Accelerated Precalculus Name _____
Solving 3 X 3 Linear Systems Algebraically Date _____ Block _____

Recall: Solve a system of equations by elimination

1.) Solve the following system by elimination.

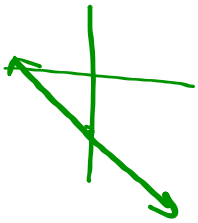
$x - 3y = -19$
$2x + y = -3$
$\times 3$

$x - 3y = -19$
$6x + 3y = -9$
$7x = -28$
$x = -4$

$2(-4) + y = -3$
$-8 + y = -3$
$y = 5$
$(-4, 5)$

$-4 - 3(5) = -19$ ✓
$2(-4) + 5 = -3$ ✓

$y = -2x - 3$



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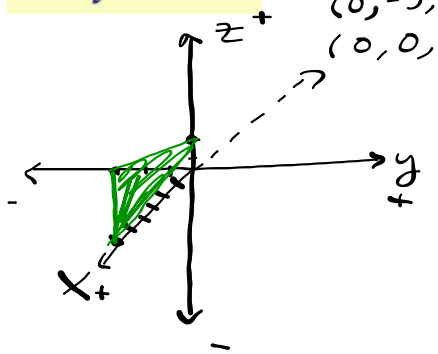
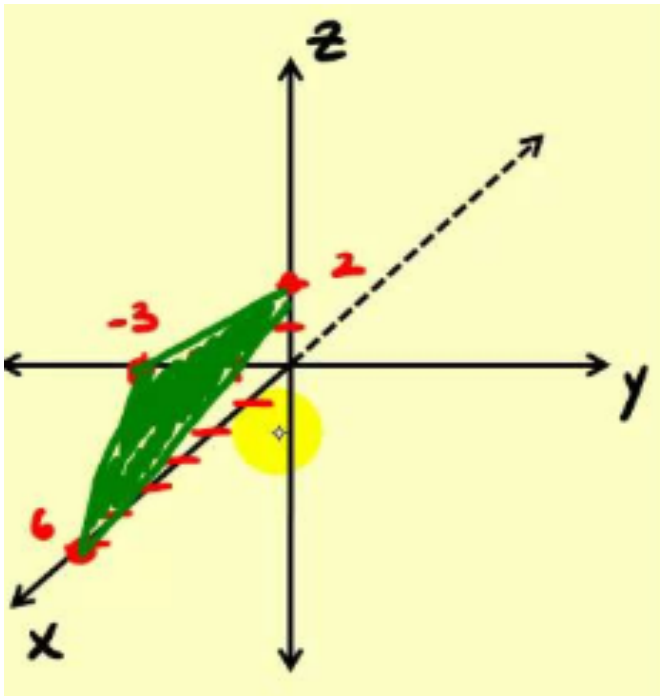
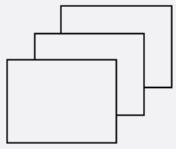
$x - 2y + 3z = 6$

$(6,0,0)$
$(0,-3,0)$
$(0,0,2)$

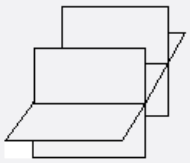




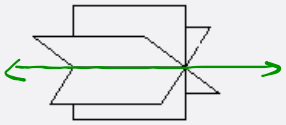
In 3D, three planes π_1, π_2 and π_3 can intersect (or not) in the following ways:



All three planes are parallel

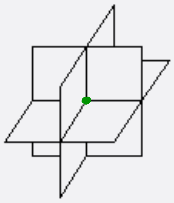


Just two planes are parallel, and the 3rd plane cuts each in a line

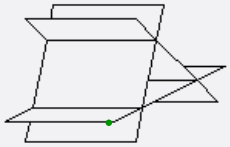


Inf. Many

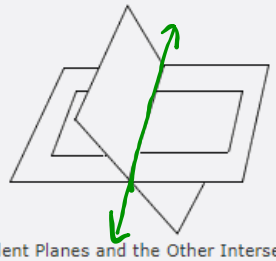
The intersection of the three planes is a line



The intersection of the three planes is a point



Each plane cuts the other two in a line



Two Coincident Planes and the Other Intersecting Them in a Line

2.) New: Solve a 3 X 3 Linear System using Elimination

- First, eliminate the same variable from 2 pairs of 2 equations (each equation should have been used at least once).
- Then solve the 2 X 2 system that remains.
- Finally, substitute the solutions of the 2 X 2 into one of the original equations to find the value of the last variable.
- Write your answer as an ordered triple, (*x, y, z*). Check the ordered-triple solution by substituting values in to each equation.

