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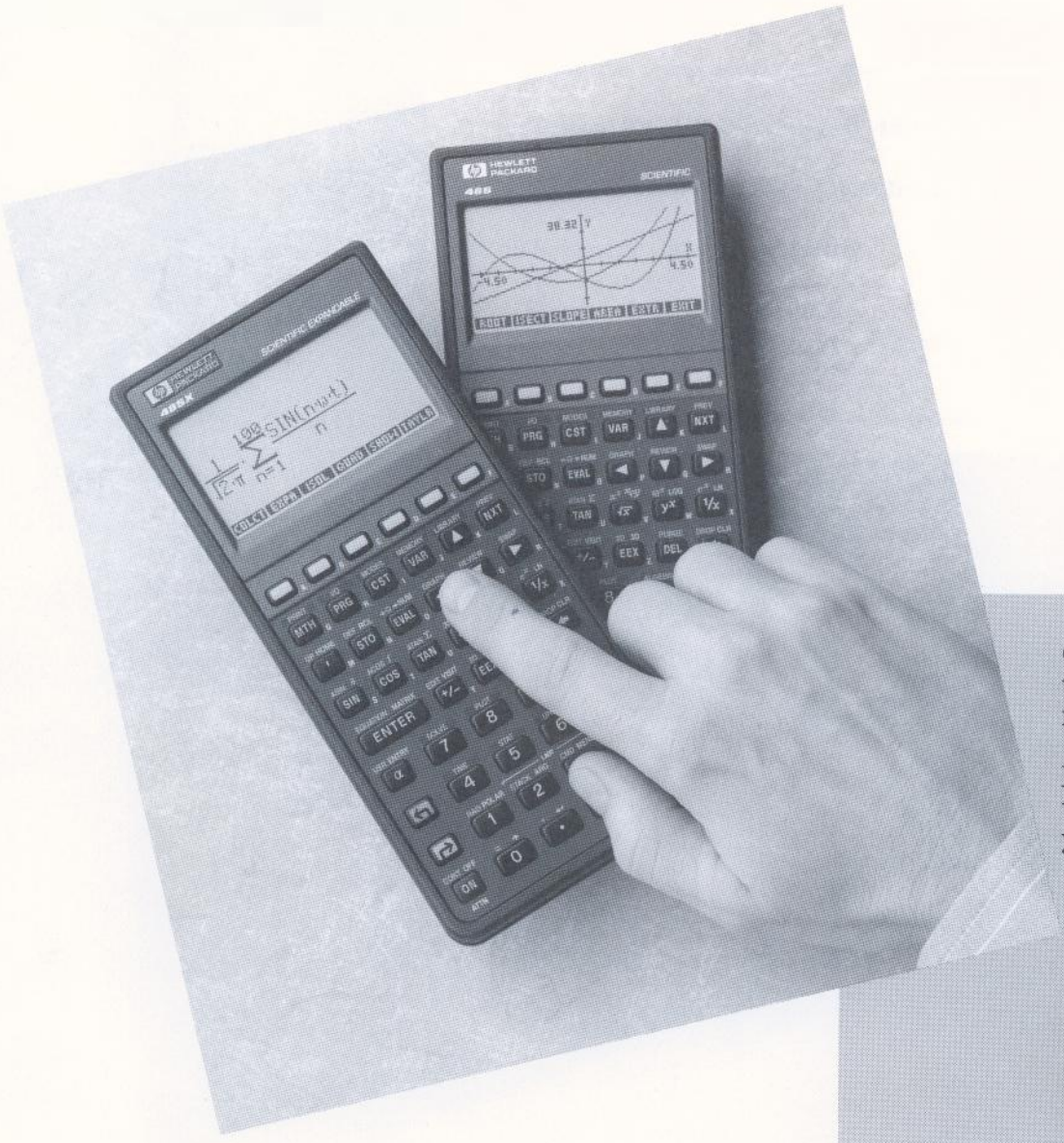

Choose the one that works best for you.

HP calculators – the best for your success

HP 48SX Scientific Expandable Calculator

HP 48S Scientific Calculator

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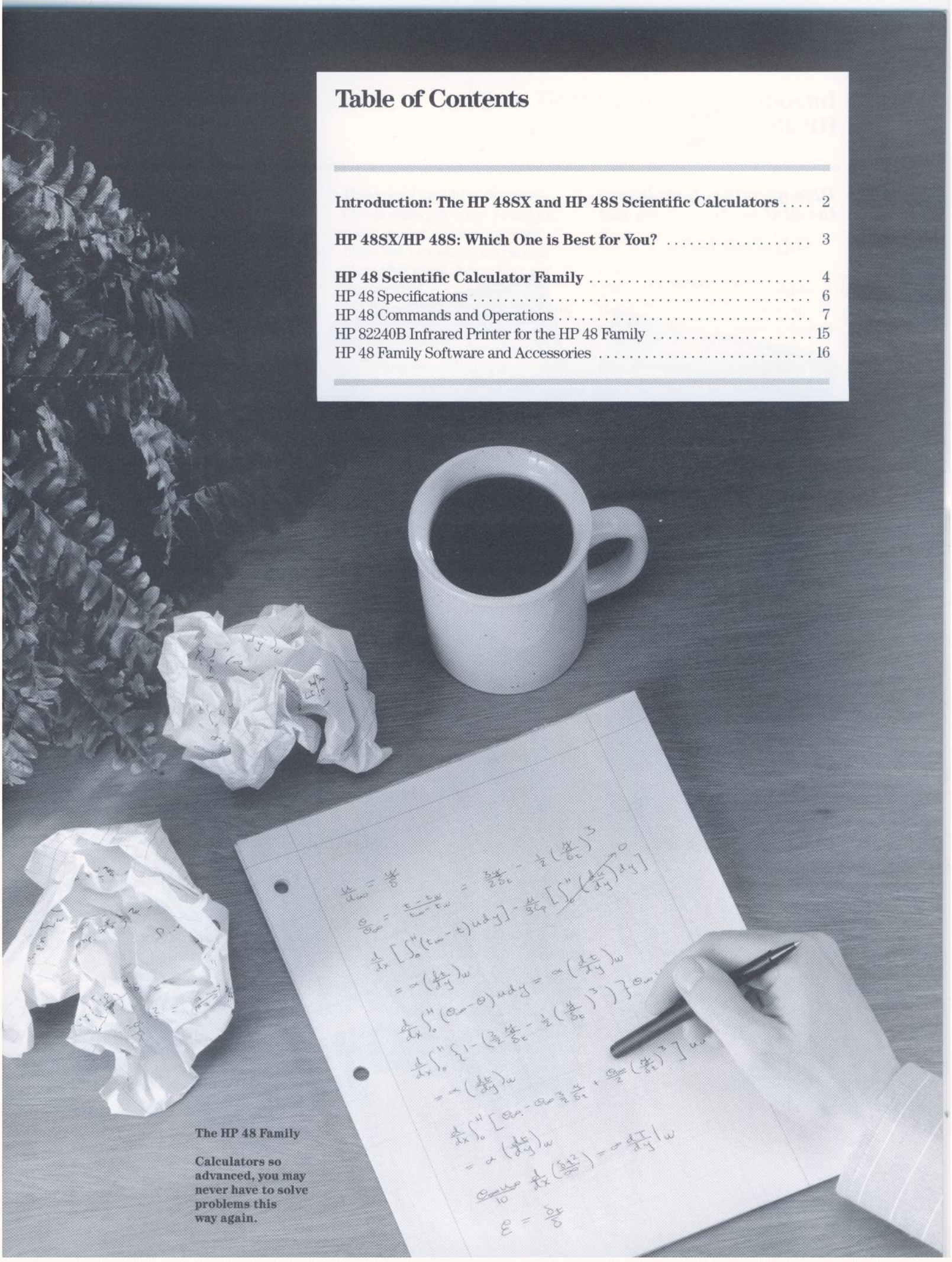


The HP 48 Family

Calculators so advanced, you may never have to solve problems this way again.

Introduction: The HP 48SX and HP 48S Scientific Calculators

HP's quantum leap into the 21st century

The HP 48SX is *still* the most powerful handheld calculator on the face of the earth. It's also become the most popular calculator found in the hands of serious engineering professionals and students. Marvel has given way to market leadership.

An award winner

The HP 48SX won the 1990 "*EDN* Innovation of the Year Award" in the computers and peripherals category. It was chosen by *Popular Science* magazine as an award winner in the "Best of What's New for 1990." *Electronic Products* magazine named the HP 48SX one of the ten most significant electronics products introduced in 1990. *New Equipment Digest* magazine chose the HP 48SX as one of the "Best of New Equipment Digest" products. And *Design News* magazine selected the HP 48SX design team as one of 30 teams in contention for their "*Design News* Excellence in Design" competition.

But the most gratifying "award" has been the feedback from thousands of engineering professionals, educators, and students who say the HP 48SX is everything they've always dreamed of in a calculator, and more.

Market sizzle becomes serious science

When HP first introduced the HP 48SX Scientific Expandable calculator in early 1990, it caused quite a stir. With breakthrough features like a direct PC link, automatic unit management, expandability, and textbook-like equation entry, it was the most powerful, capable handheld calculator on the face of the earth.

A feature set that's hard to outgrow

HP 48SX owners tell us it's hard to run up against a brick wall with their HP 48SX calculator. You don't run out of calculating brawn in the middle of a problem and have to pull out pencil and paper.

