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Week 12 Written

Mills

① we solve the system of linear equations $2x - 5y = 10$
 $7x + 2y = 28$

3 ways

② Graphically:

$$2x - 5y = 10$$

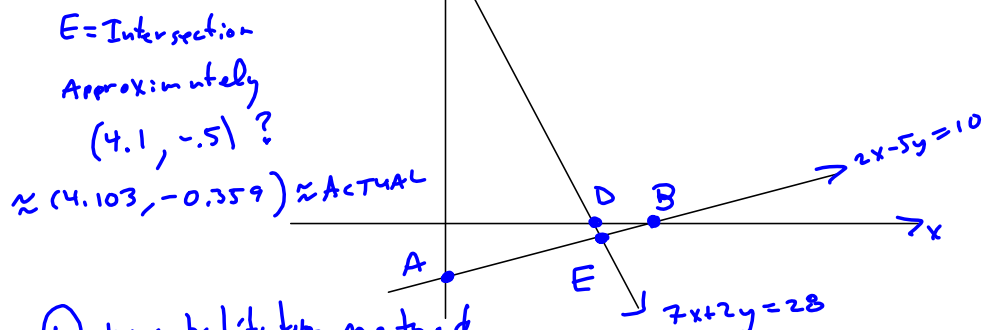
x	y
0	-2
5	0

A = (0, -2)
B = (5, 0)

$$7x + 2y = 28$$

x	y
0	14
4	0

C = (0, 14)
D = (4, 0)



③ by substitution method

10pts $2x - 5y = 10 \rightarrow 5y = 2x - 10 \rightarrow y = \frac{2x - 10}{5}$
 $7x + 2y = 28$

$$\rightarrow 7x + 2\left(\frac{2x - 10}{5}\right) = 28 \quad \text{Times 5} \quad \frac{14x}{5} - \frac{20}{5} = 28$$

$$\rightarrow 35x + 4x - 20 = 140$$

$$39x = 160$$

$x = \frac{160}{39}$

$$\rightarrow y = \frac{2x - 10}{5} = \frac{2\left(\frac{160}{39}\right) - 10}{5} = \frac{\frac{320}{39} - \frac{390}{39}}{5}$$

$$= \frac{-70}{\frac{39}{5}} = \frac{-70}{39(5)} = \frac{-70}{195} = \frac{-14}{39} = y$$

$(x, y) = \left(\frac{160}{39}, \frac{-14}{39}\right)$
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$$\approx (4.102564103, -0.3589743590)$$

$$\approx (4.103, -0.359)$$

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③ 10pts Elimination:

$$\begin{array}{rcl}
 2x - 5y = 10 & -7E1 & -14x + 35y = -70 \\
 7x + 2y = 28 & 2E2 & 14x + 4y = 56 \\
 \hline
 -7E1 + 2E2 & & 39y = -14 \\
 & & \boxed{y = -\frac{14}{39}}
 \end{array}$$

$$\Rightarrow 2x - 5y = 2x - 5\left(-\frac{14}{39}\right) =$$

$$= 2x + \frac{70}{39} = 10$$

$$\Rightarrow 78x + 70 = 390$$

$$\Rightarrow 78x = 320$$

$$\Rightarrow x = \frac{320}{78} = \frac{160}{39} = x$$

$$\begin{array}{r}
 7 \cdot 28 \\
 39 \\
 \hline
 352 \\
 840 \\
 \hline
 1092
 \end{array}$$

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2 (10pts) Elimination method to solve

$$\begin{aligned} x - 2y + z &= 18 \\ 2x - 3y + 3z &= 38 \quad E2 \\ 2x - 6y + z &= 37 \quad E3 \end{aligned}$$

$$\begin{aligned} E1 \quad x - 2y + z &= 18 \\ -2E1 + E2 \quad y + z &= 2 \\ -2E1 + E3 \quad -2y - z &= 1 \end{aligned}$$

$$\begin{aligned} E1 \quad x - 2y + z &= 18 \\ E2 \quad y + z &= 2 \\ 2E2 + E1 \quad z &= 5 \end{aligned}$$

$$y + z = y + 5 = 2$$

$$E1 \quad \Rightarrow y = -3$$

$$\begin{aligned} x - 2y + z &= x - 2(-3) + 5 = \\ &= x + 6 + 5 = x + 11 = 18 \end{aligned}$$

