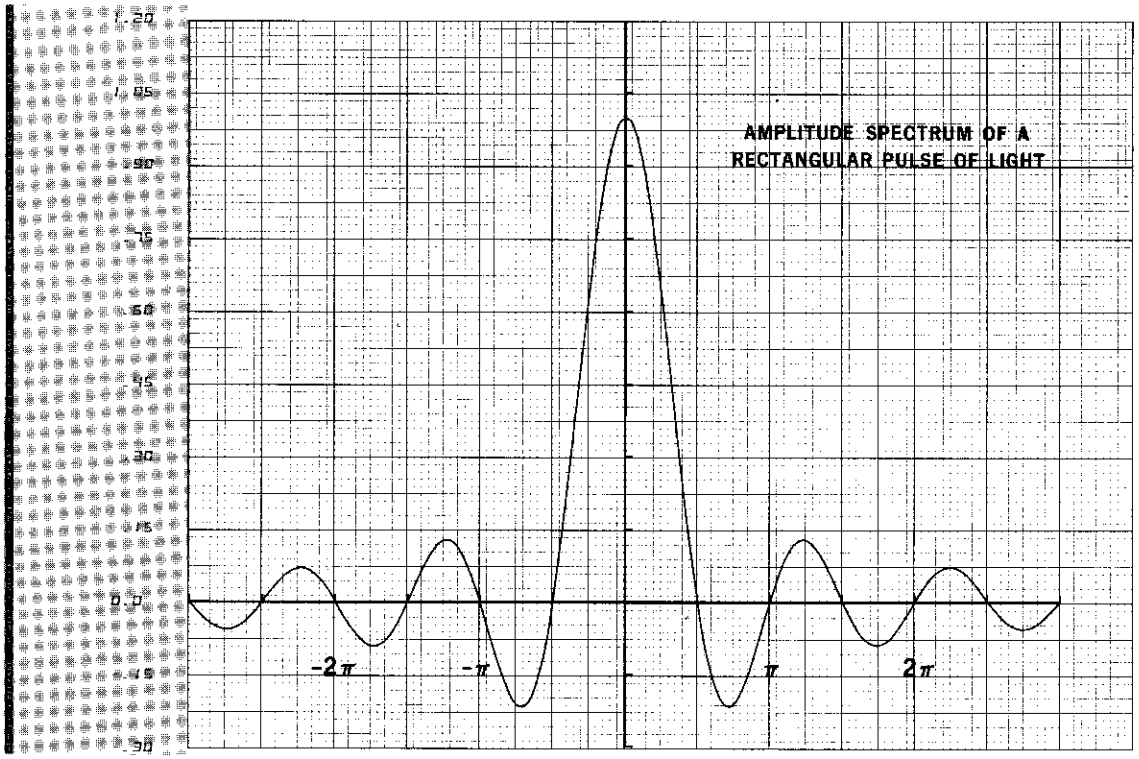
Comments: The program accepts any values of the corner frequency, ripple and filter order. It plots attenuation between two specified frequency limits, and then cycles back to allow changes in filter specifications to determine graphically the optimum filter for a given application. (Another convenient program computes the values of circuit components required to build the filter.)

Program: Tchebysheff Filter Plot; -hp- Library No. 09100-71015

Paper: 10 in. x 3 cycle plot area; -hp- Part No. 9280-0160

GENERAL

PLOT: General Y = F(X)



Equation: User specifies the steps necessary to develop his specific function. In this case, the equation is

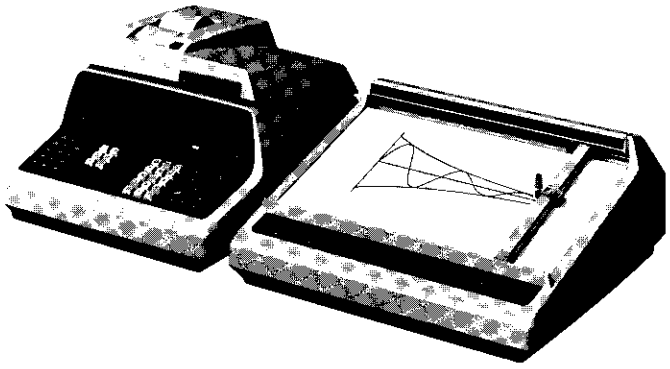
$$Y = \frac{\sin X}{X}$$

Method: The function is evaluated and plotted for incremental values of X.

Comments: The user specifies the function and the range over which the function is to be plotted. The 9100 system scales the function, prints out the axes values (Y−axis is shown) and then plots the function.

Program: Plot of Y = F(X); -hp- Library No. 09100-70415

Paper: 10 in. x 15 in. plot area; HP Part No. 9370-1004



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Printed in U.S.A.

5952-2224