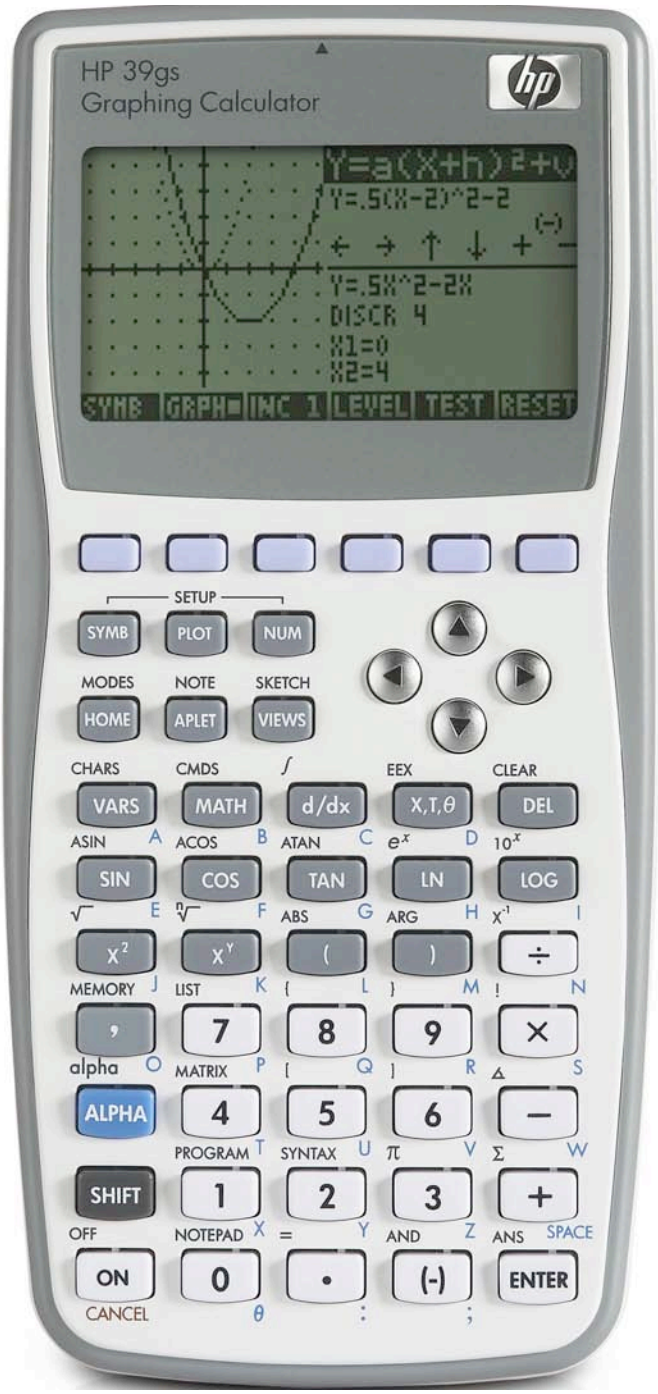
hp calculators

HP 39gs Solving Linear Systems of Equations

Linear Systems of Equations

Practice Solving Linear Systems of Equations



Linear Systems of Equations

A linear system of equations is one in which there are a set of n linear equations in k unknowns. For any linear system, exactly one of the following will be true: there is only one solution, there are an infinite number of solutions, or there are no solutions.

For example, the system of two linear equations:

$$X + Y = 11$$
$$2X – Y = 4$$

has exactly one solution, X = 5, Y = 6. This can be thought of as the intersection of the two equations. However, the system of two linear equations:

$$2X - Y = -3$$
$$2X – Y = 4$$

has no solution. If graphed, these equations would not intersect. An example of a system of two linear equations with an infinite number of solutions might be:

$$2X + 2Y = 20$$
$$X + Y = 10$$

For systems with more than two variables and/or more than two equations, similar results can be obtained.

