TI PPC NOTES

NEWSLETTER OF THE TI PROGRAMMABLE CALCULATOR CLUB

P.O. Box 1421, Largo, FL 34294

Volume 9, Number 5 September/October 1984

Once again I must apologize for a late issue. My recovery from surgery continues to be slow. I anticipate that the final "1984" issue should be distributed in mid-January of 1985.

The biggest news of this issue is the availability of over 600 programs. In mid-November we received permission from TI to proceed with the user exchange of programs previously listed in PPX. The instructions for contacting individuals who have agreed to provide programs appear on page 18. The listing of programs runs from page 19 through 24. The members are encouraged to provide additional listings of programs they would make available.

The bad news of this issue is the demise of the CC-40. See page 13. We will continue to carry CC-40 information for the benefit of members who have that machine. Members who have information concerning sources of supplies are invited to send it for distribution.

In V9N4P19 we published an income tax related program by Hewlett Ladd. We commented on some problem areas. Hewlett has provided a modified program which seems to have removed all the problem areas (see page 12). When I asked for comments as a part of last years subscription form several members responded with requests for business and tax related programs. I invite members to send in such programs as soon as they can. If I receive them in time I will include them in the issue to be distributed in January so that the programs can be used for preparation of taxes early next year.

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HAPPY

HOLIDAYS

Palmer Hanson

ERRATA:

An MBA Quirk V9N4P6 - George Thomson notes that a typographical error just above the second table indicated "...vicinity of $640,000 ..." when it should have been " ..$650,000..".

The 1.0000001 Squared 27 Times Test - V9N3P3 - Carl Rabe reports that the twenty-ninth and thirtieth digits listed on page V9N3P3 are incorrect. Laurance Leeds confirms the error. Both Carl and Laurance have have extended the calculation out to more than sixty digits. We believe the correct answer is

674530.470741 084559 382689 178029 746812 844444 +

There is also a typographical error on V9N3P3. There are only five zeroes between the ones, not the six specified by the problem as defined in Scientific American.

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44 Factorial for the TI-57 - V9N4P5 - Robert Prins reports that it is necessary to press INV C.t. to initialize before starting the calculations. This is contrary to the comments at steps 2 and 4 of the instructions.

Calculating e to Many Digits - V9N4P24 - Robert Prins notes that the 10 at steps 147/148 should be 04.

ACCURACY OF TI-59 SQUARE ROOT - George W. Thomson. I have found that comparison of a large number of square roots using the built-in TI-59 square root function either gives the correct result or is one lower in the thirteenth significant figure, divided about equally. The use of the identity, the value divided by its square root gives even more accuracy with the correct value two-thirds of the time and the balance one higher in the thirteenth significant figure. These two methods give errors in the opposite direction. An attempt to combine the two methods using the special average

(CE DIV SQRT STO 00) - (CE - RCL 00) DIV 2

gave even more accurate results with the correct value about 75 per cent of the time and the balance one too high in the thirteenth significant figure.

It would seem that this topic is of interest only to those who would compare the performance of the TI-59 with other calculating engines, but it becomes a key factor in sophisticated kinds of matrix inversion and least squares solutions where Householder type orthogonal transformations are used. A square root is needed at each stage of the pivotal reductions. Clearly, the TI-59 built-in square root is completely adequate for the purpose.

HARDWARE AVAILABILITY - Maurice Swinnen reports that he still has two TI-59's for sale. You can contact him at 9213 Lanham Severn Road, Lanham, MD 20706 . Other members have reported that they have used hardware for sale. If you are interested send a SASE and I will provide details.

MEMORY MALFUNCTION DIAGNOSTIC IN FAST MODE - George Wm. Thomson

V9N4P11 presented a memory malfunction diagnostic program which exercised the memory registers with various values. The complete diagnostic required about sixteen minutes. George modified the program for fast mode, with an attendant reduction in execution time to eight minutes. To use the program you press A and see a flashing "10." in the display. Press 7 and then EE, and sit back and wait for the program to finish.

Program Listing:

```
000  91 R/S    027  07  07    054  46  46    081  02  2     108  59 INT   135  06  6
001  69 DP     028  47 CMS    055  25 CLR    082  95  =     109  65  ×    136  69 DP
002  00  00    029  32 X:T    056  68 NOP    083  65  ×     110  02  2    137  17  17
003  03  3     030  90 ADV    057  09  9     084  01  1     111  54  )    138  25 CLR
004  08  8     031  09  9     058  09  9     085  00  0     112  95  =    139  81 RST
005  01  1     032  09  9     059  42 STO    086  00  0     113  69 DP    140  68 NOP
006  07  7     033  42 STO    060  00  00    087  95  =     114  04  04   141  68 NOP
007  03  3     034  00  00    061  73 RC*    088  85  +     115  32 X:T   142  68 NOP
008  00  0     035  05  5     062  00  00    089  53  (     116  69 DP    143  68 NOP
009  04  4     036  05  5     063  29 CP     090  53  (     117  06  06   144  68 NOP
010  00  0     037  07  7     064  67  EQ    091  53  (     118  97 DSZ   145  68 NOP
011  69 DP     038  01  1     065  01  01    092  43 RCL    119  00  00   146  76 LBL
012  02  02    039  05  5     066  18  18    093  00  00    120  00  00   147  11  A
013  03  3     040  06  6     067  32 X:T    094  55  ÷     121  61  61   148  22 INV
014  07  7     041  69 DP     068  43 RCL    095  01  1     122  01  1    149  58 FIX
015  01  1     042  04  04    069  00  00    096  00  0     123  82 HIR   150  01  1
016  07  7     043  32 X:T    070  55  ÷     097  54  )     124  37  37   151  00  0
017  03  3     044  69 DP     071  01  1     098  22 INV    125  32 X:T   152  69 DP
018  06  6     045  06  06    072  00  0     099  59 INT    126  82 HIR   153  17  17
019  03  3     046  72 ST*    073  95  =     100  65  ×     127  17  17   154  93  .
020  07  7     047  00  00    074  59 INT    101  01  1     128  55  ÷     155  01  1
021  69 DP     048  94 +/-    075  85  +     102  00  0     129  09  9     156  34 FX
022  03  03    049  74 SM*    076  01  1     103  54  )     130  95  =     157  33 X²
023  69 DP     050  00  00    077  85  +     104  85  +     131  22 INV   158  35 1/X
024  05  05    051  97 DSZ    078  28 LOG    105  01  1     132  77  GE    159  86 STF
025  25 CLR    052  00  00    079  59 INT    106  85  +     133  00  00
026  82 HIR    053  00  00    080  65  ×     107  28 LOG    134  28  28
```

FOR BI-LINGUALS - In V8N2P20 Maurice Swinnen reviewed the book Statistics by Calculator by Zehna and Barr. The book emphasized TI-59 programs. Page 95 of Volume 84, Number 16 of Government Reports Announcements carries the abstract at the right, indicating that HP-41 solutions are now available for the same problems. A hard copy is $13.00. A microfilm copy is $4.50. I have not obtained a copy.

442.765
AD-A140 573/7 **PC A06/MF A01**
Naval Postgraduate School, Monterey, CA.
HP-41C Programs and Instructions for Probability and Statistics.
Technical rept.,
P. W. Zehna. Feb 84, 113p Rept no. NPS55-84-003

The purpose of this report is to make available a set of programs and the corresponding user instructions so that the problem material found in the writer's textbooks, Probability by Calculator and Statistics by Calculator may be resolved using the HP-41C hand held calculator.

MARKOV CHAIN MODEL FOR MANPOWER ANALYSIS

Page 28 of Volume 84, Number 1 of the Government Reports Announcements carries the abstract at the right. This is another master's thesis from the Naval Postgraduate School on programmable calculator solutions. See V8N3P17 for an earlier review of a PG School master's thesis. A hard copy is $13.00. A microfilm copy is $4.50. I have not obtained a copy of this book.

400.322
AD-A132 990/3 **PC A06/MF A01**
Naval Postgraduate School, Monterey, CA.
Calculator Adaptation of the Markov Chain Model for Manpower Analysis.
Master's thesis,
Jeffrey Kendall Sapp. Jun 83, 114p

This thesis provides a foundation for the application of fundamental Markov analysis to manpower modeling in the Armed Services or in other similar organizations. A handheld calculator software package is introduced to assist students, military analysts, and others who model manpower systems. Markov analysis methods are incorporated in program software to permit discrete time investigation of the Navy's manpower structure. A user program guide for application to a broad range of manpower issues is also presented. (Author)

1300 DIGITS OF e - Robert Prins. V9N4P24/25 presented a program bo Patrick Johansson which would find 480 digits of e. Programs for fewer digits which would operate on the TI-58C or TI-66 were also presented. Patrick,s program originally appeared in Programbiten. Robert reminds me that the subsequent issue of Programbiten (Volume 80-4, pages 6-7) presented two programs by Bjorn Gustavsson which would find 980 digits and 1300 digits. The programs both run in fast mode using the archaic Pgm-02-SBR-239-9 technique, and seem to be the first fast mode programs to appear in Programbiten. Robert converted both programs to run in the Stf at the end of partition mode of fast mode entry.