HP 48SX breakthroughs that provide this kind of calculation freedom:

- **Expandability.** Use two plug-in slots to add up to 256 Kbytes of user memory (RAM) or plug-in application (ROM) cards.
- **Integrated graphics and calculus functions.** Find mathematically correct roots, intersections, local extremes, derivatives, and other solutions, not just approximations, while viewing the graph.
- **Enhanced graphics features.** Create eight plot types: functions, conic section, polar, parametric, truth, bar, histogram, and scatter plots. Plus zoom, Z-box, line, and arc drawing.
- **HP EquationWriter application.** Enter and view equations in precisely the same format used in textbooks.
- **Symbolic math.** Perform algebra and calculus operations on equations before entering values.
- **Automatic unit management.** Enter constants and variables in a variety of units and get the answer in whatever unit you need.
- **Optional Program Development Link and Serial Interface Kit.** Connect your calculator to your PC for program development and peripheral sharing.
- **Two-way infrared communications.** Transfer data between HP 48 calculators without cables or complicated commands.
- **Customization.** Use built-in HP Solve or RPL programming language. The HP Solve application lets you solve for any variable in an algebraic equation without rewriting the equation. RPL programming lets you create custom solutions to complex problems.
- **Compatibility with the HP 82240B Infrared Printer.** Document problems, conveniently and quickly.

For HP 48SX software functionality without plug-in card expandability, consider the HP 48S

If you don't need the expandability of the HP 48SX, consider the HP 48S scientific calculator. It offers all of the breakthrough features of the HP 48SX except plug-in slots for additional memory or application cards. Therefore, it costs less and is an excellent entry-level model in the HP 48 family.

HP 48SX/HP 48S: Which One is Best for You?

The HP 48SX is the top-of-the-line expandable calculator. The optional add-in RAM, application cards, and the availability of independently developed software make the HP 48SX an ideal platform for building a custom calculation "workstation." Its equation-writing and other capabilities are so advanced, you'll never have to leave the calculator to arrive at your answer.

The HP 48S has no plug-in slots but otherwise has all the functionality of the HP 48SX. It's a powerful tool for students and professionals solving complex problems in a wide variety of disciplines. You can customize it by writing programs or downloading programs into the 32 Kbytes of user memory using the serial port or the two-way infrared I/O.

HP 48 Scientific Calculator Family

HP's quantum leap into the 21st century

The HP 48 family has breakthrough features that will forever change the way you do math and engineering.

HP EquationWriter application
You enter and see equations like they appear on paper or in textbooks. The equations you work with are easy to enter and verify.

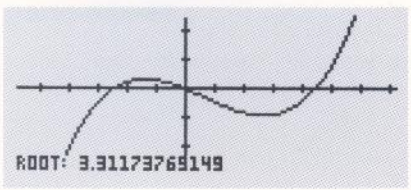
You see this:

$$\frac{1}{\sqrt{2\cdot\pi}}\cdot\sum_{n=1}^{100}\frac{SIN(n\cdot w\cdot t)}{n}$$

Instead of this:

```
'1/√(2*π)*Σ(n=1,100
,SIN(n*w*t)/n)'
```

Graphics and calculus functions combined like never before
The HP 48 finds mathematically correct roots, intersections, local extremes, derivatives, slopes and areas under a curve, while you're viewing the graph.



Symbolic math functions
Perform algebra and calculus operations before you enter values. Enter this formula:

$$\int_0^T X^2-2\cdot X+9\,dX$$

Press the evaluate EVAL key, and you'll get this answer:

$$9\cdot T-T^2+0.3333\cdot T^3$$

Automatic unit management
The HP 48 automatically keeps track of units for you. Enter constants and variables in the units you know, and get the answer in the units you need. This includes 148 built-in units and allows you to add your own or even make compound units. You never have to do this again:

$$\frac{(.305\ mol)\left(.082057\ \frac{l\cdot atm}{k\cdot mol}\right)(300\ ^\circ F)}{(3.35\ ft^3)\left(28.32\ \frac{l}{ft^3}\right)}$$

Two-way infrared input/output communications
It's the easiest way to transfer data and programs from one HP 48 family calculator to another. No cables are required.

HP Solve application
Write your own equation and solve for any variable without rewriting the equation.

Serial interface
Use your personal computer peripherals with the HP 48 via the RS-232C serial interface. Backup your HP 48 memory to your PC, transfer data and programs to or from your PC, and use your PC to develop HP 48 programs. The HP 48 has Kermit file transfer protocol built in for error checking and correction, and low-level serial commands for customized communications. Operates at 1200, 2400, 4800, and 9600 baud.

Plug-ins and Expandable Memory (for the HP 48SX only)
Plug RAM cards into the two slots to increase user memory or electronic disk by up to 256 Kbytes. Or, increase application power by using the slots to add up to 256 Kbytes of ROM-based application cards. Use any combination of user memory and application cards in your HP 48SX.

Plus all of these features:
- User-defined menus and directories
- Built-in matrix, vector, and complex number arithmetic capability
- Advanced programmability
- Softkey selection and custom key definitions
- Built-in infrared printer interface

HP 48 Specifications

All specifications apply to both the HP 48S and the HP 48SX unless otherwise noted.

Physical Specifications
- Dimensions
  18.0 x 8.1 x 2.9 cm (7.1 x 3.2 x 1.15 in)
- Weight
  264 g (9 oz) with batteries
- Power
  Three replaceable 1.5V AAA alkaline batteries

Battery Current
- Operating:

Worst case	80 mA
Typical HP 48	8 mA
Typical HP 48 and serial I/O	10 mA
Typical HP 48 and infrared printing	18 mA
Typical HP 48SX and one 32-Kbyte or 128-Kbyte RAM card	9 mA

- Idle:

Worst case	20 mA
Typical HP 48	3.5 mA
Typical HP 48 and I/O open	6.0 mA
Typical HP 48SX and one RAM card	4.5 mA

- Off:

Worse case	50 μA
Typical HP 48	11 μA

Average Battery Life
- 6 months
- Battery life depends on use and is shorter when the HP 48 is used with RAM cards, infrared printers, serial I/O, or when used extensively in graphics mode, such as when playing games. In such cases, battery life may be one month.

Operating Requirements
- Operating temperature
  0° to 45°C (32° to 113°F)
- Storage temperature
  −20° to 65°C (−4° to 149°F)
- Humidity
  90% relative humidity at 40°C (104°F) maximum

Display (liquid-crystal)
- Size 64 x 131 pixels
- Status annunciators 6
- Character font:

Status	3 x 5 dot-matrix
Standard	5 x 7 dot-matrix
Stack	5 x 9 dot-matrix

- Capacity
  Scrolling allows viewing of objects larger than the display.
- Window size
  8 lines x 22 characters per line at 5 x 7 font size

Redefinable Keys
All

Character Range
Full ECMA-94 character set (A-Z, a-z, 0-9, plus other mathematical symbols and punctuation).

Dynamic Range
- Real precision:
  $+/-\ 1.0 \times 10^{-499}$ to $+/-\ 9.99999999999 \times 10^{499}$.
  Numbers are shown with 12 mantissa digits and a 3-digit exponent. Displayed numbers are rounded to 12 significant digits or fewer as selected by the user. Internal calculations are carried out to 15 digits with a 5-digit exponent.
- Integer precision: 64 bits
- Variable types:
  Real floating point numbers, complex numbers, binary integers, strings, real vectors, complex vectors, real matrices, complex matrices, lists, names, programs, algebraic expressions, graphic objects, tagged objects, unit objects, directory objects, backup objects, library objects, extended lib names.

ROM/RAM
- Built-in operating system ROM
  256 Kbytes
- Built-in RAM
  32 Kbytes (2K used by operating system)

Expansion capabilities (HP 48SX only)
- 2 memory card slots

Built-in interfaces
- Two-way infrared and RS-232C

HP 48 Calculators Come With:
- Owner's Manual
- Quick Reference Guide
- Three AAA alkaline batteries
- Soft carrying case

HP 48 Commands and Operations

Legend:

ABCD - Keys on the keyboard are always shown in the special boxed typeface.

ABCD - Menu labels, which are found at the bottom of the display and relate to the keys on the top row of the keyboard, are shown in a shadow box.

† - These commands pertain to HP 48SX only.

Algebra

↓MATCH - Match-and-replace, beginning with top-level expression.
π - Symbolic constant π.
→ - Creates local variables.
→Q - Converts number to fractional equivalent.
→Qπ - Calculates and compares quotients of number and number/π.
↑MATCH - Match-and-replace, beginning with subexpressions.
= - "Equals" function.
APPLY - Returns evaluated expression(s) as argument(s) to unevaluated local name.
COLCT - Collects like terms in expression.
DEFINE - Creates variable or user-defined function.
e - Symbolic constant *e* (2.71828182846).
EQ→ - Separates equation into left and right sides.
EVAL - Evaluates object.
EXPAN - Expands algebraic object.
i - Symbolic constant *i*.
ISOL - Isolates variable on one side of equation.
MAXR - Maximum machine-representable real number (9.99999999999E499).
MINR - Minimum machine-representable real number (1.00000000000E-499).
QUAD - Finds solutions of first or second order polynomial.
QUOTE - Returns argument expression unevaluated.
RATIO - Prefix form of / used by HP EquationWriter application.
ROOT - Solves for unknown variable in equation.
SHOW - Reconstructs expression to resolve implicit variable name.
SIZE - Finds dimensions of list, array, string, algebraic object, or graphics object.
TAYLR - Calculates Taylor's polynomial.
' - Appends local name, or variable of integration, and its value to evaluated expression.

