LINE NUMBER	CODE	HOW TO ENTER
SET MODE TO RPN		
S001	LBL S	
S002	FIX 0	DISPLAY, FIX, 0
S003	INPUT R	
S004	XEQ L001	
S005	(R-G)/2	EQN(RCL R – RCL G)/2 ENTER
S006	STO B	
S007	FIX 1	DISPLAY, FIX, 1
S008	SQRT(A^2+B^2+C^2)-H	EQN √X RCL A y^x 2 + RCL B y^x 2 + RCL RCL H ENTER
S009	STO L	
S010	VIEW L	
S011	RTN	

HP 35s Programming Instructions

R001	LBL R	
R002	FIX 0	DISPLAY, FIX, 0
R003	INPUT S	
R004	XEQ L001	
R005	S+H	EQN(RCL S + RCL H) ENTER
R006	STO P	
R007	SQRT(P^2-A^2-C^2)*2+G	EQN √X (RCL P y^x 2 – RCL A y^x 2 – RCL + RCL G ENTER
R008	STO R	
R009	VIEW R	
R010	RTN	

L001	LBL L	
L002	FIX 1	DISPLAY, FIX, 1
L003	DEG	MODE, DEGREES
L004	INPUT F	
L005	INPUT C	
L006	FIX 0	DISPLAY, FIX, 0
L007	INPUT N	
L008	FIX 1	DISPLAY, FIX, 1

L009	INPUT X	
L010	(720*X) / N	EQN(720 * RCL X) / RCL N ENTER
L011	STO T	
L012	F/2 * SIN (T)	EQN RCL F / 2 * SIN(RCL T) ENTER
L013	STO A	
L014	F * COS (T)	EQN RCL F * COS (RCL T) ENTER
L015	STO G	
L016	1.5	
L017	STO H	
L018	RTN	

HP 32 SII

The two colored buttons in the lower left corner change the other buttons to what is written near each button in that color. For example, to enter the **PRGM** mode, press the orange shift button and the **R/S** key; to enter the **VIEW** command press the blue shift button and the **0** key. Several of the keys will display a menu of options when the key is pressed. To select the desired option, press the key immediately below it.

Turn the unit on by pressing the **C** button. Enter the program writing mode by pressing **PRGM**. The display should show **PRGM TOP**, if not press **GTO** to reset the pointer to the top of the stack. When you are done entering the program, press **C** to exit program mode. To edit the program, press **GTO X** (where **X** is the name of the program) and them press **PRGM**. You can them use the up and down arrows to move from line to line. If you are editing a line that contains an equation (**EQN**) you must delete the entire line using **CLEAR** and re-enter it. All other lines are deleted using the **<-** button.

Te execute a program press **XEQ** and the letter that the program is stored under. When the program pauses for input enter the value and press **R/S** to resume execution.

Function "S"

01 LBL S
02 DISP {FIX} 0
03 INPUT R
04 XEQ L
05 EQN (RCL R – RCL G) / 2 ENTER
06 STO B
07 DISP {FIX} 1
08 EQN √ RCL A y^x 2 + RCL B y^x 2 + RCL C y^x 2) – RCL H ENTER
09 STO L
10 VIEW L
11 RTN

Function "R"

01 LBL R
02 DISP {FIX} 0
03 INPUT S
04 XEQ L
05 EQN RCL S + RCL H ENTER
06 STO P
07 EQN √ RCL P y^x 2 – RCL A y^x 2 – RCL C y^x 2) * 2 + RCL G ENTER
08 STO R
09 VIEW R
10 RTN

Function "L"

01 LBL L
02 DISP {FIX} 1
03 MODES {DG}
04 INPUT F
05 INPUT C

```
06      DISP {FIX} 0
07      INPUT N
08      DISP {FIX} 1
09      INPUT X
10      EQN 720 * RCL X / RCL N ENTER
11      STO T
12      EQN RCL F / 2 * SIN RCL T) ENTER
13      STOA
14      EQN RCL F * COS RCL T) ENTER
15      STO G
16      1.5
17      STO H
18      RTN
```

HP 33S

The two colored shift buttons in the lower left corner change the other buttons to what is written near each button in that color. For example, to enter the **PRGM** mode press the green left shift button and the **R/S** key; to enter the **VIEW** command press the purple right shift button and the **0** key. Several of the keys will display a menu of options when the key is pressed. To select the desired option, press the display or modes button, enter, then select **0** or **1** in the menu.

Turn the unit on by pressing the **C** button. Enter the program-writing mode by pressing the green left shift and **R/S** button. The display should show **PRGM TOP**, if not press **GTO** to rest the pointer to the top of the stack. When you are done entering the program, press **C** to exit the program mode. To edit the program press **GTO X** (where **X** is the name of the program) and then press **PRGM**. You can then use the up and down arrows to move from line to line. Of you are editing a line that contains an equation (**EQN**) you must delete the entire line using **CLEAR** and re-enter it. All other lines are deleted using the **<-** button.

To execute the spoke length program press **XEQ** and the letter that the program is stored under, **S** (or **R** for rim diameter). When the program pauses for input enter the value and press **R/S** to resume execution.

Programming the Wheelsmith SLS

Set calculator to **RPN** Operating mode by pressing green left shift and x√y buttons, the enter the write mode and make sure the display shows PRGM TOP, if not press **GTO** to reset the pointer to the top of the stack. After you enter each line the HP33S will automatically advance to the next line. Commands enclosed in {} in the following functions indicated that they are chosen from the display or mode menus using the cursor keys.