The 980 digit program listing is:

```
000  92 RTN    027  00  00    054  00  00    081  00  0    108  00  0    135  00  0
001  01  1      028  00  00    055  65  ×     082  00  0    109  00  0    136  00  0
002  52 EE      029  23  23    056  43 RCL    083  00  0    110  00  0    137  76 LBL
003  09  9      030  00  0     057  99  99    084  00  0    111  00  0    138  11  A
004  22 INV     031  81 RST    058  54  )     085  00  0    112  00  0    139  22 INV
005  52 EE      032  09  9     059  97 DSZ    086  00  0    113  00  0    140  58 FIX
006  44 SUM     033  08  8     060  00  00    087  00  0    114  00  0    141  22 INV
007  98  98     034  48 EXC    061  00  00    088  00  0    115  00  0    142  57 ENG
008  97 DSZ     035  00  00    062  36  36    089  00  0    116  00  0    143  01  1
009  99  99     036  53  (     063  61 GTO    090  00  0    117  00  0    144  00  0
010  00  00     037  22 INV    064  00  00    091  00  0    118  00  0    145  69 DP
011  32  32     038  52 EE     065  01  01    092  00  0    119  00  0    146  17  17
012  22 INV     039  52 EE     066  00  0     093  00  0    120  00  0    147  47 CMS
013  49 PRD     040  01  1     067  00  0     094  00  0    121  00  0    148  04  4
014  98  98     041  00  0     068  00  0     095  00  0    122  00  0    149  05  5
015  76 LBL     042  85  +     069  00  0     096  00  0    123  00  0    150  00  0
016  15  E      043  73 RC*    070  00  0     097  00  0    124  00  0    151  42 STO
017  50 IxI     044  00  00    071  00  0     098  00  0    125  00  0    152  99  99
018  09  9      045  75  -     072  00  0     099  00  0    126  00  0    153  93  .
019  08  8      046  53  (     073  00  0     100  00  0    127  00  0    154  01  1
020  42 STO     047  24 CE     074  00  0     101  00  0    128  00  0    155  34 √x
021  00  00     048  55  ÷     075  00  0     102  00  0    129  00  0    156  33 x²
022  98 ADV     049  43 RCL    076  00  0     103  00  0    130  00  0    157  35 1/x
023  73 RC*     050  99  99    077  00  0     104  00  0    131  00  0    158  86 STF
024  00  00     051  54  )     078  00  0     105  00  0    132  00  0    159  40 IND
025  99 PRT     052  59 INT    079  00  0     106  00  0    133  00  0
026  97 DSZ     053  72 ST*    080  00  0     107  00  0    134  00  0
```

To run the program Press A and see a flashing 10. Press 7 and then EE and wait for about 8½ hours. If a printer is connected e will be printed. If you do not have a printer you should change step 025 to R/S, but do not do it until after the calculation of e is complete. The result can now be read by pressing E R/S R/S ... A zero indicates the end. A partial printout follows:

```
2.718281828   1157383418.   6928368190.   7301238197.   6848756023.
4590452353.   7930702154.   2551510865.    684161403.   3624827041.
6028747135.    891499348.   7463772111.   9701983767.   9786232090.
2662497757.   8416750924.   2523897844.   9320683282.    216099023.
2470936999.   4761460668.   2505695369.   3764648042.   5304369941.
5957496696.    822648001.   6770785449.   9531180232.   8491463140.
7627724076.   6847741185.   9699679468.   8782509819.   9343173814.
6303535475.   3742345442.   6445490598.   4558153017.   3640546253.
9457138217.   4371075390.   7931636889.   5671736133.   1520961836.
8525166427.   7774499206.   2300987931.   2069811250.   9088870701.
4274663919.   9551702761.   2773617821.   9961818815.   6768396424.
3200305992.   8386062613.   5424999229.   9304169035.   3781405927.
1817413596.   3138458300.   5763514822.   1598888519.   1456354906.
6290435729.    752044933.    826989519.   3458072738.   1303107208.
  33429526.   8265602976.   3668033182.   6673858942.   5103837505.
 595630738.    673711320.   5288693984.   2879228499.   1011574770.
1323286279.    709328709.   9646510582.   8920868058.   4171898610.
4349076323.   1274437470.    939239829.   2574927961.   6873969655.
3829880753.   4723069697.   4887933203.    484198444.
1952510190.   7209310141.   6250944311.   3634632449.
```

1300 Digits of e - (cont)

The 1300 digit program listing is:

```
000  92 RTN    027  37  37    054  16  16    081  82 HIR    108  25 CLR    135  00  0
001  82 HIR    028  22 INV    055  75  -     082  18  18    109  81 RST    136  00  0
002  07  07    029  86 STF    056  53  (     083  54  )     110  00  0     137  00  0
003  01  1     030  00  00    057  46 INS    084  59 INT    111  00  0     138  00  0
004  82 HIR    031  53  (     058  55  ÷     085  82 HIR    112  00  0     139  76 LBL
005  58  58    032  82 HIR    059  82 HIR    086  36  36    113  00  0     140  11  A
006  52 EE     033  17  17    060  18  18    087  65  ×     114  00  0     141  22 INV
007  01  1     034  61 GTO    061  54  )     088  82 HIR    115  00  0     142  58 FIX
008  02  2     035  00  00    062  59 INT    089  18  18    116  00  0     143  22 INV
009  44 SUM    036  40  40    063  82 HIR    090  54  )     117  00  0     144  57 ENG
010  99  99    037  53  (     064  06  06    091  22 INV    118  00  0     145  05  5
011  82 HIR    038  73 RC*    065  65  ×     092  52 EE     119  00  0     146  06  6
012  18  18    039  00  00    066  82 HIR    093  52 EE     120  00  0     147  05  5
013  29 CP     040  55  ÷     067  18  18    094  01  1     121  00  0     148  82 HIR
014  67  EQ    041  01  1     068  85  +     095  00  0     122  00  0     149  08  08
015  01  01    042  52 EE     069  32 X:T    096  32 X:T    123  00  0     150  69 DP
016  08  08    043  03  3     070  54  )     097  82 HIR    124  00  0     151  17  17
017  01  1     044  75  -     071  65  ×     098  16  16    125  00  0     152  47 CMS
018  00  0     045  59 INT    072  01  1     099  72 ST*    126  00  0     153  93  .
019  00  0     046  82 HIR    073  52 EE     100  00  00    127  00  0     154  01  1
020  42 STD    047  06  06    074  03  3     101  87 IFF    128  00  0     155  34 √X
021  00  00    048  54  )     075  82 HIR    102  00  00    129  00  0     156  33 X²
022  86 STF    049  53  (     076  46  46    103  00  00    130  00  0     157  35 1/X
023  00  00    050  53  (     077  75  -     104  24  24    131  00  0     158  86 STF
024  97 DSZ    051  32 X:T    078  53  (     105  61 GTO    132  00  0     159  40 IND
025  00  00    052  85  +     079  46 INS    106  00  00    133  00  0
026  00  00    053  82 HIR    080  55  ÷     107  01  01    134  00  0
```

Again, press A and see a flashing 10. Press 7 and then EE and wait somewhat over twenty-four hours for calculations to finish. The result is neither printed or displayed, but can be found thirteen digits per register starting at R99 and ending at R00.

---

48 DIGITS OF e ON THE TI-57 - Robert Prins. This month's TI-57 program (not TI-57LCD) provides another illustration of the power of that little calculator. Key in the program listed below. Press SBR 0. After about 7 minutes and forty seconds the calculator stops with a zero in the display. The 48 digits can be found in R1 (msd) through R6 (lsd).

```
00  06        6          13  08        8          27  33 0     RCL 0      41 -39 1 INV PRD 1
01  38 0    EXC 0        14  34 1    SUM 1        28  22       X:T        42  15       CLR
02  22      X:T          15  43        (          29  32 0     STO 0      43 -61   INV SBR
03  43        (          16  33 1    RCL 1        30  56       DSZ        44  86 0     LBL 0
04  00        0          17  65        -          31  51 1     GTO 1      45 -19   INV C.T
05  55        ×          18  89        x̄          32  44         )        46  04         4
06  86 1    LBL 1        19  49      INT          33  22       X:T        47  00         0
07  33 0    RCL 0        20  55        ×          34  86 2     LBL 2      48  51 2     GTO 2
08  22      X:T          21  38 6    EXC 6        35  32 0     STO 6
09  32 0    STO 0        22  38 5    EXC 5        36  07         7
10  44        )          23  38 4    EXC 4        37 -18   INV LOG
11 -42   INV  EE         24  38 3    EXC 3        38  34 1    SUM 1
12  42        EE         25  38 2    EXC 2        39  56       DSZ
                         26  38 1    EXC 1        40  71       RST
```

ANOTHER BRAINTEASER - Myer Boland writes: "I just wanted to get even with Robert Prins and that girl." I assume he means the Prins brainteasers from V9N2P13 and V9N4P7, and Kelley Stanage's problem from V9N3P16 (solution elsewhere in this issue). Myer's problem is:

> When I took the number of bells from the number of shells and then followed through I got 1.785329835. Explain.

That's all there is to the puzzle.

NUMERIC REPRESENTATION IN THE TI-99/4 AND CC-40 - Laurance Leeds

In V9N4P7 Myer Boland reported that he could recover fourteen digits of pi on the TI-99/4 with the equation P = 4000*ATN(1). If one tries to convert the answer from 1000*pi to pi by dividing by 1000, then the end result reverts to a twelve digit value. The same results were reported for the CC-40. These results follow directly from the radix 100 arithmetic mechanization (see page F-2 of the CC-40 Manual or page III-13 of the TI-99/4 manual.

Both machines use seven radix 100 bytes for the mantissa. This is just another way of saying that the arithmetic is performed using seven blocks, each of two decimal digits, with the value of each block ranging from zero through 99. The exponent is selected so that the decimal point of the mantissa immediately follows the most significant digit. In short, the arithmetic is in base 100. The mechanization explains why

```
   40 * ATN(1) gives 14 digits of pi
  400 * ATN(1) gives 12 digits of pi
 4000 * ATN(1) gives 14 digits of pi
40000 * ATN(1) gives 12 digits of pi
```

and also why (4000*ATN(1))/1000 gives a 12 digit result. We will see that the twelve digit results are thirteen digit results which include a trailing (non-displayed) zero. In the same manner the thirteen digit TI-59 yields an apparent twelve digit value, but actually a correctly rounded 13 digit value for pi. Consider two representative calculations:

400 * ATN(1)	4000 * ATN(1)
ATN(1) = 78.53 98 16 33 97 45 x 100^{-1}	= 78.53 98 16 33 97 45 x 100^{-1}
400 = 4.00 00 00 00 00 00 x 100^{+1}	4000 = 40.00 00 00 00 00 00 x 100^{+1}
3 12	31 20
2 12	21 20
3 92	39 20
0 64	6 40
1 32	13 20
3 88	38 80
1 80	18 00
3 14.15 92 65 35 89 80 x 100^{0}	31 41.59 26 53 58 98 00 x 100^{0}

Rounding to seven radix 100 digits yields:

3 14.15 92 65 35 90	31 41.59 26 53 58 98

and scaling the mantissa and exponent yields:

3.14 15 92 65 35 90 x 100^{+1}	31.41 59 26 53 58 98 x 100^{+1}

A similar exercise for dividing 4000*ATN(1) by 1000 is left to the reader.

