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# 3×3 SYSTEMS

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**Solve the system:**

$$\begin{array}{rcl} 4x - 2y + 3z = -14 & & \text{[Equ 1]} \\ 6x + y - z = 13 & & \text{[Equ 2]} \\ -x + 3y - 4z = 24 & & \text{[Equ 3]} \end{array}$$

Start with Equ 1 and Equ 2 to eliminate the  $x$ :

$$\begin{array}{rcl} 4x - 2y + 3z = -14 & (\text{times } 3) & \Rightarrow 12x - 6y + 9z = -42 \\ 6x + y - z = 13 & (\text{times } -2) & \Rightarrow -12x - 2y + 2z = -26 \\ \hline & \text{Add:} & -8y + 11z = -68 \quad \text{[Equ 4]} \end{array}$$

Now use Equ 1 and Equ 3 to eliminate the  $x$ :

$$\begin{array}{rcl} 4x - 2y + 3z = -14 & (\text{leave it}) & \Rightarrow 4x - 2y + 3z = -14 \\ -x + 3y - 4z = 24 & (\text{times } 4) & \Rightarrow -4x + 12y - 16z = 96 \\ \hline & \text{Add:} & 10y - 13z = 82 \quad \text{[Equ 5]} \end{array}$$

Solve the 2×2 system consisting of Equ 4 and Equ 5:

$$\begin{array}{rcl} \text{[Equ 4]} & -8y + 11z = -68 & (\text{times } 5) \Rightarrow -40y + 55z = -340 \\ \text{[Equ 5]} & 10y - 13z = 82 & (\text{times } 4) \Rightarrow 40y - 52z = 328 \\ \hline & \text{Add:} & 3z = -12 \\ & & \Rightarrow z = -4 \end{array}$$

We now calculate  $y$  using Equ 4 and our newly found value of  $z$ :

$$\begin{aligned} & -8y + 11z = -68 \\ \Rightarrow & -8y + 11(-4) = -68 \\ \Rightarrow & -8y - 44 = -68 \\ \Rightarrow & -8y = -24 \\ \Rightarrow & y = 3 \end{aligned}$$

And lastly, we solve for  $x$  using Equ 1 and our values of  $y$  and  $z$ :

$$\begin{aligned} & 4x - 2y + 3z = -14 \\ \Rightarrow & 4x - 2(\mathbf{3}) + 3(-4) = -14 \\ \Rightarrow & 4x - 6 - 12 = -14 \\ \Rightarrow & 4x - 18 = -14 \\ \Rightarrow & 4x = 4 \\ \Rightarrow & x = 1 \end{aligned}$$

We conclude that the solution of the system of 3 equations in 3 variables is

$$x = 1, y = 3, z = -4$$

We could **CHECK** our solution by plugging the values of  $x$ ,  $y$ , and  $z$  into ALL THREE of the original equations.

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# Homework

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TEXT:

Pg 499

Problems 1, 3, 5

Pg 510

Problems 27, 29, 31

[These problems are just for extra practice. Do NOT do these the way the book describes.]