

# KPV-67 - Linear Equations & 9 Unknowns

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Using Gaussian elimination, this program solves any system of linear equations in up to 9 unknowns. Input data may be entered manually, prompted by a loop, or by providing a data card. All data is held in the calculator's memory, no external storage is required. Worst-case execution time is less than a second.

## NOTES

Each equation:

$$a_{11}x_1 + a_{12}x_2 + \dots = b_1$$

$$a_{21}x_1 + a_{22}x_2 + \dots = b_2$$

...

is held in a block of extended memory:

R.01...R.09, with  $b_1$  in R.00

R.11...R.19, with  $b_2$  in R.10

...

After solving,

R.91...R.99 (as well as internal registers R1...R9) hold the results  $x_1...x_9$ .

To load the equations from a data card, define registers R.00...R.89 as described above, ignoring unused registers. Important: Set register RE to the number of equations.

The number format is defined in subroutine 27 (last lines of program) and may be modified as appropriate.

The secondary registers of the calculator are not used.

**EXAMPLE 1: 2 x 2**

Solve the following system in 2 unknowns (manually):

$$5x_1 - 7x_2 = -11$$

$$9x_1 + 8x_2 = 42$$

Enter number of unknowns:

**2 A**                      **1 .**              **01**

A beep sounds, signaling that the program is waiting for user input. The display indicates that coefficient 1 of equation 01 is expected.

Enter the first coefficient:

**5**                              **2 .**              **01**

After the pause expires, the next coefficient (2) is requested:

**7 CHS**                      **3 .**              **01**

Enter the right side of the equation:

**11 CHS**                      **1 .**              **02**

All values of equation 01 are printed out.

Now enter the values of the second equation:

**9**                              **2 .**              **02**

**88**                              **3 .**              **02**

Oops, we've wrongly entered 88 instead of 8. We'll fix that shortly.

**42**                              **2 . 0000**

The display shows that all equations have been entered (2).

The printer prompts you to solve the system by tapping the function key E. But first we have to fix the wrong coefficient in row 2.

Looking at the printer output we see that the 88 went into location R.12. We replace the value with the correct one:

**8 STO.12**

Tap D to verify the matrix:

```
5.0000 01
-7.0000 02
-11.0000 00

9.0000 11
8.0000 12
42.0000 13
```

Solve the system:

```
E          2.0000  91 x1
           3.0000  92 x2
```

The solution is also stored in registers R1 and R2.

The time window for entering values is defined by the pause length (as selected in Settings.) Each keypress restarts the pause.

To store a value, a number key must have been pressed (or decimal point or EEX.)

You can even calculate a coefficient, e.g.  $2\sqrt{2} \div$  to use half of the square root of 2.  
To enter  $e = 2.718\dots$  you may press 1, then  $e^x$ .  $\pi$  might be entered as  $\pi 0 +$  or  $\pi 1 \times$ .

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### EXAMPLE 2: 5 x 5

*To solve a system stored on a data card:*

Load data card "LinEq 00680D"

Print matrix (optional):

```
D          5.0000  01
          -1.0000  02
           1.0000  03
           . . .
```

Solve:

```
E          2.0000  91 x1
           0.3333  92 x2
          -0.5000  93 x3
           0.8333  94 x4
          -3.0000  95 x5
```