Warm Up

Solve the following system of equations:

$4x + 9 = 3y - 6z$
$3z = 10 + 2x + 4y$
$2y = 4z - 11 - 3x$

$4x-3y+6z=-9$
$-2x-4y+3z=10$
$3x+2y-4z=-11$

$4x-3y+6z=-9$
(+) $-4x-8y+6z=20$
$-11y+12z=11$

$-6x-12y+9z=30$
(+) $6x+4y-8z=-22$
$-8y+z=8$

"2 x 2 system"

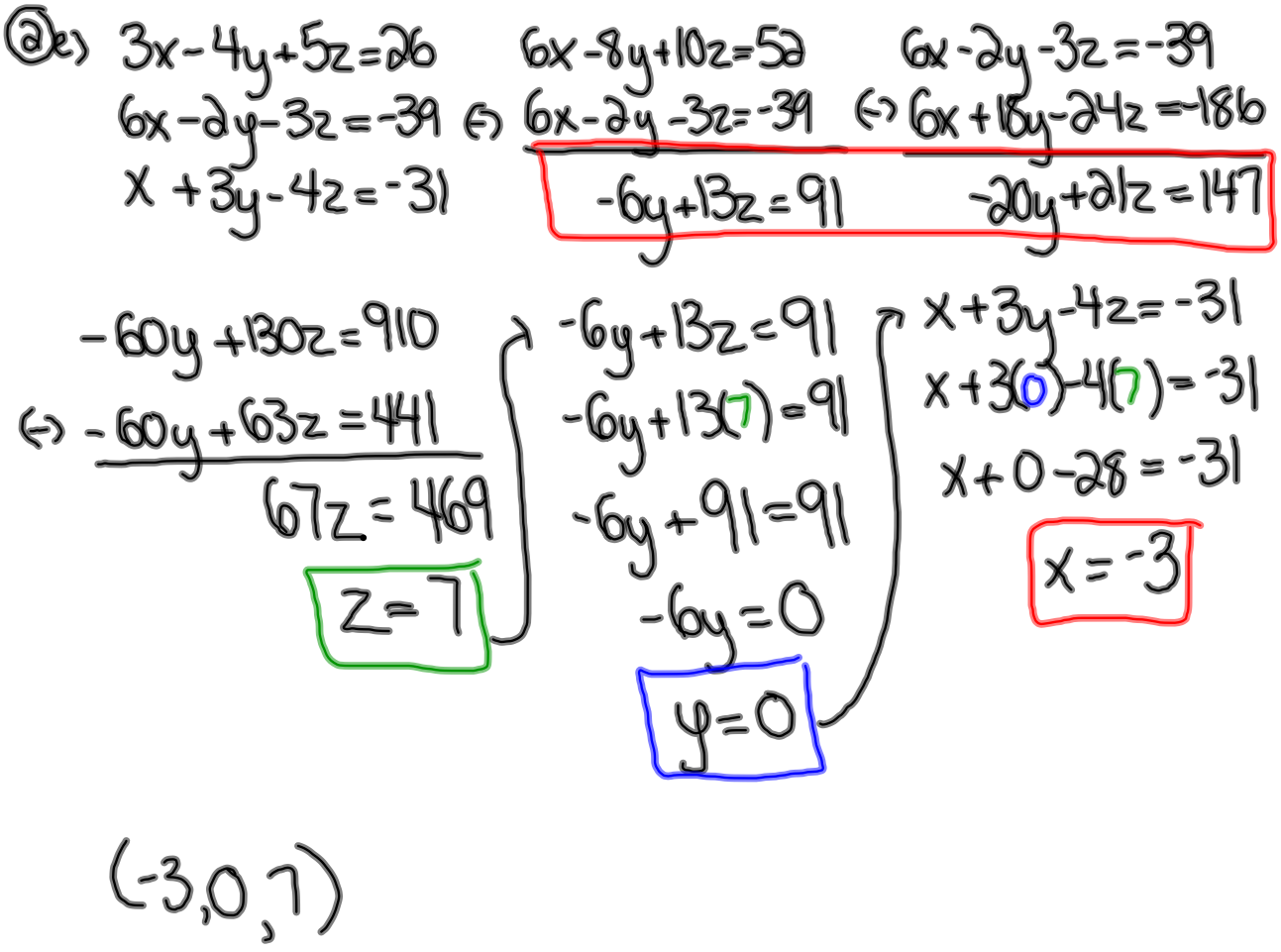
$-11y+12z=11$
(-) $-96y+12z=96$
$85y=-85$
$y=-1$

