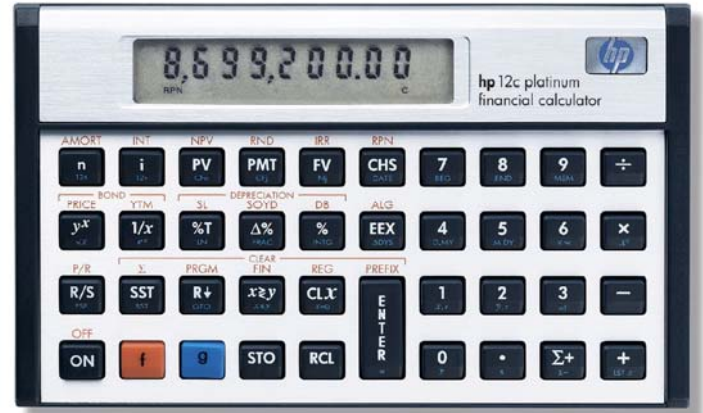




hp calculators

HP 12C Platinum
Programming in Algebraic vs. RPN Modes



Programming in Algebraic vs. RPN Modes

Practice writing several small programs in each mode

Programming in Algebraic vs. RPN Modes

This learning module will illustrate and explore some similarities and differences that arise when programming the HP12C Platinum calculator in algebraic mode compared to RPN mode. It is assumed that the reader is already familiar with programming. For background information, see the *HP12C Platinum Owner's Handbook and Programming Guide*, parts II and III plus the Appendix A, and in the *HP12C Platinum Solutions Handbook*. Also see the learning module on *Writing a Small Program*.

The primary difference between these modes when writing a program is the same as using the machine in normal mode: the order in which operations are carried out. In RPN mode, the values are prepared on the stack and then an operation is carried out, while in algebraic mode, the operators are keyed in between values. Since in many cases, the manual solution to a problem is quicker in RPN mode than algebraic mode, RPN programs are often smaller than their algebraic equivalents. Given the large size of available program memory on the HP12C Platinum, this difference is rarely a matter of concern.

When writing a program in either RPN or algebraic modes, the user has access to a stack of four registers that can contain intermediate results or values for use later in a program. More care must be given to rearranging these values in algebraic programs than in RPN programs, but they are still quite useful as illustrated in some of the examples below.

Practice writing several programs in each mode

Example 1: Write a program to solve for the breakeven point in dollars required to achieve a target return on sales. Input to the program should be the fixed cost, contribution margin percentage, and target return on sales percentage.

Solution: To clear any program previously written and write the program that performs these calculations, press:

CLx **f** **P/R** **f** **PRGM**

Then key in the either of the programs listed below. Note that only one of these programs can be in the calculator's memory at one time. To try both of the programs, use one version first and then return to the beginning instructions in this solution before keying in the other version. Also, if you plan to execute the RPN program version, make sure the HP12C Platinum is in RPN mode before doing so. If you plan to execute the algebraic program version, make sure the HP12C Platinum is in ALG mode before doing so.

RPN Program Listing

Keystroke	Display
f P/R f PRGM	000 ,
−	001 , 30
÷	002 , 10
f P/R g GTO 000	0.00

Algebraic Program Listing

Keystroke	Display
f P/R f PRGM	000 ,
−	001 , 30
X\RightarrowY	002 , 34
X\RightarrowY	003 , 34
÷	004 , 10
X\RightarrowY	005 , 34
X\RightarrowY	006 , 34
=	007 , 36
f P/R g GTO 000	0.00

HP 12C Platinum Programming in Algebraic vs. RPN Modes

The input instructions for each program version: Key in fixed cost and press **ENTER**. Key in contribution margin percentage and press **ENTER**. Key in target return on sales percentage. For algebraic mode only, press **ENTER** again. Then in either mode, press **R/S**.

Note how short the RPN program is. This is because given the input order, the values on the stack are in the exact order required to find the solution by performing the subtraction followed by the division. The algebraic mode requires the double **X \leftrightarrow Y** instructions in order to have the HP12C Platinum subtract the number in the lower level of the stack from a number in a higher level of the stack. This process is quite handy in many situations.

