Solving Linear Systems by Elimination

Feb 16/2010

Ex.1. Solve
$17x + 23y = 35$ ①
$26x - 23y = -121$ ②

① + ②
$43x = -86$
$\frac{43x}{43} = \frac{-86}{43}$
$x = -2$

sub $x = -2$ into ① (but ② will also work!)
$17(-2) + 23y = 35$
$-34 + 23y = 35$
$+34 \quad +34$
$23y = 69$
$\frac{23y}{23} = \frac{69}{23}$
$y = 3$

∴ solution is $(-2, 3)$

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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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Solve:

1. $x + y = 60$ ①
   $x - y = 8$ ②

$y \rightarrow +1$ and -1
$x \rightarrow +1$ and $+1$
(both can be eliminated)

eliminate y

$x + y = 60$ ①
$x - y = 8$ ②
① + ②
$2x = 68$
$x = 34$

$\therefore$ solution is $(34, 26)$

Sub $x = 34$ into ①
$(34) + y = 60$
$-34 \quad -34$
$y = 26$

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2. $5x + 2y = 5$ ① $3x - 4y = -23$ ②

Since coefficients do not match, multiply one (or both) equations by a whole number.
→ could match x or y, but y seems easier.

① × 2: $10x + 4y = 10$ ③
② : $3x - 4y = -23$
add $13x = -13$
$x = -1$

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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3. $3(x + 2) - (y + 1) = 7$ $4x + 3(y - 2) = 0$

$3x+6-y-1=7$ $4x+3y-6=0$

$3x-y+5=7$ $4x+3y=6$ ②

$3x-y=2$ ①

① × 3: $9x-3y=6$ ③

② : $4x+3y=6$

add $13x=12$

$x=\frac{12}{13}$

Sub $x=\frac{12}{13}$ into ①

$3\left(\frac{12}{13}\right)-y=2$

$\frac{36}{13}-y=\frac{26}{13}$

$-y=-\frac{10}{13}$

$y=\frac{10}{13}$

∴ solution is $\left(\frac{12}{13},\frac{10}{13}\right)$

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

LCD = 8 LCD = 6

① × 8: $8\left(\frac{x}{2}\right)+8\left(\frac{y}{8}\right)=8(4)$

$4x+y=32$ ③

② × 6: $6\left(\frac{x}{3}\right)-6\left(\frac{y}{2}\right)=6(-2)$

$2x-3y=-12$ ④

④ × 2: $4x-6y=-24$ ⑤

③ : $4x+y=32$

subtract $-7y=-56$

$\frac{-7y}{-7}=\frac{-56}{-7}$

$y=8$

sub $y=8$ into ③

$4x+(8)=32$

$4x=24$

$x=6$

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Assigned Work:

p.101 #(2, 3, 6)(odd), 10adf, 22*

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