Numeric Representation in the TI-99/4 and CC-40 - (cont)

Although both the CC-40 and the TI-99/4 allow entry of a fourteen digit base ten number, the storage of the number depends upon the location of the decimal point. For example,

The entry	1234567.8912345
translates to	1.23 45 67 89 12 34 50 x 100^3
which rounds to	1.23 45 67 89 12 35 x 100^3

The rounding of the seventh radix 100 digit (the 13th and 14th base 10 digits) in accordance with the value of the eighth radix 100 digit occurs immediately after the calculation. This precludes the use of the seventh block for programs which require all of the base 10 digits to be exact, as in multi-precision work.

A safe rule is to program as though the machine is an exact twelve digit calculator, never permitting any overflow into the seventh block if this information can affect the result.

Since the rounding also occurs in division, modulo division may not give the desired result. For example, we ask for the residue when N = 12345678901563 is divided by 547. Since N is a fourteen digit number we use modulo division, say with the algorithm

N mod M = N - M * INT(N/M)

Both the CC-40 and the TI-99/4A return -2 as the answer. The correct answer is 545. The base 100 arithmetic is not the culprit; the rounding is. While it is true that in this example N is congruent to -2 mod 547, this result could surely mess up program calculations.

Editor's Note: My Radio Shack Model 100 which also does 14 digit arithmetic gets the correct answer using the algorithm above.

MORE ON DATA INPUT TO PERSONAL COMPUTERS - Larry Leeds writes "It came as a shock to discover that the machines would alter input data! Of no useful significance, but of passing interest, is the fact that one can enter a 16 digit base 10 number and the machine will examine the 15th and 16th digits to see if the 7th base 100 block should be rounded.

```
Enter:  A = 123456.7891234599
        PRINT A - 123456
```

The displayed result will be .78912346 "

Editor's Note: Even more entry tricks are available. The CC-40 has an eighty character line which can be scrolled to view any 31 characters.

```
Enter:  B=12345678901234567890123456789012345678901234567890
        PRINT B
```

and see 1.234568E+49 in the display. Also,

```
Enter:  C=.00000000000000000000123456789
        PRINT C
```

and see 1.234568E-21 in the display.

PRINTING WITH THE HX-1000 - P. Hanson

V9N4P26 reported that I had received an HX-1000 Printer/Plotter for use with my CC-40, but that I had been unable to establish communication with my CC-40. With the assistance of the Customer Service Center in Tampa I was able to isolate the problem to the CC-40. Apparently, there was some problem with the hex-bus in the engineering models. As part of the exchange for a working model I also upgraded to the 18K version of the CC-40. The extra memory will permit solution for higher order matrices, a subject I will cover in a future issue.

The HX-1000 permits two print modes: either 18 characters per line or 36 characters per line. The 36 character mode permitted translation of an old calendar program for the Model 100 for use with the CC-40. A full size printout is:

FEBRUARY 1900

SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

Printout of a single month requires about 21 seconds--much slower than the time required with the TI-59 when using one of the fast mode programs. Of course, the printer/plotter output can be expected to be slow since it draws each letter. In the calendar program the month and year are printed in the 18 character per line mode, and the remainder in the 36 character per line mode.

Listings can be obtained in either mode. The listing for the calendar program at the right was printed in the 36 character mode and enlarged for easier reading. Preliminary tests indicate that the automatic printing from the Solid State Software modules will be in the compressed mode. In the next issue I will demonstrate the plotting feature.

```
500 DIM Q(12),C$(5)
505 DATA 31,28,31,30,31,30,31,31,30,
31,30,31
510 FOR I=1 TO 12:READ Q(I):NEXT I
515 DATA "JANUARY  ","FEBRUARY ","MA
RCH    ","APRIL    ","MAY      ","JU
NE     "
520 DATA "JULY     ","AUGUST   ","SE
PTEMBER","OCTOBER  ","NOVEMBER ","DE
CEMBER "
525 INPUT "Enter Month (1-12): ";M
535 IF M<1 OR M>12 THEN 525
540 INPUT "Enter Year (>1582): ";R
545 IF R<1583 THEN 540
550 IF R-4*INT(R/4)=0 THEN Q(2)=29
555 IF R-100*INT(R/100)=0 THEN Q(2)=
28
560 IF R-400*INT(R/400)=0 THEN Q(2)=
29
565 R1=R-1:R2=R+INT(R1/4)-INT(R1/100
)+INT(R1/400)
570 FOR I=0 TO M-1:R2=R2+Q(I):NEXT I
575 D1=R2-7*INT(R2/7)
580 RESTORE 515:FOR I=1 TO M:READ M$
:NEXT I
585 OPEN #1,"1@".OUTPUT
590 PRINT #1,TAB(3);M$;" ";R
600 PRINT #1,CHR$(18);
615 PRINT #1,"  SUN  MON  TUE  WED
THU  FRI  SAT"
620 PRINT #1
625 C$(0)=RPT$(" ",D1)
630 FOR I=1 TO (7-D1):C$(0)=C$(0)&"
  "&STR$(I)&" ":NEXT I
635 PRINT #1,C$(0)
640 C$(0)="":C$(4)="":C$(5)=""
645 I=8-D1
650 FOR K=1 TO 5
653 IF K=1 THEN C$(K)="    " ELSE C$(
K)="  "
655 FOR L=1 TO 7
660 IF I>8 THEN B$="    " ELSE B$="
  "
662 IF L=7 THEN B$=""
665 C$(K)=C$(K)&STR$(I)&B$
670 I=I+1:IF I>Q(M)THEN 700
675 NEXT L
680 NEXT K
700 FOR I=1 TO 5:PRINT #1:PRINT #1,C
$(I):NEXT I
705 PRINT #1
710 CLOSE #1:GOTO 525
```

HARDWARE AVAILABILITY - Member J. M. Gallego continues to have both magnetic cards and Solid State Software Modules available for sale. His inventory on November 1 was:

150 Boxes of 40 Blank Magnetic Cards with Carrying Case
11 Securities Analysis modules
10 Navigation modules
8 Aviation modules

He will continue to sell the modules for sixteen dollars ($16.00) each, and the boxes of magnetic cards for eight dollars ($8.00) each while they last. Shipping is included. U.S. members should send money orders only to:

Q. Jose M. Gallego
250 Quintard Avenue, Apt. 96
Chula Vista CA 92011/4924

Members from other countries should write to make necessary arrangements.

HARDWARE AVAILABILITY - A visit to the TI Customer Service Center in Tampa revealed that they had all of the Solid State Modules available for forty dollars ($40.00) plus postage and handling of two dollars ($2.00). They also have a "Pool Water" module available for forty-five dollars ($45.00) plus postage and handling of two dollars ($2.00). You can call 813-870-6430 and ask for Renee. Mention TI PPC Notes. Or you can write to:

TI Customer Service Center
5010 West Kennedy Boulevard, Suite 101
Tampa, Florida 33609

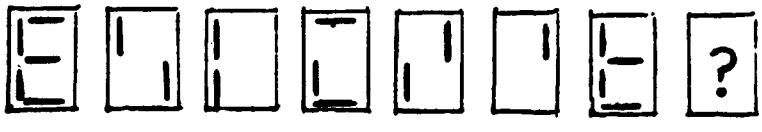
The current exchange pride for a TI-59 at that facility is $63.50 .

HARDWARE AVAILABILITY IN EUROPE - Robert Prins writes that he has found a shop which has the following modules for sale at FL 110, or approximately $30.00 :

2 Leisure Library modules
1 Agriculture module
1 RPN module
1 Aviation module
1 Securities Analysis module
1 Real Estate/Investment module
2 Marine Navigation modules.

Members who are interested can write to: Robert A. H. Prins
A. Nobellaan 112
3731 DX De Bilt
The Netherlands

BRAINTEASER SOLUTION - Maurice Swinnen writes: " Your brainteaser of V9N3P16 is nice but hardly a challenge for old foxes. Your pictures represent the non-lit segments in a seven segment display. The first one is a 1, then a 2, etc. The last one is a seven. In an eight all the segments are lit, so the space with a question mark should have NOTHING in it." See the diagram below.



ELLIPTIC INTEGRALS AND FUNCTIONS - R. K. Leaman. This program finds the complete elliptic integral of the first kind K(k) and the second kind E(k). The following functions of the first kind are calculated: elliptic sine, elliptic cosine, elliptic delta, and elliptic amplitude. A descending landen transformation is used to calculate the elliptic sine. All other functions of the first kind are calculated from the elliptic sine. The program exits in the degree mode. Both input and output values are printed.

Instructions:

1. Press E' to initialize. See a zero in the display.
2. Calculate K(k) where $0 \leq k < 1$. Either:
   a. Enter k and press A. See K(k) returned; or
   b. Enter k^2 and press A'. Both k^2 and k will be printed, and K(k) will be returned to the display.
3. Calculate E(k). Either step 2.a or 2.b must precede this step, and K(k) must be in the display. Press B' and see E(k) returned.

NOTE: Step 2.a or 2.b must precede steps 4 through 7.

4. Enter u and press B to return the elliptic sine, sn(u,k).
5. Enter u and press C to return the elliptic cosine, cn(u,k).
6. Enter u and press D to see the elliptic delta, dn(u,k).
7. Enter the results of either step 4 or step 5 and press E to return the elliptic amplitude, am(u,k).