$-8y+z=8$
$-8(-1)+z=8$
$8+z=8$
$z=0$

$4x-3y+6z=-9$
$4x-3(-1)+6(0)=-9$
$4x+3+0=-9$
$4x=-12$
$x=-3$

$(-3,-1,0)$

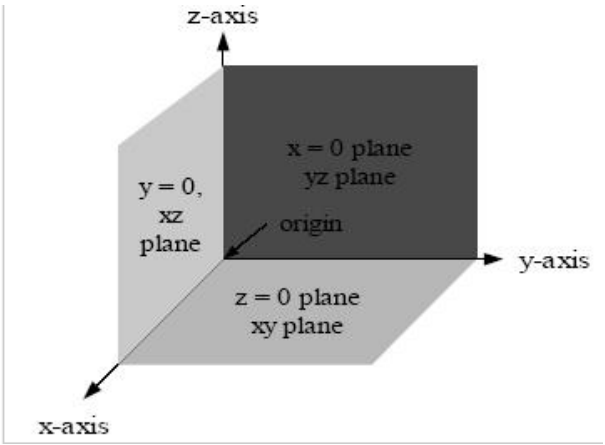
Questions from Homework



(-3, 0, 7)

ALGEBRA OF 3-SPACE

- Coordinate geometry that represents space in **three** dimensions
- Coordinates are in the form of an ordered triplet **(x, y, z)**
- Three planes exist: **xy** plane, **xz** plane, **yz** plane

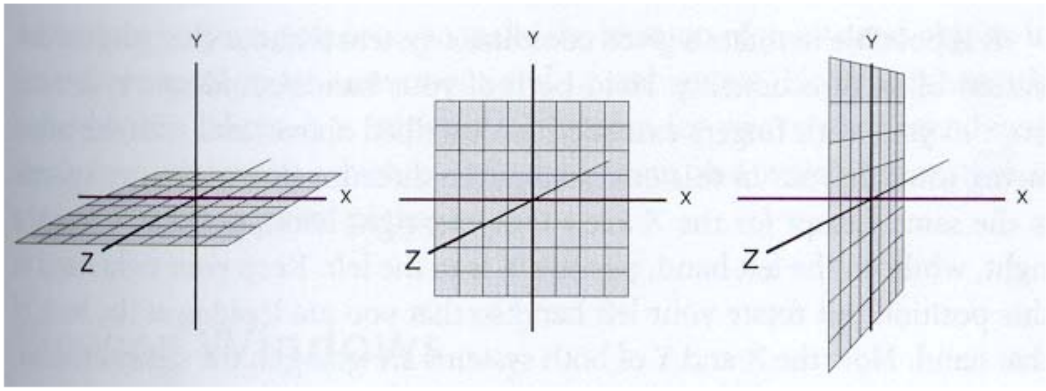


x axis -axis coming "out of the page"

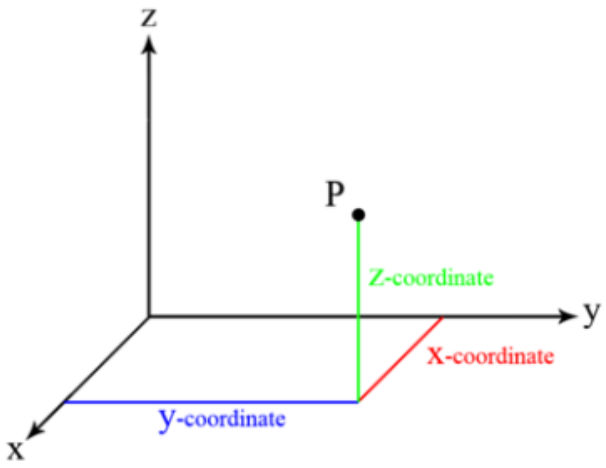
y axis - horzontal axis

z axis - vertical axis

xz plane **xy** plane **yz** plane

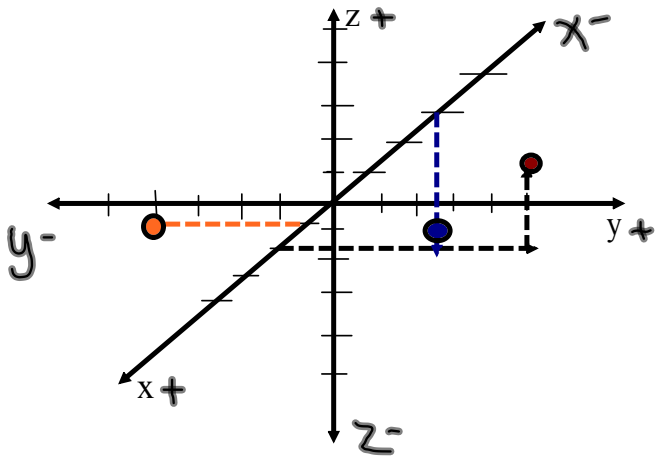


Plotting Points in 3-Space



Plotting points in 3-space...