Solution: Test the operation of the programs by entering the sample cases below.

Case 1: Fixed Cost = \$250,000; Contribution Margin Percentage = 25%; Target Return on Sales Percentage = 5%

In RPN Mode, press: **2 5 0 0 0 0 ENTER 0 . 2 5 ENTER 0 . 0 5 R/S**
 In algebraic mode, press: **2 5 0 0 0 0 ENTER 0 . 2 5 ENTER 0 . 0 5 ENTER R/S**
 (Note the last **ENTER** before the **R/S** key. This is needed the way the algebraic mode solution is presented)

Answer: Breakeven sales = \$1,250,000

Case 2: Fixed Cost = \$80,000; Contribution Margin Percentage = 40%; Target Return on Sales Percentage = 8%

In RPN Mode, press: **8 0 0 0 0 0 ENTER 0 . 4 ENTER 0 . 0 8 R/S**
 In algebraic mode, press: **8 0 0 0 0 0 ENTER 0 . 4 ENTER 0 . 0 8 ENTER R/S**
 (Note the last **ENTER** before the **R/S** key. This is needed the way the algebraic mode solution is presented)

Answer: Breakeven sales = \$250,000

Example 2: Write a program to calculate the factorial of a number. Input to the program the number for which the factorial is to be calculated. Assume the input range is greater than 0 and less than 70 and that the value entered is an integer.

Solution: To clear any program previously written and write the program that performs these calculations, press:
CLX **f** **P/R** **f** **PRGM**

Then key in the either of the programs listed below. Note that only one of these programs can be in the calculator's memory at one time. To try both of the programs, use one version first and then return to the beginning instructions in this solution before keying in the other version. Also, if you plan to execute the RPN program version, make sure the HP12C Platinum is in RPN mode before doing so. If you plan to execute the algebraic program version, make sure the HP12C Platinum is in ALG mode before doing so.

RPN Program Listing

Keystroke	Display
\boxed{f} $\boxed{P/R}$ \boxed{f} \boxed{PRGM}	000,
\boxed{ENTER}	001, 36
\boxed{ENTER}	002, 36
$\boxed{1}$	003, 1
$\boxed{-}$	004, 30
\boxed{g} $\boxed{x=0}$	005, 43 35
\boxed{g} \boxed{GTO} $\boxed{0}$ $\boxed{1}$ $\boxed{0}$	006, 43, 33, 010
\boxed{X}	007, 20
\boxed{g} \boxed{LSTx}	008, 43 40
\boxed{g} \boxed{GTO} $\boxed{0}$ $\boxed{0}$ $\boxed{3}$	009, 43, 33, 003
$\boxed{R\downarrow}$	010, 33
\boxed{f} $\boxed{P/R}$ \boxed{g} \boxed{GTO} 000	0.00

Algebraic Program Listing

Keystroke	Display
\boxed{f} $\boxed{P/R}$ \boxed{f} \boxed{PRGM}	000,
\boxed{STO} $\boxed{1}$	001, 44 1
\boxed{RCL} $\boxed{1}$	002, 45 1
$\boxed{-}$	003, 30
$\boxed{1}$	004, 1
$\boxed{=}$	005, 36
\boxed{g} $\boxed{x=0}$	006, 43 35
\boxed{g} \boxed{GTO} $\boxed{0}$ $\boxed{1}$ $\boxed{0}$	007, 43, 33, 010
\boxed{STO} \boxed{X} $\boxed{1}$	008, 44 20 1
\boxed{g} \boxed{GTO} $\boxed{0}$ $\boxed{0}$ $\boxed{3}$	009, 43, 33, 003
\boxed{RCL} $\boxed{1}$	010, 45 1
\boxed{f} $\boxed{P/R}$ \boxed{g} \boxed{GTO} 000	0.00

The input instructions for each program version: Key in the number. For algebraic mode only, press \boxed{ENTER} . Then in either mode, press $\boxed{R/S}$.