Program Listing:

```
000  92 RTN    046  85  +     092  65  ×     138  76 LBL    184  61 GTO    230  43 RCL
001  76 LBL    047  43 RCL    093  89  π     139  16  A'    185  02  02    231  07  07
002  10  E'     048  00  00    094  55  ÷     140  99 PRT    186  09  09    232  55  ÷
003  25 CLR    049  95  =     095  43 RCL    141  34 √x     187  76 LBL    233  02  2
004  60 DEG    050  42 STO    096  01  01    142  76 LBL    188  14  D     234  95  =
005  81 RST    051  00  00    097  55  ÷     143  11  A     189  93  .     235  61 GTO
006  43 RCL    052  85  +     098  02  2     144  99 PRT    190  29 CP     236  02  02
007  02  02    053  01  1     099  95  =     145  42 STO    191  67  EQ    237  50  50
008  42 STO    054  95  =     100  38 SIN    146  02  02    192  01  01    238  76 LBL
009  00  00    055  49 PRD    101  42 STO    147  71 SBR    193  96  96    239  15  E
010  89  π     056  01  01    102  04  04    148  00  00    194  42 STO    240  43 RCL
011  55  ÷     057  75  -     103  01  1     149  06  06    195  03  03    241  08  08
012  02  2     058  01  1     104  00  0     150  61 GTO    196  22 INV    242  87 IFF
013  95  =     059  95  =     105  32 X:T    151  02  02    197  86 STF    243  00  00
014  42 STO    060  72 ST*    106  73 RC*    152  50  50    198  00  00    244  02  02
015  01  01    061  05  05    107  05  05    153  76 LBL    199  22 INV    245  64  64
016  01  1     062  55  ÷     108  85  +     154  12  B     200  86 STF    246  87 IFF
017  42 STO    063  02  2     109  01  1     155  93  .     201  01  01    247  01  01
018  06  06    064  95  =     110  54  )     156  29 CP     202  71 SBR    248  02  02
019  42 STO    065  49 PRD    111  65  ×     157  67  EQ    203  00  00    249  69  69
020  07  07    066  06  06    112  43 RCL    158  01  01    204  81  81    250  22 INV
021  09  9     067  43 RCL    113  04  04    159  62  62    205  65  ×     251  86 STF
022  42 STO    068  06  06    114  55  ÷     160  42 STO    206  43 RCL    252  00  00
023  05  05    069  44 SUM    115  53  (     161  03  03    207  02  02    253  22 INV
024  94 +/-    070  07  07    116  73 RC*    162  86 STF    208  95  =     254  86 STF
025  22 INV    071  43 RCL    117  05  05    163  00  00    209  33 X²    255  01  01
026  28 LOG    072  00  00    118  65  ×     164  71 SBR    210  94 +/-   256  42 STO
027  32 X:T    073  32 X:T    119  43 RCL    165  00  00    211  85  +     257  08  08
028  69 DP     074  22 INV    120  04  04    166  81  81    212  01  1     258  99 PRT
029  25  25    075  77  GE    121  33 X²    167  61 GTO    213  95  =     259  98 ADV
030  01  1     076  00  00    122  85  +     168  02  02    214  34 √x    260  92 RTN
031  75  -     077  27  27    123  01  1     169  53  53    215  61 GTO    261  61 GTO
032  43 RCL    078  43 RCL    124  95  =     170  76 LBL    216  02  02    262  02  02
033  00  00    079  01  01    125  42 STO    171  13  C     217  56  56    263  60  60
034  33 X²     080  92 RTN    126  04  04    172  93  .     218  76 LBL    264  22 INV
035  95  =     081  43 RCL    127  69 DP     173  29 CP     219  17  B'    265  38 SIN
036  34 √x     082  03  03    128  35  35    174  67  EQ    220  43 RCL    266  61 GTO
037  42 STO    083  99 PRT    129  43 RCL    175  01  01    221  01  01    267  02  02
038  00  00    084  71 SBR    130  05  05    176  79  79    222  65  ×     268  50  50
039  94 +/-    085  00  00    131  77  GE    177  42 STO    223  53  (     269  22 INV
040  85  +     086  06  06    132  01  01    178  03  03    224  01  1     270  39 COS
041  01  1     087  69 DP     133  06  06    179  86 STF    225  75  -     271  61 GTO
042  54  )     088  35  35    134  43 RCL    180  01  01    226  43 RCL    272  02  02
043  55  ÷     089  70 RAD    135  04  04    181  71 SBR    227  02  02    273  66  66
044  53  (     090  43 RCL    136  60 DEG    182  00  00    228  33 X²    274  00  0
045  01  1     091  03  03    137  92 RTN    183  81  81    229  65  ×     275  00  0
```

Elliptic Integrals and Functions - (cont)

Editor's Note: I made a quick comparison of the results of this program with values for K(k) and E(k) from Table 17.1 of AMS-55. The program output for K(k) was within 21.E-12 of the AMS-55 value if k was not close to one. The program output for E(k) was within 1.E-09 of the AMS-55 value.

FLOOR AND CEILING FUNCTIONS - Both Charlie Williamson and Don Graham have written suggesting that these functions would make good programming challenges. The floor is the largest integer not greater than the input, and the ceiling is the smallest integer not less than the input. Both Charlie and Don have submitted solutions. Don's solutions, including a label at the start and a RTN at the end, are 16 steps for the floor, and 18 steps for the ceiling. Don writes that the trick is to get the floor to work for negative numbers within 10^{-13} of zero, and to get the ceiling to work with positive numbers within the same range. It is also advisable to test ±9999999999.999 .

THE SECOND ROBERT PRINS BRAINTEASER - V9N4P7 gave the solution for the first Robert Prins brainteaser (which no one solved), and presented a second problem, which Robert suggested was even harder. Charlie Williamson has been thinking about the problem of stopping with a RTN when the subroutine register is not empty. He observes that there is a similarity to George Vogel's first programming puzzle in V5N7P5. For newer members who may not have that issue, the problem stated:

> You design a program which stops in the middle of a subroutine and according to the value displayed, you plan to use your judgement to decide whether to press A or B to complete the computation. Let's say that labels A and B are both within the subroutine, e.g., ... R/S LBL A 2 + LBL B 1 = RTN .... But it doesn't work. The program always stops at the RTN and will not return to the main program. What is wrong? ...

WATOR - In the "Computer Recreations" column in the December 1984 issue of Scientific American A. K. Dewdney describes an ecological war between sharks and fish on a toroidal planet called Wa-Tor. He outlines the programming required for a personal computer. It seems to me that we should be able to program the equivalent, albeit a smaller planet, on the TI-59. Who will accept that challenge?

CC-40 STATUS - In late November I called Educalc for information on peripherals and supplies for the CC-40. I was told that TI was discontinuing the CC-40. A call to the TI Consumer Hotline, 800-842-2737, confirmed that the CC-40 development had been stopped. There will be repair support for CC-40 hardware both in and out of warranty, but no new products will be released. We will continue to provide coverage of the CC-40 and peripherals in TI PPC Notes. Some peripherals continue to be for sale at the TI exchange centers. Other sources for supplies are available. I have used the Radio Shack ink cartridges successfully in the Printer/Plotter.

1984 FEDERAL INCOME TAX RETURN - Hewlett Ladd. V9N4P19 described a program which would accept "Taxable Income" and return a printout including the input value, the tax, the top percentage bracket, and the average percentage. A set of constants were provided for calculations of a joint return. A problem was seen in using the same program for the single taxpayer schedule since there was one more bracket there. There was also a potential problem in being sure that the correct tax table was being used. The revised program presented here resolves both difficulties. When the table values are changed to cover a different schedule the subsequent initialization provides a printout which will identify the schedule being used. The highest bracket information for the single taxpayer schedule is stored in bank 2 along with the constants used for annotation on the printer (at locations 70 and 71). Appropriate branching ensures that the values are ignored for the three other schedules.

Instructions:

1. Set the partitioning to 9 Op 17 and enter banks 1 and 2.

2. Select the bank 4 which corresponds to the schedule to be used from the four card sides. Enter it in bank 4.

3. Initialize by pressing 2nd-E'. A heading will be printed which identifies the schedule being used.

4. Enter the taxable income and press A. See a flashing "1" in the display. Press 7 and then EE and wait for the printout. Repeat as many times as desired for other taxable incomes.

5. To reprint the heading press E. Note: if you press E' a second time the highest two brackets of the single taxpayer schedule will not operate properly. If you inadvertently press E' a second time it will be necessary to reenter the appropriate bank 4 card side and re-initialize, or enter the appropriate constant (60 through 63) for the schedule being used into R00 and re-initialize.

7. To change to another schedule, enter the appropriate bank 4 card side and re-initialize by pressing 2nd-E'.

Bank 4 Schedules:

Joint		Head of Household		Married Filing Separate		Single	
60.	00	61.	00	62.	00	63.	00
3400.	01	2300.	01	1700.	01	2300.	01
5500. 00231	02	4400. 00231	02	2750. 001155	02	3400. 00121	02
7600. 00483	03	6500. 00483	03	3800. 002415	03	4400. 00241	03
11900. 01085	04	8700. 00791	04	5950. 005425	04	6500. 00535	04
16000. 01741	05	11800. 01318	05	8000. 008705	05	8500. 00835	05
20200. 02497	06	15000. 01894	06	10100. 012485	06	10800. 01203	06
24600. 03465	07	18200. 02534	07	12300. 017325	07	12900. 01581	07
29900. 0479	08	23500. 03806	08	14950. 02395	08	15000. 02001	08
35200. 06274	09	28800. 0529	09	17600. 03137	09	18200. 02737	09
45800. 09772	10	34100. 06986	10	22900. 04886	10	23500. 04115	10
60000. 15168	11	44700. 10696	11	30000. 07584	11	28800. 05705	11
85600. 2592	12	60600. 17374	12	42800. 1296	12	34100. 07507	12
109400. 3663	13	81800. 26914	13	54700. 18315	13	41500. 10319	13
162400. 626	14	108300. 396341	14	81200. 313	14	55300. 16115	14
0.	15	0.	15	0.	15	0.	15
0. 11	16	0. 11	16	0. 11	16	0. 11	16
0. 12	17	0. 12	17	0. 12	17	0. 12	17
0. 14	18	0. 14	18	0. 14	18	0. 14	18
0. 16	19	0. 17	19	0. 16	19	0. 15	19
0. 18	20	0. 18	20	0. 18	20	0. 16	20
0. 22	21	0. 2	21	0. 22	21	0. 18	21
0. 25	22	0. 24	22	0. 25	22	0. 2	22
0. 28	23	0. 28	23	0. 28	23	0. 23	23
0. 33	24	0. 32	24	0. 33	24	0. 26	24
0. 38	25	0. 35	25	0. 38	25	0. 3	25
0. 42	26	0. 42	26	0. 42	26	0. 34	26
0. 45	27	0. 45	27	0. 45	27	0. 38	27
0. 49	28	0. 48	28	0. 49	28	0. 42	28
0. 5	29	0. 5	29	0. 5	29	0. 48	29

