



Calculus and Advanced Math

PN 12052-1A

Mathematics Series Calculus and Advanced Mathematics Serial Number: 53479173648

CalcWare[™] User's Guide

SPARCOM CORPORATION

Mathematics Series

Calculus and Advanced Math PN 12052-1A

Notice

This manual, the accompanying software, and the examples contained herein are provided "as is" and are subject to change without notice. Sparcom Corporation makes no warranty of any kind with regard to this manual or the accompanying software, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Sparcom Corporation shall not be liable for any errors or for incidental or consequential damages in connection with the furnishing, performance, or use of this manual, the accompanying software, or the examples herein.

© Copyright Sparcom Corporation 1994. All rights reserved. Reproduction, transmission in any form or by any means, adaptation, or translation of this manual is prohibited without prior written permission of Sparcom Corporation, except as allowed under the copyright laws.

The owner of this manual is granted a one-user, non-commercial license to use the enclosed software, and may not copy, distribute, or transfer the software under any circumstances without prior written permission of Sparcom Corporation.

CalcWare is a trademark of Sparcom Corporation. Macintosh is a registered trademark of Apple Computer Incorporated.

Customer Support

Customer satisfaction is important to Sparcom Corporation. Technical support is available Monday through Friday, 9 a.m. to 12 p.m. Pacific Coast Time, by calling (503) 757-8416. Your questions are also welcome by facsimile (503) 753-7821 or by e-mail (Internet: support@sparcom.com).

Credits

CalcWare[™] was made possible by:

- Product Manager: Alan Fudge.
- Project Leader: Scott M. Burke.
- Software Development: Brian J. Maguire.
- User's Guide: Sara Algots.
- User's Guide Editing: Scott M. Burke, Cynthia Ellis, Alan Fudge, Brian J. Maguire, Megha Shyam, Bill Welsch.
- Beta Testers: Cynthia Ellis, Dr. Robert Moore, Bill Welsch.

Sparcom Corporation P.O. Box 927 Corvallis, OR 97339 U.S.A.

Printing History

Edition 1

August 1994

Software Reorder No. 12052-1A

Contents

CONTENTS	
Part 1: Introduction to CalcWare	
1 GETTING STARTED	9
System Requirements	9
Manual Conventions	10
Copying CalcWare to your Computer	11
PC	11
Macintosh	11
Installing CalcWare onto your HP 48	12
To prepare for installation	12
To install the CalcWare shell onto the HP 48	12
To install CalcWare applications onto the HP 48	13
To install all CalcWare applications at once	13
Using CalcWare	14
To start CalcWare	14
To move around in CalcWare	14
To use the home screen	14
To use the Options menu	15
To use the Calculator Modes screen	16
Deleting CalcWare	17
To delete a CalcWare application	17
To delete the CalcWare shell and all applications	17
2 APPLICATION TYPES	18
Analysis Routines	18
To use an Analysis routine	19
Descriptions of Analysis Menu Keys	20
Reference Tables	22
To use a Reference table	22
Description of Reference Menu Keys	23

Part 2: Mathematics Series Calculus and Advanced Math	
3 AI GEBRAIC FUNCTIONS	97
To Install Algebraic Functions	27
Partial Fraction Expansion	28
Taylor Polynomial	29
4 DERIVATIVES	30
To install Derivatives	30
To Look up a Derivative	31
To Solve a Derivative	31
Derivatives Reference	33
5 INTEGRALS	34
To Install Integrals	34
Integration Functions	35
Integrals	36
To Solve an Integral	36
Integrals Reference	38
6 SERIES	46
To install Series	46
Taylor	47
7 SPECIAL FUNCTIONS	48
To Install Special Functions	48
Bessel Functions	49
Beta Function	49
Error Functions	50
Gamma Function	50
8 TRANSFORMS	51
To install Transforms	51
9 VECTORS	53
To install Vectors	53

Appendices and Index	
A TROUBLESHOOTING	57
General Questions	57
Analysis Questions	58
Reference Questions	60
B SERVICE AND WARRANTY	61
Technical Support	61
Shipping Instructions	62
If your disk requires service	62
Service Charge for Out-of-Warranty Disk	62
Disk: Limited 90-Day Warranty	63
What Is Covered	63
What Is Not Covered	63
INDEX	64

Part 1

Introduction to CalcWare



1 Getting Started

This chapter covers:

- System Requirements
- Manual Conventions
- Copying CalcWare to your Computer
- □ Installing CalcWare onto your HP 48
- Using CalcWare
- Deleting CalcWare

System Requirements

Hardware

- Any computer that can run connectivity software and read PC-formatted disks: IBM PC or compatible Macintosh[®]
- HP 48G series calculator: HP 48G HP 48GX
- Serial interface cable

Software

- Any connectivity software: CalcWare Link HP 48 Serial Interface Kit Kermit
- Any CalcWare applications software: Mathematics Series Electrical Engineering Series Mechanical Engineering Series Physics Series Chemistry Series
- CalcWare shell software (included on any CalcWare applications disk)

NOTE

If your computer cannot read PC-formatted disks, contact Sparcom Corporation to inquire about alternate formats. There are a few simple conventions used throughout this manual:

- Keys on the HP 48 keyboard are shown in a boxed typeface, e.g., ENTER.
- The green and purple key labels located above the keys on the HP 48 are also shown in a boxed typeface. For instance, the I/O command is a green label located above the 1 key, and is accessed by pressing the green shift key it then the 1 key. These keystrokes are represented in the following manner: IP I/O.
- *Menu keys* are located at the bottom of the HP 48 screen and correspond directly to the top row of keys on the HP 48 keyboard. They are shown in inverse typeface, such as **HOME**.
- Field names are indicated in bold typeface, such as Result.
- All examples assume that pressing \square locks the alpha entry mode. If you have set the HP 48 system flag -60, press \square instead of \square to lock Alpha entry mode.
- Each heading displays a *map* of the path taken to get to that particular application. For example, the Partial Fraction Expansion application is in the Mathematics directory under Algebraic Functions.



• There are two types of CalcWare applications. These are indicated by the following icons, which appear under the heading of each application:





• For each example, there is a listing of the mode settings required to obtain the indicated results. To change the modes, press real at any CalcWare screen.

PC

- 1. Insert the CalcWare applications disk into the floppy drive.
- 2. If you are in Windows, bring up a DOS prompt.
- 3. At the DOS prompt, type: **a**: and press ENTER. (If your floppy drive is not **a**:, replace "a" with the correct drive letter.)
- 4. Type: install c: and press ENTER. (If your hard drive is not c:, replace "c" with the correct drive letter.)
- 5. When installation is complete, the CalcWare files will be in the directory **c:\calcware** on your hard disk.
- 6. Optional: Exit the DOS prompt and return to Windows.

NOTE	For convenience, the installation creates two exact copies of this CalcWare product on your hard drive:
	 A hierarchical version organized by topic in subdirectories (e.g. math) for downloading a few applications; and
	 A flat version with all the files in one directory (e.g. math.all) for downloading the entire series at once.

Macintosh

- 1. Insert the CalcWare applications disk into the floppy drive. If your Macintosh cannot read PC-formatted disks, contact Sparcom Corporation to inquire about alternate formats.
- Drag the floppy disk icon onto your hard drive icon. If you are using System 6, a dialog box will appear to confirm the operation—click OK to continue. This will create a copy of the floppy disk on your hard drive.
- When copying is complete, the CalcWare files will be in a folder on your hard drive of the same name as the floppy disk. (For example, MATH_A.10 or MATH_B.10 for the Mathematics series.)
- 4. Rename the newly-created folder to calcware.
- Optional: If you have multiple products from the same CalcWare series, you should combine duplicate folders inside calcware as necessary. (In DOS, the installation script does this automatically.)

The instructions below are general instructions for installing the CalcWare shell and applications onto your HP 48 from your computer. These instructions do not provide specific details for using your connectivity software on your computer because of the wide variety of communications packages available.

NOTE	Sparcom Corporation will provide customer support for registered users of CalcWare Link, which is Sparcom's connectivity software for the PC or Macintosh.
	We cannot provide customer support for any other connectivity software—instead, please refer to the manufacturer's documentation that accompanied the software.

To prepare for installation

Turn on the HP 48.
If necessary, press we to quit any software (such as
CalcWare) and return to the HP 48 stack.
Start the connectivity software.
Attach the serial cable to the HP 48 and the computer.