Algebraic Manipulation (HP EquationWriter)

[ ] - Returns equation to stack as string.
CLR - In HP EquationWriter application entry mode, clears screen; clears *PICT*.
EQUATION - Selects HP EquationWriter application.
RCL - Inserts algebraic from level 1 into HP EquationWriter equation.
STO - Returns GROB of HP EquationWriter equation to stack.
{ } - Switches implicit parentheses on and off.
← → - Commute arguments.
← A - Associate left.
← D - Distribute left.
← M - Merge-factors-left.
← T - Move term left.
→) - Expand-subexpression-right.
(← - Expand-subexpression-left.
*** 1** - Multiply by 1.
/ 1 - Divide by 1.
A → - Associate right.
A F - Add fractions.
D → - Distribute right.
E ^ - Replace power-product with power-of-power.
L * - Replace log-of-power with product-of-log.
M → - Merge-factors-right.
T → - Move term right.
^ 1 - Raise to power 1.
- ( ) - Double negate and distribute.
→ ( ) - Distribute prefix function.
E ( ) - Replace power-of-power with power-product.
L ( ) - Replace product-of-log with log-of-power.
SUB - Returns specified subexpression to stack.
→DEF - Expands trigonometric and hyperbolic functions in terms of EXP and LN.
+1-1 - Add and subtract 1.
1 / ( ) - Double-invert and distribute.
DINV - Double invert.
DNEG - Double negate.
EXPR - Highlights subexpression for which specified object in top level function.
TRG * - Expands trigonometric and hyperbolic functions of sums and differences.
(( )) - Parenthesize neighbors.
COLCT - Collects like terms in specified subexpression.
REPL - Replaces specified subexpression with algebraic from stack.
RULES - Activates RULES transformation menu for specified object.

Calculus

∫ - Integral.
∂ - Derivative.
TAYLR - Calculates Taylor's polynomial.

Character Strings

→STR - Converts object into string.
+ - Adds two objects.
AND - Logical or binary AND.
CHR - Converts character code to one-character string.
NOT - Logical or binary NOT.
NUM - Returns character code of first character in string.
OR - Logical or binary OR.
POS - Returns the position of substring in string or object in list.
REPL - Replaces portion of object with another like object.
SIZE - Finds dimensions of list, array, string, algebraic object, or graphics object.
SUB - Extracts specified portion of list, string, or graphics object.
XOR - Logical or binary exclusive OR.

Continued

Legend:

[ABCD] - Keys on the keyboard are always shown in the special boxed typeface.

ABCD - Menu labels, which are found at the bottom of the display and relate to the keys on the top row of the keyboard, are shown in a shadow box.

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Complex Numbers

* - Multiplies two objects.
– - Subtracts two objects.
→V2 - Combines two real numbers into a 2-D vector or complex number.
√ - Returns square root of object.
+ - Adds two objects.
/ - Divides two objects.
^ - Raises number to specified power.
ABS - Absolute value.
C→R - Separates complex number into two real numbers.
CONJ - Returns complex conjugate.
IM - Returns imaginary part of complex number or array.
INV - Reciprocal.
NEG - Negate.
R→C - Real-to-complex conversion.
RE - Returns real part of complex number or array.
RND - Rounds fractional part.
SIGN - Returns sign of number.
SQ - Returns square of object.
TRNC - Truncates (rounds down).
V→ - Separates 2- or 3- element vector according to current angle mode.

Computer Math

* - Multiplies two objects.
– - Subtracts two objects.
+ - Adds two objects.
/ - Divides two objects.
AND - Logical or binary AND.
ASR - 1-bit arithmetic shift right.
B→R - Binary-to-real conversion.
BIN - Sets binary base.
DEC - Sets decimal base.
HEX - Sets hexadecimal base.
NEG - Negate.
NOT - Logical or binary NOT.
OCT - Sets octal base.
OR - Logical or binary OR.
R→B - Real-to-binary conversion.
RCWS - Recalls binary integer wordsize.
RL - Rotates left by one bit.
RLB - Rotates left by one byte.
RR - Rotates right by one bit.
RRB - Rotates right by one byte.
SL - Shifts left by one bit.
SLB - Shifts left by one byte.
SR - Shifts right by one bit.
SRB - Shifts right by one byte.
STWS - Sets binary integer wordsize.
XOR - Logical or binary exclusive OR.

Customization

ASN - Makes a single user-key assignment.
ATTACH - Attaches specified library to current directory.
DELKEYS - Clears specified user-key assignment.
DETACH - Detaches specified library from current directory.
MENU - Displays built-in or custom menu.
RCLF - Returns binary integer representing states of system and user flags.
RCLKEYS - Returns list of current user-key assignments.
RCLMENU - Returns menu number of current menu.
STOF - Sets state of system and user flags.
STOKEYS - Makes multiple user-key assignments.
TMENU - Displays list-defined menu but does not change contents of *CST*.
[CST] - Selects CST (custom) menu.
[LIBRARY] - Selects LIBRARY menu.
[USR] - Turns User mode on and off.

HP Solve Application

RCEQ - Returns equation in *EQ* to level 1.
STEQ - Stores level 1 equation in *EQ*.
→STK - Copies selected equation, matrix, alarm, or matrix element to level 1.
FAST - Switches displaying equation names only and names plus contents of equations.
EXPR= - Returns expression value or equation values.

Hyperbolic and Logarithmic Functions

ACOSH - Arc hyperbolic cosine.
ALOG - Common (base 10) antilogarithm.
ASINH - Arc hyperbolic sine.
ATANH - Arc hyperbolic tangent.
COSH - Hyperbolic cosine.
e - Symbolic constant *e* (2.71828182846).
EXP - Constant e raised to power of object in level 1.
EXPM - Natural exponential minus 1 (e^x - 1).
LN - Natural (base e) logarithm.
LNP1 - Natural logarithm of (argument +1).
LOG - Common (base 10) logarithm.
SINH - Hyperbolic sine.
TANH - Hyperbolic tangent.

I/O

BAUD - Sets one of four available baud rates.
BUFLEN - Returns number of characters in serial buffer.
CKSM - Selects one of three available checksum error-detect schemes.
CLOSEIO - Closes I/O port.
FINISH - Terminates Kermit server mode.
KERRM - Returns text of most recently-received Kermit error packet.
KGET - Gets data from another device.
OPENIO - Opens serial port.
PARITY - Selects one of 5 possible parity settings.
PKT - Sends KERMIT commands to a server.
RECN - Waits for stack-specified data from remote source running Kermit software.
RECV - Waits for sender-specified data from remote source running Kermit software.
SBRK - Sends serial break.
SEND - Sends contents of variable to another device.
SERVER - Puts HP 48SX into Kermit Server mode.
SRECV - Reads specified number of characters from I/O port.
STIME - Sets serial transmit/receive timeout.
TRANSIO - Selects one of three character translation settings.
XMIT - Without Kermit protocol, performs serial send of string.
IR/W - Switches IR and Wire transmission modes.
ASCII - Switches between ASCII and binary mode.

Matrices and Vectors

* - Multiplies two objects.
– - Subtracts two objects.
+ - Adds two objects.
/ - Divides two objects.
→ARRY - Combines numbers into array.
→V2 - Combines two real numbers into a 2-D vector or complex number.
→V3 - Combines three real numbers into 3-D vector.
ABS - Absolute value.
ARRY→ - Returns array elements to stack.
CON - Creates constant array.
CONJ - Returns complex conjugate.
CROSS - Cross product of 2- or 3-element vector.
DET - Determinant of a matrix.
DOT - Dot product of two vectors.
GET - Gets element from array or list.
GETI - Gets element from array or list and increments index.
IDN - Creates identity matrix of specified size.
IM - Returns imaginary part of complex number or array.
INV - Reciprocal.
NEG - Negate.
PUT - Replaces element in array or list.
PUTI - Replaces element in array or list and increments index.
RDM - Redimensions array.
RE - Returns real part of complex number or array.
RND - Rounds fractional part.
RNRM - Calculates row norm of array.
RSD - Calculates correction to solution of system of equations.
SIZE - Finds dimensions of list, array, string, algebraic object, or graphics object.
SQ - Returns square of object.
TRN - Transposes matrix.
TRNC - Truncates (rounds down).
V→ - Separates 2- or 3-element vector according to current angle mode.
MATRIX - Selects HP MatrixWriter application.
GO↓ - Sets top-to-bottom entry mode.
GO→ - Sets left-to-right entry mode.
VEC - Switches vector and array modes.
←WID - Decreases column width and increments number of displayed columns.
-COL - Deletes current column in HP MatrixWriter application.
-ROW - Deletes current row.
→STK - Copies selected equation, matrix, alarm, or matrix element to level 1.
+COL - Inserts a row of zeros at current column in HP MatrixWriter application.
+ROW - Inserts row of zeros at current row.
VIEW - Copies object into appropriate environment for viewing.
WID→ - Increases column width and decrements number of displayed columns.

Memory Management

ARCHIVE - Makes backup copy of HOME directory.
ATTACH - Attaches specified library to current directory.
BYTES - Returns object size (in bytes) and checksum for object.
CLUSR - Purges all user variables. (included for 28S compatability)
CLVAR - Purges all user variables.
CRDIR - Creates a directory.
DETACH - Detaches specified library from current directory.
† FREE - Frees merged memory.
HOME - Selects *HOME* directory.
LIBS - Lists all libraries attached to current directory.
MEM - Bytes of available memory.
† MERGE - Merges plug-in RAM card memory with main memory.
NEWOB - Decouples object from list or variable name.
ORDER - Rearranges current directory so that variables appear in VAR (variables) menu in order specified in list.
PATH - Returns list containing path to current directory.
PGDIR - Purges specified directory.
PURGE - Purges one or more specified variables.
PVARS - Returns list of current backup objects and libraries within a port.
RCL - Recalls object stored in specified variable to stack.
RESTORE - Replaces *HOME* directory with backup copy.
STO - Stores object in variable.
TVARS - Returns variables containing specified object type.
UPDIR - Makes parent directory the current directory.
VARS - Returns list of variables in current directory.
VTYPE - Returns type number of object stored in local or global name.
VAR - Selects VAR (variables) menu.
CAT - Selects Catalog.
EQ+ - Adds selected equation to list in *EQ*.
NEW - Takes algebraic or matrix from stack, prompts for name, stores named algebraic in *EQ*, or named matrix in Σ*DAT*.
NXEQ - Rotates list of equations in *EQ*.

Continued

Legend:

[ABCD] - Keys on the keyboard are always shown in the special boxed typeface.

ABCD - Menu labels, which are found at the bottom of the display and relate to the keys on the top row of the keyboard, are shown in a shadow box.

† - These commands pertain to HP 48SX only.

