

section 4.1

4.1 LL

$$2) \begin{cases} -3x + y = 8 \\ -x + 2y = -9 \end{cases}$$

a) $(-5, -7)$

$$\begin{aligned} -3(-5) + (-7) &\stackrel{?}{=} 8 \\ 15 - 7 &\stackrel{?}{=} 8 \\ 8 &\stackrel{?}{=} 8 \end{aligned}$$

$$\begin{aligned} -(-5) + 2(-7) &\stackrel{?}{=} -9 \\ 5 - 14 &\stackrel{?}{=} -9 \\ -9 &\stackrel{?}{=} -9 \end{aligned}$$

yes

b) $(-5, 7)$

$$\begin{aligned} -3(-5) + (7) &\stackrel{?}{=} 8 \\ 15 + 7 &\stackrel{?}{=} 8 \\ 22 &\neq 8 \end{aligned}$$

no

$$4) \begin{cases} 2x + 3y = 6 \\ y = \frac{2}{3}x + 2 \end{cases}$$

a) $(-6, 2)$

$$\begin{aligned} 2(-6) + 3(2) &\stackrel{?}{=} 6 \\ -12 + 6 &\stackrel{?}{=} 6 \\ -6 &\neq 6 \end{aligned}$$

no

b) $(-3, 4)$

$$\begin{aligned} 2(-3) + 3(4) &\stackrel{?}{=} 6 \\ -6 + 12 &\stackrel{?}{=} 6 \\ 6 &= 6 \end{aligned}$$

$$(4) \stackrel{?}{=} \frac{2}{3}(-3) + 2$$

$$4 \stackrel{?}{=} -2 + 2$$

$$4 \neq 0$$

no

for 5-24 use line graphing technique of Chapter 3
on a single set of axes to determine if the 2 lines:
does not intersect (11 lines, no solution)
intersect on one point (1 solution)
2 lines are equal (infinite solutions)

$$26) y = \frac{3}{2}x + 1$$

$$m_1 = \frac{3}{2}$$

$$2x - 3y = 7$$

$$\frac{-7 + 3y \quad -7 + 3y}{2x - 7 = 3y}$$

$$\frac{2x - 7}{3} = \frac{3y}{3}$$

$$\frac{2}{3}x - \frac{7}{3} = y$$

$$m_2 = \frac{2}{3}$$

$$\frac{3}{2} = m_1 \neq m_2 = \frac{2}{3}$$

1 solution

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$$28) y = -\frac{1}{2}x + 5$$

$$m_1 = -\frac{1}{2}$$

$$x + 2y = 10$$

$$\frac{-x \quad -x}{2y = -x + 10}$$

$$\frac{2y}{2} = \frac{-x + 10}{2}$$

$$y = -\frac{1}{2}x + 5$$

$$m_2 = -\frac{1}{2}$$

$$y = -\frac{1}{2}x + 5$$

$$y = -\frac{1}{2}x + 5$$

since both lines
are same

infinite solutions

$$30) \begin{cases} 2x + y = -4 \longrightarrow y = (-2x - 4) \\ 3x - 2y = -6 \end{cases}$$

$$3x - 2(-2x - 4) = -6$$

$$3x + 4x + 8 = -6$$

$$7x + 8 = -6$$

$$\frac{-8 \quad -8}{7x = -14}$$

$$\frac{7x}{7} = \frac{-14}{7}$$

$$x = -2$$

$$y = -2(-2) - 4$$

$$y = 4 - 4 = 0$$

check

$$3(-2) - 2(0) \stackrel{?}{=} -6$$

$$-6 - 0 \stackrel{?}{=} -6$$

$$-6 \checkmark = -6$$

$$x = -2, y = 0$$

$$(-2, 0)$$

$$32) \begin{cases} x - 2y = -5 \rightarrow x = 2y - 5 \\ 2x - 3y = -4 \end{cases}$$