To install the CalcWare shell onto the HP 48

HP 48:	If necessary, press H to go to the HOME directory of the HP 48.
HP 48:	Press 🗩 ► to put the HP 48 into server mode.
Computer:	Change to the calcware directory on your hard drive and
	download the files setupcw and cw.lib to the HP 48.
HP 48:	When the transfer is complete, press 2003 to exit server mode.
HP 48:	Press WAR to display the HP 48 user memory and then SETUP
	to install the CalcWare shell. (You may need to press NUT until SETUP appears in the menu keys.)
HP 48:	When the installation is complete, the HP 48 will turn off.
	Press IN to turn it back on.

NOTE	The HP 48 screen may blink or shift briefly to one side
	when it is turned on—this is normal.

To install CalcWare applications onto the HP 48

HP 48:	If necessary, press P I to go to the HOME directory of the HP 48.
HP 48: Computer:	Press D to put the HP 48 into server mode. Change to the subdirectory under calcware which contains the desired CalcWare application files and download them to the HP 48. (To determine exactly which files to send, see the diagram at the beginning of the relevant chapter in this manual.)
HP 48: HP 48:	When the transfer is complete, press we to exit server mode. Press Function to display the library menu and then CWART CW to start CalcWare. All of the CalcWare applications you just downloaded will be installed automatically.
NOTE	When you enter the first CalcWare application screen for this product, you will be requested to enter the serial number that appears on the inside front cover of this manual.

To install all CalcWare applications at once

If you have an HP 48GX, you may wish to take advantage of the .all directory (e.g. math.all) and download all of the CalcWare applications at once. (The HP 48G does not have enough free memory to do this.)

•	• • •
HP 48:	If necessary, press H I to go to the HOME directory of the
	HP 48.
HP 48:	Press 🗩 🕨 to put the HP 48 into server mode.
Computer:	Change to the .all subdirectory (e.g. math.all) under
	calcware for the desired series.
HP 48:	When the transfer is complete, press we to exit server mode.
HP 48:	Press 🗩 🖽 to display the library menu and then CWAR
	CW to start CalcWare. The CalcWare series you just
	downloaded will be installed automatically.

To start CalcWare

- 1. Press 🗩 📾 to display the library menu.
- 2. Press **CWAR** then **CW** to start CalcWare.

 NOTE
 At any point, you can exit CalcWare and return to the

 HP 48 stack by pressing Weil (the ON key). Sometimes you
 will need to press Weil more than once. You can return to

 CalcWare at the same screen you left from, by pressing
 Image: Comparison of the pressing

 Image: Comparison of the pressing Comparison of the pressing
 Image: Comparison of the pressing

To move around in CalcWare

The HP 48 arrow keys are your navigation tools for accessing every part of CalcWare. The right arrow \blacktriangleright takes you to the next screen. The left arrow \blacksquare takes you to the previous screen. When you have gone as far as you can go in one path with \blacktriangleright , you can return back with \blacksquare . For example:



You can also press \blacksquare we to return directly to the home screen. The up arrow \blacksquare and down arrow \blacksquare allow you to move the highlight bar from one line to another, selecting a new topic or a new field.

To use the home screen

The home screen appears when you start CalcWare for the first time or when you press row from any CalcWare screen. It lists the CalcWare series that are currently installed in your HP 48. To select a series, move the highlight bar to the desired series and press NTER or .



NOTE	To move back to a previous screen at any time, press <a>[] or
	UP or (). To return to the home screen at any
	time, press 🗩 🖼.

Deletes the selected item from the HP 48 user memory. To reinstall the item, download it from the computer. See "To install CalcWare applications onto the HP 48," page 13.

OPTS Displays the Options menu. See "To use the Options menu," page 15. OULT Exits CalcWare and returns to the HP 48 stack.

At screens other than the home screen, an additional menu key may appear:

Goes to the previous screen (this is the same as pressing \triangleleft or $(\square \square \square)$

To use the Options menu

The Options menu provides useful utilities and helps you customize settings for CalcWare. These settings apply to CalcWare only, not to the HP 48 stack. To access the Options menu, press **OPTS**. This will display the following menu keys:

- →STK Copies the highlighted item to the HP 48 stack without leaving CalcWare.
- STACK Copies the highlighted item to the HP 48 stack and allows you to view and/or manipulate the item at the stack. For edit fields

→STK STACK HELP= FONT UNITS EXIT

only: When you have finished editing the item at the stack, press OK to leave the stack and insert the edited item into the current edit field, or press **CANCE** to leave the stack without changing the value of the current edit field. For all other fields and for reference tables: Edits made at the stack will not affect the value in the field. Press **EXIT** to leave the stack and return to CalcWare.

- **HELP** (*if available*) Toggles display of help text on the bottom of the screen. When the box inside the key appears (**HELP**), help is turned on.
- **FONT** Toggles font size between large and small. The small font displays information in proportional, uppercase letters only. The large font displays information in a mono-spaced, case-sensitive font.
- UNITS Toggles units on or off. When the box inside the key appears (UNITT), units are turned on.
- **EXIT** Leaves the Options menu and returns to the regular menu.

ABOUT (Press INT to display this menu key) Displays product information and the current version of the active CalcWare application. This menu key is located on the next page of menu keys. When finished, press I FEV or INT to go to the previous page of menu keys.

To use the Calculator Modes screen

All the examples in this manual list the mode settings required to obtain the indicated results:

Example

To change the modes on the HP 48, press 🗩 🚾 to display the HP 48 Calculator Modes screen. This screen sets the default settings for both CalcWare and the HP 48. Once you exit CalcWare, these settings will remain in effect. The Calculator Modes screen is available throughout CalcWare.

To change any of the settings at the Calculator Modes screen, use the arrow keys to select the desired item and press **CHOOS** or **U**- to step through the choices. When you are finished changing the settings, press **CANCL** or **ENTER** to save the changes. To exit the screen without changing the settings, press **CANCL** or **ENTER**.

Number Format: Press **HOOS** or to select Standard, Fixed, Scientific or Engineering. If applicable, enter the desired number of decimal places.

	🗱 CAL	CULAT	OR MO	DES 🗱	
NUMBE	R FOR	MAT:	3td		
ANGLE	MEAS	URE: [)egr	ees	
CUUBD	CVCTE	м. С			1 ->
Cuuno	21216	an r		anyu	Tat
Z BEEP	31316	_ CLOC	К	_FM,	Tai
∠ BEEP Choosi	E NUM	_CLOC BER DI	K I <u>sp</u> lay	angu _FM, FDRM/	1 ar AT

modes

Standard Degrees

Rectangular

Angle Measure: Press @HOOS or \checkmark to select degrees, radians, or grads. This setting determines how angular functions interpret angular inputs and what angle measure is used to display angular outputs.

Coord System: (Coordinate System) Press **CHOOS** or $\overline{\mathcal{P}}$ to select rectangular, polar or spherical. This setting determines whether complex numbers are displayed as (x,y) or $(r, \measuredangle \theta)$.

From this screen you can also enable the standard beep, display a ticking clock, and change the fraction mark (FM) from "." to "," or vice versa. To change any other HP 48 system flags, press **FILAGI**. For more information about the other flags, see your HP 48G Series User's Guide.

CalcWare is customizable, allowing you to load into your HP 48 just the applications that you need at any given time. Once you are finished with an application, you can easily delete it from your HP 48 user memory to make room for another application. You can also delete the CalcWare shell and all CalcWare applications to free a significant amount of user memory in your HP 48.

To delete a CalcWare application

- 1. Use the \blacksquare and \blacktriangleright keys to move to the screen listing the application you wish to delete.
- 2. Use the 🔽 and 🔺 keys to select the name of the application you wish to delete.
- 3. Once the correct application has been selected, press **DELT** to delete it.

```
CAUTION IDEL will immediately delete the selected item from your HP 48 user memory.
```

You can delete the following items with **DELE**:

- A single application, such as Trigonometric Functions
- A group of applications, such as Trigonometry
- An entire series, such as Mathematics

To delete the CalcWare shell and all applications

- 1. Go to the HP 48 stack. (If you are currently in CalcWare, press we to exit and return to the stack.)
- 2. Press 🕞 🖼 to display the library menu.
- 3. Press **CWAR** then **DELET** to delete CalcWare.