Object Management

→GROB - Converts objects into graphics object.
→LIST - Combines specified objects into list.
→STR - Converts object into string.
→TAG - Combines objects in levels 1 and 2 to create tagged object.
+ - Adds two objects.
BYTES - Returns object size (in bytes) and checksum for object.
DTAG - Removes all tags from object.
EVAL - Evaluates object.
GET - Gets element from array or list.
GETI - Gets element from array or list and increments index.
LIST→ - Returns list elements to stack.
OBJ→ - Returns object components to stack.
POS - Returns the position of substring in string or object in list.
PUT - Replaces element in array or list.
PUTI - Replaces element in array or list and increments index.
REPL - Replaces portion of object with another like object.
SIZE - Finds dimension of list, array, string, algebraic object, or graphics object.
STR→ - Converts string to component objects.
SUB - Extracts specified portion of list, string, or graphics object.
SYSEVAL - Evalutes system object. *Use only as specified by HP applications.*
TYPE - Returns type-number of argument object.
[→NUM] - Evaluates object to number.
[VISIT] - Copies object into appropriate environment for editing.
ECHO - Copies object in current level to command line.
EDEQ - Returns contents of *EQ* to command line for editing.
VIEW - Copies object into appropriate environment for viewing.
→LIST - Combines objects from level 1 to current level into a list.

Operating Modes

CF - Clears specified flag.
DEG - Sets Degrees mode.
ENG - Sets display mode to Engineering.
FIX - Selects Fix display mode.
GRAD - Selects Grads mode.
RAD - Sets Radians mode.
RCLF - Returns binary integer representing states of system and user flags.
SCI - Selects Scientific display mode.
SF - Sets specified flag.
STD - Selects Standard display mode.
STOF - Sets state of system and user flags.
[POLAR] - Switches rectangular and polar coordinates.
[RAD] - Switches Radians and Degrees mode.
ML - Switches multi-line and single-line display.
ARG - Enables/disables LASTARG recovery.
CLK - Switches ticking clock display on and off.
CMD - Enables/disables last command line recovery.
FM, - Switches period and comma fraction mark.
M/D - Switches date display format.
R∠∠ - Selects Polar/Spherical mode.
R∠Z - Selects Polar/Cylindrical mode.
STK - Switches Last Stack recovery on and off.
SYM - Switches Symbolic and Numerical Results mode.
XYZ - Selects Rectangular mode.
BEEP - Enables/disables error BEEP.
CNCT - Switches curve filling on and off.
12/24 - Switches between 12-hour and 24-hour display formats.

Other Keyboard Operations

[α] - Turns alpha-entry mode on and off.
[←] - Deletes character to left of cursor.
[▼] - Moves cursor down.
[↰][◀] - In HP EquationWriter application and Graphics environments: Invokes scrolling mode.
[↰][▼] - Moves pointer down one page.
[↰][▲] - Moves pointer up one page.
[↰][PREV] - Selects previous page of menu.
[◀] - Moves cursor left.
[+/-] - If cursor is on a number, changes sign of mantissa or exponent of that number. Otherwise, acts as NEG key.
[↱][▼] - Moves cursor to bottom.
[↱][◀] - Moves cursor to start.
[↱][▶] - Moves cursor to end.
[↱][▲] - Moves cursor to top.
[▶] - Moves cursor right.
[▲] - Moves cursor up.
[ATTN] ([ON]) - Aborts program execution, aborts command line; exits special environments; clears messages.
[DEL] - Deletes character.
[EEX] - Types E or moves cursor to existing exponent in command line.
[ENTER] - Enters contents of command line. If no command line is present, executes DUP.
[ENTRY] - Switches Algebraic- and Program-entry modes.
[LAST CMD] - Displays previous contents of command line.
[LAST MENU] - Selects last displayed page of previous menu.
[NXT] - Selects next page of menu.
[OFF] - Turns calculator off.
[ON] - Turns calculator on.
[REVIEW] - Reviews data, and operator names and types parameters in current application.
[SPC] - Types a blank space.
INS - Switches between insert/replace character.
←DEL - Deletes all characters from cursor to start of word.
DEL→ - Deletes all characters from cursor to start of next word.
←SKIP - Moves cursor left to next logical break.
SKIP→ - Moves cursor right to next logical break.

Plotting and Graphics

*H - Adjusts vertical plot scale.
*W - Adjusts horizontal plot scale.
→ GROB - Converts object into graphics object.
→ LCD - Displays specified graphics object in stack display.
ΣLINE - Returns an expression representing the best-fit line according to the selected statistical model.
+ - Adds two objects.
ARC - Draws arc in *PICT*.
AUTO - Scales *y*-axis.
AXES - Sets specified coordinates of axes intersection; stores labels.
BAR - Selects BAR plot types.
BARPLOT - Draws bar plot of data in Σ*DAT*.
BLANK - Creates blank graphics object.
BOX - Draws box with opposite corners defined by specified coordinates.
C→PX - Converts user-unit coordinates to pixel coordinates.
CENTR - Sets center of plot display at specified (x,y) coordinates.
CONIC - Selects CONIC plot types.
DEPND - Specifies name of dependent plot variable.
DRAW - Plots equation without axes.
DRAX - Draws axes.
ERASE - Erases *PICT*.
FUNCTION - Selects FUNCTION plot type.
GOR - Superimposes graphics object onto graphics object.
GRAPH - Enters Graphics environment.
GXOR - Superimposes inverting graphics object onto graphics object.
HISTOGRAM - Selects HISTOGRAM plot type.
HISTPLOT - Draws histogram of data in Σ*DAT*.
INDEP - Specifies independent variable in a plot.
LABEL - Labels axes with variable names and ranges.
LCD→ - Returns graphics object to stack representing stack display.
LINE - Draws line between coordinates in levels 1 and 2.
NEG - Negate.
PARAMETRIC - Selects PARAMETRIC plot type.
PDIM - Changes size of *PICT*.
PICT - Returns *PICT* to level 1.
PIX? - Tests whether specified pixel in *PICT* is on or off.
PIXOFF - Turns off specified pixel in *PICT*.
PIXON - Turns on specified pixel in *PICT*.
PMAX - Sets upper-right plot coordinates.
PMIN - Sets lower-left plot coordinates.
POLAR - Selects POLAR plot type.
PVIEW - Displays *PICT* with specified pixel at upper-left corner of display.
PX→C - Converts pixel coordinates to user-unit coordinates.
RCEQ - Returns equation in *EQ* to level 1.
REPL - Replaces portion of object with another like object.
RES - Sets spacing between plotted points.
SCALE - Sets scale of PLOT axes.
SCATRPLOT - Draws scatter plot of statistical data in Σ*DAT*.
SCATTER - Selects SCATTER plot type.
SIZE - Finds dimensions of list, array, string, algebraic object or graphics object.
STEQ - Stores level 1 equation in *EQ*.
SUB - Extracts specified portion of list, string or graphics object.
TEXT - Displays stack display.
TLINE - Switches pixels on line defined by coordinates in levels 1 and 2.
TRUTH - Selects TRUTH plot type.
XRNG - Specifies *x*-axis display range.
YRNG - Specifies *y*-axis display range.
GRAPH - Invokes scrolling mode.
REVIEW - Reviews data and parameters in current application.
STO - Returns GROB of HP EquationWriter equation to stack.
+ / - - Switches cursor style between superimposing and inverting cross.
→ STK - Copies selected object to stack.
AREA - Calculates and displays area under function graph between two *x*-values specified by the mark and cursor; returns area to stack.
AUTO - Scales *y*-axis; then plots equation.
BOX - Draws box with opposite corners defined by mark and cursor.
CENT - Redraws graph with center at cursor position.
CIRCL - Draws circle with center and radius defined by mark and cursor.
CNCT - Switches curve filling on and off.
COORD - Displays cursor coordinates.
DEL - Erases area whose opposite corners are defined by mark and cursor.
DOT - - Turns off pixels as cursor moves.
DOT + - Turns on pixels as cursor moves.
DRAW - Plots equation with axes.
EXTR - Moves graphics cursor to nearest extremum, displays coordinates, and returns them to stack.
F ' - Plots first derivative of function, replots function, and adds derivative to *EQ*.
F (X) - Displays value of function at *x-value* specified by cursor. Returns function value to stack. value to stack.
FAST - Switches displaying equation names only and names plus contents of equations.
ISECT - Displays intersection coordinates, and returns coordinates to stack.
KEYS - Removes menu labels.
LABEL - Labels axes with variable names and ranges.
LINE - Draws line from mark to cursor.
MARK - Sets mark at cursor position.
PLOT - Makes the selected entry the current statistical matrix.
REPL - Replaces portion of *PICT* with graphics object.
RESET - Resets plot parameters in *PPAR*.
ROOT - Displays value of root, returns value to stack
SLOPE - Calculates and displays slope of function at cursor position, returns slope to stack.
SUB - Returns specified portion of *PICT* to stack.
TLINE - Switches pixels on and off on line between mark and cursor.
X - Selects *x*-axis zoom.
XAUTO - Selects *x*-axis zoom with autoscaling.
X Y - Selects *x*- and *y*-axis zoom.
Y - Selects *y*-axis zoom.
Z-BOX - Zooms in to box whose opposite corners are defined by mark and cursor.

Continued

Legend:

ABCD - Keys on the keyboard are always shown in the special boxed typeface.

ABCD - Menu labels, which are found at the bottom of the display and relate to the keys on the top row of the keyboard, are shown in a shadow box.

† - These commands pertain to HP 48SX only.

Printing

CR - Causes printer to do carriage return/line feed.
DELAY - Sets delay time between lines sent to printer.
OLDPRT - Remaps HP 48SX character set to match HP 82240A Infrared Printer.
PR1 - Prints object in level 1.
PRLCD - Prints display.
PRST - Prints all objects on stack.
PRSTC - Prints all objects on stack in compact format.
PRVAR - Prints name and contents of one or more variables (including port names).