In this case, both programs are the same length. The RPN program is carried out entirely on the stack without using any memory registers. The algebraic mode program uses memory 1. Another memory register could be used instead of memory one, but since storage register arithmetic (at step 008) is used, the replacement must be a memory in the range of 0 through 4.

Both programs are essentially doing the same thing: taking the initial number, subtracting one from it, testing to make sure that this decremented value is not equal to zero (if so, the program is finished), and then multiplying the running product by this decreased value and looping through the process again, but using the decreased value as the new base from which one is subtracted.

Solution: Test the operation of the programs by entering the sample cases below.

Case 1: Find the factorial of 5. It should be $5 \times 4 \times 3 \times 2 \times 1$, or 120.

In RPN Mode, press: $\boxed{5}$ $\boxed{R/S}$

In algebraic mode, press: $\boxed{5}$ \boxed{ENTER} $\boxed{R/S}$

(Note the last \boxed{ENTER} before the $\boxed{R/S}$ key. This is needed the way the algebraic mode solution is presented)
Answer: $5! = 120$.

Case 2: Find the factorial of 10. It should be $10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$, or 3,628,800.

In RPN Mode, press: $\boxed{1}$ $\boxed{0}$ $\boxed{R/S}$

In algebraic mode, press: $\boxed{1}$ $\boxed{0}$ \boxed{ENTER} $\boxed{R/S}$

(Note the last \boxed{ENTER} before the $\boxed{R/S}$ key. This is needed the way the algebraic mode solution is presented)
Answer: $10! = 3,628,800$.

Example 3: Write a program to calculate the binomial probability distribution function.

Solution: To clear any program previously written and write the program that performs these calculations, press:

$\boxed{\text{CLX}}$ $\boxed{\text{f}}$ $\boxed{\text{P/R}}$ $\boxed{\text{f}}$ $\boxed{\text{PRGM}}$

RPN Program Listing

Keystroke	Display
$\boxed{\text{f}}$ $\boxed{\text{P/R}}$ $\boxed{\text{f}}$ $\boxed{\text{PRGM}}$	000,
$\boxed{\text{STO}}$ $\boxed{1}$	001, 44 1
$\boxed{\text{R}\downarrow}$	002, 33
$\boxed{\text{STO}}$ $\boxed{2}$	003, 44 2
$\boxed{\text{R}\downarrow}$	004, 33
$\boxed{\text{STO}}$ $\boxed{3}$	005, 44 3
$\boxed{\text{RCL}}$ $\boxed{2}$	006, 45 2
$\boxed{-}$	007, 30
$\boxed{\text{g}}$ $\boxed{\text{n!}}$	008, 43 3
$\boxed{\text{RCL}}$ $\boxed{2}$	009, 45 2
$\boxed{\text{g}}$ $\boxed{\text{n!}}$	010, 43 3
$\boxed{\text{X}}$	011, 20
$\boxed{\text{RCL}}$ $\boxed{3}$	012, 45 3
$\boxed{\text{g}}$ $\boxed{\text{n!}}$	013, 43 3
$\boxed{\text{X}\approx\text{y}}$	014, 34
$\boxed{\div}$	015, 10
$\boxed{\text{RCL}}$ $\boxed{1}$	016, 45 1
$\boxed{\text{RCL}}$ $\boxed{2}$	017, 45 2
$\boxed{\text{y}^{\text{x}}}$	018, 21
$\boxed{\text{X}}$	019, 20
$\boxed{1}$	020, 1
$\boxed{\text{RCL}}$ $\boxed{1}$	021, 45 1
$\boxed{-}$	022, 30
$\boxed{\text{RCL}}$ $\boxed{3}$	023, 45 3
$\boxed{\text{RCL}}$ $\boxed{2}$	024, 45 2
$\boxed{-}$	025, 30
$\boxed{\text{y}^{\text{x}}}$	026, 21
$\boxed{\text{X}}$	027, 20
$\boxed{\text{f}}$ $\boxed{\text{P/R}}$ $\boxed{\text{g}}$ $\boxed{\text{GTO}}$ 000	0.00