CAUTION DELET will delete the CalcWare shell and all applications from your HP 48 user memory. The HP 48 screen may blink or shift briefly to one side. This is normal.

4. To reinstall CalcWare, see "Installing CalcWare onto your HP 48," page 12.

2 Application Types

Analysis Routines

One type of CalcWare application is an *analysis routine*. Analysis routines have fields for entering data, choosing inputs, and displaying results. The screen below is from the analysis routine, Trigonometric Functions. To download this application, follow the instructions on page 13, "To install CalcWare applications onto the HP 48," and download the following file:

е	HP 48 CalcWare Structure
	Tutorial
\rightarrow	Trigonometric Functions
	re →

Once the application has been downloaded, if you are not already in CalcWare, press **CWAR CWAR** to start CalcWare. Then enter the Trigonometric Functions screen by pressing these keys:



To use an Analysis routine

- 1. Enter values for all edit fields and select values for all choose fields.
- 2. Press **SOLVE** to calculate the results of the analysis, which will be displayed in *result* fields.
- 3. When finished, press I or IIP to return to the previous screen (in this case, Tutorial) or press I to return to the home screen.

																			_	
																			D	
					-															
					1 1 1 1 mar 1													111 Col 11 Col 11		
-		_		_																
_			_	_																
				_																
																	_	~ ~ ~ ~		
_				_																
	_																			
				_																

What is the secant of 45° ?

- 1. If necessary, set the modes:
 - a. Press result to go to the Calculator Modes screen.
 - b. Set the modes as listed in the Example heading above:

Number Format:StandardAngle Measure:DegreesCoord System:RectangularBeep, Clock, FM:your choice

- c. Once the modes are set, press
- Move the highlight bar to the X field (an edit field) type 45 and press ENTER.¹
- 3. At the **Func** field (a choose field), press **CHOOS** or **ENTER** to display the choices for the field. Move the

X: 45 Func: Sec	TRIC FUNCT	IONS 🗱 🗱
RESULT: 1.414	21356237	
RESULT: FUNCTI	IN VALUE	
	11-12-1	ant us

CALCULATOR MODES

COORD SYSTEM: Rectangular

_FM/

_CLOCK

CHOOSE NUMBER DISPLAY FORMAT Dehoose Flag Dance Dis

ANGLE MEASURE: Degrees

NUMBER FORMAT:

¥ BEEP

highlight bar down to SEC and press **CK** or **ENTER**. Or, you can just press $\boxed{1}$ at the **Func** field to step through the choices.

- 4. Press SOLVE to calculate Result.²
- 5. *Optional*: At the **Result** field, press **STK** to copy the result to the stack for use in further calculations, once you exit CalcWare.
- 6. When finished, press I or IIP to return to the previous screen (in this case, Tutorial) or press I we to return to the home screen.

¹ If the value must be entered in specific units, or if there are special conditions or limits on the input, that information will appear in the help text.

² Some analysis routines have too many result fields to display on the input screen. In such cases, a separate output screen is displayed with all the result fields.

Descriptions of Analysis Menu Keys

The menu keys in analysis screens change depending on the type of field that is highlighted. Analysis screens use three basic types of fields: edit fields, choose fields, and result fields. These fields and their associated menu keys are described below. The **OPTS** and **SOLVE** menu keys are always present, regardless of the field type.

Edit Fields

These fields accept values entered from the keyboard. In the above example, \boldsymbol{X} is an edit field.

- EDIT Edits the highlighted item. The menu keys then change to the standard HP 48 editing keys. Press ENTER to save editing changes or WE to cancel editing.
- STACK Copies the highlighted item to the HP 48 stack and allows you



to view and/or manipulate the item at the stack. When you have finished editing the item at the stack, press **CK** to leave the stack and insert the edited item into the current edit field, or press **CANCE** to leave the stack without changing the value of the current edit field.

OPTS Displays the Options menu. See "To use the Options menu," page 15. **TYPES** Displays the allowed object types, such as real number, list, real

array, algebraic, etc. (see the table below). Move the highlight bar to the desired input type and press **NEW** to enter a new item of that type, with the appropriate delimiters. Or press **NOK** to return to the analysis screen without entering a new item.

To Enter a	Such as	Type these keys
Real Number	10	10
Complex Number	(1,2)	
Name	Х	
List	{ 2 2 3 }	(1) 2 2 3
Real Array	[1 2 3]	(1) 1 2 3
Complex Array	[(1,2) (3,2)]	
Algebraic	'SIN(X)'	
Binary integer	#123d	🗭 🗰 1 2 3 🖂 🗲 d

SOLVE Performs a calculation using the entered values. The results are displayed in the result fields. If there are too many result fields to fit on the screen, they will be displayed in a separate result screen.

Choose Fields

These fields only accept values from a pre-defined list that is accessed by pressing **CHOOS**. In above example, **Func** is a choose field.

■ Displays the possible choices for a choose field. In the list of choices, highlight the desired item and press ■ OK■ or ■ NTER, or press ■ ANCL to abort the selection.



STACK Copies the highlighted item to the HP 48 stack and allows you to view and/or manipulate the item at the stack. For a choose field: edits made at the stack will not affect the value in the field. Press EXIT to leave the stack and return to CalcWare.

- **OPTS** Displays the Options menu. See "To use the Options menu," page 15.
- **SOLVE** Performs a calculation using the entered values. The results are displayed in the result fields. If there are too many result fields to fit on the screen, they will be displayed in a separate result screen.

Result Fields

These fields display the results of a calculation. In the above example, **Result** is a result field.

- Copies the highlighted item to the HP 48 stack.
- STACK Copies the highlighted item to the HP 48 stack and allows you to view and/or manipulate the item at the stack. For a result field: edits made at the stack will



not affect the value in the field. Press **EXIT** to leave the stack and return to CalcWare.

- **OPTS** Displays the Options menu. See "To use the Options menu," page 15.
- SOLVE Performs a calculation using the entered values. The result is displayed in the result fields. If there are too many result fields to fit on the screen, they will be displayed in a separate result screen.
- **EXIT** (*Result screens only*) This key appears when there are too many result fields to fit on the input screen and a separate result screen is created. The **EXIT** key returns to the input screen.

NOTE Pressing **Press** will not work at a result screen. To return to the home screen, first press **Press** to return to the input screen, then press **Press**.

Reference Tables

A second type of CalcWare application is a *reference table*. Reference tables display information organized in the same manner as a printed reference book. The information may consist of data, equations, text, or a combination of these types. The screen below is from the reference table, SI Prefixes. To download this application, follow the instructions on page 13, "To install CalcWare applications onto the HP 48," and download the following file:

Computer File Structure	•	HP 48 CalcWare Structure
C→ c:\		
🗁 calcware		
🗁 tutorial		Tutorial
tusipref.ref	\rightarrow	SI Prefixes

Once the application has been downloaded, if you are not already in CalcWare, press CWAR CWAR TOWN to start CalcWare. Then enter the SI Prefixes screen pressing these keys:



To use a Reference table

- 1. Choose parameters (*if appropriate*). Some reference tables have choose fields which control the specific data to be displayed, while other reference tables consist of only one table of data.
- 2. Locate the specific item of interest using the arrow keys. With some reference tables, you can press **DESC** to toggle the positions of the

reference data and the help text, which may make it easier to find the desired item.

- 3. Optional: Press STK to copy the selected item to the stack for use in further calculations. The item will reamin on the stack when you exit CalcWare.
- 4. Optional: If the item is an equation, to view it in the EquationWriter, select the equation, press STACK and then ▼. To scroll to the right or left (for long equations), press ▶ or ◄. When you have finished viewing the item, press to exit the EquationWriter to the HP 48 stack, then EXIT to return to CalcWare.
- 5. When finished, press I or I to return to the previous screen (in this case, Tutorial) or press I to return to the home screen.

Some reference tables are more advanced and can perform calculations, much like analysis routines. For these types of reference tables, the basic steps are similar to those used in analysis routines, as described in "To use an Analysis routine" page 19. Solving reference tables will always have a SOLVE key.

Description of Reference Menu Keys

- ►STK Copies the highlighted item to the HP 48 stack.
- STACK Copies the highlighted item to the HP 48 stack and allows you to view and/or manipulate the item at the stack. For a reference table: edits made at the stack will

SI	PREFIXES
Y: 1624	
Ē: 1Ē18	
🕂 1215	
G: 1E9	Ť
YOTTA	
F STK STRCK	OPTS DESC

not affect the value in the field. Press **EXIT** to leave the stack and return to CalcWare.

