

Solving Linear Systems by Elimination

Feb 10/2011

Ex.1. Add the equations together

$$\begin{array}{r}
 17x + 23y = 35 \quad \textcircled{1} \\
 + \quad 26x - 23y = -121 \quad \textcircled{2} \\
 \hline
 43x + 0y = -86 \\
 \\
 \frac{43x}{43} = \frac{-86}{43} \\
 \boxed{x = -2}
 \end{array}$$

Sub $x = -2$ into $\textcircled{1}$ or $\textcircled{2}$

$$17(-2) + 23y = 35$$

$$-34 + 23y = 35$$

$$\frac{23y}{23} = \frac{69}{23}$$

$$\boxed{y = 3}$$

 $\therefore (-2, 3)$ is
the solution

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Steps:

1. Write equations in the form: $ax + by = c$.
2. Look for the coefficients of one of the variables to be the same (sign does not matter).
3. If necessary, multiply one or both equations by a whole number to achieve step 2.
4. a) Same coefficient, same sign: **subtract**
b) Same coefficient, opposite sign: **add**.
5. Solve the resulting equation.
6. Substitute to find the value of the other variable.

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Ex.2. Solve: $x + y = 60$ $x - y = 8$

to eliminate x

$$\begin{array}{rcl} x + y & = & 60 \quad (1) \\ x - y & = & 8 \quad (2) \\ \hline \end{array}$$

$(1) - (2):$

$$\frac{2y}{2} = \frac{52}{2}$$

$$y = 26$$

$y - (-y) = y + y = 2y$

Sub $y = 26$ into ~~(1)~~ or (2) (easiest)

$$x - (26) = 8$$

$$x = 34$$

\therefore solution is $(34, 26)$

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Ex.3. Solve $5x + 2y = 5$ (1) $3x - 4y = -23$ (2)

$$\begin{array}{rcl} x & & y \\ 5 \times 3 & = & 15 \\ 3 \times 5 & = & 15 \end{array}$$

$$\begin{array}{rcl} y & & \\ 2 \times 2 & = & 4 \\ -4 \rightarrow & = & 4 \end{array}$$

$(1) \times 2: 10x + 4y = 10$

$(2): 3x - 4y = -23$

add:

$$\begin{array}{rcl} 13x & & = -13 \\ 13 & & 13 \\ \hline x & = & -1 \end{array}$$

Sub $x = -1$ into (1)

$$5(-1) + 2y = 5$$

$$-5 + 2y = 5$$

$$2y = 10$$

$$y = 5$$

\therefore solution is $(-1, 5)$

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Ex.4. $\frac{x}{2} + \frac{y}{8} = 4$ ① $\frac{x}{3} - \frac{y}{2} = -\frac{2}{1}$ ②

* multiply by LCD of each eqn

① $\times 8$: $\overset{4}{\cancel{8}} \left(\frac{\overset{1}{\cancel{x}}}{\underset{1}{\cancel{2}}} \right) + \overset{1}{\cancel{8}} \left(\frac{\overset{1}{\cancel{y}}}{\underset{1}{\cancel{8}}} \right) = 8(4)$ $\frac{8}{2}$ $\frac{8}{8}y$

$4x + y = 32$ ③

② $\times 6$: $\overset{2}{\cancel{6}} \left(\frac{\overset{1}{\cancel{x}}}{\underset{1}{\cancel{3}}} \right) - \overset{3}{\cancel{6}} \left(\frac{\overset{1}{\cancel{y}}}{\underset{1}{\cancel{2}}} \right) = 6(-2)$
 $2x - 3y = -12$ ④

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Assigned Work:

p.54 # 1, 4, 6odd, 11odd

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