Lesson 4 – Sec. 7.5: Solving Systems by Elimination

Use **elimination** when **no** coefficients (the number in front of the variable) are 1.

Example 1: Solve this linear system:

① $3x + 2y = 2$

② $4x - 2y = 5$

Which terms can we eliminate by *adding* equations together?

$$2y + (-2y) = 0$$

$$3x + 2y = 2$$
$$+ \; 4x - 2y = 5$$
$$\overline{ \; 7x \qquad = 7}$$
$$\frac{7x}{7} = \frac{7}{7}$$
$$x = 1$$

Solve for y:

$$3x + 2y = 2$$
$$3(1) + 2y = 2$$
$$3 + 2y = 2$$
$$-3 \qquad -3$$
$$\frac{2y}{2} = \frac{-1}{2}$$
$$y = -\frac{1}{2}$$

Check: $P(1, -\frac{1}{2})$

* use other equation.

$$4(1) - 2(-\frac{1}{2}) = 5$$
$$4 + 1 = 5 \qquad 5 = 5 \checkmark$$

Example 2: Solve this linear system:

$$3\left[4x + 3y = 15\right] = 12x + 9y = 45$$
$$8x - 9y = 15$$

$$12x + 9y = 45$$
$$+ \; 8x - 9y = 15$$
$$\overline{\; 20x \qquad = 60 \;}$$
$$\frac{20x}{20} = \frac{60}{20}$$
$$x = 3$$

$$4x + 3y = 15$$
$$4(3) + 3y = 15$$
$$12 + 3y = 15$$
$$-12 \qquad -12$$
$$3y = 3 \qquad y = 1$$

$P(3, 1)$

check: $8x - 9y = 15$
$$8(3) - 9(1) = 15$$
$$24 - 9 = 15$$
$$15 = 15 \checkmark$$

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Example 3: Solve this linear system:

$$3x - 4y = 7$$
$$5x - 6y = 8$$

$$5[3x - 4y = 7]$$
$$-3[5x - 6y = 8]$$
$$\Big\} \rightarrow$$

$$15x - 20y = 35$$
$$+ \;\; -15x + 18y = -24$$
$$\overline{ -2y = 11}$$

$$3x - 4\left(-\tfrac{11}{2}\right) = 7$$

$$y = -\tfrac{11}{2}$$

$$3x + 22 = 7$$
$$\underline{\;-22 \quad -22\;}$$

$$P\left(-5, -\tfrac{11}{2}\right)$$

check: $5(-5) - 6\left(-\tfrac{11}{2}\right) = 8$

$$-25 + 33 = 8$$

$$3x = -15$$
$$x = -5$$

$$8 = 8 \checkmark$$

Example 4: Solve this linear system:

$$\left[\tfrac{2}{3}x - \tfrac{1}{2}y = 4\right] \times 6$$
$$\left[\tfrac{1}{2}x + \tfrac{1}{4}y = \tfrac{5}{2}\right] \times 4$$

* clear fractions by multiplying by LCD.

$$(6)\tfrac{2}{3}x - (6)\tfrac{1}{2}y = 4(6)$$

$$4x - 3y = 24$$

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$$-2[2x + y = 10]$$

$$+ \;\; -4x - 2y = -20$$
$$\overline{ -5y = 4}$$

$$y = -\tfrac{4}{5}$$

$$(5)2x + (5)\left(-\tfrac{4}{5}\right) = 10(5)$$

$$P\left(\tfrac{27}{5}, -\tfrac{4}{5}\right)$$

$$10x - 4 = 50$$
$$+4 \quad +4$$

$$10x = 54$$

$$x = \tfrac{54}{10}\,^{\div 2}_{\div 2} = \tfrac{27}{5}$$

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