PICT (*if available*) Displays a picture. This menu key will not appear for reference tables which do not have a picture.

OPTS Displays the Options menu. See "To use the Options menu," page 15.

- **DESC** (*if available*) Toggles positions of the reference data and the help text. This menu key will not appear for reference tables which do not contain switchable information.
- **SOLVE** (*if available*) Performs a custom calculation using the data in the reference table. This menu key will not appear for reference tables which do not have a custom solving routine. The details of the calculation will be explained in the relevant chapters.

Part 2

Mathematics Series

Calculus and Advanced Math

Mathematics Algebraic Functions **Partial Fraction Expansion Taylor Polynomial** Calculus Derivatives Integrals Integration Functions 01: Elementary 02: A+BX 03: A+BX, C+DX 04: A+BX^N 05: C^2+X^2. X^2-C^2 06: √(A+BX) 07: √(X^2+A^2) 08: √(X^2-A^2) 09: √(A^2-X^2) 10: Trig. (SIN) 11: Trig. (COS) 12: Trig. (SIN and COS) 13: Trig. (Other) 14: Inverse Trig. 15: Logarithmic 16: Exponential 17: Hyperbolic 18: Definite Series Taylor **Special Functions Bessel Functions Beta Function** Error Functions Gamma Function

Transforms Fourier Transforms Definitions Properties Transform Pairs Laplace Transforms Definitions Properties Transform Pairs z-Transforms Definitions Properties Transform Pairs Vectors Cross Products Curl **Del Operator** Divergence Dot Products Gradient Laplacian

3 Algebraic Functions

This chapter covers:

- Partial Fraction Expansion
- Taylor Polynomial

To Install Algebraic Functions

- 1. Send the files marked with "" below from the computer to the HP 48. See "To install CalcWare applications onto the HP 48," page 13.
- 2. Start CalcWare by pressing **CWAR CWAR** and go to the Algebraic Functions screen.

Computer File Structure	HP 48 CalcWare Structure				
🗁 c:\					
🗁 calcware					
🗁 math		Mathematics			
🗁 algebra		Algebraic Functions			
🗈 pfe.anl	\rightarrow	Partial Fraction Expansion			
taylorx.anl	\rightarrow	Taylor Polynomial			

Partial Fraction Expansion

Mathematics Series Algebraic Functions Partial Fraction Expansion

The partial fraction expansion application separates a rational function of the form f(x)/g(x) by splitting it into a sum of fractions with simpler denominators.



What is the partial fraction expansion of

- 1. Enter [23] for **Numer** by typing **(1)** 2 **SPC** 3 **ENTER**.
- 2. Enter [1210] for **Denom**.
- 3. Choose Coefficients for Inputs, if necessary.
- 4. Press SOLVE to calculate Result.
- 5. Optional: To view the formula in the EquationWriter, press STACK then \blacksquare . If necessary, press \blacksquare and \blacktriangleright to scroll to the right and left. When you have finished viewing the formula, press was and then

EXIT to exit the EquationWriter and return to CalcWare.

What is the partial fraction expansion of the rational function $\frac{x+4}{x(x-2)(x+5)}$?

- 1. Enter [-4] for Numer
- 2. Enter [0 2 -5] for **Denom**.
- 3. Choose Roots for Inputs.
- 4. Press **SOLVE** to calculate **Result**.

PARTIAL FRACTION EXPANSION NUMER: [-DENOM: [0 0+.42857143/(8-2. RESULT: PARTIAL FRACTION EXPANSION +STK STACK OPTS SOLVE

PARTIAL FRACTION EXPANSION NUMER: [2 3] DENOM: [1 2 1 RESULT: PARTIAL FRACTION EXPANSION

OPTS

SOLVE

Standard Degrees Rectangular

$$\frac{3}{X} + \left(\frac{-1}{(X+1)^2} - \frac{3}{X+1}\right)$$

$$\frac{2x+3}{x^3+2x^2+x}$$
?

ESTK STRCK

Taylor Polynomial

Mathematics Series Algebraic Functions ➤ Taylor Polynomial



This application computes the *Taylor polynomial* of a function to the specified order about a given point.

What is the 2nd-order Taylor polynomial of sin(x) about the point x=2?

- 1. Enter 'SIN(X)' for **Expr** by typing
- 2. If necessary, enter X for Var.
- 3. Enter 2 for **Order** and 2 for **Point**. (Note: Press result if you need to set the angle measure to radians.)
- 4. Press **SOLVE** to calculate **Result**.

EXPR: 'S VAR: X ORDER: X POINT: 2 REQUILT	AYLOR F IN(X)' Astosfæ	OLYNOMIA 74268264	161461
RESULT: P	OLYNOM	IAL ABOUT	POINT
951K [518	UR.	TUNIST	[SULVE]

Note

This application extends the built-in HP 48 routine TAYLR to allow for expansion of the Taylor polynomial about *any* point. The built-in HP 48 routine actually does a Maclaurin series expansion about the point 0.

Mathematics Series Calculus > Derivatives

4 Derivatives



This application includes a large table of derivatives which can be viewed, copied to the stack, or solved.

To install Derivatives

- 1. Send the files marked with "≧" below from the computer to the HP 48. See "To install CalcWare applications onto the HP 48," page 13.
- 2. Start CalcWare by pressing 🕞 LEWM CWAR CW and go to the Derivatives screen.

Computer File Structure		HP 48 CalcWare Structure
🗁 c:\		
🗁 calcware		
🗁 math		Mathematics
🗁 calculus		Calculus
derivatv.ref	\rightarrow	Derivatives

To Look up a Derivative

Example

Look up a derivative: What is $\frac{\partial}{\partial x} \tan(x)$?

- Optional: To view the formula in the EquationWriter, press STACK then
 ▼. If necessary, press
 and ▶
 to scroll to the right and left. When you have finished viewing the formula, press
 formula and then
 EXTING to exit the EquationWriter and return to CalcWare.



To Solve a Derivative

All of the derivatives are templates for solving, and each template is useful for solving derivatives of a particular form. For example:

This template	Solves derivatives of this form	Such as
∂X(A*U)	A constant multiplied by a function of X	'5*X', '10*X^2', 'π*√X'
∂X(A^U)	A constant raised to the power of a function of X.	'5^X', '–1^(X^2)', 'T^(3*X)'

Each template contains several *placeholder* variables which you must fill in to solve a derivative. There are only six different placeholders—A, N, M, U, V, and W—and they should be replaced with either *constants* or *functions of X*, as follows:

This placeholder	Should be replaced with a	Such as
A, N or M	Constant with respect to X	0.25, 10, -3, 'SIN(π)', T, '3*V'
U, V or W	Function of X	'SIN(X)', X^3, 'T(X)', '3*V(X)'

Standard Degrees Rectangular The instructions below are general instructions for solving derivatives. A detailed example follows.

- 1. Scroll through the Derivatives table with \blacksquare and \blacksquare
- 2. When you have highlighted the desired template, press SOLVE.
- 3. Enter values for the placeholder variables in the derivative and press **SOLVE** to calculate the derivative.

NOTE Before solving a derivative, make sure you have chosen the correct template.

Example

Solve the derivative shown to the right. This derivative is of the form $\frac{U^N}{V^M}$, where U and V are placeholders for ln(X) and $\frac{\partial}{\partial x} \left[\ln(x) \right]^2$

Standard Degrees

Rectangular

X, both functions of X; and N and M are placeholders for 2 and 3, both constants with respect to X.