1984 Federal Income Tax Return - (cont)

Program Listing - Bank 1:

```
000  91 R/S     040  00  00     080  06  06     120  03  3      160  22 INV     200  15  E
001  25 CLR     041  59 INT     081  43 RCL     121  22 INV     161  52 EE      201  43 RCL
002  43 RCL     042  95  =      082  67  67     122  67  EQ      162  42 STO     202  34  34
003  14  14     043  42 STO     083  69 DP      123  01  01     163  30  30     203  69 DP
004  59 INT     044  31  31     084  04  04     124  35  35     164  43 RCL     204  00  00
005  22 INV     045  01  1      085  43 RCL     125  43 RCL     165  31  31     205  69 DP
006  77  GE     046  05  5      086  32  32     126  35  35     166  65  ×      206  01  01
007  01  01     047  44 SUM     087  65  ×      127  32 X:T     167  43 RCL     207  43 RCL
008  14  14     048  00  00     088  01  1      128  43 RCL     168  32  32     208  64  64
009  01  1      049  73 RC*     089  00  0      129  70  70     169  95  =      209  69 DP
010  42 STO     050  00  00     090  00  0      130  59 INT     170  44 SUM     210  02  02
011  00  00     051  42 STO     091  95  =      131  22 INV     171  30  30     211  43 RCL
012  73 RC*     052  32  32     092  69 DP      132  77  GE     172  61 GTO     212  65  65
013  00  00     053  65  ×      093  06  06     133  01  01     173  00  00     213  69 DP
014  59 INT     054  43 RCL     094  43 RCL     134  75  75     174  59  59     214  03  03
015  77  GE     055  31  31     095  66  66     135  43 RCL     175  43 RCL     215  69 DP
016  00  00     056  95  =      096  69 DP      136  14  14     176  70  70     216  05  05
017  23  23     057  44 SUM     097  04  04     137  42 STO     177  42 STO     217  98 ADV
018  69 DP      058  30  30     098  43 RCL     138  36  36     178  36  36     218  91 R/S
019  20  20     059  43 RCL     099  33  33     139  43 RCL     179  43 RCL     219  00  0
020  61 GTO     060  69  69     100  65  ×      140  29  29     180  71  71     220  00  0
021  00  00     061  69 DP      101  01  1      141  42 STO     181  42 STO     221  00  0
022  12  12     062  04  04     102  00  0      142  32  32     182  32  32     222  00  0
023  69 DP      063  32 X:T     103  00  0      143  43 RCL     183  61 GTO     223  00  0
024  30  30     064  69 DP      104  95  =      144  35  35     184  01  01     224  00  0
025  73 RC*     065  06  06     105  58 FIX     145  75  -      185  43  43     225  00  0
026  00  00     066  35 1/X     106  02  02     146  32 X:T     186  76 LBL     226  00  0
027  22 INV     067  65  ×      107  69 DP      147  43 RCL     187  10 E'      227  00  0
028  59 INT     068  43 RCL     108  06  06     148  36  36     188  09  9      228  00  0
029  52 EE      069  30  30     109  22 INV     149  59 INT     189  69 DP      229  76 LBL
030  05  5      070  95  =      110  58 FIX     150  95  =      190  17  17     230  11  A
031  95  =      071  42 STO     111  98 ADV     151  42 STO     191  73 RC*     231  32 X:T
032  22 INV     072  33  33     112  66 PAU     152  31  31     192  00  00     232  09  9
033  52 EE      073  43 RCL     113  81 RST     153  43 RCL     193  42 STO     233  69 DP
034  42 STO     074  68  68     114  43 RCL     154  36  36     194  34  34     234  17  17
035  30  30     075  69 DP      115  37  37     155  22 INV     195  43 RCL     235  04  4
036  32 X:T     076  04  04     116  32 X:T     156  59 INT     196  00  00     236  05  5
037  75  -      077  43 RCL     117  42 STO     157  52 EE      197  42 STO     237  30 TAN
038  32 X:T     078  30  30     118  35  35     158  05  5      198  37  37     238  33 X²
039  73 RC*     079  69 DP      119  06  6      159  95  =      199  76 LBL     239  86 STF
```

Program Constants - Bank 2:

```
2532242937.     60
2316632036.     61
2863361733.     62
3604292227.     63
  37131427.     64
1700000000.     65
  13424061.     66
  37323361.     67
  37134400.     68
  37402440.     69
81800.28835     70
        0.5     71
```

Comments: The use of the calculations defined in this program are required for taxable incomes over $50,000 . The statutory tables which must be used for taxable incomes under $50,000 are based on the same calculations where the taxable income has been rounded to multiples of $50 . Thus, results found with this program will not match those in the statuatory tables, but should be within a few dollars.

MORE HARDWARE AVAILABILITY - TI representatives tell me that there is a source for new TI-59's at a price in the $100.00 range. Call David Graves at 213-682-3641 for information.

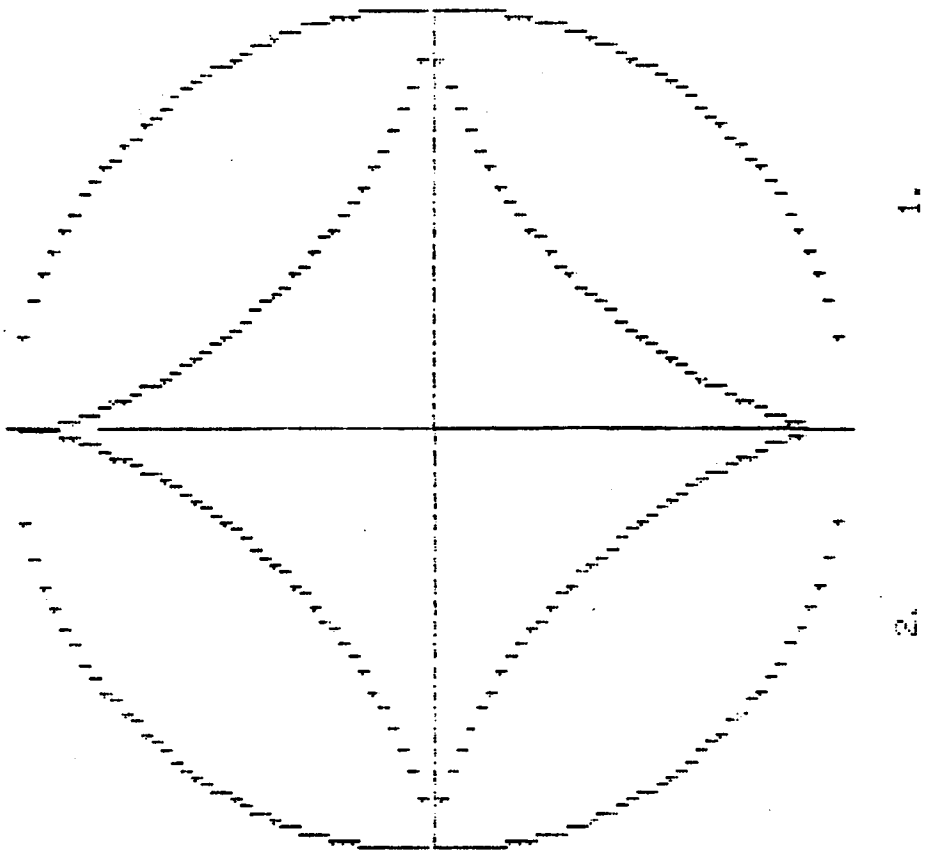
PC-200 STATUS - Page 24 of the Educalc catalog, issue No. 23, indicates that this printer for the BA-55 and TI-66 will become available in the first quarter of 1985 for $59.95.

AN ASTROID IN A CIRCLE - L. Mortola. V9N3P28 noted that there had been renewed interest in high resolution graphics. Dr. Mortola has submitted many examples of plotting higher plane curves such as hyperbolas, cardioids and roses. The example below combines a circle with an astroid, sometimes called a hypocycloid of four revolutions. The equations used are:

$$y = \pm\left[1 - (x^2)^{1/3}\right]^{3/2} \qquad y = \pm\sqrt{1 - x^2}$$

The listing below is for use with Michael Sperber's Plot 60 routine from V6N4-5P5. Steps 238 through 265 define the astroid. Steps 266 through 280 define the circle. Register R15 is used for temporary storage of the positive value of either the astroid or circle. The value is recovered and the sign is changed to plot the negative value (See 262-265 and 277-280). Steps 281-282 define the x axis. Steps 224 through 237 are used to identify the x value for plotting the y axis. Because of the non-integer value used for delta-x, it may not be exactly at x=0. Steps 286 through 306 load the print registers for a vertical line, and branch directly to the printing routine. The plotting parameters are

# of points	=	85
Ymin	=	-1
Ymax	=	+1
Xo	=	-1
Delta-x	=	1/42 = 0.0238095238
# of tapes	=	2



224	29	CP		266	43	RCL	
225	50	I×I		267	05	05	
226	55	÷		268	33	X²	
227	93	.		269	94	+/-	
228	00	0		270	85	+	
229	02	2		271	01	1	
230	03	3		272	95	=	
231	75	-		273	34	FX	
232	01	1		274	42	STO	
233	95	=		275	15	15	
234	22	INV		276	11	A	
235	77	GE		277	43	RCL	
236	02	02		278	15	15	
237	86	86		279	94	+/-	
238	43	RCL		280	11	A	
239	05	05		281	25	CLR	
240	33	X²		282	14	D	
241	45	Y×		283	61	GTO	
242	53	(		284	02	02	
243	01	1		285	24	24	
244	55	÷		286	06	6	
245	03	3		287	04	4	
246	54	)		288	06	6	
247	95	=		289	04	4	
248	94	+/-		290	06	6	
249	85	+		291	04	4	
250	01	1		292	06	6	
251	95	=		293	04	4	
252	45	Y×		294	06	6	
253	53	(		295	04	4	
254	03	3		296	42	STO	
255	55	÷		297	09	09	
256	02	2		298	42	STO	
257	54	)		299	10	10	
258	95	=		300	42	STO	
259	42	STO		301	11	11	
260	15	15		302	42	STO	
261	11	A		303	12	12	
262	43	RCL		304	61	GTO	
263	15	15		305	02	02	
264	94	+/-		306	46	46	
265	11	A					