Program Branching

CASE - Begins CASE structure.
DO - Begins indefinite loop.
ELSE - Begins ELSE clause.
END - Ends program structures.
FOR - Begins definite loop.
IF - Begins test clause.
IFERR - Begins test clause.
IFT - IF-THEN command.
IFTE - IF-THEN-ELSE function.
NEXT - Ends a definite-loop structure.
REPEAT - Begins REPEAT clause.
START - Begins definite loop.
STEP - Ends definite loop.
THEN - Begins THEN clause.
UNTIL - Begins UNTIL clause.
WHILE - Begins indefinite loop.

Program Control

→ - Creates local variables.
BEEP - Sounds beep.
CF - Clears specified flag.
CLLCD - Blanks stack display.
CONT - Continues halted program.
DISP - Displays object in specified display line.
DOERR - Aborts program execution and displays specified message.
ERRO - Clears last error number.
ERRM - Returns last error message.
ERRN - Returns last error number.
FREEZE - Freezes one or more of three display areas.
HALT - Halts program execution.
INPUT - Suspends program execution, displays message, and waits for data.
KEY - Returns number indicating last key pressed.
KILL - Aborts all suspended programs.
MENU - Displays built-in or custom menu.
OFF - Turns calculator off.
PROMPT - Displays prompt string in status area and halts program execution.
RCLMENU - Returns menu number of current menu.
SF - Sets specified flag.
WAIT - Halts program execution for specified number of seconds or until key pressed.
SST - Single-steps through suspended program.
DBUG - Halts program execution before first object.
NEXT - Displays but does not execute next one or two objects in suspended program.
SST↓ - Single-steps through suspended program and its subroutines.

Program Test

≥ - "Greater-than-or-equal" comparison.
≤ - "Less-than-or-equal" comparison.
≠ - "Not-equal" comparison.
< - "Less-than" comparison.
== - "Equality" comparison.
> - "Greater-than" comparison.
AND - Logical or binary AND.
FC? - Tests if specified flag is clear.
FC?C - Tests if specified flag is clear, then clears it.
FS? - Tests if specified flag is set.
FS?C - Tests if specified flag is set, then clears it.
NOT - Logical or binary NOT.
OR - Logical or binary OR.
SAME - Tests two objects for equality.
XOR - Logical or binary exclusive OR.

Real Numbers

% - Returns level 2 percent of level 1.
%CH - Returns % changes from level 2 to level 1.
%T - Returns percent fraction that one number is of another.
* - Muliplies two objects.
– - Subtracts two objects.
√ - Returns square root of object.
+ - Adds two objects.
/ - Divides two objects.
ABS - Absolute value.
CEIL - Returns next greater integer.
D→R - Degrees-to-radians conversion.
FLOOR - Next smaller integer.
FP - Returns fractional part of a number.
INV - Reciprocal.
IP - Integer part of real number.
MANT - Mantissa (decimal part) of number.
MAX - Maximum or two real numbers.
MAXR - Maximum machine-representable real number (9.99999999999E499).
MIN - Minimum of two real numbers.
MINR - Minimum machine-representable real number (1.00000000000E499).
MOD - Modulo.
NEG - Negate.
R→D - Radians-to-degrees conversion.
RND - Rounds fractional part.
SIGN - Returns sign of number.
SQ - Returns square of object.
TRNC - Truncates (rounds down).
XPON - Returns exponent of number.
XROOT - Returns level 1 root of level 2.
^ - Raises number to specified power.

Stack Management

CLEAR - Clears stack.
DEPTH - Returns number of objects on stack.
DROP - Drops object in level 1; moves all remaining objects down one level.
DROP2 - Drops first two objects from stack.
DROPN - Drops *n* objects from stack.
DUP - Duplicates object in level 1.
DUP2 - Duplicates objects in level 1 and level 2.
DUPN - Duplicates *n* objects on stack.
LAST - Returns previous argument(s) to stack.
LASTARG - Returns previous argument(s) to stack.
OVER - Duplicates object in level 2 in level 1.
PICK - Copies object in level *n* to level 1.
ROLL - Moves object in level (*n* + 1) to level 1.
ROLLD - Moves object in level 2 to level *n*.
ROT - Moves object in level 3 to level 1.
SWAP - Exchanges objects in levels 1 and 2.
← - In command line, deletes character to left of cursor; deletes contents of current stack level.
LAST STACK - Restores previous stack.
↑STK - Selects Interactive Stack.
KEEP - Clears all levels above current level.
LEVEL - Enters current level number into level 1.

Statistics and Probability

! - Factorial.
Σ - Summation.
Σ– - Subtracts data point from matrix in Σ*DAT*.
Σ+ - Adds data point to matrix in Σ*DAT*.
ΣLINE - Returns best-fit line for data in Σ*DAT* according to selected statistical model.
ΣX - Returns sum of data in independent column in Σ*DAT*.
ΣX*Y - Returns sum of products of data in independent and dependent columns in Σ*DAT*.
ΣX^2 - Returns sum of squares of data in independent column in Σ*DAT*.
ΣY - Returns sum of data in independent column in Σ*DAT*.
ΣY^2 - Returns sum of squares of data in independent column in Σ*DAT*.
BESTFIT - Selects statistical model yielding largest correlation coefficient (absolute value).
BINS - Sorts elements in independent variable column of Σ*DAT* into *N* + 2 bins (up to a maximum of 1048573 bins).
CLΣ - Purges statistical data in Σ*DAT*.
CNRM - Calculates column norm of array.
COLΣ - Specifies dependent and independent columns in Σ*DAT*.
COMB - Returns number of combinations of *n* items taken *m* at a time.
CORR - Calculates correlation coefficient of statistical data in Σ*DAT*.
COV - Calculates covariance of statistical data in Σ*DAT*.
EDITΣ - Copies statistical data in Σ*DAT* to HP MatrixWriter application.
EXPFIT - Sets curve-fitting model to exponential.
HISTPLOT - Draws histogram of data in Σ*DAT*.
LINFIT - Sets curve-fitting model to linear.
LOGFIT - Set curve fitting model to logarithmic.
LR - Calculates linear regression.
MAXΣ - Maximum column values in statistics matrix in Σ*DAT*.
MEAN - Calculates mean of statistical data in Σ*DAT*.
MINΣ - Finds minimum column values in statistics matrix in Σ*DAT*.
NΣ - Returns number of rows in Σ*DAT*.
PERM - Permutations.
PREDV - Predicted value.
PREDX - Returns predicted value for independent variable, given value of dependent variable.
PREDY - Returns predicted value for dependent variable, given value of independent variable.
PWRFIT - Set curve-fitting model to Power.
RAND - Returns random number.
RCLΣ - Recalls current statistical matrix in Σ*DAT*.
RDZ - Sets random number seed.
SCATRPLOT - Draws scatter plot of statistical data in Σ*DAT*.
SDEV - Calculates standard deviation.
STOΣ - Stores current statistics matrix in Σ*DAT*.
TOT - Sums each column of matrix in Σ*DAT*.
UTPC - Returns probability that chi-square random variable is greater than *x*.
UTPF - Returns probability that Snedecor's F random variable is greater than *x*.
UTPN - Returns probability that normal random variable is greater than *x*.
UTPT - Returns probability that Students *t* random variable is greater than *x*.
XCOL - Specifies independent-variable column in matrix in Σ*DAT*.
YCOL - Selects indicated column of Σ*DAT* as dependent-variable column for two-variable statistics. statistics.
→STK - Copies selected object to level 1.
PLOT - Makes the selected entry the current statistical matrix and displays the third page of the STAT menu.
1-VAR - Makes the selected entry the current statistical matrix and displays the second page of the STAT menu.
2-VAR - Makes the selected entry the current statistical matrix and displays the fourth page of the STAT menu.
SLOPE - Calculates and displays slope of function at cursor position, returns slope to stack.

Storage Arithmetic

DECR - Decrements value of specified variable.
INCR - Increments value of specified variable.
SCONJ - Conjugates contents of variable.
SINV - Replaces contents of variable with its inverse.
SNEG - Negates contents of variable.
STO* - Multiplies contents of specified variable by specified number.
STO– - Subtracts specified number or array from contents of specified variable.
STO+ - Adds specified number or array to contents of specified variable.
STO/ - Divides contents of specified variable by specified number.

Continued

Legend:

ABCD - Keys on the keyboard are always shown in the special boxed typeface.

ABCD - Menu labels, which are found at the bottom of the display and relate to the keys on the top row of the keyboard, are shown in a shadow box.

† - These commands pertain to HP 48SX only.

Time and Appointments

→DATE - Sets specified system date.
→HMS - Converts base 10 number to HMS format.
→TIME - Sets system time.
ACK - Acknowledges displayed past due alarm.
ACKALL - Acknowledges all past due alarms.
CLKADJ - Adds specified number of clock ticks to system time.
DATE - Returns system date.
DATE+ - Returns new date from specified date and number of days.
DDAYS - Returns number of days between two dates.
DELALARM - Deletes alarm from system alarm list.
FINDALARM - Returns first alarm due after specified time.
HMS– - Subtracts in HMS format.
HMS→ - Converts from HMS to decimal format.
HMS+ - Adds in HMS format.
RCALARM - Recalls specified alarm from system alarm list.
STOALARM - Stores level 1 alarm in system alarm list.
TICKS - Returns system time as binary integer in units of clock ticks.
TIME - Returns current time as a number.
TSTR - Converts date and time in number form to string form.