- 1. Move the highlight bar to $\partial X(U^N/V^M)...$
- 2. Press SOLVE.
- Enter 'LN(X)' for U, 2 for N, X for V, and 3 for M.
- 4. Press SOLVE.
- 5. Optional: To view the formula in the Equation Writer, press STACK then
 ▼. If necessary, press <a and b to scroll to the right and left. When you have finished viewing the formula, press www.mem.andthen formula, press www.mem.an

3X(UXY)=U 3X(UXYX)) 3X(UYY)=(1 3X(UY)=(1 3X(1U)=1/1 3X(1U)=-1 3X(12U)=-1 3X(1	DERIVAT X & X(V) + V = U X V X & X / X & X(U) - I X U^ (U) X & (2 X / U) X & 1 / U^ 2 X & = - N / U^ (A & H & M ()	IVES \$ \$ (M)+ UX3X X(U) X(U) X(U) N+1)3 DEM	U) YXWXX (Y))/Y (U) (U)	××(L↑
+STK STR(K		PTS		SOLVE
U: 'LN(X)' N: 2 V: X M: 3 (33)ULCLA DERIVATIVE	9XCU~N/	V^M)	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
FALK STRCK		PTS		SOLVE

Derivatives Reference

9 (H)	9 Χ(Χ)	<u>9X</u> (U·U)
<u>∂</u> (U+V-W)	<u>9×</u> (∩∧)	<u>9X</u> (∩.A.M) 9
<u>9×(∩</u>)	<u>9×</u> (∩ _N)	<u>努(</u> 10)
$\frac{\partial}{\partial X}\left(\frac{1}{U}\right)$	$\frac{\partial}{\partial X} \left(\frac{1}{U^{N}} \right)$	$\frac{9X}{9}\left(\frac{\Lambda_{W}}{\Pi_{N}}\right)$
<u>∂</u> (U ^N ,Ų ^M)	<u>∂</u> (LN(U))	<u>9</u> ×([₽] 0)
$\frac{9}{9}$ (EXP(N))	$\frac{\partial X}{\partial}(0^{\vee})$	$\frac{\partial}{\partial X}(SIN(U))$
$\frac{\partial X}{\partial X}(COS(U))$	<u>а</u> (там(u))	<u>∂X</u> (COT(U))
$\frac{\partial}{\partial X}(SEC(U))$	<u>∂X</u> (CSC(U))	<u>∂</u> (ASIN(U))
<u>ð</u> (ACOS(U))	$\frac{\partial}{\partial X}(ATAN(U))$	<u>∂</u> (ACOT(U))
$\frac{\partial}{\partial X}$ (ASEC(U))	$\frac{\partial}{\partial X}(RCSC(U))$	∂ (SINH(U))
∂ X(COSH(U))	$\frac{\partial}{\partial X}$ (TANH(U))	∂ δX (COTH(U))
<u>ð</u> (SECH(U))	$\frac{\partial X}{\partial t}$ (CSCH(U))	$\frac{\partial}{\partial X}(\text{RSINH}(U))$
$\frac{\partial}{\partial X}(\text{ACOSH(U)})$	<mark>∂</mark> (Atanh(U))	<u>-</u> <u> Ә</u> (ACOTH(U))
$\frac{\partial}{\partial X}$ (RSECH(U))	∂ }X (ACSCH(U))	

Mathematics Series Calculus

> Integrals

5 Integrals

This chapter covers:

- Integration Functions
- □ Integrals

To Install Integrals

- 1. Send the files marked with "`■" below from the computer to the HP 48. See "To install CalcWare applications onto the HP 48," page 13.
- 2. Start CalcWare by pressing **CWAR CWAR** and go to the Integrals screen.

Computer File Structure		HP 48 CalcWare Structure		
🗁 c:\				
🗁 calcware				
🗁 math		Mathematics		
		Calculus		
C integral		Integration		
🗎 intgfunc.anl	\rightarrow	Integration Functions		
int01.ref	\rightarrow	01: Elementary		
₿ int02.ref	→	02: A+BX		
₿ int03.ref	→	03: A+BX, C+DX		
int04.ref	_ →	04: A+BX^N		
int05.ref	→	05: C^2+X^2, X^2-C^2		
int06 ref		06: √(A+BX)		
₿ int07 ref	_`	07: √(X^2+A^2)		
₿ int08 ref	_`	08 [.] √(X^2-A^2)		
int09 ref	Ś	09: √(A^2-X^2)		
lint0.ref	Ś	10: Trig (SIN)		
la int11 ref		11: Trig. (COS)		
∎ int12 ref	~	12: Trig. (SIN and COS)		
	7	12: Trig. (Other)		
		14: Inverse Trig		
	\rightarrow	14. Inverse Thg.		
	\rightarrow			
int16.ref	\rightarrow			
int17.ref	\rightarrow	17: Hyperbolic		
int18.ref	\rightarrow	18: Definite		
Integration Functions

Mathematics Series Calculus Integrals

> Integration Functions

This application approximates the definite integral of a function over a specified closed interval and number of partitions. The left, right, and midpoint rectangle functions are based on the Riemann lower, upper and midpoint sums, while the trapezoidal method and Simpson's rule are based on different algorithms.

										_		
and the second sec	A CONTRACT OF A	the second se										
and the second se		and the second second second								 		
and the second se										 		
and the second se												
										 	_	- C.

Approximate the area under the curve sin(x) on the interval $[0,\pi/2]$ using Simpson's rule with 10 partitions.

- 1. Enter 0 for Start.
- Enter π/2 for End, by typing
 STACK (π/2 runst be calculated using the stack because the End field requires a real number and will not accept 'π/2'.)



- 3. Enter 'SIN(X)' for F(X)
- 4. If necessary, enter 10 for Part.
- 5. Choose Simpson's Rule for **Tech**.
- Press SOLVE to calculate Result. The approximation is 1.00000339223. (Note: If your result differs, press result to set the angle measure to radians.)
- 7. Optional: Compare this result with the other integration methods.
 - a. Move the highlight bar to **Tech** and choose Left Rectangles. (**Tip:** Press 💤 to select the next value in the choose field.)
 - b. Press SOLVE to calculate Result. The answer is .91940317002.
 - c. Repeat steps 1 and 2 for Right Rectangles, Midpoint Rectangles, and Trapezoidal Method. This illustrates that Simpson's Rule is the most accurate of the approximation methods. However, the analytical solution is 1.

Note

In using the Simpson's Rule, the value for **Part** must always be entered as an even integer as the algorithm uses the "even partitions" convention.

Chapter 5 Integrals

Integrals

Mathematics Series Calculus ➤ Integrals



The integrals application includes hundreds of integrals, which can be viewed, copied to the stack, or solved.

Standard Degrees Rectangular

Look up an indefinite integral: What is $\int \tan(x) dx$?

- Move the highlight bar to 13: Trig. (Other) and press ENTER or
 . The first formula is the answer.

ICD1(AXX)=1/A ICD1(AXX)=1/A ISEC(AXX)=1/A ISEC(AXX)=1/A ISEC(AXX)=1/A ICSC(AXX)=1/A ICSC(AXX)=1/A ITAN(AXX)^2=1 ICD1(AXX)^2=-	G. (DTHER ELNISING XLN(SICGA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECCA) XLN(SECA) XL	7580 8)) 8)+TAN 74+AX8 8)-COT 87-2)) 8)-8 8)-8 8)-8
+STK [STRCK]	OPTS	SOLVE

$$\int_{L}^{U} TAN(A \cdot X) \, dX = \frac{-1}{A} \cdot LN(CO)$$

Note

U and L represent the upper and lower limits of the integral.

To Solve an Integral

All of the integrals are templates for solving, and each template is useful for solving integrals of a particular form. Also, each template contains several *placeholder* variables which you must fill in to solve a integral. There are only six different placeholders—A, B, C, D, N, and M—and they should be replaced with constants, as follows:

This placeholder	Should be replaced with a	Such as
A, B, C, D, N or	Constant with respect to	0.25, 10, -3, 'SIN(π)', T, '3*V'
М	X	

The instructions below are general instructions for solving integrals. A detailed example follows.

- 1. Scroll through the appropriate Integrals table with \blacktriangle and \bigtriangledown .
- 2. When you have highlighted the desired template, press SOLVE.
- 3. Enter values for the placeholder variables in the integral and press **SOLVE** to calculate the integral.
- 4. When you have finished with Integrals, press d to return to the previous screen, or press return to the home screen.

NOTE	Before solving a integral, make sure you have chosen the
	correct template.

Example 2

Part 1

Solve the indefinite integral: $\int \cot(5x)^2 dx$. This integral is of the form

 $COT(A \cdot X)^2$, where A is 5.

