Your Name

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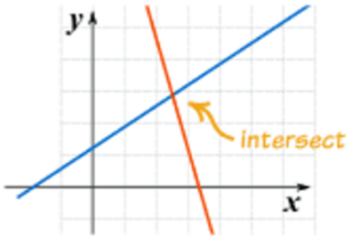
Notes

Lesson 1.4 - Solving Systems of 3 Variable Equations

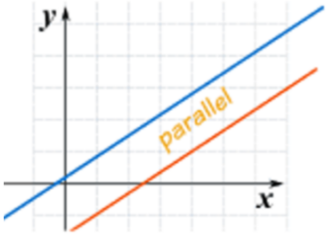
No Solution/Infinitely Many Solutions

Systems of 2 Linear Equations

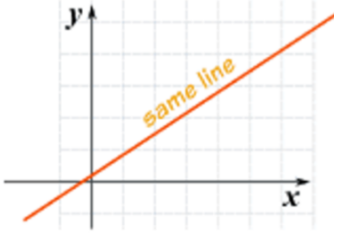


One Solution

Solve and end up with a solution *(x,y)*.



No Solution

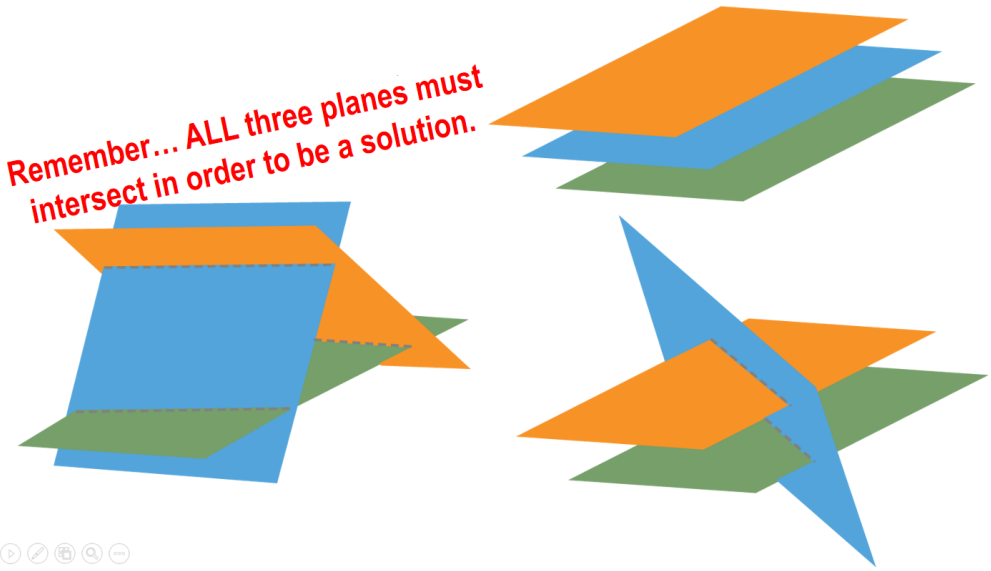


∞ Solutions

When solving, both variables are eliminated! Look at the statement that is left when the variables are gone.

False = No Solution	True = Infinite Solutions
0 = 5 or 1 = 10	*0 = 0 or 5 = 5*

What if there is NO solution?



Systems with No Solution

If you eliminate a variable and all three variables cancel and you get a false statement

Three Variable Equations with NO solutions…

$x+y+z=2$ Equation 1 multiply by -3

$3x+3y+3z=14$ Equation 2

$x-2y+z=4$ Equation 3

$-3x-3y-3z=-6$

$3x+3y+3z=14$

$0=8$

Two is company
Three is a crowd
Pick a variable &
KICK IT OUT!

Since this is a ***false equation***, you can conclude the original system of equations has **no solution.**

And… you're done!
There isn't a solution to find.

What is the graphical situation here?