$$2(2y - 5) - 3y = -4$$

$$4y - 10 - 3y = -4$$

$$\begin{array}{r} y - 10 = -4 \\ +10 \quad +10 \\ \hline y = 6 \end{array}$$

$$\begin{aligned} x &= 2(6) - 5 \\ &= 12 - 5 = 7 \end{aligned}$$

check

$$2(7) - 3(6) \stackrel{?}{=} -4$$

$$14 - 18 \stackrel{?}{=} -4$$

$$-4 \stackrel{\checkmark}{=} -4$$

$$\begin{aligned} x &= 7, y = 6 \\ (7, 6) \end{aligned}$$

$$34) \begin{cases} 5x - 2y = -6 \\ y = 3x + 3 \end{cases}$$

$$5x - 2(3x + 3) = -6$$

$$5x - 6x - 6 = -6$$

$$\begin{array}{r} -x - 6 = -6 \\ +x \quad +6 \quad +6 \quad +x \\ \hline 0 = x \end{array}$$

$$y = 3(0) + 3$$

$$y = 3$$

check

$$5(0) - 2(3) \stackrel{?}{=} -6$$

$$0 - 6 \stackrel{?}{=} -6$$

$$-6 \stackrel{\checkmark}{=} -6$$

$$\begin{aligned} x &= 0, y = 3 \\ (0, 3) \end{aligned}$$

$$36) \begin{cases} 2x + 5y = 1 \\ y = \frac{1}{3}x - 2 \end{cases}$$

$$2x + 5\left(\frac{1}{3}x - 2\right) = 1$$

$$2x + \frac{5x}{3} - 10 = 1$$

$$\text{LCD} = 3$$

$$\left(\frac{3}{1}\right)\left(\frac{2x}{1} + \frac{5x}{3} - \frac{10}{1}\right) = \left(\frac{1}{1}\right)\left(\frac{3}{1}\right)$$

$$6x + 5x - 30 = 3$$

$$11x - 30 = 3$$

$$\begin{array}{r} +30 \quad +30 \\ \hline 11x = 33 \\ \hline 11 \quad 11 \end{array}$$

$$x = 3$$

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

$$= 1 - 2 = -1$$

check

$$2(3) + 5(-1) \stackrel{?}{=} 1$$

$$6 - 5 \stackrel{?}{=} 1$$

$$1 \stackrel{\checkmark}{=} 1$$

$$\boxed{x = 3, y = -1}$$

$$\boxed{(3, -1)}$$

$$38) \begin{cases} 2x + y = 5 \\ x - 2y = -15 \rightarrow x = (2y - 15) \end{cases}$$

$$2(2y - 15) + y = 5$$

$$4y - 30 + y = 5$$

$$\begin{array}{r} 5y - 30 = 5 \\ +30 \quad +30 \\ \hline 5y = 35 \end{array}$$

check

$$\begin{array}{r} 5y = 35 \\ \hline 5 \quad 5 \\ y = 7 \end{array}$$

$$\begin{array}{r} 2(-1) + (7) \stackrel{?}{=} 5 \\ -2 + 7 \stackrel{?}{=} 5 \\ 5 \stackrel{\checkmark}{=} 5 \end{array}$$

$$\begin{array}{r} x = 2(7) - 15 \\ = 14 - 15 \\ x = -1 \end{array}$$

$$\boxed{x = -1, y = 7}$$

$$\boxed{(-1, 7)}$$

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$$40) \begin{cases} y = -2x - 1 \\ y = -\frac{1}{3}x + 4 \end{cases}$$

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

$$\text{LCD} = 3$$

$$\left(\frac{3}{1}\right)\left(-\frac{2x}{1} - \frac{1}{1}\right) = \left(-\frac{1x}{3} + \frac{4}{1}\right)\left(\frac{3}{1}\right)$$

$$-6x - 3 = -x + 12$$

$$+6x - 12 + 6x - 12$$

$$\frac{-15}{5} = \frac{5x}{5}$$

$$-3 = x$$

$$y = -2(-3) - 1$$

$$= 6 - 1 = 5$$

check

$$(5) \stackrel{?}{=} -\frac{1}{3}(-3) + 4$$

$$5 \stackrel{?}{=} 1 + 4$$

$$5 \checkmark = 5$$

$$\boxed{x = -3, y = 5}$$

$$\boxed{(-3, 5)}$$

$$42) \begin{cases} x = 2y \\ 4x - 8y = 0 \end{cases}$$

$$4(2y) - 8y = 0$$

$$8y - 8y = 0$$

$$0 \checkmark = 0$$

identity
infinite solution

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

$$\frac{1}{2}x = y$$

"ordered pair"