- 1. Make sure you are in the 13: Trig. (Other) screen.
- Move the highlight bar to ∫COT(A*X)^2..., which is the last integral in the list, and press SOLVE.
- 3. Enter 5 for A.
- 3. Choose Indefinite for **Type**.
- 4. Press **SOLVE** to calculate **Result**: $\int \cot(5x)^2 dx = -(.2\cot(5x)) - x + C.$ *C* represents a constant of integration, which remains unspecified for the indefinite result.
- 5. Optional: To view the formula in the EquationWriter, press STACK then V. If necessary, press and F to scroll to the right and left. When you have finished viewing the formula, press we want and then EXIME to exit the EquationWriter and return to CalcWare.

A: 5	ICO 🗱	T(AXX)^2	
TYPE: U	DEFIN	TE.	CINICE WAS
In Such	-0.15		
INTEGRAL		••••••	
PER ISLEN		DOTE:	

Standard Radians

Rectangular

Part 2

Now solve the *definite* integral: $\int_{1}^{3} \cot(5x)^2 dx$.

- 1. Move the highlight bar to **Type** and choose Definite. (Note: Two new fields will appear for the limits.)
- Enter 1 for Lower Limit and 3 for Upper Limit. (Note: If your answer differs, press → ∞ to set the angle measure to radians.)

A: S TYPE: DEFINIT LOWER LIMIT: UPPER LIMIT: ABULT: SICE	DT(AXX)^2)) E 1 3 ISSUS92205	
INTEGRAL SETS STADS	OPTS	SOLVE

3. Press **SOLVE** to calculate **Result**. The answer is -1.82551592206.

Integrals Reference

1: Elementary Integrals



2: A+BX Integrals



3: A+BX,C+DX Integrals



4: A+BX^N Integrals



5: C^2±X^2,X^2-C^2 Integrals



6: √(A+BX) Integrals





7: √(X^2+A^2) Integrals



8: √(X^2-A^2) Integrals





9: √(A^2-X^2) Integrals



10: Trig. (SIN) Integrals





11: Trig. (COS) Integrals



12: Trig. (SIN and COS) Integrals



13: Trig. (Other) Integrals

JTAN(A·X) dX	COT(A·X) dX	SEC(A·X) dX	SEC(A·X) dX
∫CSC(A·X) dX	CSC(A·X) dX	TAN(A·X) ² dX	Cot(r:x) ² dx

14: Inverse Trigonometric Integrals



15: Logarithmic Integrals



16: Exponential Integrals





	SINH(X) dX	∫COSH(X) dX	∫TANH(X) dX	∫сотн(х) ах
	SECH(X) dX	CSCH(X) dX	X·SINH(X) dX	X·COSH(X) dX
∫sec	Н(Х) ∙ТАМН(Х) АХ∫СSC	H(X) ·COTH(X) dX	SINH(X) ² dX	Cosh(x) ² dx
	TANH(X) ² dX	Coth(x) ² ax	SECH(X) ² dX	CSCH(X) ² dX
	RSINH(X)dx	RCOSH(X/AX	$\left[\operatorname{ACOSH} \left(\frac{X}{A} \right) \right] dX$	ATANH $\left(rac{X}{A} ight)$ dx
	ACOTH $\left(rac{X}{A} ight)$ dx	RSECH(X) dX	ACSCH(X) dX	ׯSINH(Å)dX
, Y	RCOSH(X) dx	K-ATANH(X)dx	хнсотн(<u>х</u>)ах Ј	X-ASECH(X) dX
ڑ ا	√ACSCH(X) dX	•		

18: Definite Integrals



Chapter 5 Integrals

Mathematics Series > Series



This chapter includes:

Taylor

To install Series

- 1. Send the files marked with "[™]]" below from the computer to the HP 48. See "To install CalcWare applications onto the HP 48," page 13.
- 2. Start CalcWare by pressing 🕞 LEWM CWAR CW and go to the Series screen.

Computer File Structure		HP 48 CalcWare Structure
🗁 c:\		
C calcware		
🗁 math		Mathematics
🗁 series		Series
🖺 sertaylr.ref	\rightarrow	Taylor

Taylor		

Mathematics Series Series ➤ Taylor

This application includes the definition of the Taylor series, which can be viewed or copied to the stack.

What is the definition of the Taylor series?

- 1. The answer is displayed on the screen.
- 2. Optional: To view the formula in the EquationWriter, press STACK then
 If necessary, press and to scroll to the right and left. When you have finished viewing the formula, press we want the EquationWriter and return to CalcWare.

F(X)=ZFN(A)/	TAYLOR NIXCH-ADMN
FN MEANS NTI ASTR STAUS	I DERIVATIVE OF F
M.F	

Note

The HP 48 does not support the nth derivative in a formal notation, so FN is used to represent $F^{(N)}$, the *n*th derivative of F.

7 Special Functions

This chapter covers:

- Bessel Functions
- Beta Function
- Error Functions
- **Gamma** Function

To Install Special Functions

- 1. Send the files marked with "" below from the computer to the HP 48. See "To install CalcWare applications onto the HP 48," page 13.
- 2. Start CalcWare by pressing **CWAR CWAR** and go to the Special Functions screen.

Computer File Structure

HP 48 CalcWare Structure

calcware		
🗁 math		Mathematics
🗁 special		Special Functions
🖹 bessel.anl	\rightarrow	Bessel Functions
🗎 beta.anl	\rightarrow	Beta Function
🗎 error.anl	\rightarrow	Error Functions
gamma.anl	\rightarrow	Gamma Function

🗁 c:\

Bessel Functions

Mathematics Series Special Functions ➤ Bessel Functions



The Bessel functions application³ computes the numerical values for the Bessel functions of the first and second kind, $J_n(X)$ and $Y_n(X)$.

Example

Standard Degrees Rectangular

What is the value of $Y_1(1.5)$?

- 1. Enter 1.5 for X
- 2. Choose Y for Func
- 3. Enter 1 for Order.
- 4. Press SOLVE to calculate Result, which is -.412308626896.

Beta Function



Mathematics Series Special Functions ➤ Beta Function

The beta function application computes the numerical value for a beta function of two real arguments. The definition of the beta function is:

$$\mathcal{B}(x,y) = \int_{0}^{1} t^{x-1} (1-t)^{y-1} dt \quad x > 0 \quad y > 0$$

The beta function relates to the classical gamma function as follows:

 $\beta(x, y) = \frac{\Gamma(x)\Gamma(y)}{\Gamma(x+y)}$

Standard Degrees

Rectangular

Example

What is the value of $\beta(1.25, 1.6)$?

- 1. Enter 1.25 for X and 1.6 for Y.
- 2. Press SOLVE to calculate Result, which is .462954997062.

X: 1.25 Y: 1.6	FUNCTION 🎆	
RESULT: .4629	54997062	
RESULT: BETA F	UNCTION VALU	E

³ The Bessel functions are based on algorithms in Press, William H., et al., *Numerical Recipes in C*, Cambridge University Press, Cambridge, 1989, §6.4.

Error Functions

Mathematics Series Special Functions ➤ Error Functions

The error functions application computes the numerical values for the error function and complementary error functions of one real argument. The definitions of the error function and complementary

error function are:

$$erf(x) = \frac{2}{\sqrt{\pi}} \int_{0}^{x} e^{-t^{2}} dt$$
 $erfc(x) = 1 - erf(x) = \frac{2}{\sqrt{\pi}} \int_{x}^{\infty} e^{-t^{2}} dt$

Example

What is the value of erfc(.25)?

- 1. Enter .25 for X.
- 2. Choose ERFC for **Func**.
- 3. Press SOLVE to calculate Result, which is .723673609832.



Standard Degrees

Rectangular

Gamma Function

Mathematics Series Special Functions Series Gamma Function

This application computes the numerical value for a gamma function of one real argument. The definition of the gamma function is:

$$\Gamma(x) = \int_{0}^{\infty} t^{x-1} e^{-t} dt \quad x > 0$$

The gamma function relates to the factorial function as follows: $\Gamma(x+1) = x!$

																	_	
																	_	
																		C 100 P
					_													× * * * * *
		_																
_																		
		_	_													A		
		_		_														
		_	_															
_		_	_	_	_										_			
		_	_															
	_			_														
				_														

What is the value of $\Gamma(1.5)$?

- 1. Enter 1.5 for X.
- 2. Press SOLVE. The result is .886226925453.

X: 1.5	A FUNCTION	
RESULT: .8862	26925453	
RESULT: GAMMA	FUNCTION Y	ALUE

1

Mathematics Series > Transforms

8 Transforms



The transforms application includes Fourier transforms, Laplace transforms, and z-Transforms, which can be viewed or copied to the stack.

