Solving 3x3 system of equations by linear combination

Goal:
Use linear combination to get 2 equations with 2 variables
and then use linear combination to eliminate another variable.

http://www.mathwarehouse.com/algebra/planes/systems/three-variable-equations.php

Solve this system by linear combination: (2,-5,4)

1. I $x - 3y - 2z = 9$

II $3x + 2y + 6z = 20$

III $4x - y + 3z = 25$

3I $3(x - 3y - 2z = 9)$

$3x - 9y - 6z = 27$

II $3x + 2y + 6z = 20$

A $6x - 7y = 47$ 4

B $-5x + 4y = -30$ 7

$24x - 28y = 188$

$-35x + 28y = -210$

$-11x = -22$

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

$x = 2$

-2 III $-2(4x - y + 3z = 25)$

$-8x + 2y - 6z = -50$

II $3x + 2y + 6z = 20$

B $-5x + 4y = -30$

B $-5(2) + 4y = -30$

$-10 + 4y = -30$

$+10 \quad +10$

$\frac{4y}{4} = \frac{-20}{4}$

$y = -5$

subst into

II $3x + 2y + 6z = 20$

$3(2) + 2(-5) + 6z = 20$

$6 - 10 + 6z = 20$

$-4 + 6z = 20$

$+4 \quad +4$

$\frac{6z}{6} = \frac{24}{6}$

$z = 4$

Check
(2) -3(-5)-2(4) = 9
2 +15 - 8 = 9
17 - 8 = 9
9 = 9 ✓

Check
3(2) +2(-5)+6(4) = 20
6 -10 +24 = 20
30 -10 = 20
20 = 20 ✓

Check
4(2) -(-5)+3(4) = 25
8 + 5 +12 = 25
25 = 25 ✓

3. I $x + y + z = 5$

II $3x - z = 2$ ← **LOOK!**

III $x - y + 2z = 0$

I $x+y+z=5$

III $x-y+2z=0$

A $2x+3z=5$

II $3x-z=2$ ×3 → $9x-3z=6$

$2x+3z=5$

$9x-3z=6$

$11x = 11$

$x=1$

$(1,3,1)$

$2x+3z=5$

$2(1)+3z=5$

$2+3z=5$

$-2 \quad -2$

$3z=3$

$\frac{3z}{3}=\frac{3}{3}$

$z=1$

$x+y+z=5$

$(1)+y+(1)=5$

$y+2=5$

$y=3$

Check

(1) +(3)+(1) = 5

5 = 5 ✓

Check

3(1) - (1) = 2

3 - 1 = 2

2 = 2 ✓

Check

(1) -(3)+2(1) = 0

1 - 3 + 2 = 0

-2 + 2 = 0

0 = 0 ✓