CLK - Switches ticking clock display on and off.
DAY - Sets alarm repeat interval to *n* days.
HR- - Decrements time by one hour.
HR+ - Increments time by one hour.
M / D - Switches date display format.
MIN - Sets alarm repeat interval in minutes.
SEC - Sets alarm repeat interval to *n* seconds.
SET - Sets alarm.
→STK - Copies selected equation to level 1; copies selected matrix to level 1; copies selected alarm to level 1; copies selected matrix element to level 1.
A/PM - Switches clock between AM and PM. Switches alarm time between AM and PM.
EXEC - Sets alarm execution action; recalls alarm execution action to stack.
HOUR - Sets alarm repeat interval to *n* hours.
MIN– - Decrements system time by one minute.
MIN + - Increments system time by one minute.
NONE - Cancels alarm repeat interval and returns to TIME ALRM menu.
SEC– - Decrements current time by 1 second.
SEC+ - Increments current time by 1 second.
WEEK - Sets alarm repeat interval to *n* weeks.
12/24 - Switches between 12-hour and 24-hour display formats.
> DATE - Sets specified alarm date.
> TIME - Sets alarm time.
EXECS - Shows alarm-execution action.

Trigonometric Commands

→HMS - Converts base 10 number to HMS format.
ACOS - Arc cosine.
ARG - Returns polar angle θ.
ASIN - Arc sine.
ATAN - Arc tangent.
COS - Cosine.
HMS– - Subtracts in HMS format.
HMS→ - Converts from HMS to decimal format.
HMS+ - Adds in HMS format.
SIN - Sine.
TAN - Tangent.

Units

ANGLE - Minute of arc, Second of arc, Grade, Radian, Steradian, Degree
AREA - Are, Barn, Square Centimeter, Acre, Square foot, Hectare, Square inch, Square kilometer, Square meter, International square mile, US statute square mile, Square yard
ELECTRICITY - Ampere, Coulomb, Faraday, Farad, Henry, Mho, Siemens, Volt, Weber, Ohm
ENERGY - International Table Btu, Calorie, Erg, Electron volt, Foot-poundf, Joule, Kilocalorie, Mega electron volt, Tesla, EEC therm
FORCE - Dyne, Gram Force, Kilopound, Newton, Poundal
LENGTH - Angstrom, Astronomical unit, Chain, Centimeter, Fathom, Fermi, International foot, Survey foot, Inch, Kilometer, Light year, Meter, Micron, International mile, mil, US Statute mile, Millimeter, Megaparsec, Nautical mile, Parsec, Rod, International yard
LIGHT - Candela, Footcandle, Footlambert, Lambert, Lumen, Lux, Phot, Stilb
MASS - Carat, Gram, Grain, Kilogram, Avoirdupois pound, Troy pound, Mole, Troy ounce, Ounce, Slug, Metric ton, Short ton, Long (UK) ton, Unified atomic mass
POWER - Horsepower, Watt
PRESSURE - Atmosphere, Bar, Inches of mercury, Inches of water, Millimeter of mercury (torr) Pascal, Pounds per square inch, Torr (mmHg)
RADIATION - Gray absorbed dose, Rad absorbed dose, Rem dose equivalent, Sievert dose equivalent, Becquerel activity, Curie activity, Roentgen radiation exposure
SPEED - Speed of light, Centimeters per second, Feet/second, Standard freefall, Nautical miles per hour, Kilometers per hour, Miles per hour, Meters per second
TEMPERATURE - Degrees Celsius, Degrees Fahrenheit, Kelvin, Degrees Rankine
TIME - Day, Hour, Hertz, Minute, Second, Year
VISCOSITY - Poise, Stokes
VOLUME - Barrel, Bushel, Cubic centimeter, US cup, Board feet, Cubic foot, US gallon, Canadian gallon, UK gallon, Cubic inch, Cubic meter (Stere), Milliliter (cubic centimeter), US fluid ounce, UK fluid ounce, Peck, Pint, Quart, Stere, Tablespoon, Teaspoon, Cubic yard

Unit Management

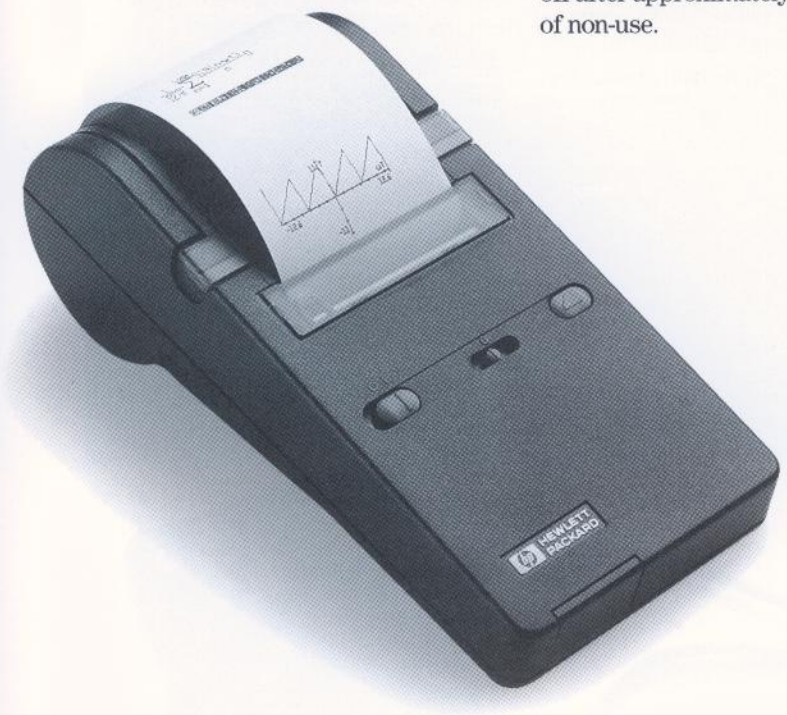
→UNIT - Combines objects in levels 1 and 2 to create unit object.
CONVERT - Converts unit object to dimensions of specified compatible unit.
UBASE - Converts unit object to SI base units.
UFACT - Factors specified compound unit.
UVAL - Returns scalar of specified unit object.

HP 82240B Infrared Printer for the HP 48 Family

The battery-powered infrared printer is a revolutionary companion for your calculator. Since it operates with an invisible infrared beam, no cord is necessary to connect it to the calculator. Producing hard copies – in the field or in your office – couldn't be easier. And this improved version offers easier-to-read output and automatic shutoff for extended battery life.

Operation is easy, too. Simply aim your calculator at the printer (from up to 18 inches away), send print directions, and you get a neat, clean copy of your calculations. You can print out a complete record of your work, or select and print only what you need.

Just four AA batteries give the infrared printer go-anywhere portability. Or to extend battery life, plug in the optional AC adapter. And with the automatic shutoff feature, the infrared printer will turn itself off after approximately ten minutes of non-use.



HP Infrared Printer Specifications

Physical Specifications

- Dimensions
  9.1 x 18.5 x 6.35 cm (3.6 x 7.3 x 2.5 in)
- Weight
  472 g (16 oz) with paper and batteries
- Interface
  Infrared

Power Requirements

- Batteries
  Four replaceable 1.5V AA
- Optional AC adapter output
  9 to 12V AC or DC; 500 to 1500 mA
  HP 82241A in U.S. and Canada, 110V, 50-60 Hz
  HP 82241AB in Europe, 220V, 50 Hz
  HP 82241AG in Australia, 240V, 50 Hz
  HP 82241AJ in Japan, 100V, 50 Hz
  HP 82241AU in United Kingdom, 240V, 50 Hz
- Operating time
  Approximately 6,000 lines of continuous printing with one set of non-rechargeable batteries.

Operating Requirements

- Operating temperature
  0° to 50°C (32° to 122°F)
- Storage temperature
  −40° to 60°C (−40° to 140°F)
- Relative humidity
  5% to 95% at 40°C (104°F)

Print Format

- Technique
  Thermal dot-matrix
- Speed
  1.8 seconds/line at low battery; 0.8 seconds/line with fresh batteries or adapter.
- Text-mode character cell structure
  5x7 dot-matrix
- Graphics mode resolution
  166-dot columns at 90.7 dots/inch horizontal; 72.6 dots/inch vertical; 8-dot printhead. Paper advances 8-dot rows after each line, for continuous graphic printing.
- Line length (characters)
  24 per line
- Character set
  HP ROMAN8, ECMA-94
- Printhead life
  500,000 lines

Paper Feed
Friction

Print Buffer
200 characters

HP 48 Family Software and Accessories

PC Connection Software

HP 82209A Serial Interface Kit
HP 48 to Apple Macintosh Computers*

Share your computer peripherals with your HP 48
Protect your HP 48 data and programs by storing them to your computer disk drive.

Access the power of your HP 48 using the large keyboard and display of your computer
HP 48 commands are easy to enter on your computer keyboard. The Serial Interface Kit software sends commands to the HP 48 and returns results to your computer screen for easy viewing.

Use your favorite computer text editor with the HP 48
Write and edit HP 48 programs; enter large matrices and statistical data in a familiar way.

HP 82208B Program Development Link**

Save program development time by turning your PC into an HP 48 program development system
The Program Development Link cable and software let you transfer files between your HP 48 and PC, and use your PC to write HP 48 applications. Included is a pull-down, menu-driven editor that allows you to open one or two edit windows, format programs and comments, access HP 48 special characters, search and replace, and copy, cut, paste and undo. You can write complete applications in the editor and, with a single keystroke, transfer them to the HP 48. Because the Program Development Link keeps track of changes, you save time by transferring only changed variables.