Ex: a) (2, 6, 3) b) (-3, 0, -4) c) (1, -4, 0)

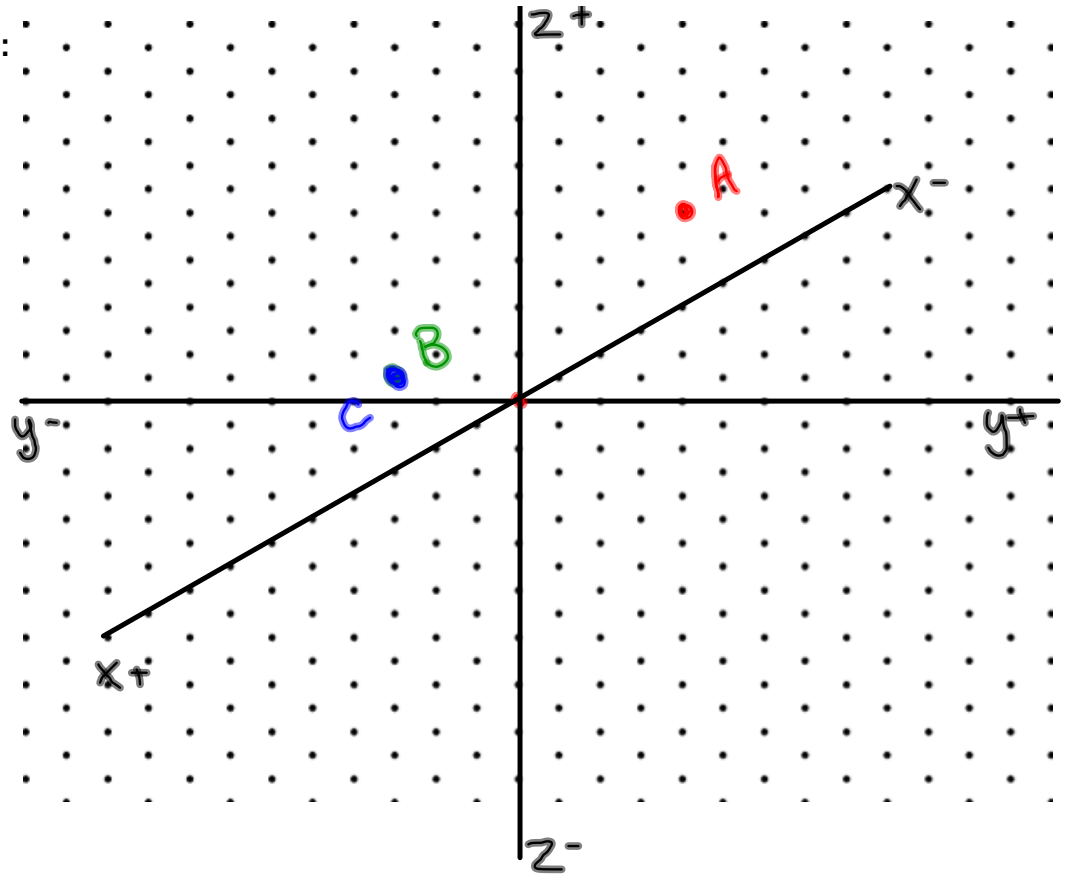


Plot the following:

A (-2, 1, 3)

B (3, 0, 2)

C (-1, -2, 0)



Finding Intercepts in 3D

As in two dimensions...

x intercept can be found when $y = 0$ and $z = 0$

$(x,y,z) \longrightarrow (x,y,z)$

y intercept can be found when $x = 0$ and $z = 0$

$(x,y,z) \longrightarrow (0,y,0)$

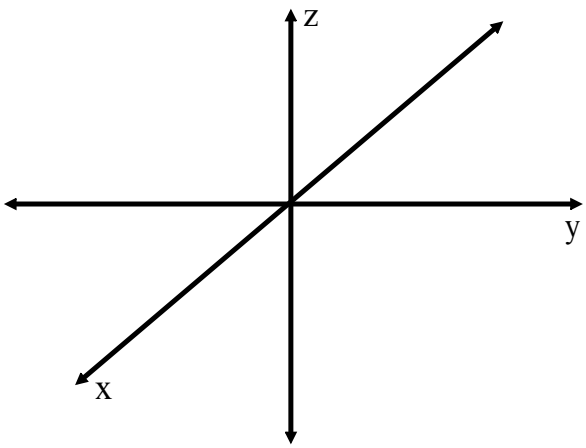
z intercept can be found when $x = 0$ and $y = 0$