COPYING THE DISPLAY INTO THE T REGISTER - P. Hanson. The problem of copying the value from the display register into the t register, while keeping the value in the display register, was discussed in V3N3P4 of 52 Notes, and again in V5N6P4 and V5N7P1 of TI PPC Notes. Several solutions have been proposed:

(CP + x⇄t)	by Jared Weinberger in V3N3P4 of 52 Notes
y^x x⇄t 1)	by J. H. Lewis in V5N6P4
+ x⇄t 0)	by Jeff Rosedale in V5N7P1
x x⇄t 1)	by Morton Matthews in V5N7P1
CP + x⇄t)	by Maurice Swinnen in V5N7P1

At least four steps are required, and care must be taken with some routines if pending operations are to be preserved. Robert Prins' treatise on the flag register and hexadecimal codes (V9N3P28) proposes a two step routine:

> "h54 will copy the t register into the display if immediately following x=t while preserving pending operations. This is a two step equivalent of copying yhe display into the t register. Doing certain things between x=t and h54 (including CP strangely enough) may produce other results."

To demonstrate the technique install the calculator on a printer. Enter the program steps listed in the left hand column below. Then, generate the h54 code at location 016 with any of the hexadecimal implanting sequences, say with 10 Op 17 GTO 016 CLR Pgm 19 SBR 045 P/R LRN Ins LRN RST CLR. If you try to list the result you get the printout in the center column below, indicating that there is a one in 016 and zeroes in 017 through 023. But if you go to LRN and SST through those steps you will find the code in the right hand column. Press A and the program will stop with 5.141592654 = (2 + pi) in the display. Press x⇄t and see pi in the display.

If the calculator is not on a printer the technique does not work. After pressing A the calculator stops with 7.1333333 23 in the display, and x⇄t yields pi in the display.

008 00 0	008 00 0	008 00 0
009 76 LBL	009 76 LBL	009 76 LBL
010 11 A	010 11 A	010 11 A
011 29 CP	011 29 CP	011 29 CP
012 02 2	012 02 2	012 02 2
013 85 +	013 85 +	013 85 +
014 89 π	014 89 π	014 89 π
015 32 X:T	015 32 X:T	015 32 X:T
016 03 3	016 01 1	016 54)
017 94 +/-	017 00 0	017 95 =
018 81 RST	018 00 0	018 91 R/S
019 00 0	019 00 0	019 38 SIN
020 00 0	020 00 0	020 30 TAN
021 00 0	021 00 0	021 31 LRN
022 00 0	022 00 0	022 39 COS
023 00 0	023 00 0	023 71 SBR
024 00 0	024 93 .	024 93 .
025 00 0	025 00 0	025 00 0

This is just a sample of the material in the Prins treatise. As noted in V9N3P28 Robert will air mail a copy to readers for $6.00 in U.S. funds. Use an international postal money order or cash. Write to Robert A. H. Prins, Alfred Nobellaan 112, 3731 DX De Bilt, Netherlands.

PLOT 60 IN FAST MODE - Robert Prins. Anyone who has used the Plot 60 program knows that it is painfully slow. This program uses fast mode to obtain a reduction in execution time of nearly 50 per cent.

User Instructions:

1. Enter the program "before initialization" as listed on page 17. Be sure to use 2nd-CLR (code 20) at location 019.

2. Perform the hexadecimal code implant sequence. Press 10 Op 17 CLR GTO 016 Pgm 19 SBR 045 P/R LRN and see 016 55 in the display. Press Ins and see 016 55 in the display. Press SST 16 times and see 032 65 in the display. Press Ins LRN RST CLR 6 Op 17. If you list the program you will find the code for "after initialization" as shown on page 17.

3. Press GTO 216 LRN. Enter your functions in a manner similar to that used with the original Plot 60. However, since subroutine calls are not allowed, the function is ended with x≠t to save the result in the t register, followed by the address of the first instruction in the next function, followed by GTO 118. The last function is followed by 93 GTO 118. Press LRN to return to keyboard control.

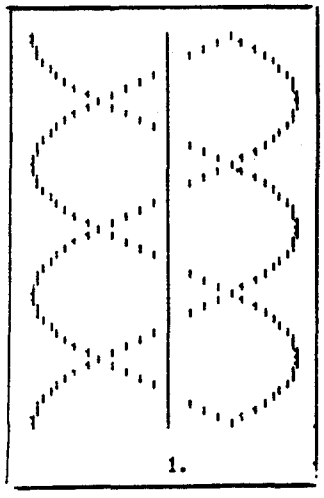
4. Enter the functions in a manner similar to that used in the original Plot 60 program:

a. Enter the number of points and press A.
b. Enter Y-min and press R/S.
c. Enter Y-max and press R/S
d. Enter Xo, the starting value of X, and press R/S.
e. Enter delta-x, the increment in X, and press R/S.
f. Enter the number of tapes and press R/S. Plotting will begin.

Sample Problem:

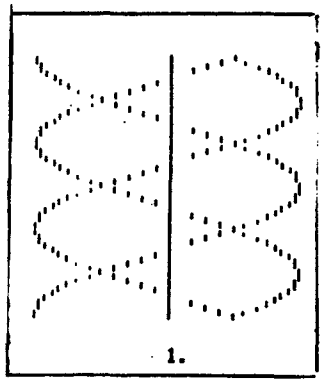
The functions and resulting plot are shown for the original Plot 60 at the left and for the fast mode version at the right. The function parameters were 61 points, Y-min = -1.05, Y-max = +1.05, Xo = -180, delta-x = 6, and one tape. The plot with the original program too 24.5 minutes. The plot with the fast mode program took 12.6 minutes. Note some compression in the fast mode plot.

```
224  25 CLR
225  11  A
226  39 COS
227  11  A
228  85  +
229  01  1
230  02  2
231  00  0
232  95  =
233  39 COS
234  11  A
235  85  +
236  02  2
237  04  4
238  00  0
239  95  =
240  39 COS
241  14  D
242  61 GTO
243  02  02
244  24  24
```




```
216  29 CP
217  02  2
218  02  2
219  03  3
220  61 GTO
221  01  01
222  18  18
223  39 COS
224  32 X:T
225  02  2
226  03  3
227  01  1
228  61 GTO
229  01  01
230  18  18
231  85  +
232  01  1
233  02  2
234  00  0
235  95  =
236  39 COS
```

```
237  32 X:T
238  02  2
239  04  4
240  04  4
241  61 GTO
242  01  01
243  18  18
244  85  +
245  02  2
246  04  4
247  00  0
248  95  =
249  39 COS
250  32 X:T
251  09  9
252  03  3
253  61 GTO
254  01  01
255  18  18
```



Plot 60 in Fast Mode - (cont)

Listing Before Initialization:

```
000  92 RTN   036  94 +/-   072  97 DSZ   108  12  12   144  85  +     180  94 +/-
001  76 LBL   037  73 RC*   073  00  00   109  69 DP    145  09  9     181  22 INV
002  11  A    038  47  47   074  00  00   110  04  04   146  75  -     182  57 ENG
003  61 GTO   039  42 STO   075  72  72   111  43 RCL   147  59 INT   183  82 HIR
004  00  00   040  06  06   076  98 ADV   112  04  04   148  42 STO   184  08  08
005  40  40   041  92 RTN   077  43 RCL   113  44 SUM   149  13  13   185  53  (
006  76 LBL   042  42 STO   078  08  08   114  05  05   150  54  )     186  73 RC*
007  12  B    043  01  01   079  99 PRT   115  92 RTN   151  65  ×     187  13  13
008  61 GTO   044  22 INV   080  43 RCL   116  42 STO   152  05  5     188  55  ÷
009  00  00   045  44 SUM   081  02  02   117  14  14   153  42 STO   189  43 RCL
010  18  18   046  02  02   082  44 SUM   118  01  1    154  07  07   190  07  07
011  76 LBL   047  92 RTN   083  01  01   119  53  (    155  94 +/-   191  22 INV
012  13  C    048  44 SUM   084  98 ADV   120  53  (    156  75  -     192  28 LOG
013  25 CLR   049  02  02   085  97 DSZ   121  32 X:T   157  59 INT   193  33 X²
014  69 DP    050  92 RTN   086  08  08   122  75  -    158  68 NOP   194  82 HIR
015  05  05   051  42 STO   087  00  00   123  43 RCL   159  68 NOP   195  48  48
016  74 SM*   052  03  03   088  64  64   124  01  01   160  44 SUM   196  54  )
017  90  90   053  92 RTN   089  00  0    125  54  )    161  07  07   197  53  (
018  12  B    054  42 STO   090  92 RTN   126  55  ÷    162  54  )     198  22 INV
019  20 CLR   055  04  04   091  00  0    127  43 RCL   163  65  ×     199  59 INT
020  30 TAN   056  92 RTN   092  48 EXC   128  02  02   164  03  3     200  65  ×
021  30 TAN   057  42 STO   093  09  09   129  54  )    165  54  )     201  04  4
022  61 GTO   058  08  08   094  69 DP    130  77  GE   166  53  (     202  54  )
023  54  )    059  22 INV   095  01  01   131  02  02   167  59 INT   203  59 INT
024  00  0    060  49 PRD   096  00  0    132  12  12   168  85  +     204  22 INV
025  93  .    061  02  02   097  48 EXC   133  29 CP    169  01  1     205  67  EQ
026  01  1    062  43 RCL   098  10  10   134  22 INV   170  75  -     206  02  02
027  34 ΓX    063  06  06   099  69 DP    135  77  GE   171  50 I×I   207  12  12
028  33 X²    064  42 STO   100  02  02   136  02  02   172  65  ×     208  82 HIR
029  35 1/X   065  00  00   101  00  0    137  12  12   173  02  2     209  18  18
030  86 STF   066  43 RCL   102  48 EXC   138  53  (    174  01  1     210  74 SM*
031  71  71   067  03  03   103  11  11   139  53  (    175  85  +     211  13  13
032  35 1/X   068  42 STO   104  69 DP    140  53  (    176  04  4     212  43 RCL
033  54  )    069  05  05   105  03  03   141  52 EE    177  07  7     213  05  05
034  66 PAU   070  12  B    106  00  0    142  65  ×    178  54  )     214  83 GD*
035  50 I×I   071  13  C    107  48 EXC   143  04  4    179  52 EE    215  14  14
```