Algebraic Program Listing

Keystroke	Display
$\boxed{\text{f}}$ $\boxed{\text{P/R}}$ $\boxed{\text{f}}$ $\boxed{\text{PRGM}}$	000,
$\boxed{\text{STO}}$ $\boxed{1}$	001, 44 1
$\boxed{\text{R}\downarrow}$	002, 33
$\boxed{\text{STO}}$ $\boxed{2}$	003, 44 2
$\boxed{\text{R}\downarrow}$	004, 33
$\boxed{\text{STO}}$ $\boxed{3}$	005, 44 3
$\boxed{-}$	006, 30
$\boxed{\text{RCL}}$ $\boxed{2}$	007, 45 2
$\boxed{=}$	008, 36
$\boxed{\text{g}}$ $\boxed{\text{n!}}$	009, 43 3
$\boxed{\text{X}}$	010, 20
$\boxed{\text{RCL}}$ $\boxed{2}$	011, 45 2
$\boxed{\text{g}}$ $\boxed{\text{n!}}$	012, 43 3
$\boxed{\div}$	013, 10
$\boxed{\text{RCL}}$ $\boxed{3}$	014, 45 3
$\boxed{\text{g}}$ $\boxed{\text{n!}}$	015, 43 3
$\boxed{\text{X}\approx\text{y}}$	016, 34
$\boxed{=}$	017, 36
$\boxed{\text{RCL}}$ $\boxed{1}$	018, 45 1
$\boxed{\text{y}^{\text{x}}}$	019, 21
$\boxed{\text{RCL}}$ $\boxed{2}$	020, 45 2
$\boxed{\text{X}}$	021, 20
$\boxed{\text{X}\approx\text{y}}$	022, 34
$\boxed{=}$	023, 36
$\boxed{1}$	024, 1
$\boxed{-}$	025, 30
$\boxed{\text{RCL}}$ $\boxed{1}$	026, 45 1
$\boxed{=}$	027, 36
$\boxed{\text{RCL}}$ $\boxed{3}$	028, 45 3

Algebraic Program Listing (Continued)

\square	029,	30
RCL 2	030,	45 2
y^x	031,	21
$x \approx y$	032,	34
$x \approx y$	033,	34
=	034,	36
X	035,	20
$x \approx y$	036,	34
=	037,	36
f P/R g GTO 000	0.00	

The input instructions for each program version: Key in the number of trials. Press \square . Key in the number of successes. Press \square . Key in the probability of a success. For algebraic mode only, press \square . Then in either mode, press \square . Also, if you plan to execute the RPN program version, make sure the HP12C Platinum is in RPN mode before doing so. If you plan to execute the algebraic program version, make sure the HP12C Platinum is in ALG mode before doing so.

Solution: Test the operation of the programs by entering the sample cases below.

Case 1: In 10 trials, what is the probability of 5 successes, if the probability of a success on any trial is 50%?

In RPN Mode, press: 1 0 \square 5 \square 0 . 5 \square

In algebraic mode, press: 1 0 \square 5 \square 0 . 5 \square \square

(Note the last \square before the \square key. This is needed the way the algebraic mode solution is presented)

Answer: 0.2461 or 24.61%.

Case 2: In 20 trials, what is the probability of 0 successes, if the probability of a success on any trial is 5%?

In RPN Mode, press: 2 0 \square 0 \square 0 . 0 5 \square

In algebraic mode, press: 2 0 \square 0 \square 0 . 0 5 \square \square

(Note the last \square before the \square key. This is needed the way the algebraic mode solution is presented)

Answer: 0.3585 or 35.85%.

These examples just begin to show the many ways the HP12C Platinum can be customized for your everyday needs.

For more information, see the *HP12C Platinum Owner's Handbook and Programming Guide*, parts II and III plus the Appendix A, and in the *HP12C Platinum Solutions Handbook*. Also see the HP12C Platinum learning module on *Writing a Small Program*.