

Math 124 Lesson Plan - Day 3 of Multi-variate Equations Section 9.3 - Expressing the solution of a dependent system

When a system of equations has many solutions where one equation cancels out, the solutions can be expressed in terms of one variable, call it t .

$$\begin{array}{l} E_x: \quad X - Y + 5Z = -2 \\ \quad \quad 2X + Y + 4Z = 2 \\ \quad \quad 2X + 4Y - 2Z = 8 \end{array} \quad \begin{array}{l} -2R_1 + R_2 \\ -2R_1 + R_3 \end{array} \quad \begin{array}{l} X - Y + 5Z = -2 \\ 3Y - 6Z = 6 \\ 6Y - 12Z = 12 \end{array}$$

$$\begin{array}{l} X - Y + 5Z = -2 \\ 3Y - 6Z = 6 \\ 6Y - 12Z = 12 \end{array} \quad \begin{array}{l} \\ -2R_2 + R_3 \end{array} \quad \begin{array}{l} X - Y + 5Z = -2 \\ 3Y - 6Z = 6 \\ 0 \quad 0 = 0 \end{array}$$

Z dropped out. (Z will be set to t .)

1) Express x and y in terms of z

$$Y - 2Z = 2 \rightarrow \boxed{Y = 2Z + 2} \quad \boxed{X = -3Z}$$

$$X - Y + 5Z = -2$$

$$X - (2Z + 2) + 5Z = -2$$

$$X - 2Z - 2 + 5Z = -2$$

$$X = -3Z$$

Let $t =$ any real number

then let $z = t$

$$Y = 2t + 2$$

$$X = -3t$$

All solutions are of form
 $(-3t, 2t + 2, t)$

Variable z is dependent on x and y for this system of equations.

$(-3t, 2t+2, t)$ t is the parameter for solution set.

Let $t = 2$

Then solution = $(-6, 6, 2)$

Let $t = -1$,

Then solution = $(3, 0, -1)$

Let $t = 0$

Then solution = $(0, 2, 0)$.