Listing After Initialization:

```
000  92 RTN   036  61 GTO   072  12  B    108  00  0    144  65  ×     180  94 +/-
001  76 LBL   037  02  02   073  13  C    109  48 EXC   145  04  4     181  22 INV
002  11  A    038  16  16   074  97 DSZ   110  12  12   146  85  +     182  57 ENG
003  61 GTO   039  90 LST   075  00  00   111  69 DP    147  09  9     183  82 HIR
004  00  00   040  47 CMS   076  00  00   112  04  04   148  75  -     184  08  08
005  40  40   041  42 STO   077  72  72   113  43 RCL   149  59 INT   185  53  (
006  76 LBL   042  06  06   078  98 ADV   114  04  04   150  42 STO   186  73 RC*
007  12  B    043  92 RTN   079  43 RCL   115  44 SUM   151  13  13   187  13  13
008  61 GTO   044  42 STO   080  08  08   116  05  05   152  54  )     188  55  ÷
009  00  00   045  01  01   081  99 PRT   117  92 RTN   153  65  ×     189  43 RCL
010  18  18   046  22 INV   082  43 RCL   118  42 STO   154  05  5     190  07  07
011  76 LBL   047  44 SUM   083  02  02   119  14  14   155  42 STO   191  22 INV
012  13  C    048  02  02   084  44 SUM   120  01  1    156  07  07   192  28 LOG
013  25 CLR   049  92 RTN   085  01  01   121  53  (    157  94 +/-   193  33 X²
014  69 DP    050  44 SUM   086  98 ADV   122  53  (    158  75  -     194  82 HIR
015  05  05   051  02  02   087  97 DSZ   123  32 X:T   159  59 INT   195  48  48
      0       052  92 RTN   088  08  08   124  75  -    160  44 SUM   196  54  )
017  92 RTN   053  42 STO   089  00  00   125  43 RCL   161  07  07   197  53  (
018  22 INV   054  03  03   090  64  64   126  01  01   162  54  )     198  22 INV
019  58 FIX   055  92 RTN   091  00  0    127  54  )    163  65  ×     199  59 INT
020  60 DEG   056  42 STO   092  92 RTN   128  55  ÷    164  03  3     200  65  ×
021  61 GTO   057  04  04   093  00  0    129  43 RCL   165  54  )     201  04  4
022  00  00   058  92 RTN   094  48 EXC   130  02  02   166  53  (     202  54  )
023  26  26   059  42 STO   095  09  09   131  54  )    167  59 INT   203  59 INT
024  54  )    060  08  08   096  69 DP    132  77  GE   168  85  +     204  22 INV
025  00  0    061  22 INV   097  01  01   133  02  02   169  01  1     205  67  EQ
026  93  .    062  49 PRD   098  00  0    134  12  12   170  75  -     206  02  02
027  01  1    063  02  02   099  48 EXC   135  29 CP    171  50 I×I   207  12  12
028  34 ΓX    064  43 RCL   100  10  10   136  22 INV   172  65  ×     208  82 HIR
029  33 X²    065  06  06   101  69 DP    137  77  GE   173  02  2     209  18  18
030  35 1/X   066  42 STO   102  02  02   138  02  02   174  01  1     210  74 SM*
031  86 STF   067  00  00   103  00  0    139  12  12   175  85  +     211  13  13
032  12  12   068  43 RCL   104  48 EXC   140  53  (    176  04  4     212  43 RCL
033  68 NOP   069  03  03   105  11  11   141  53  (    177  07  7     213  05  05
034  43 RCL   070  42 STO   106  69 DP    142  53  (    178  54  )     214  83 GD*
035  05  05   071  05  05   107  03  03   143  52 EE    179  52 EE    215  14  14
```

PPX PROGRAMS AVAILABLE FROM TI PPC MEMBERS - Palmer Hanson

In V8N5P24 I suggested that club members should set up an informal program exchange to preserve access to the programs from PPX Exchange. I listed six programs of my own and fifteen others that I had purchased from PPX Exchange. The response from members was gratifying. Over six hundred programs have been made available.

Some members asked whether we needed approval from TI. After several months I have received permission from TI for our plans. Pages V9N5P19 through V9N5P24 list the programs which are available. The programs are listed in order by PPX number with abbreviated titles. A code precedes each PPX number which identifies up to three owners according to a number or letter code. I have the programs identified with a code 1, including programs provided by George Thomson and E. W. Folk. I will loan these programs to members under the same conditions described in V8N5P24: send one dollar (no checks please, two dollars overseas) for each program that you wish to borrow. It is understood that the programs will be returned promptly to be available for other members.

Other members who are willing to provide programs have preferred other arrangements, say by providing copies for a fee rather than lending their copy. The table below lists the codes, names and addresses. Since it has been over a year since they volunteered to provide this service, I suggest that you contact them for current status. Be sure to send a stamped and self-addressed envelope for their reply.

Code	Owner and Addresses
1	TI PPC Notes, P. O. Box 1421, Largo, Florida 34294-1421
2	Maurice Swinnen, Lanham Severn Road, Lanham, Maryland 20706
3	Robert McQuattie, 5848 Cottonwood Drive, Lorain, Ohio 44053
4	Lem Matteson, 8313 Ward Parkway, Kansas City, Missouri 64114
5	Heinz Zuschlag, 180 Shelton Road, Trumbull, Connecticut 06611
6	Bob Patton, 1713 Parkcrest Terrace, Arlington, Texas 76012
7	A. E. Mackenzie, 160 Alto Drive, Oak View, California 93022
8	Paul D. Sperry, 4260 Grinnell Avenue, Boulder, Colorado 80303
9	Jose M. Gallego, 250 Quintard Ave - Apt 96, Chula Vista, CA 92011
A	Harry Rosenberg, 1900 South Eads Street, Arlington, VA 22202
B	Myer Boland, 66 Overlook Way, Englishtown, NJ 07726

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```
9   018001 - Break-even Point Margin of Safety
9   018002 - DD633 Pricing Program
2   028007 - Labor & Material Cost Estimate
9   038004 - Inventory Control
19  048001 - Gompertz Growth Curve Fit
2A  058003 - Small Business General Payroll
29  068002 - Webster Fixed Time Traffic Signal Delay
9   068003 - Vehicles Entering Intersection Green Light
8   068007 - Standard Queue Model M/M/1
1   078004 - Life Insurance Cost
A   088005 - Loan Amortization
1   088006 - Anal. of Graduated Pay Mtg. Loan
9   088013 - Buying vs Renting
9   098002 - Invoice Preparation
9   098004 - Universal Multiple Discounter
1   098015 - Cost Estimate for Construction
2   108005 - Small Business Accounting
A   108010 - Sources and Uses
1   128001 - Loan Analysis
1   128007 - APR for Prepaid Loan
9   128011 - Skip Payment/Balloooon Payment Loans
4   128013 - Yearly Amortization Schedule II
9   128021 - Loan Amorization
A   128023 - Omnibus Debt Amortization Schedules
4   128024 - Fast Mode Loan Payment Schedule
4   128025 - Statement Savings Daily Compounding ...
9   148002 - Household Budgetting
19  148003 - Budget Analysis
9   148005 - Long Distance Telephone Charge
1A  148007 - Checkbook
4   148010 - Checkbook & Savings Account Balance
1   148013 - Checking Account Management
9   148020 - Discount/Interest
129 178001 - Income Tax Form 1040
2   178003 - Federal Income Tax 1978
1   178005 - Tax Sheltered Retirement Analysis
1   188003 - Universal Rate of Return
1   188004 - Call Option Ratio Writing
1   188009 - Call Option Spreading
1   188010 - Screen Stocks
1   188011 - Value of Call Option
2   188014 - Stock Portfolio Record Keeping
A   188023 - Market Beater Stock Selection
A   188030 - Stock Option Straddle Evaluation
A   188042 - Searching for Call Option Spreads
A   188049 - Yields & Taxes:  Bonds & Money Market Funds
1   188052 - Portfolio Monitor
A   188053 - Portfolio Analysis
1   188914 - Internal Rate of Return
4   198047 - Savings Passbook Interest Calculations
```