$2(x - y - z = 7 \cdot 2)$ A
$-x + 2y - 3z = -12$ B
$3x - 2y + 7z = 30$ C

① B + C

$-x + 2y - 3z = -12$
$3x - 2y + 7z = 30$
$2x + 4z = 18$

② 2A + B

$2x - 2y - 2z = 14$
$-x + 2y - 3z = -12$
$x - 5z = 2$

③ $x + 2z = 9$
$-(x - 5z) = 2(-1)$
$x + 2z = 9$
$-x + 5z = -2$
$7z = 7$
$z = 1$

④ $7 - y - 1 = 7$
$-y + 6 = 7$
$-y = 1$
$y = -1$

$x + 2(1) = 9$
$x + 2 = 9$
$x = 7$

$(7, -1, 1)$

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3.) Solve the system using elimination.

$x - y + z = 0$ A
$-x + 2y - 3z = -5$ B
$2x - 3y + 5z = 8$ C

① A+B
$x - y + z = 0$
$-x + 2y - 3z = -5$
$y - 2z = -5$

② 2B+C
$-2x + 4y - 6z = -10$
$2x - 3y + 5z = 8$
$y - z = -2$

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

④ $x - 1 + 3 = 0$
$x + 2 = 0$
$x = -2$

$(-2, 1, 3)$

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Recall: Solve a system of equations by substitution

4.) Solve the following system by substitution.

$2x - 3y = -2$
$4x + y = 24 \rightarrow y = -4x + 24$

$2x - 3(-4x + 24) = -2$
$2x + 12x - 72 = -2$
$14x = 70$
$x = 5$

$2(5) - 3y = -2$
$10 - 3y = -2$
$-3y = -12$
$y = 4$

$(5, 4)$

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5.) New: Solve a 3 X 3 Linear System using Substitution.

- First, solve for one of the variables in one of the equations.
- Substitute the expression for that variable into each of the (two) remaining equations. Simplify; you should have 2 equations with 2 variables.
- Solve the 2 X 2 system. Substitute both values back into the first equation you used for substitution at the beginning to find the last value.
- Write your answer as an ordered triple, (*x*, *y*, *z*). Check the ordered-triple solution by substituting values in to each equation.

$x - 3y - 3z = 28$ A
$-6x + 2y + 2z = -24$ B
$x = -6y - 29$ C

*Complete #6 before #5!

① C → A
$-6y - 29 - 3y - 3z = 28$
$-9y - 3z - 29 = 29$
$-9y - 3z = 57$ → $-3y - z = 19$
$38y + 2z = -198$ → $19y + z = -99$

② C → B
$-6(-6y - 29) + 2y + 2z = -24$
$36y + 174 + 2y + 2z = -24$
$38y + 2z = -198$

③
$16y = -80$
$y = -5$

$-3(-5) - z = 19$
$15 - z = 19$
$-z = 4$
$z = -4$

④ $x = -6y - 29$
$x = -6(-5) - 29$
$x = 1$

$(1, -5, -4)$

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Which method did you prefer? Note: The overall goal is to choose the best method for solving.

6.) Solve by substitution.

$5x + 2y + 2z = 17$ A
$-5x + 5y - z = 30$ B
$z = y - 1$ C

① C → A
$5x + 2y + 2(y - 1) = 17$
$5x + 2y + 2y - 2 = 17$
$5x + 4y = 19$

② C → B
$-5x + 5y - (y - 1) = 30$
$-5x + 5y - y + 1 = 30$
$-5x + 4y = 29$

③
$5x + 4y = 19$
$-5x + 4y = 29$
$8y = 48$
$y = 6$

$5x + 4(6) = 19$
$5x + 24 = 19$
$5x = -5$
$x = -1$

④ $z = 6 - 1 = 5$

$(-1, 6, 5)$

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