$$\Rightarrow x = 7$$

$$(x, y, z) = (7, -3, 5)$$

$$\begin{aligned} -2E1 \quad -2x + 4y - 2z &= -36 \\ E2 \quad 2x - 7y + 3z &= 38 \\ \hline y + z &= 2 \end{aligned}$$

$$\begin{aligned} -2E1 \quad -2x + 4y - 2z &= -36 \\ E3 \quad 2x - 6y + z &= 37 \\ \hline -2y - z &= 1 \end{aligned}$$

$$\begin{aligned} 2E2 \quad 2y + 2z &= 4 \\ -2y - z &= 1 \end{aligned}$$

$$z = 5$$

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3 roots
2

Dependent, ∞ solns

$$\begin{aligned} x + 5y - 3z &= -1 \\ 3x + 12y - 8z &= 3 \\ 2x + 7y - 5z &= 4 \end{aligned}$$

$$\begin{aligned} E1 \quad x - 5y + 3z &= 1 \\ -3E1 + E2 \quad -3y + z &= 6 \\ -2E1 + E3 \quad -3y + z &= 6 \end{aligned} \quad \left. \begin{array}{l} -3y + z = 6 \\ -3y + z = 6 \end{array} \right\} \text{Same}$$

$$\begin{aligned} E1 \quad x - 5y + 3z &= 1 \\ -E2 \quad 3y - z &= -6 \\ 0 &= 0 \end{aligned}$$

$$\boxed{z = any}$$

$$\begin{aligned} 3y &= z - 6 \\ y &= \frac{z-6}{3} \end{aligned}$$

$$x - 5y + 3z = x - 5\left(\frac{z-6}{3}\right) + 3z$$

$$= x - \frac{5z-30}{3} + 3z = 1$$

$$\rightarrow 3x - 5z + 30 + 9z = 3$$

$$3x + 4z + 30 = 3$$

$$3x = -4z - 27$$

$$x = \frac{-4z-27}{3}$$

$$(x, y, z) = \left(\frac{-4z-27}{3}, \frac{z-6}{3}, z \right)$$

b) $z = 0$:

$$(x, y, z) = (-9, -2, 0)$$

 $z = 1$:

$$(x, y, z) = \left(-\frac{31}{3}, -\frac{5}{3}, 1 \right)$$

 $z = -1$:

$$(x, y, z) = \left(-\frac{23}{3}, -\frac{7}{3}, -1 \right)$$

$$3x + 12y - 8z = 3$$

$$2x + 7y - 5z = 4$$

$$-x - 5y + 3z = 1$$

$$\begin{array}{r} -3E1 \quad -3x - 15y + 9z = +3 \\ E2 \quad 3x + 12y - 8z = 3 \\ \hline -3y + z = 6 \end{array}$$

$$\begin{array}{r} -2E1 \quad -2x - 10y + 6z = 2 \\ E3 \quad 2x + 7y - 5z = 4 \\ \hline -3y + z = 6 \end{array}$$

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(4) 10p+5 Dependent. No Sol'n.

$$\begin{aligned} 3x + 12y - 8z &= 3 \\ 2x + 7y - 5z &= 4 \\ -x - 5y + 3z &= 3 \end{aligned}$$

$$\begin{aligned} x + 5y - 3z &= -3 \\ 3x + 12y - 8z &= 3 \\ 2x + 7y - 5z &= 4 \end{aligned}$$

$$\begin{aligned} E1 \quad x - 5y + 3z &= 1 \\ -3E1 + E2 \quad -3y + z &= 12 \\ -2E1 + E3 \quad -3y + z &= 10 \end{aligned} \left. \begin{array}{l} \\ \\ \end{array} \right\} \begin{array}{l} \text{Same, except} \\ 12 \neq 10 \end{array}$$

$$\begin{aligned} -3E1 \quad -3x - 15y + 9z &= 9 \\ E2 \quad 3x + 12y - 8z &= 3 \\ \hline -3y + z &= 12 \end{aligned}$$

$$\begin{aligned} -2E1 \quad -2x - 10y + 6z &= 6 \\ E3 \quad 2x + 7y - 5z &= 4 \\ \hline -3y + z &= 10 \end{aligned}$$

$$\begin{aligned} E1 \quad x - 5y + 3z &= 1 \\ -E2 \quad 3y - z &= -6 \\ -E2 + E3 \quad 0 &= -2? \end{aligned}$$

That's absurd. Either I made a mistake or there never was a solution!

No Solution