2 parallel planes and one intersecting plane

Parallel Planes if: ax + by + cz can be the same but with different d

Same Planes if:ax + by + cz and d can be exactly the same

Ex2: Solve the system.

$$\begin{aligned} x+y+z&=1 \quad (1)\\ 6x+9y-12z&=14 \quad (2)\\ 12x+18y-24z&=-11 \quad (3) \end{aligned}$$

2 · (2) ≠ (3) not · 2

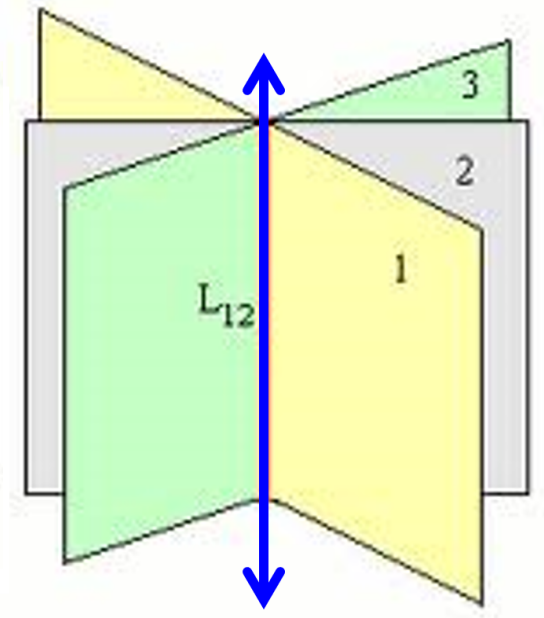
(2) and (3) Parallel

No Solution

Be smart
Check for any parallel planes

Two is company
Three is a crowd
Pick a variable &
KICK IT OUT!

What if there are INFINITE solutions? How do I find the intersection points if the planes intersect in a LINE?



Systems with Infinite Solutions

1. If as you eliminate a variable, and two variables cancel and you are immediately left with one variable = a number

OR you eventually get a true statement like 0 = 0

What happens when three planes intersect in a LINE?

Solve the system.

$2x + y + z = 0$ Equation 1
$x - 2y - 2z = 0$ Equation 2
$x + y + z = 0$ Equation 3

SOLUTION

$x - 2y - 2z = 0$ Equation 2
$-x - y - z = 0$ -1 times Equation 3
$-3y - 3z = 0$ New Equation 2

$2x + y + z = 0$ Equation 1
$-2x - 2y - 2z = 0$ -2 times Equation 3
$-y - z = 0$ New Equation 1

$-3y - 3z = 0$
$3y + 3z = 0$
$0 = 0$ Identity... many solutions

You are NOT DONE!

2. Take the common equation and solve for one variable, this is the expression for that coordinate in the triple.

3. Then substitute the two expressions for the two variables in to an original equation to get the expression for the other variable.

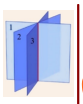
$-y - z = 0$ Step 2
Solve for y
$y = -z$

So the y coordinate is $-z$, the equation is in terms of z so the z coordinate will be itself

$(0, -z, z)$

(x, y, z)
?

Step 3
$x + y + z = 0$
$x + (-z) + z = 0$
$x = 0$



Solve the system using any algebraic method.

① $x + 2y - z = 4$ (4)
② $3x - y + 4z = -2$
③ $6x + 5y + z = 10$

Two is company, Three is a crowd
Pick a variable & KICK IT OUT!

① $x + 2y - z = 4$
③ $6x + 5y + z = 10$
$7x + 7y = 14$

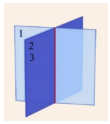
① $4x + 8y - 4z = 16$
② $3x - y + 4z = -2$
$-1(7x + 7y = 14)$

$7x + 7y = 14$
$-7x - 7y = -14$
$0 = 0$ I.M.S.

$7x + 7y = 14$
$7x = -7y + 14$
$x = -y + 2$
since equation is in terms of y y is itself

x, y,
$(-y + 2, y, y - 2)$

$x + 2y - z = 4$
$(-y + 2) + 2(y) - z = 4$
$y + 2 - z = 4$
$-y \quad -y$
$2 - z = -y + 4$
$-2 \quad -2$
$-z = -y + 2$
$z = y - 2$



① $2x + 2y + 2z = -2$

② $2x + 3y + 2z = 4$ (-1)

③ $x + y + z = -1$ (-2)

① $2x + 2y + 2z = -2$

② $-2x - 3y - 2z = -4$

$-y = -6$

$y = 6$

going to be a line of solutions because exactly 2 variables canceled

① $2x + 2y + 2z = -2$

③ $-2x - 2y - 2z = 2$

$0 = 0$

① + ③ are the same plane

To find x and y you can plug in $y = 6$ into any of the three original equations to get the new equation that you solve for one variable for and the other is in terms of

③ $x + y + z = -1 \rightarrow x + 6 + z = -1$

$x + z = -7$

$x = -z - 7$

and

② $2x + 3y + 2z = 4 \rightarrow 2x + 3(6) + 2z = 4$

$2x + 2z = -14$

$x = -z - 7$

See! they both give you the same equations!

$(-z - 7, 6, z)$