Immediate execution window
The Program Development Link includes a feature called the immediate execution window, into which you can enter HP 48 command lines. Press return and the resulting stack is sent back to your PC. For example, enter this HP 48 command line:

```
'√(45.30^2+26.20^2)' EVAL
```

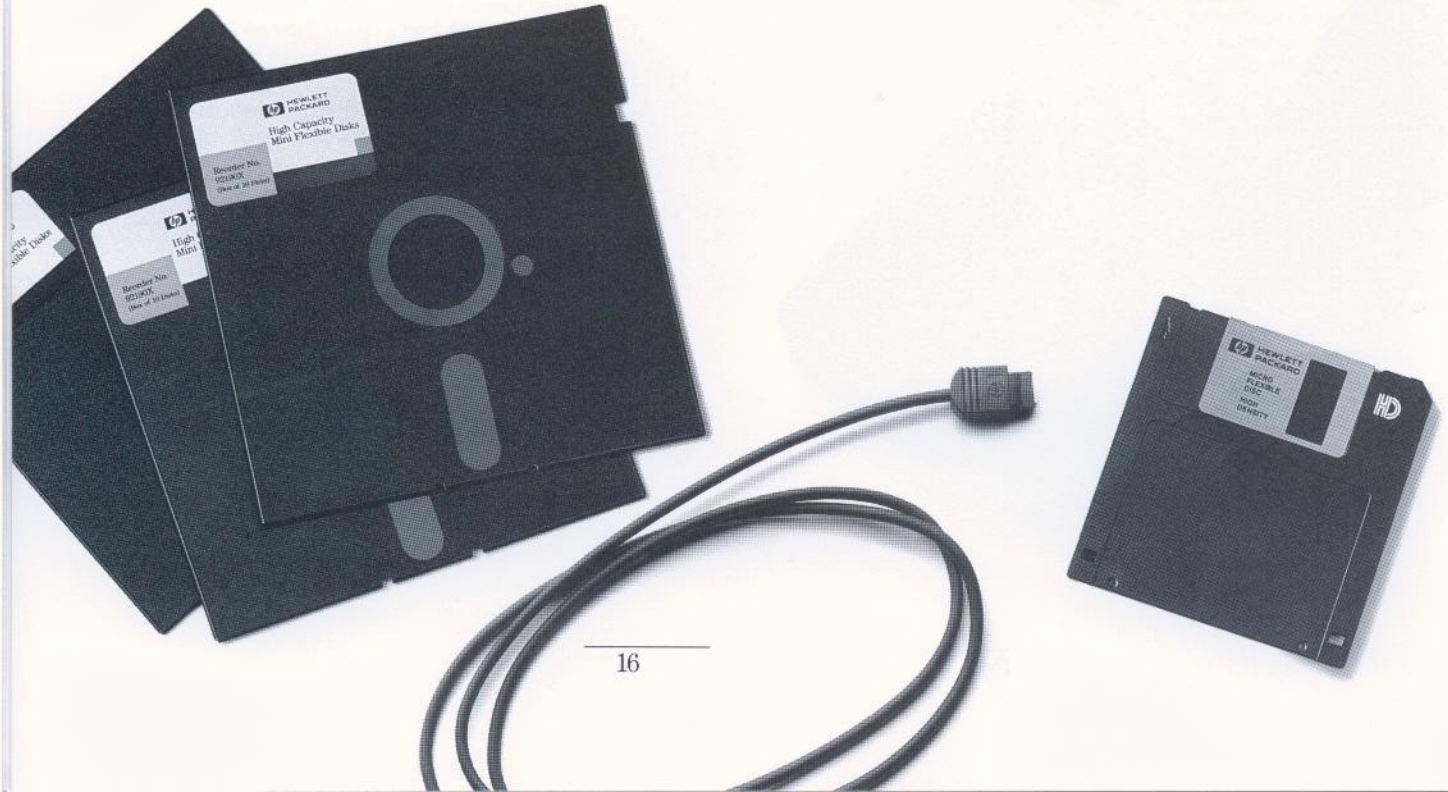
Press return. The stack goes to your PC and the immediate execution window displays the result:

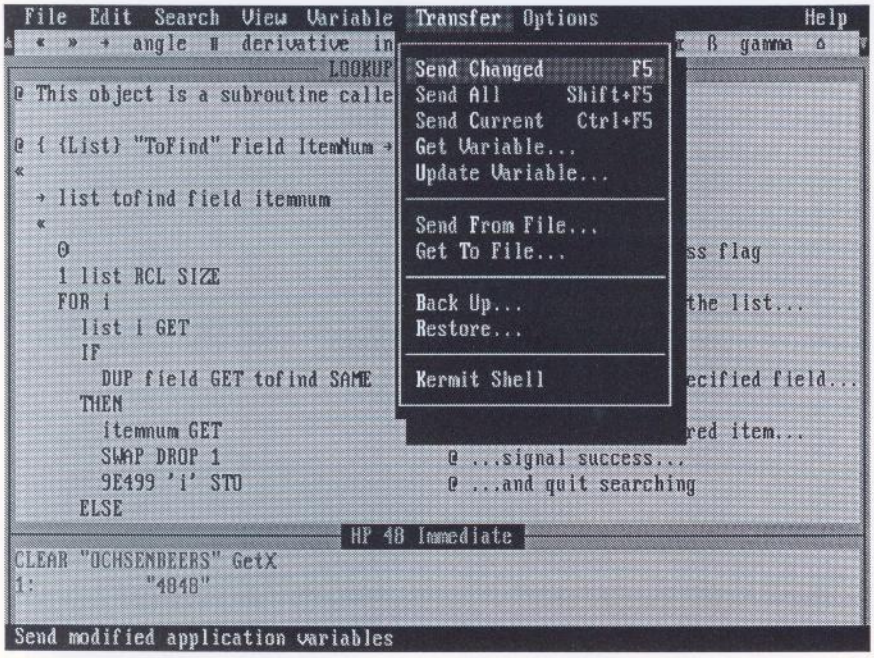
```
1:          52.3309659762
```

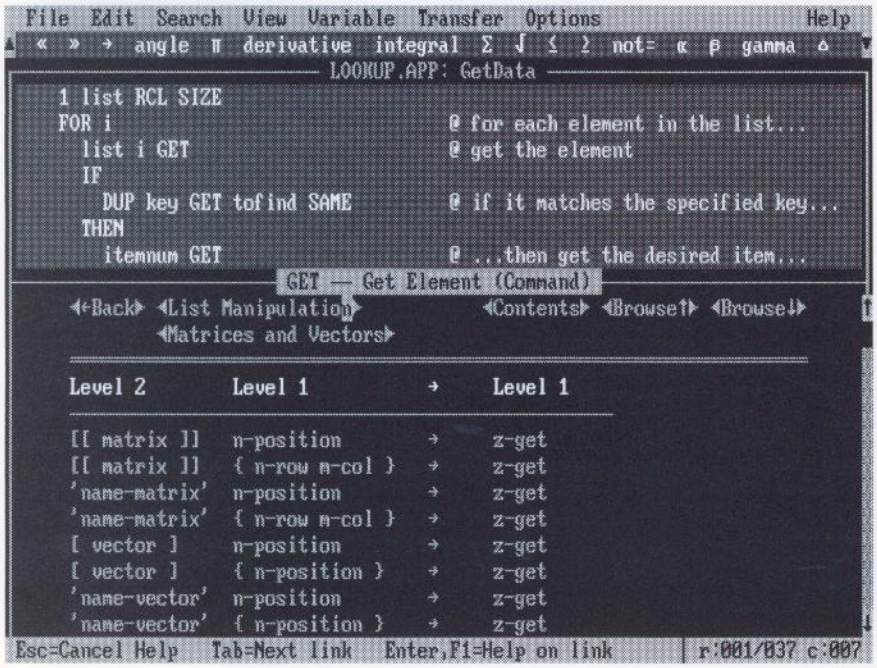
You can edit previous command lines and execute them again. And, segments of your program can be copied from the edit window, pasted into the immediate execution window, and tested.

On-line reference manual
Click your mouse on any HP 48 command, and see the corresponding page of the HP 48 Programmer's Reference Manual (P/N 00048-90054).

HP 48 special characters
Display most HP 48 characters (such as «, », →, π, Σ) on your PC screen, and access them via your mouse or keyboard.







Serial Interface Kit and Program Development Link Specifications

Physical Specifications

- Cable weight
  46.9 g (1.7 oz)
- Cable length
  1.5 m (59 in)

Program Development Link Only

- IBM version connectors
  4-pin custom (HP 48) to 9-pin DIN (cable)
  9-pin DIN to 25-pin DIN (adapter)
- IBM software media
  5¼ inch 360-Kbyte disk
  3½ inch 720-Kbyte disk

Serial Interface Kit Only

- Apple Macintosh version connectors
  4-pin custom to 8-pin mini-DIN (cable)
- Apple Macintosh media
  3½ inch 800-Kbyte disk

* Requires an open serial port (9-pin mini-DIN)
** Requires MS-DOS® 3.0 or above, hard disk, 640 Kbytes of user memory, and an open PC serial port (9- or 25-pin connection).

HP 82211A HP Solve Equation Library Application Card

Over 300 science and engineering equations plus reference tools

The Equation Library is a collection of equations and commands that lets you solve typical science and engineering problems. The library consists of more than 300 equations grouped into 15 technical subjects containing more than 100 equation titles. Each equation title contains one or more equations that help you solve that type of problem.

Despite this wealth of information, the Equation Library is not difficult to use. Use the HP 48SX cursor keys to browse through equation topics such as columns and beams, electricity, and fluid flow. Then, with a touch of a key, you'll see a set of related equations. Choose your equation. The HP 48SX displays it, gives you a picture of the physical system (if appropriate), and lists the descriptions of each variable in the equation.