$(x,y,z) \longrightarrow (0,0,z)$

Plotting Planes in 3-Space

- Use the **intercept method** to plot the x, y, and z intercepts to form a triangle
- The triangle is part of the plane being sketched

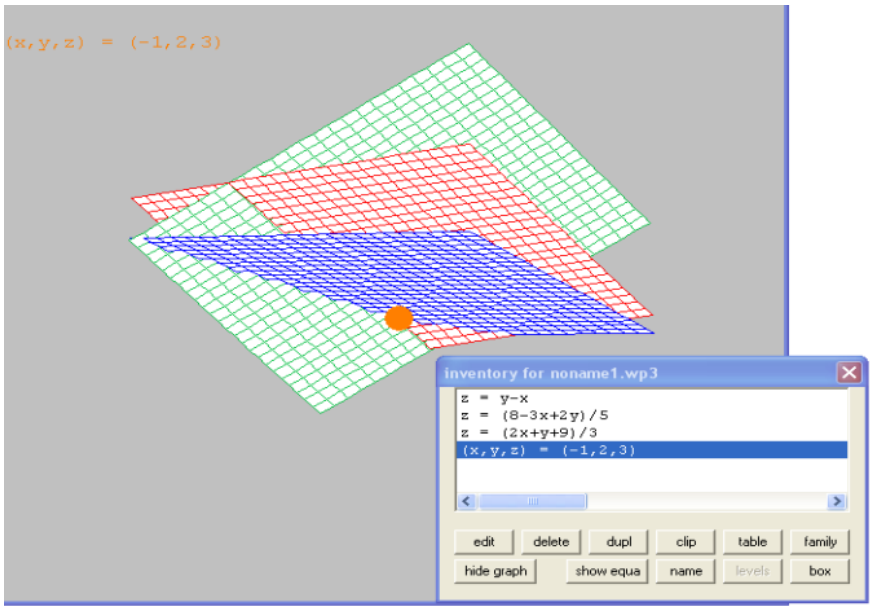
Ex. 2x - y + 3z = 6



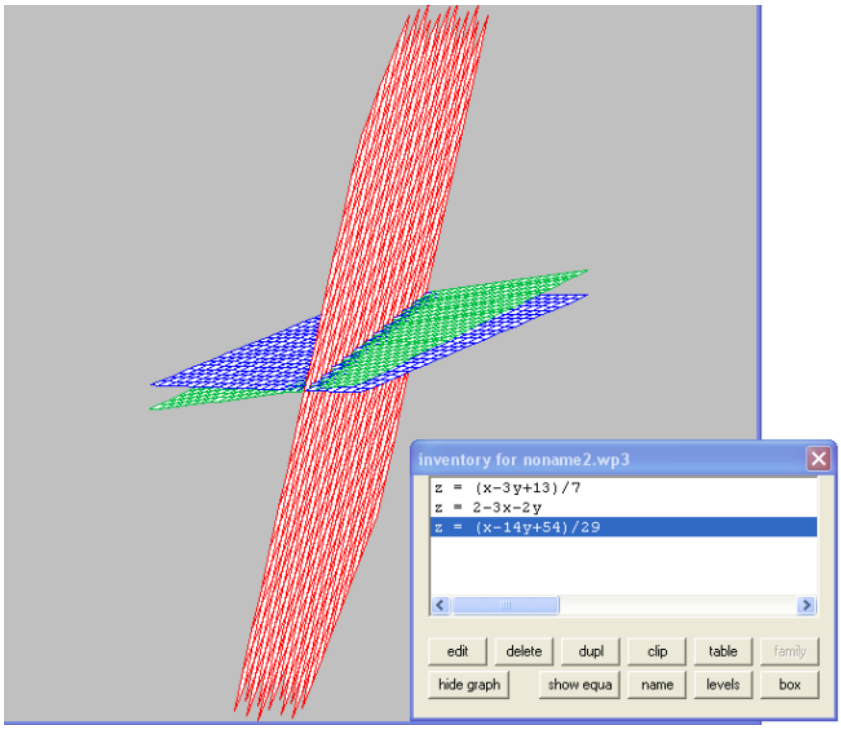
Types of Systems

Remember: Looking at **intersecting planes**!