$$\boxed{(x, \frac{1}{2}x)}$$

$$48) \begin{cases} y = \frac{7}{8}x + 4 \\ -7x + 8y = 6 \end{cases}$$

$$-7x + 8\left(\frac{7}{8}x + 4\right) = 6$$

$$-7x + 7x + 32 = 6$$

$$32 \neq 6$$

contradiction

no solution

11 lines

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$$\begin{aligned}
 46) \begin{cases} 5x + 2y = 2 & \longrightarrow 5x + 2y = 2 \\ -3x - y = 0 & \xrightarrow{2} -6x - 2y = 0 \end{cases} \\
 \hline
 \begin{array}{r} -x = 2 \\ -2 \quad +x \quad -2 \quad +x \\ \hline -2 = x \end{array} \\
 -3(-2) - y = 0 \\
 6 - y = 0 \\
 \quad +y \quad +y \\
 \hline
 6 = y
 \end{aligned}$$

check

$$\begin{aligned}
 5(-2) + 2(6) &\stackrel{?}{=} 2 \\
 -10 + 12 &\stackrel{?}{=} 2 \\
 2 &\checkmark = 2
 \end{aligned}$$

$$x = -2, y = 6$$

$$(-2, 6)$$

$$\begin{aligned}
 48) \begin{cases} 2x - 5y = 7 & \longrightarrow 2x - 5y = 7 \\ 3x - y = 17 & \xrightarrow{-5} -15x + 5y = -85 \end{cases} \\
 \hline
 \begin{array}{r} -13x = -78 \\ +78 + 13x \quad +78 + 13x \\ \hline 78 = 13x \\ 13 \quad 13 \\ \hline 6 = x \end{array} \\
 3(6) - y = 17 \\
 18 - y = 17 \\
 -17 + y \quad -17 + y \\
 \hline
 1 = y
 \end{aligned}$$

check

$$\begin{aligned}
 2(6) - 5(1) &\stackrel{?}{=} 7 \\
 12 - 5 &\stackrel{?}{=} 7 \\
 7 &\checkmark = 7
 \end{aligned}$$

$$x = 6, y = 1$$

$$(6, 1)$$

$$\begin{aligned}
 50) \begin{cases} 3x - 5y = -9 & \xrightarrow{2} 6x - 10y = -18 \\ 5x + 2y = 16 & \xrightarrow{-5} -25x + 10y = -80 \end{cases} \\
 \hline
 \begin{array}{r} 31x = 62 \\ 31 \quad 31 \\ \hline x = 2 \end{array}
 \end{aligned}$$

50) continued...

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$$\begin{array}{r} 5(2) + 2y = 16 \\ 10 + 2y = 16 \\ \underline{-10 \quad -10} \\ 2y = 6 \\ \underline{\quad 2 \quad 2} \\ y = 3 \end{array}$$

check

$$\begin{array}{l} 3(2) - 5(3) \stackrel{?}{=} -9 \\ 6 - 15 \stackrel{?}{=} -9 \\ -9 \checkmark = -9 \end{array}$$

$$x = 2, y = 3$$

$$(2, 3)$$

$$52) \begin{cases} 3x + 8y = -3 \xrightarrow{2} 6x + 16y = -6 \\ 2x + 5y = -3 \xrightarrow{-3} -6x - 15y = 9 \end{cases}$$

$$y = 3$$

$$\begin{array}{r} 2x + 5(3) = -3 \\ 2x + 15 = -3 \\ \underline{-15 \quad -15} \\ 2x = -18 \\ \underline{\quad 2 \quad 2} \\ x = -9 \end{array}$$

check

$$\begin{array}{l} 3(-9) + 8(3) \stackrel{?}{=} -3 \\ -27 + 24 \stackrel{?}{=} -3 \\ -3 \checkmark = -3 \end{array}$$

$$x = -9, y = 3$$

$$(-9, 3)$$

$$54) \begin{cases} 3x + 8y = 67 \xrightarrow{5} 15x + 40y = 335 \\ 5x + 3y = 60 \xrightarrow{-3} -15x - 9y = -180 \end{cases}$$

$$\begin{array}{r} 3 \overline{) 155} \\ 31 \quad 31 \\ \hline y = 5 \end{array}$$