The HP 39gs presents several ways of solving linear systems. For linear systems with 2 or 3 unknowns (a 2x2 or 3x3 system), the Linear Equation aplet (covered in chapter 8 of the User's Guide) can be used. In addition, the built-in matrix functions of the HP 39gs can also be used to solve linear systems. These methods are shown in the examples below.

Practice Solving Linear Systems of Equations

Example 1: Solve the linear system shown below.

$$2X + Y = 8$$
$$X + Y = 5$$

Solution: Since this is a 2x2 system, use the Linear Equation aplet to solve it.

HOME APLET (The Linear Equation aplet's location in the aplet list depends on when it was last used, and this might vary from person to person and calculator to calculator. Use the ▲ and ▼ keys to highlight the aplet. Once highlighted, continue with the keystrokes below.)

Figure 1

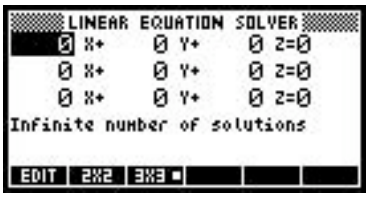


Figure 2

2 ENTER 1 ENTER 8 ENTER 1 ENTER 1 ENTER 5 ENTER

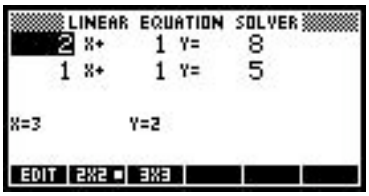


Figure 3

Answer: X = 3, Y = 2.

Example 2: Solve the linear system shown below.

4X + 5Y + Z = 0
3X + 2Y – Z = 7
-1X +112Y + 3Z = 127

Solution: For this solution, use the HP 39gs matrix functions. The first step is to create the coefficient matrix.

HOME SHIFT MATRIX

Figure 6

Figure 7

ENTER

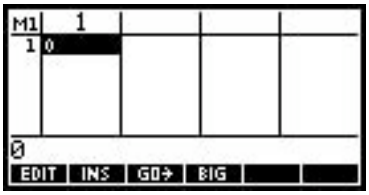


Figure 8

4 ENTER 5 ENTER 1 ENTER ▼
3 ENTER 2 ENTER (-) 1 ENTER ▼

(-) 1 ENTER 1 1 2 ENTER 3 ENTER

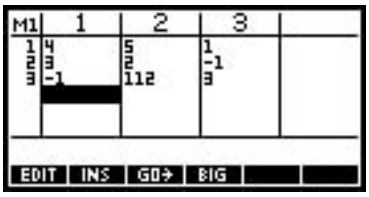


Figure 9

SHIFT MATRIX

Figure 10

The next step is to create the vector containing the system's constants.

▼ ▼

Figure 11

ENTER 0 ENTER 7 ENTER 1 2 7 ENTER

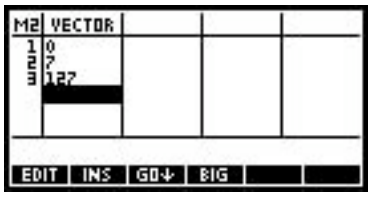


Figure 12

HOME ALPHA M 1 SHIFT x^{-1} × ALPHA M 2

Figure 13

ENTER

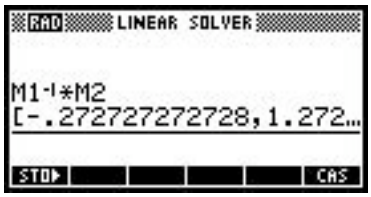


Figure 14

▲ EDIT ALPHA M 3 SHIFT MATRIX ▼ ▼ EDIT

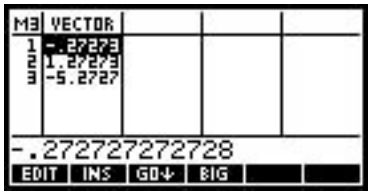


Figure 15

Answer: X = -0.27273 (-3/11), Y = 1.27273 (14/11), and Z = -5.2727 (-58/11).