To install Transforms

- 1. Send the files marked with "≧" below from the computer to the HP 48. See "To install CalcWare applications onto the HP 48," page 13.
- 2. Start CalcWare by pressing 🕞 LEWM CWAR CW and go to the Transforms screen.

Computer File Structure		HP 48 CalcWare Structure
C→ c:\		
🗁 calcware		
🗁 math		Mathematics
🗁 transforms		Transforms
		Fourier Transforms
trnfdefn.ref	\rightarrow	Definitions
trnfprop.ref	\rightarrow	Properties
trnftran.ref	\rightarrow	Transform Pairs
		Laplace Transforms
trnldefn.ref	\rightarrow	Definitions
trnlprop.ref	\rightarrow	Properties
trnltran.ref	\rightarrow	Transform Pairs
		z-Transforms
trnzdefn.ref	\rightarrow	Definitions
trnzprop.ref	\rightarrow	Properties
trnztran.ref	\rightarrow	Transform Pairs

Standard Degrees Rectangular

What is the definition of the inverse Fourier transform?

- Move the highlight bar to Fourier Transforms and press ENTER or
 .
- 2. Move the highlight bar to Definitions and press ENTER or **•**.
- 3. Move the highlight bar to the second formula. This is the answer
- 4. Optional: To view the formula in the EquationWriter, press STACK then
 ▼. If necessary, press < and ▶ to scroll to the right and left. When you have finished viewing the



formula, press we we and then **EXIT** to exit the Equation Writer and return to Calc Ware.

Look up the Laplace transform of the time function f(t)=t.

- 1. Move the highlight bar to Laplace Transforms and press **ENTER** or **•**.
- 2. Move the highlight bar to Transform Pairs and press ENTER or ►.
- 3. Scroll down to T: 1/s^2. This is the answer.
- 4. Optional: To view the formula in the Equation Writer, press STACK then
 If necessary, press and to scroll to the right and left. When you have finished viewing the formula, press FREE REE and then





EXIT to exit the EquationWriter and return to CalcWare.

Mathematics Series > Vectors





The vectors application includes definitions and identities for dot products, cross products, the del operator, gradient, divergence, curl, and the Laplacian, which can be viewed or copied to the stack.

To install Vectors

- 1. Send the files marked with "[™]]" below from the computer to the HP 48. See "To install CalcWare applications onto the HP 48," page 13.
- 2. Start CalcWare by pressing **CWAR CWAR** and go to the Vectors screen.

Computer File Structure		HP 48 CalcWare Structure
C→ c:\		
🗁 calcware		
🗁 math		Mathematics
C vectors		Vectors
vectors.ref	\rightarrow	Cross Products
vectcurl.ref	\rightarrow	Curl
vectdel.ref	\rightarrow	Del Operator
vectdiv.ref	\rightarrow	Divergence
vectdot.ref	\rightarrow	Dot Products
vectgrad.ref	\rightarrow	Gradient
vectlapl.ref	\rightarrow	Laplacian
•		

																			100 C 100 C 100
																		~~~~	-
	_																		
_			_	 	- <b>-</b>	_													
	_																		
	_	_				_													
			_	 															
																		and the contract of the second	
_				 	_												 		
			_			_													
	_																		
_				 _		_													
																	_		

What is the formula for divergence in spherical coordinates?

- Move the highlight bar to Divergence and press ENTER or 
   The fifth formula is the answer.
- 2. Optional: To view the formula in the Equation Writer, press STACK then
  If necessary, press and to scroll to the right and left. When you have finished viewing the formula, press we will be and then
  If necessary, press and then
  If necessary press and press press and press press and press press press and press p



#### Note

In these equations, the vector components of the function F are indicated by FX, FY, FR, F $\theta$ , etc. These correspond to the standard notation  $F_X$ ,  $F_Y$ ,  $F_R$ ,  $F_{\theta}$ , etc.

# **Appendices and Index**



This appendix lists the most common questions about CalcWare. Scan this list before calling customer support—you might save yourself a phone call!

This appendix covers:

- General Questions
- Analysis Questions
- **D** Reference Questions

#### **General Questions**

These are the most commonly asked questions about general features of CalcWare.

- Q Why is there a 'CalcWare' directory in my HP 48 user memory? (The directory appears as **CALC** when you press **WAR** to display the variables in your HP 48 user memory.)
  - A The 'CalcWare' directory is where CalcWare applications are installed in your HP 48 when you run the CalcWare shell. This directory appears empty, but that is to protect it from files being accidentally deleted, which would cause erratic behavior. CalcWare applications should be deleted from the CalcWare shell with the DELE key, not from the HP 48 stack.
- **Q** What do the three dots (...) mean at the end of an item on the screen?
  - A They mean that the item is too wide to fit on the screen. To view the entire item, highlight it and press **STACK** to take it to the HP 48 stack, where it will be shown on multiple lines. If the item is an equation, it can also be viewed in the EquationWriter by pressing **v**.
- **Q** I downloaded a CalcWare application, but was interrupted by an "Insufficient Memory" error during the transfer. What can I do?

- A Either delete an installed CalcWare application (using DELL from inside CalcWare) or purge other objects from your HP 48 user memory. See "To delete a CalcWare application," page 17, or see your HP 48G User's Guide for more information about purging HP 48 objects. You should have at least 4K of free memory in your HP 48 to run CalcWare, but you will need more free memory if you want to install additional CalcWare applications. To check the bytes of free memory in your HP 48, press free memory.
- Q I pressed **ECWE**, but got an "Insufficient Memory" error. What can I do?
  - A Purge some objects from your HP 48 user memory or delete the CalcWare shell and all CalcWare applications and reinstall a smaller number of CalcWare applications. The CalcWare shell typically needs at least 3K to 4K of free memory to run. If you do not have 3K to 4K free memory, you may be unable to run the CalcWare shell, which means you will also be unable to delete individual CalcWare applications with the **DELT** key from within CalcWare. The only solution to this is to either free up enough user memory by purging other objects or delete all of CalcWare and reinstall the CalcWare shell and a smaller number of CalcWare applications.

## **Analysis Questions**

These are the most commonly asked questions about CalcWare applications which are analysis routines.

- **Q** I'm solving a problem involving a trigonometric function, and the result isn't the value I expected. What could be wrong?
  - A Your HP 48 angle measure mode setting is probably the cause. Press ress to display the Calculator Modes screen and check the angle measure setting. Note: For proper evaluation of trigonometric derivatives and integrals, make sure your HP 48 angle measure is set to radians.
- **Q** I pressed **SOLVE** and got an expression with  $\pi/180$  in it. What does that mean?

- A Your HP 48 is in degrees mode and the solution involves a trigonometric function, so the result includes the conversion factor  $\pi/180$  to convert between degrees and radians. Press  $\square$  we to enter the Calculator Modes screen and set your HP 48 angle measure to radians.
- Q When I press **SOLVE**, I'm getting a symbolic result but want a numeric result or vice versa. What could be wrong?
  - A Your HP 48 symbolic results mode setting is probably the cause. Press to display the Calculator Modes screen. Then press FLAG to display the system flags screen. For numeric outputs, make sure flag 03 reads, "Function -> num" and has a check mark in front of it. For symbolic outputs, make sure flag 03 reads, "Function -> symb" and has no check mark in front of it. After changing the setting, press DOKO OKO to save the flag settings and exit the Calculator Modes screen.

If you are getting symbolic results and want numeric results, it is possible that one or more of the variables in the result may not be defined numerically, which means you will need to enter a numeric value for it.

If you are getting numeric results and want symbolic results, it is possible that one or more of the variables in the result have values stored in them in your HP 48 user memory outside CalcWare. If a variable exists in your HP 48 user memory, its value may have been substituted into the result, giving a numeric answer. To purge the variable from your HP 48 user memory, press STACK to go the HP 48 stack and press refer to go to the HOME directory, which is the most likely location of the variable. Enter the name of the variable you want to purge by typing refer to go to the HOME directory which is the most likely location of the variable. Enter the name of the variable you want to purge by typing refer to go to calcWare and re-solve the problem.

- Q When I press SOLVE, I get the message, "Undefined Name." Why?

These are the most commonly asked questions about CalcWare applications which are reference tables. If your question relates to a solving feature of a reference table, see also the above section, "Analysis Questions."

