Algebra 2 3.4

Solve systems of linear equations in 3 variables

Use systems to solve problems

(x, y, z)

(q, r, s)

ordered triple

no solution

infinitely many solutions

substitution

elimination

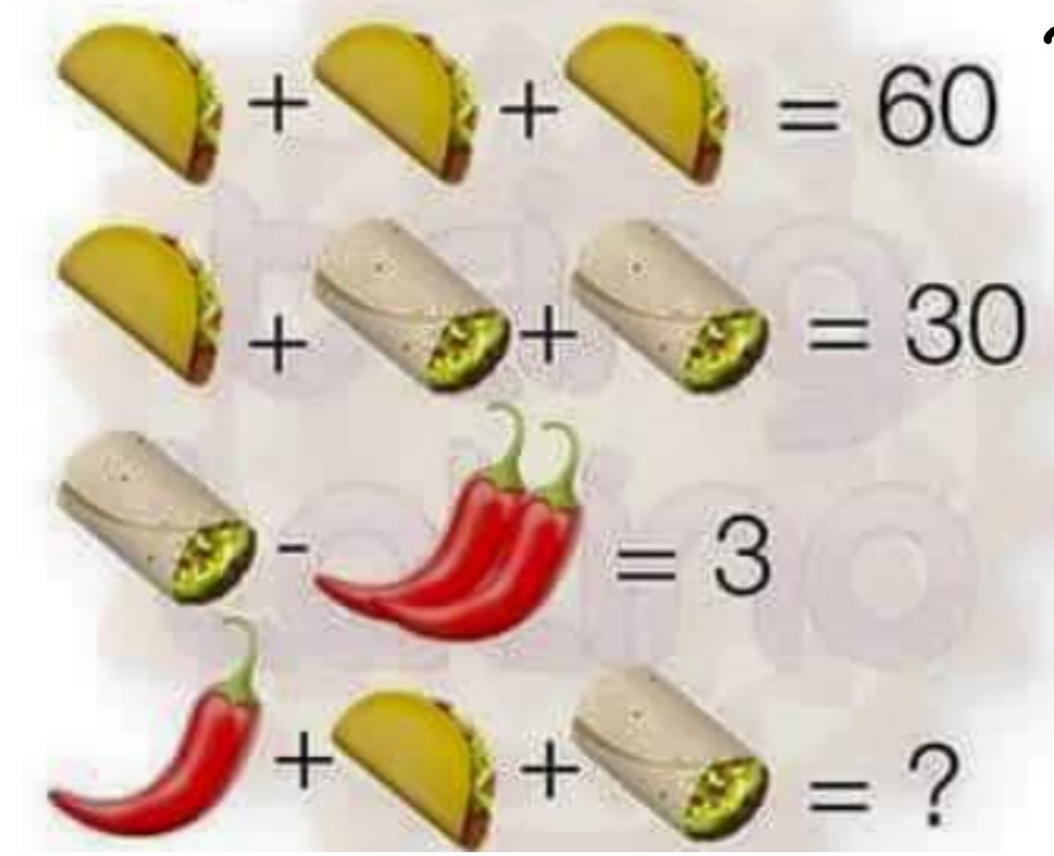
$x + 3 = 5$

$x + y = 6$

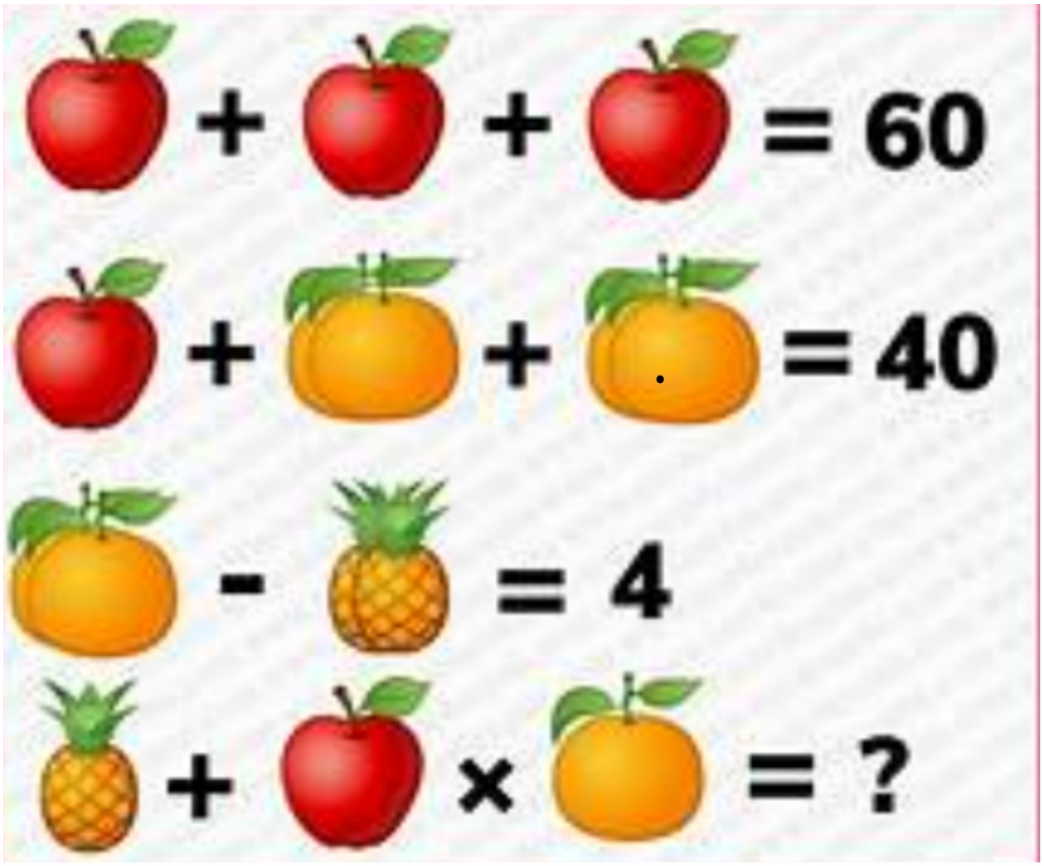
$x - y = 4$

whiteboards? if time

Can you solve this?