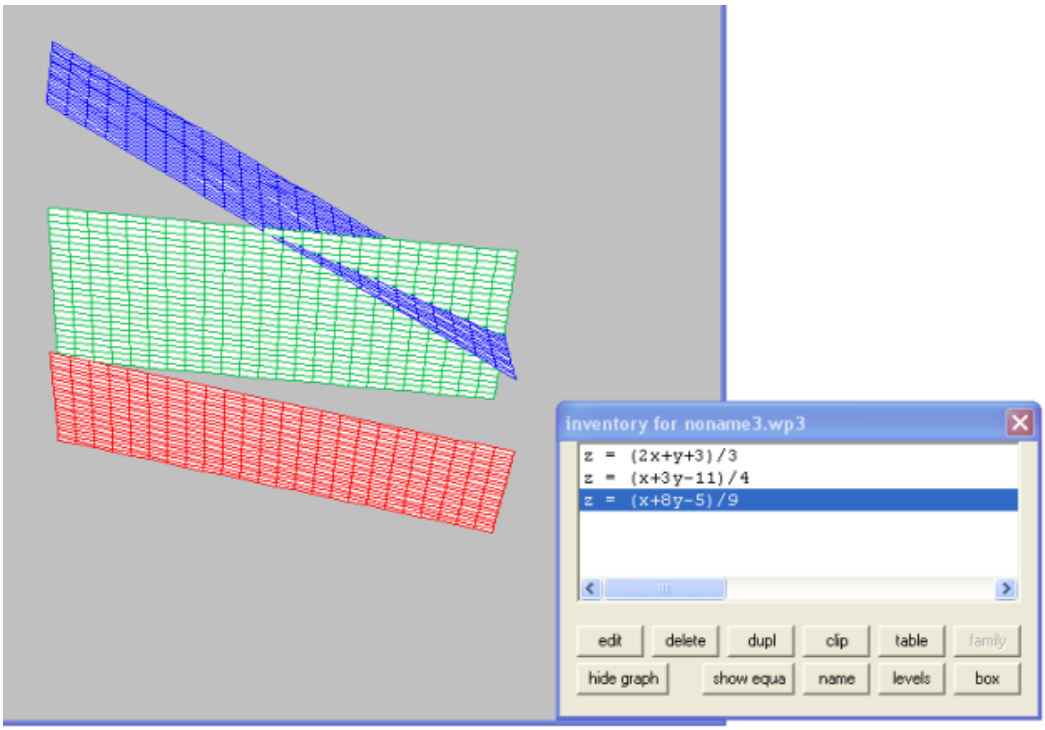
Consistent: At least one solution



Dependent: Infinite number of solutions

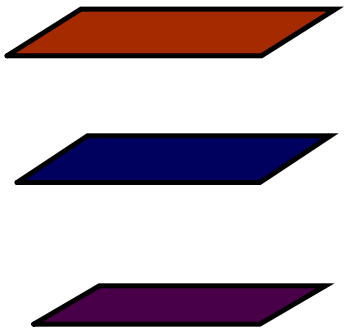


Inconsistent: No Solutions

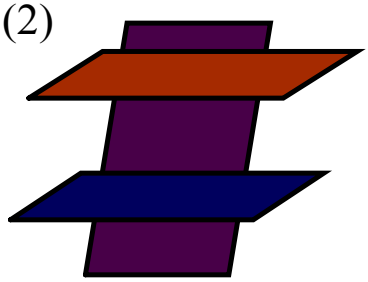


3 Possible Orientations That Give No Solution...

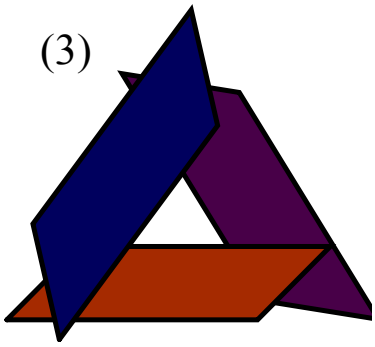
(1)



(2)



(3)



I. Consistent System with a Unique Solution

$x - y + z = 0$
$3x - 2y + 5z = 8$
$2x + y - 3z = -9$

STEPS:
1) Eliminate one of the variables
2) Solve the 2 x 2 system
3) Use "backward substitution" to obtain a solution

Homework

Handout: Solving Systems of Equations in 3-Space

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II. Consistent System with a Dependent Solution
(must create a parametric solution)

$x - 3y - 7z = -13$
$3x + 2y + z = 2$
$x - 14y - 29z = -54$

Write a general solution in terms of a parameter (i.e. $z = t$). For each value assigned to the parameter there will be one distinct solution.