- Q How do I copy the help text to the stack?
  - A You can't. Only reference data can be copied to the stack.
- Q I want to solve an equation in a reference table but there's no **SOLVE** key in the menu. How do I solve the equation?
- Q I copied an equation to the stack that the HP 48 won't solve. What could the problem be?
  - A Some reference equations use mathematical functions or operators that the HP 48 does not accept. After copying the equation to the stack, if it begins and ends with single quotes ('), the HP solver should have no trouble with it. However, if the equation begins and ends with double quotes ("), then the equation is *not* a valid expression and the HP 48 cannot solve it. The latter type of equations are intended only for reference information and cannot be solved.

# **B** Service and Warranty

## **Technical Support**

You can get answers to your questions about CalcWare from Sparcom Corporation. Contact us in one of the following ways:

- E-Mail Internet: support@sparcom.com Compuserve: >Internet:support@sparcom.com FidoNet: To:support@sparcom.com
- Standard Mail Sparcom Corporation Attn: Technical Support Department P.O. Box 927 Corvallis, OR 97339, USA
- Telephone (503) 757–8416 Monday to Friday, 9 a.m. to 12 noon, Pacific Time
- Facsimile (503) 753–7821

#### If your disk requires service

- 1. Call Sparcom Corporation for a Return Merchandise Authorization (RMA) number.
- 2. Ship the products back to Sparcom Corporation in the following manner:
  - Include your return address, phone number and a detailed description of the problem.
  - INCLUDE YOUR **RMA** NUMBER WITH THE MERCHANDISE. The RMA number must be written on the outside of the package, or the package will be returned to you unopened.
  - If the product is still under warranty, include the proof of purchase date.
  - Include a check, purchase order, or credit card number and expiration date (VISA or MasterCard) to cover the estimated charge.
  - Should the disk require further service, Sparcom Corporation will notify you of the additional repairs and charges.
  - Ship your disk, postage prepaid, in protective packaging adequate to prevent damage. Ship the package to:

Sparcom Corporation RMA #______ 897 NW Grant Avenue Corvallis, OR 97330, USA

• We highly recommend that you insure the shipment.

Products are usually serviced and reshipped within five working days.

## Service Charge for Out-of-Warranty Disk

Charges for out-of-warranty repairs are individually determined based on time and material. These charges are subject to your local sales or value-added tax, wherever applicable.

#### What Is Covered

The disk is warranted by Sparcom Corporation against defects in materials and workmanship for ninety (90) days from the date of original purchase. If you sell your disk or give it as a gift, the warranty is automatically transferred to the new owner and remains in effect for the original ninety-day period. During the warranty period, we will repair or, at our option, replace at no charge a disk that proves to be defective, provided you return the disk, shipping prepaid, to Sparcom Corporation. (Replacement may be made with a newer disk of equal or better functionality.)

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state, province to province, or country to country.

#### What Is Not Covered

This warranty does not apply if the disk has been damaged by accident or misuse or as the result of service or modification by other than an authorized Sparcom Corporation service center.

No other express warranty is given. The repair or replacement of the disk is your exclusive remedy. ANY OTHER IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS IS LIMITED TO THE NINETY-DAY DURATION OF THIS WRITTEN WARRANTY. Some states, provinces, or countries do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. IN NO EVENT SHALL SPARCOM CORPORATION BE LIABLE FOR CONSEQUENTIAL DAMAGES. Some state, provinces, or countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Products are sold on the basis of specifications applicable at the time of manufacture. Sparcom Corporation shall have no obligation to modify or update products, once sold.

# Index

## A

algebraic functions installation • 27 partial fraction expansion • 28 Taylor polynomial • 29 alpha entry mode • 10 lock • 10 analysis routines • 18 angle measure • 16 arrow keys • 14

#### В

Bessel function • 49 beta function • 49

## С

Calculator Modes screen • 16 CalcWare deleting • 17 installation • 9, 11 starting • 14 types of applications • 10, 18 CalcWare Link • 9 computer requirements • 9 connectivity software • 9 coordinate system • 16 customer support • ii, 61

#### D

derivatives installation • 30 reference • 33

#### Ε

EquationWriter • 23 error function • 50 examples Bessel function • 49 beta function • 49 derivatives • 31 derivatives, solving • 32 error function • 50 gamma function • 50 integrals, indefinite • 36, 37 integration functions • 35 partial fraction expansion • 28 Taylor polynomial • 29 Taylor series • 47 transforms • 52 trigonometric functions • 19 vectors • 54

#### G

gamma function • 50 getting started • 9

#### Η

hardware requirements • 9 heading map • 10 help text • 18 home screen • 14 HP 48 Serial Interface Kit • 9 server mode • 12

#### I

installation algebraic functions • 27 all CalcWare applications • 13

CalcWare applications • 13 CalcWare shell • 12 derivatives • 30 HP 48 • 12 integration • 34 Macintosh • 11 PC • 11 series • 46 special functions • 48 transforms • 51 vectors • 53 integrals • 36 solving • 36 integration installation • 34 integrals • 36 A+BX • 38  $A+BX,C+DX \cdot 39$ A+BX^N • 39 C^2±X^2,X^2-C^2 • 39 Definite • 45 elementary • 38 Exponential • 44 Hyperbolic • 45 Inverse Trigonometric • 44 Logarithmic • 44 SORT(A+BX) • 39 SORT(A^2-X^2) • 41  $SQRT(X^{2}+A^{2}) \cdot 40$ SQRT(X^2-A^2) • 40 Trig. (COS) • 42 Trig. (Other) • 43 Trig. (SIN and COS) • 43 Trig. (SIN) • 41 integration functions • 35

#### Κ

Kermit • 9 keystrokes • 10

#### Μ

manual conventions • 10 menu keys >stk • 15 about • 16 choos • 21 cw • 13 cwar • 13

del • 15 desc • 23 edit • 20 exit • 15, 21 font • 15 for choose fields • 21 for edit fields • 20 for result fields • 21 help • 15 opts • 15 pict • 23 quit • 15 setup • 12 solve • 21, 23 stack • 15, 20, 21, 23 types • 20 units • 15 up•15 modes • 10, 16

#### Ν

number format • 16

## 0

options menu • 15

#### Ρ

partial fraction expansion • 28 polynomial Taylor • 29

#### R

reference tables • 22

#### S

series installation • 46 Taylor • 47 server mode • 12 service • ii charges • 62 setup • 12 shipping instructions • 62 software requirements • 9 solve • 21 special functions Bessel • 49 beta • 49 error • 50 gamma • 50 installation • 48 starting CalcWare • 14 system requirements • 9

## Т

Taylor polynomial • 29 Taylor series • 47 technical support • ii transforms installation • 51

#### V

vectors installation • 53 view • 23

#### W

warranty • 63



**Mathematics Series** 

PN 12052-1A

## **Calculus and Advanced Mathematics**

Easy-to-use, diskette-based software for professionals and students in mathematics, engineering and the physical sciences who use the HP 48G calculator.

#### **Solve Math Problems**

Includes numerous analytical routines and reference data for problem solving, such as:

- Integration Functions Integral Tables
- Algebraic Functions Derivatives
- Series
- Iransforms • Vector Reference

#### **Perform Partial Fraction Expansion**

Never use paper and pencil to write out a partial fraction expansion again! Just type the roots or coefficients into the HP 48 and press solve. 
 Image: State State

RESULT: PARTIAL FRACTION EXPANSION

OPTS

SOLVE

OPTS

INTEGRAL

02: A+BX

→STK STACK

Contents: User's Guide, Software

#### The following items are needed to run CalcWare application software:

• HP 48G or HP 48GX Calculator

- Serial Interface Cable
- Connectivity Software: CalcWare Link for PC or Macintosh, HP Serial Interface Kit or other transfer software such as Kermit
- Personal Computer that can run connectivity software: IBM PC Compatible or Macintosh that reads PC-formatted diskettes



#### **Sparcom Corporation**

897 NW Grant Avenue • Corvallis, Oregon 97330 USA 503-757-8416

Technical information contained herein is subject to update and may be changed without prior notice.

©1994 Sparcom Corporation. CalcWare is a trademark of Sparcom Corporation. HP is a registered trademark of Hewlett-Packard Company. Macintosh is a registered trademark of Apple Computer. Kermit is a trademark of Columbia University.