```
9   198048 - Analysis of Financial Statements (Ratios)
9   198049 - Project Economic Analysis
6A  198058 - Financial Statement Analysis
A   198061 - Financial Statement Analysis
4   198069 - Days Interest
A   198071 - Investment Portfolio Optimization
9   208005 - Exponential Smoothing
2   208007 - Multiple Linear Regression
189 208008 - Polynomial Regression
1   208009 - Two Variable Polynomial Curve Fit
B   208013 - Best Fit to Eight Curves
9A  208016 - Multiple Regression - 5 Ind. Variables
8   208022 - Multiple Regression with Step-wise Option
2   208027 - Time/Volume Learning Curve
3   208033 - Sine Curve Fit
2   208039 - Logistic Curve Fit
138 208040 - Eight Curve Fit
29  208041 - Multiple Curve Fit
39  208050 - Automatic Curve Fit
6   208056 - Rational Curve Fit
9   208057 - Data Fitting
9   208058 - Exponential Function Fit
12  208059 - Polynomial Curve Fit with Errors
9   208060 - Least Squares Polynomial Fit
89  208067 - Non-linear Regression Analysis
8   208076 - Least Squares Polynomial Fit
1   208077 - Nonlinear Least Squares
9   208078 - Hyperbolic Curve Fit
1   208081 - Linearity Analysis from Multipoint Data
9   218001 - Chi Square Two way ANOVA
9   218002 - Randomized Block Design - ANOVA Test
9   218004 - Two Way ANOVA without Replication
9   218005 - One Way ANOVA
19  218009 - Factorial; ANOVA; 20 Replicates
8   218021 - Scheffe A Posteriori Test
9   218024 - Two Way ANOVA with Replicates
8   218027 - Bartlett's Test of Homogeniety of Variance
3   218032 - 3 Way ANOVA - Factorial Design
8   218034 - Kruskal-Wallis ANOVA and Post Hoc Tests
8   218035 - Friedman's ANOVA and Post Hoc Tests
3   218040 - Two Way ANOVA with Interaction
8   218048 - Tukey Test for Non-Additivity
8   218060 - Variance Analysis Package
9   228001 - The Spearman Rank Correlation Coefficient
9   228002 - 3x3 Covariance Matrix & Correlation Coeff.
9   228003 - Mult., Partial & Linear Correl. Coefficients
9   228004 - Mann Whitney Wilcoxon Test
9   228006 - Wilcoxon/Mann/Whitney Two Sample Test
8   228008 - D Test for Normal Distribution
8   228013 - Kolmogorov-Smirnov 1 Sample
```

8 228017 - Kolmogorov-Smirnov 2 Sample
8 228025 - Newman-Keuls Studentized Range Statistic
8 228038 - Poisson Statistics
8 228044 - Non-parametric Tests ...
8 238005 - Chi-square Test for Goodness of Fit
9 248003 - Student's T Distribution and Inverse
1 248007 - Random Date Generator
2 258002 - Decision Tree (Probability)
8 268002 - Runs Test for Randomness
8 268003 - Student'sT Distribution and Inverse
2 268005 - Bayes' Discrete Probability Distribution
2 268007 - Poisson Distribution
8 268011 - Inverse F Distribution
8 268018 - Inverse Chi-squared Distribution
9 278006 - Statistical Lot Analysis
9 278007 - Op Characteristics for Single Sampling Plans
9 278008 - Single Sampling Plan Design
9 278009 - AOQL Single Sampling Plans
9 278010 - Unit Sequential Sampling Plans
9 278011 - Variable Sampling Plan Design
9 278012 - Op Characteristics for Sampling Plans
2 288005 - System Reliability
2 288006 - Failure Rate Determination
8 298080 - Fisher's Test, Including P(Tail), Ss Unlimited
3 308052 - Eigenvalues & Eigenvectors by Power Method
3 308079 - Solution of Ill-conditioned Quartics
3 308093 - Eigenvalues, Eigenvectors by Jacobi Method
9 318006 - Complex Keyboard
3 318012 - Mult of Complex Polynomials (10th Order)
3 318014 - Mult of Complex Polynomials (19th order)
2 328004 - Complete Discrete Fourier Transform
9 338001 - Roots of a Polynomial (Newton's Method)
4 338003 - Roots of Fourth Degree Polynomial
9 338005 - Quartic, Cubic, Quadratic Solutions
69 338009 - Lin-Bairstow Roots of Polynomial
9 338010 - Routh-Hurwitz Stability Test
3 338028 - Polynomial Coefficients from Roots
9 338034 - Thiele Rational Interpolation
3 338037 - Improved Solution of Equations
3 338039 - Polynomial Evaluation
1 348001 - Gauss-Legendre Numerical Integration
9 348004 - Adaptive Simpson's Method (Integration)
3 348017 - Simpson Approximation for a Triple Integral
3 348018 - Numerical Integration with Log Chaining
B 348020 - Ten Point Gaussian Integration
3 348022 - General Gaussian Integration
39 348023 - Singular & Infinite Integrals
3 348026 - Gauss-Laguerre Integration
2 358002 - Runge-Kutta-Zonnfeld (System)
3 358003 - Initial Value Differential Equations & Systems

3 358007 - Partial Derivatives & Jacobian up to 6 x 6
3 358020 - Euler's Equation
9 358021 - List & Plot D. E. Solutions
3 358022 - 10th Order Implicit Obrechkoff Method
19 368002 - Base Conversion
4 368005 - Roman Numerals
9 368011 - Decimal-Fraction Conversions
9 368013 - Relative Stability for Linear Multistep Methods
B 368018 - Diophantine Equations
49 368027 - Roman Numeral Math
3B 368034 - Diophantine Equations
4 368043 - Decimal to Fraction Conversions
2 378003 - Probability an Arrival is Lost
23 388001 - Linear Programming
127 388003 - PERT/CPM (Operations Research)
3 388004 - Linear Programming - Mixed Constraints
1 398001 - Zeroes of Quadratic & Cubic
1 398004 - Maxima & Minima
4 398005 - Extra Precision Factorials I & II
19 398006 - Functions & Derivatives
1 398010 - Least Mean Square Fit of a Polynomial
4 398035 - Extended Range Factorials
9 398049 - Rectangular-Spherical Coordinate Conversion
9 398050 - Ellipse & Circle Plotter
B 398054 - Precision Fraction to Decimal Conversion
9 398055 - Coordinate Rotation & Translation
3 398064 - Synthetic Division - Diminishing Roots
9 398065 - Cubic Spline Interpolation
34 398070 - Roots of Quartic - Complex Coefficients
4 398084 - Quartic, Cubic, Quadratic Equations
9 398094 - Polynomial Division
9 398096 - Polar Graphing Program
4 398116 - Prime Number Generator
9 398122 - Addition of Fractions
1B 398131 - High Speed Prime Tester
7 398136 - Solid Geometry
7 398137 - Inscribed & Circumscribed Circles
14 398153 - Simultaneous Equations
B 398159 - Unlimited Precision Division
4B 398165 - Multiple Precision Square Root & Remainder
1 398171 - Exact Factorials to 610 Factorial
4 398172 - Quadratic & Linear Equations
3 398176 - 3-D Vector Calculator
B 398182 - The Multiplier
3 398184 - Compendium of Polynomials
B 398186 - Roots using Newton-Raphson Method
3 398193 - Vector Rotation
4 398194 - Properties of Circles
3 398198 - Polynomial Change in Variable
1 398201 - Prime Number Data Base Generator

1	398205	- Simultaneous Equations
7	398210	- Line Circle Intersection
7	398212	- Solid Mensuration
7	398213	- Plane Mensuration
9	398220	- RPN Vector Calculator
1	398225	- Prime Factors of an Integer
4	398227	- Extended Scientific Notation
3	398228	- Partial Derivatives
3	398232	- General Function for Numerical Analysis
49B	398239	- Triple Precision Arithmetic
3	398242	- Square Root Double Precision
3	398243	- Prime Factors of Integers
9	398266	- Arityhmetic with Fractions
4	398267	- Intersection of Two Chords
14	398278	- 13 Digit Modulo 30 Speedy Factor Finder
B	398280	- Mullers Zeroes of Functions
2	398281	- Precision Division 24 to 120 Digits
7	398282	- Area Bounded by One or Two Curves
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3	398286	- High Accuracy Solution of Quartics
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9	408013	- Gravity due to Latitude & Altitude
1	408015	- Specific Gravity
2	408017	- Gravity Modelling 3D Dipping Prism
9	408018	- Rydberg Formula
4	408019	- Circular Orbits
9	408023	- Nuclear Binding Energy & Radius
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9	408040	- Density of Dry and Moist Air
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9	408065	- Refractive Index of Infrared Cells: II
9	408067	- Refractive Index of Infrared Cells: I
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8	408078	- Vector Shorts
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2	468001	- Magnetic Modelling 2D Prism

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8 498002 - Skew/T Log-P Adiabatic Chart
12 508001 - Calorie Determined Weight Program
4 508013 - Serum Ethonal Level (Drunk Test)
1 548007 - Scanning DNA - Enzyme Sites
9 588003 - Custom Metric Diet Planner
8 608002 - Sattleite Finder
8 608007 - Approximation of the 1962 Standard Atmosphere
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1 618001 - Flash Calculation, L/V TBD
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1 618008 - Solution to Pipe Problems - Liquids
1 618009 - McCabe-Thiele Binary Distillation
12 618010 - Steam Tables - Vapor
1 618012 - Heat Transfer Coef/Pressure Drop
1 618013 - Incompressible Fluid Pipeline Pressure Drop
1 618014 - Heat Exchanger Thermodynamics
1 618015 - Heat Exchanger LMDT
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1 618036 - Two Phase Flow
1 618051 - Restrictive Orifice Sizing
9 618058 - Critical Properties of Organic Substances
8 618071 - Peng-Robinson Equation of State
1 628001 - Trapezoidal Channel Depth & Velocity
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1 628022 - Hazen-Williams Formula
1 628024 - Equivalent Pipe Method
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2 638009 - Boolean Truth Table
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1 648006 - Three Winding Transformer Load
2 648023 - Practical Applications of Smith Chart

1 648037 - Three Winding Transformer Impedance
2 648045 - Ladder Network Analysis
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1 648076 - Induction Motor Equivalent Circuit
4 648085 - AC Impedance and Reactance
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4 648091 - Bridge Circuits and Delta to Star
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1 648096 - Heat Trace
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2 658011 - Network Analyzer Impedance Measurements
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1 658029 - Ohms and Power Law
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1 658055 - Transformer Analysis
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2 658070 - Speaker Crossover
2 658078 - Noise Prediction
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2 658092 - Atmospheric Ray Trace (Radar)
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9 678001 - Critical Mass
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1 748001 - Software Development Estimator
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9 788003 - Mean Sidereal Time
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5 908027 - Store/Sort Utility Program
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9 908101 - Histogram, Bar Graph, Point Plotter
1 908104 - Stop Watch Timer
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1 908142 - Bucket Sort
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5 908147 - General Utility Plot
9 908151 - Data Encryption
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6 908153 - Multiple Indirect Levels (Memory)
4 908162 - SR-52 Listing Mark 3
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1 908175 - Memory Malfunction Diagnostic
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9 908200 - Triangular Diagrams
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4 918073 - Auto Draw Poker
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9 918097 - Pictorial Black Box
2 918106 - Knight's Tour
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1 918290 - Poem Machine II
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1 988004 - Individual Bowling Average and Handicap
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