Function "S"

```
1.      LBL S
2.      DISP {FX} 0
3.      INPUT R
4.      XEQ L
5.      EQN ( RCL R – RCL G ) / 2 ENTER
6.      STO B
7.      DISP {FX} 1
8.      EQN √ RCL A yx 2 + RCL B yx 2 + RCL C yx 2 ) – RCL H ENTER
9.      STO L
10.     VIEW L
11.     RTN
```

Function "R"

```
1.      LBL R
2.      DISP {FX} 0
3.      INPUT S
4.      XEQ L
5.      EQN RCL S + RCL H ENTER
6.      STO P
7.      EQN √ RCL P yx 2 – RCL A yx 2 – RCL C yx 2 ) * 2 + RCL G ENTER
8.      STO R
9.      VIEW R
10.     RTN
```

Function "L"

```
1.      LBL L
2.      DISP {FX} 1
3.      MODES {DG}
4.      INPUT F
5.      INPUT C
6.      DISP {FX} 0
7.      INPUT N
8.      DISP {FX} 1
```

```
9.      INPUT X
10.     EQN 720 * RCL X / RCL N ENTER
11.     STO T
12.     EQN RCL F / 2 * SIN RCL T ) ENTER
13.     STO A
14.     EQN RCL F * COS RCL T ) ENTER
15.     STO G
16.     1.5
17.     STO H
18.     RTN
```

CASIO fx 4000

Getting Started

If you aren't familiar with the calculator then turn it on and try a few simple calculations. Notice that it works differently than most other calculators, displaying everything you enter like an equation. There are left and right arrows that can move the cursor about and you can correct mistakes. The "E XE" key has the same function as an "=" key on most other calculators, and pressing it will evaluate the expression, provided it is valid mathematically.

Notice that most of the keys have more than one symbol associated with them. We'll need letters of the alphabet when we program, and they are accessed by entering the alpha mode. Pressing the alpha key lets you type one alpha character and then return to the normal mode. Notice that when the alpha key is pressed the display shows an "A" to indicate the alpha mode. If you want to type several alpha characters then it's fastest to use the alpha lock (shift alpha). To leave the alpha lock mode, press the alpha key. One useful capability when editing is inserting characters by means of the insert key; this allows you to insert a character at the current cursor location.

Programming

You must hit MODE 3, then shift and DEL to erase all programs. Then hit MODE + to be in comp mode.

To write or edit programs enter mode 2. You'll see a line of digits 0 to 9 that represent areas where programs can be written. Left and right arrows will move the cursor to the number you wish to select. Pressing "EXE" lets you start writing a program or edit what's already there. Once again, the left and right arrows give you mobility. To program the calculator enter the instructions exactly as shown below. Note that Lbl and Prg are single keys and are not spelled with individual letters. Fix and Deg are accessed by modes listed in the calculator face. Good Luck! ☺

In program 0:

Lbl 0:"RIM DIA":?→R:Prg 2:(R-G)÷2→B: $\sqrt{(A^2 + B^2 + C^2)} - H \rightarrow Q$

In program 1:

Lbl 1:"SPOKE":?→S:Prg 2:S+H→P: $\sqrt{(P^2 - A^2 - C^2)} \times 2 + G \rightarrow Z$

In program 2:

Lbl 2:Fix 0:Deg:"FLANGE DIA":?→F:"CTR TO FLNG":?→C:"NO SPOKES":?→ M:"NO CROSS":?→N:720xN÷M→T:F x sin T ÷ 2 →A:F x cos T →F:1.5 →H

To exit write mode: MODE 1

The Casio fx4500P

The three colored buttons in the upper left corner change the other buttons to what is written near each button in that color. For example, to enter the exponent "^{2}", press the SHIFT and √ keys; to enter an "=" sign, press the 2ndF and (-) keys. Pressing the key and any button shown in the first and third lines of the chart under the screen will result in entering whatever is printed below, or in the second or fourth lines. For example, to enter :Fix:, press MODE 7. The alphabet mode can be locked on by pressing SHIFT and ALPHA keys; press ALPHA again to exit alphabet.

Turn the unit on by pressing the AC button. Enter the program writing mode by pressing MODE and then EXP. You will see a very small WRT at the bottom of the screen. Leave the write mode by pressing MODE and EXP. Review functions by leaving the write mode and pressing FILE, then press the up and down arrows to move from line to line.

Programming the Wheelsmith SLS

Enter the write mode. You will see ***Filename?*** And ***F1*** on the screen. Enter the word SPOKE. Then press EXE. Move to line one by pressing the down arrow key. The screen will display F1 L1. Enter line 1 of function F1 press the FILE key to return to the start of F1 and press FILE again to move to another function. And so forth.

Function F1

	SPOKE
L1	Fixø (MODE 7)
L2	R"RIM DIA"
L3	Prog L
L4	B=(R-G)/2
L5	Fix 1
L6	Q"SPOKE LNTH"= $\sqrt{(A^2 + B^2 + C^2)}$-H

Function F2

	RIM
L1	Fixø
L2	S"SPOKE USED"
L3	Prog L
L4	P=S+H
L5	Z"RIM DIA"= $\sqrt{(P^2 – A^2 – C^2)}$x2+G

Function F3

	L
L1	Fix 1
L2	Deg (MODE 4)
L3	F"FLANGE DIA"
L4	C"CTR TO FLNG"
L5	Fixø
L6	M"NUM CROSS"
L7	Fix 1

L8 N”NUM CROSS”
L9 T=720xN/M
L10 A=F/2 x sin T
L11 G=F x cos T
L12 H=1.5

To test calculators:
Run program
Rimø = 548
Flangeø = 38
C to Flange = 35.5
# spokes = 32
Cross = 3

Length = 268.2