$$\begin{array}{r} 5x + 3(5) = 60 \\ 5x + 15 = 60 \\ \underline{-15 \quad -15} \\ 5x = 45 \\ \underline{\quad 5 \quad 5} \\ x = 9 \end{array}$$

check

$$\begin{array}{l} 3(9) + 8(5) \stackrel{?}{=} 67 \\ 27 + 40 \stackrel{?}{=} 67 \\ 67 \checkmark = 67 \end{array}$$

$$x = 9, y = 5$$

$$(9, 5)$$

$$56) \begin{cases} \frac{1}{3}x - y = -3 \xrightarrow{3} x - 3y = -9 \xrightarrow{-2} -2x + 6y = 18 \\ x + \frac{5}{2}y = 2 \xrightarrow{2} 2x + 5y = 4 \rightarrow \underline{2x + 5y = 4} \end{cases}$$

check (use mod. equations)

$$2(-3) + 5(2) \stackrel{?}{=} 4$$

$$-6 + 10 \stackrel{?}{=} 4$$

$$4 \stackrel{?}{=} 4$$

$$\boxed{x = -3, y = 2}$$

$$\boxed{(-3, 2)}$$

$$\frac{11y}{11} = \frac{22}{11}$$

$$y = 2$$

$$x - 3(2) = -9$$

$$x - 6 = -9$$

$$+6 \quad +6$$

$$\underline{x = -3}$$

$$58) \begin{cases} x + \frac{1}{3}y = -1 \xrightarrow{3} 3x + y = -3 \xrightarrow{-3} -9x - 3y = 9 \\ \frac{1}{3}x + \frac{1}{2}y = 1 \xrightarrow{6(LCD)} 2x + 3y = 6 \rightarrow \underline{2x + 3y = 6} \end{cases}$$

check (use mod. equation)

$$2\left(\frac{-15}{7}\right) + 3\left(\frac{24}{7}\right) \stackrel{?}{=} 6$$

$$\frac{-30}{7} + \frac{72}{7} \stackrel{?}{=} 6$$

$$\frac{42}{7} \stackrel{?}{=} 6$$

$$6 \checkmark = 6$$

$$\boxed{x = \frac{-15}{7}, y = \frac{24}{7}}$$

$$\boxed{\left(\frac{-15}{7}, \frac{24}{7}\right)}$$

$$-7x = 15$$

$$\frac{-15 + 7x}{7} = \frac{-15 + 7x}{7}$$

$$\frac{-15}{7} = \frac{7x}{7}$$

$$\frac{-15}{7} = x$$

$$3\left(\frac{-15}{7}\right) + y = -3$$

$$\frac{-45}{7} + y = -3$$

$$\left(\frac{7}{1}\right)\left(\frac{-45}{7} + \frac{y}{1}\right) = \left(\frac{-3}{1}\right)\left(\frac{7}{1}\right)$$

$$-45 + 7y = -21$$

$$+45 \quad +45$$

$$\frac{7y}{7} = \frac{24}{7}$$

$$y = \frac{24}{7}$$

$$60) \begin{cases} 2x + y = 3 \xrightarrow{-3} -6x - 3y = -9 \\ 6x + 3y = 9 \longrightarrow 6x + 3y = 9 \end{cases}$$

$$0 = 0$$

identity
infinite solutions

$$\begin{array}{r} 2x + y = 3 \\ -2x \quad -2x \\ \hline y = -2x + 3 \end{array}$$

$$\boxed{\begin{array}{l} x, y = -2x + 3 \\ (x, -2x + 3) \text{ "ordered pair"} \end{array}}$$

$$62) \begin{cases} -3x - y = 8 \xrightarrow{2} -6x - 2y = 16 \\ 6x + 2y = -16 \longrightarrow 6x + 2y = -16 \end{cases}$$

$$0 = 0$$

identity
infinite solutions

$$\begin{array}{r} -3x - y = 8 \\ -8 + y \quad -8 + y \\ \hline -3x - 8 = y \end{array}$$

$$\boxed{\begin{array}{l} x, y = -3x - 8 \\ (x, -3x - 8) \text{ "ordered pair"} \end{array}}$$

64-a) elimination

64-b) substitution

66-a) substitution

66-b) elimination