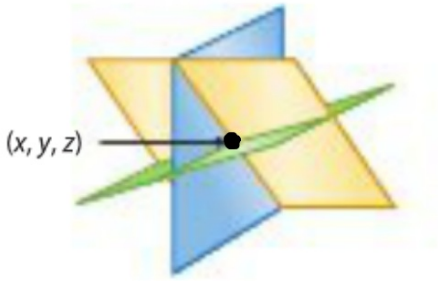
T = 20
B = 5
P = 1

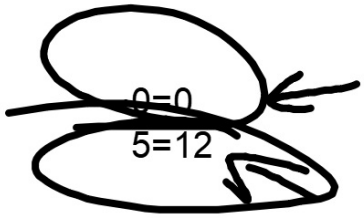


3 + 26 · 5 = 103

One Solution

The three individual planes intersect at a specific point.





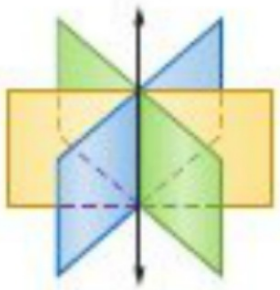
int many

NS

Infinitely Many Solutions

The planes intersect in a line.

Every coordinate on the line represents a solution of the system.



The planes intersect in the same plane.

Every equation is equivalent.
Every coordinate in the plane represents a solution of the system.

Don't worry about "which" infinitely many it is...

No Solution There are no points in common with all three planes.

We won't worry about *which* no solution it is.

(x, y, z)

(-1, -5, 7)

Be strategic!
1. elimination
2. elim again
(or could use subs)

Same

B. $-4(-1) + (-5) - 5(7) = -36$

4 + 5 − 35 = −36

Example 1 A System with One Solution

Solve the system of equations.

$$3x - 2y + 4z = 35$$
$$-4x + y - 5z = -36$$
$$5x - 3y + 3z = 31$$

The coefficient of 1 in the second equation makes y a good choice for elimination.

A. $3(-1) - 2y + 4(7) = 35$

$-3 - 2y + 28 = 35$

$-2y + 25 = 35$

$-25 \quad -25$

$-2y = 10$

$y = -5$

B + C → y's

$-12x + 3y - 15z = -108$

$5x - 3y + 3z = 31$

E $-7x - 12z = -77$

A + B → y's

$3x - 2y + 4z = 35$

$-8x + 2y - 10z = -72$

D. $-5x - 6z = -37$ (×−2)

$10x + 12z = 74$

$-7x - 12z = -77$

$\frac{3x}{3} = \frac{-3}{3}$

$x = -1$

D. $-5(-1) - 6z = -37$

$5 - 6z = -37$

$-5 \quad -5$

$\frac{-6z}{-6} = \frac{-42}{-6}$

$z = 7$

$-3\cdot3+5\cdot-2\ 2\cdot-4=-27$
$-9+-10+-8=-27$

1) **Guided Practice**

Strategery: elim is usually a good place to start

$(3,-2,-4)$

1A. A $2x+4y-5z=18$

B $-3x+5y+2z=-27$

C $-5x+3y-z=-17$ $\times 2$

A. $2\cdot3+4\cdot-2-5z=18$

$6+-8-5z=18$

$-2-5z=18$

$+2 \quad +2$

$\frac{-5z=20}{-5} \quad -5$

A + C → z

$2x+4y-5z=18$

$+25x-15y+5z=85$

D. $27x-11y=103$

B + C → z

$-3x+5y+2z=-27$

$-10x+6y-2z=-34$

E. $-13x+11y=-61$

D + E → y

$27x-11y=103$

$-13x+11y=-61$

$\frac{14x}{14}=\frac{42}{14}$

$x=3$

E $-13\cdot3+11y=-61$

$-39+11y=-61$

$+39 \quad +39$

$\frac{11y}{11}=\frac{-22}{11}$

$y=-2$

#variables = # equations

- Seats closest to an amphitheater stage cost $30. The seats in the next section cost $25, and lawn seats are $20. There are twice as many seats in section B as in section A. When all 19,200 seats are sold, the amphitheater makes $456,000.

A system of equations in three variables can be used to determine the number of seats in each section.

Whiteboards

$(-6, 2, 8)$

A **1B.** $4x - 3y + 6z = 18$

B $-x + 5y + 4z = 48$

C $6x - 2y + 5z = 0$

A + B → X

$4x - 3y + 6z = 18$

$-4x + 20y + 16z = 192$

D $17y + 22z = 210$

B + C → X

$-6x + 30y + 24z =$

$6x - 2y + 5z =$

E $28y + 29z =$

Example 2 No Solution and Infinite Solutions

Solve each system of equations.

a. $5x + 4y - 5z = -10$
$-4x - 10y - 8z = -16$
$6x + 15y + 12z = 24$

b. $-6a + 9b - 12c = 21$
$-2a + 3b - 4c = 7$
$10a - 15b + 20c = -30$

GuidedPractice

2A. $-4x - 2y - z = 15$
$12x + 6y + 3z = 45$
$2x + 5y + 7z = -29$

2B. $3x + 5y - 2z = 13$
$-5x - 2y - 4z = 20$
$-14x - 17y + 2z = -19$