Here's an example for cantilever beam deflection:

Equation

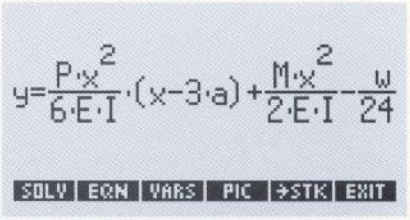
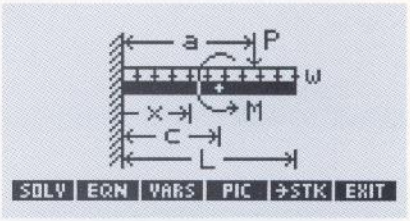
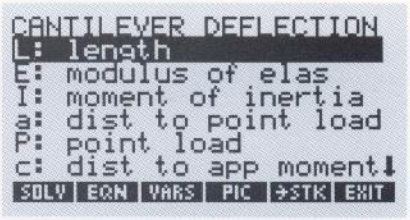
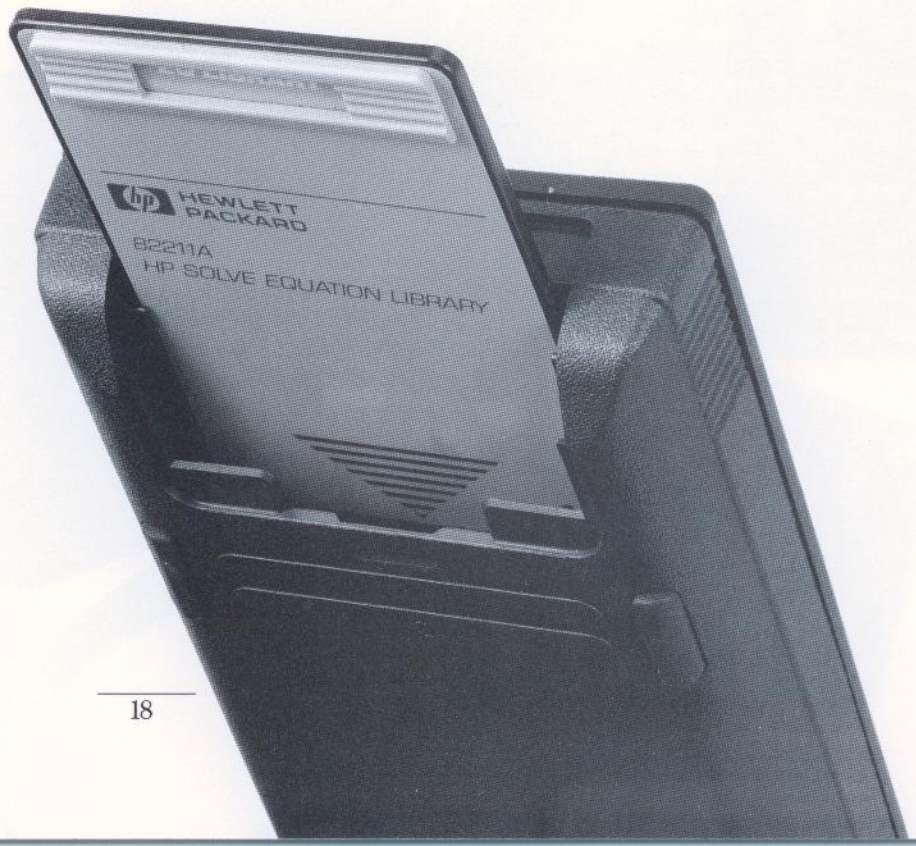


Diagram of physical system



Variable descriptions





The 15 physical subjects included in the Equation Library are:

Columns and beams
- Elastic Buckling
- Eccentric Columns
- Simple Deflection
- Simple Slope
- Simple Moment
- Simple Shear
- Cantilever Deflection
- Cantilever Slope
- Cantilever Moment
- Cantilever Shear

Electricity
- Coulomb's Law
- Ohm's Law and Power
- Voltage Divider
- Current Divider
- Wire Resistance
- Series and Parallel R
- Series and Parallel C
- Series and Parallel L
- Capacitive Energy
- Inductive Energy
- RLC Current Delay
- DC Capacitor Current
- Capacitor Charge
- DC Inductor Voltage
- RC Transient
- RL Transient
- Resonant Frequency
- Plate Capacitor
- Cylindrical Capacitor
- Solenoid Inductance
- Toroid Inductance
- Sinusoidal Voltage
- Sinusoidal Current

Fluids
- Pressure at Depth
- Bernoulli Equation
- Flow with Losses
- Flow in Full Pipes

Forces and Energy
- Linear Mechanics
- Angular Mechanics
- Centripetal Force
- Hooke's Law
- 1D Elastic Collisions
- Drag Force
- Law of Gravitation
- Mass-Energy Relation

Gases
- Ideal Gas Law
- Ideal Gas State Change
- Isothermal Expansion
- Polytropic Processes
- Isentropic Flow
- Real Gas Law
- Real Gas State Change
- Kinetic Theory

Heat Transfer
- Heat Capacity
- Thermal Expansion
- Conduction
- Convection
- Conduction + Convection
- Black Body Radiation

Magnetism
- Straight Wire
- Force Between Wires
- B Field in Solenoid
- B Field in Toroid

Motion
- Linear Motion
- Object in Free Fall
- Projectile Motion
- Angular Motion
- Circular Motion
- Terminal Velocity
- Escape Velocity

Optics
- Law of Refraction
- Critical Angle
- Brewster's Law
- Spherical Reflection
- Spherical Refraction
- Thin Lens

Oscillations
- Mass-Spring System
- Simple Pendulum
- Conical Pendulum
- Torsional Pendulum
- Simple Harmonic

Plane Geometry
- Circle
- Ellipse
- Rectangle
- Regular Polygon
- Circular Ring
- Triangle

Solid Geometry
- Cone
- Cylinder
- Parallelepiped
- Sphere

Solid State Devices
- PN Step Junctions
- NMOS Transistors
- Bipolar Transistors
- JFETs

Stress Analysis
- Normal Stress
- Shear Stress
- Stress on an Element
- Mohr's Circle

Waves
- Transverse Waves
- Longitudinal Waves
- Sound Waves

Physical constants library

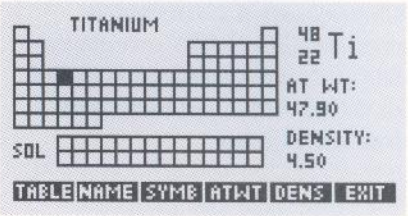
Work with equations that require physical constants, such as gravity and speed of light, without having to look them up or enter them. The HP 48SX automatically puts the constant in the right place in the equation.

The physical constants included are:

- Avogadro's number
- Boltzmann constant
- Molar volume
- Universal gas constant
- Standard temperature
- Standard pressure
- Stefan-Boltzmann constant
- Speed of light in vacuum
- Permittivity of vacuum
- Permeability of vacuum
- Acceleration due to gravity
- Gravitational constant
- Planck's constant
- Dirac's constant
- Electronic charge
- Electron rest mass
- q/me ratio (electron charge-to-mass)
- Proton rest mass
- mp/me ratio (proton mass/electron mass)
- Fine structure constant
- Magnetic flux quantum
- Faraday constant
- Rydberg constant
- Bohr radius
- Bohr magneton
- Nuclear magneton
- Photon wavelength
- Photon frequency
- Compton wavelength
- 1 radian
- 2π radians
- 180° angle
- Constant from Wien's displacement law
- k/q (Boltzmann/electronic charge)
- $\epsilon 0/q$ (permittivity/electronic charge)
- $q \times \epsilon 0$ (electronic charge x permittivity)
- Dielectric constant of silicon
- Dielectric constant of silicon dioxide
- Reference intensity

Periodic table of elements

Press a key to view the periodic table – including atomic weights, atomic numbers, densities of elements, boiling points, and a total of 25 properties. You may never need to refer to a periodic table in a textbook again.



HP Solve Equation Library Application Specifications:

Physical Specifications
- Weight
  23.8 g (0.8 oz)
- Dimensions
  8.6 x 5.3 x 0.3 cm (3.4 x 2.1 x 0.1 in)

Operating Requirements
- Operating temperature
  0° to 45°C (32° to 113°F)
- Storage temperature
  −20° to 65°C (−4° to 149°F)

HP 82210A HP 41CV Emulator Application Card

Get the best of two worlds
Move up to the power and breakthrough capabilities of the HP 48SX calculator, and take your HP 41CV programs along using the HP 41CV Emulator application card. It emulates all HP 41CV commands and most non-graphics commands of the HP 82240A or HP 82240B Infrared Printers.

Flexible data and program access
Share data between the HP 48SX and HP 41CV emulation environments. In emulation mode, the HP 48SX keyboard is reassigned to HP 41 functions. A keyboard overlay serves as a guide to HP 41CV commands. Or, make your own key assignments; they are active in the emulator's USER mode.

Familiar display
The default display shows all four HP 41 stack registers and annunciators.

HP 41CV Emulator Application Card Specifications

Physical Specifications
- Weight
  23.8 g (0.8 oz)
- Dimensions
  8.6 x 5.3 x 0.3 cm (3.4 x 2.1 x 0.1 in)

Operating Requirements
- Operating temperature
  0° to 45°C (32° to 113°F)
- Storage temperature
  −20° to 65°C (−4° to 149°F)

RAM Cards (for the HP 48SX only)

HP 82215A 128-Kbyte Battery-backed RAM Card

HP 82214A 32-Kbyte Battery-backed RAM Card

Take advantage of up to an additional 256 Kbytes of RAM
Plug in one or two RAM cards and develop large programs and store more data in your HP 48SX.

Choose the memory configuration you need
Add any combination of 32-Kbyte and 128-Kbyte RAM cards to increase user memory of the HP 48SX, or use as an electronic disk.

Save your information, even when you unplug the RAM card from the HP 48SX
Each card is powered by its own replaceable, long-lasting battery. When a card has been configured as electronic disk, the battery protects the data or programs on the card.

RAM Card Specifications

Physical Specifications
- Weight
  23.8 g (0.8 oz)
- Dimensions
  8.6 x 5.3 x 0.3 cm (3.4 x 2.1 x 0.1 in)

Operating Requirements
- Operating temperature
  0° to 45°C (32° to 113°F)
- Storage temperature
  −20° to 65°C (−4° to 149°F)

Power:
- Battery
  CR2016 button-type battery
- Typical battery current
  128 Kbytes RAM 1.0 μA
  32 Kbytes RAM 0.5 μA
  (When installed, cards draw power from HP 48SX)
- Typical battery life
  2-3 years

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Technical information covered in this brochure and product availability are subject to change without notice.

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