p. 261, #1-19 odd, #26

1. Step 2

$$\begin{aligned} x + 2y &= 13 \\ -x + y &= 5 \\ \hline 0 + 3y &= 18 \end{aligned}$$

Step 3

$$\begin{aligned} 3y &= 18 \\ \frac{3y}{3} &= \frac{18}{3} \\ y &= 6 \end{aligned}$$

Step 4

$$\begin{aligned} x + 2y &= 13 \\ x + 2(6) &= 13 \\ x + 12 &= 13 \\ -12 \quad & \quad -12 \\ x &= 1 \end{aligned}$$

Check

$$\begin{aligned} x + 2y &= 13 \\ 1 + 2(6) &\stackrel{?}{=} 13 \\ 1 + 12 &\stackrel{?}{=} 13 \\ 13 &= 13 \checkmark \end{aligned} \qquad \begin{aligned} -x + y &= 5 \\ -1 + 6 &\stackrel{?}{=} 5 \\ 5 &= 5 \checkmark \end{aligned}$$

The solution is (1, 6).

3. Step 2

$$\begin{aligned} 5x + 6y &= 50 \\ x - 6y &= -26 \\ \hline 6x + 0 &= 24 \end{aligned}$$

Step 3

$$\begin{aligned} 6x &= 24 \\ \frac{6x}{6} &= \frac{24}{6} \\ x &= 4 \end{aligned}$$

Step 4

$$\begin{aligned} x - 6y &= -26 \\ 4 - 6y &= -26 \\ -4 \quad & \quad -4 \\ \hline -6y &= -30 \\ \frac{-6y}{-6} &= \frac{-30}{-6} \\ y &= 5 \end{aligned}$$

Check

$$\begin{aligned} 5x + 6y &= 50 & \qquad x - 6y &= -26 \\ 5(4) + 6(5) &\stackrel{?}{=} 50 & 4 - 6(5) &\stackrel{?}{=} -26 \\ 20 + 30 &\stackrel{?}{=} 50 & 4 - 30 &\stackrel{?}{=} -26 \\ 50 &= 50 \checkmark & -26 &= -26 \checkmark \end{aligned}$$

The solution is (4, 5).

5. Step 2

$$\begin{array}{r} -3x - 5y = -7 \\ \underline{-4x + 5y = 14} \\ -7x + 0 = 7 \end{array}$$

Step 3

$$\begin{aligned} -7x &= 7 \\ \frac{-7x}{-7} &= \frac{7}{-7} \\ x &= -1 \end{aligned}$$

Step 4

$$\begin{aligned} -4x + 5y &= 14 \\ -4(-1) + 5y &= 14 \\ 4 + 5y &= 14 \\ \underline{-4} \quad & \quad \underline{-4} \\ 5y &= 10 \\ \frac{5y}{5} &= \frac{10}{5} \\ y &= 2 \end{aligned}$$

Check

$$\begin{array}{rr} -3x - 5y = -7 & -4x + 5y = 14 \\ -3(-1) - 5(2) \stackrel{?}{=} -7 & -4(-1) + 5(2) \stackrel{?}{=} 14 \\ 3 - 10 \stackrel{?}{=} -7 & 4 + 10 \stackrel{?}{=} 14 \\ -7 = -7 \checkmark & 14 = 14 \checkmark \end{array}$$

The solution is $(-1, 2)$.

7. Rewrite Equation 1 in the form $ax + by$.

$$-y - 10 = 6x$$
$$-y - 10 + 10 = 6x + 10$$
$$-y = 6x + 10$$
$$-y - 6x = 6x - 6x + 10$$
$$-6x - y = 10$$

Step 2

$$\begin{array}{r} -6x - y = 10 \\ 5x + y = -10 \\ \hline -x + 0 = 0 \end{array}$$

Step 3

$$-x = 0$$
$$\frac{-x}{-1} = \frac{0}{-1}$$
$$x = 0$$

Step 4

$$5x + y = -10$$
$$5(0) + y = -10$$
$$0 + y = -10$$
$$y = -10$$

Check

$$-y - 10 = 6x \qquad\qquad 5x + y = -10$$
$$-(-10) - 10 \stackrel{?}{=} 6(0) \qquad\qquad 5(0) + (-10) \stackrel{?}{=} -10$$
$$10 - 10 \stackrel{?}{=} 0 \qquad\qquad 0 - 10 \stackrel{?}{=} -10$$
$$0 = 0 \checkmark \qquad\qquad -10 = -10 \checkmark$$

The solution is $(0, -10)$.

9. Step 1

$$x + y = 2$$
$$2x + 7y = 9$$

Multiply by -2.

Step 2

$$-2x - 2y = -4$$
$$2x + 7y = 9$$
$$0 + 5y = 5$$

Step 3

$$5y = 5$$
$$\frac{5y}{5} = \frac{5}{5}$$
$$y = 1$$

Step 4

$$x + y = 2$$
$$x + 1 = 2$$
$$-1 \quad -1$$
$$x = 1$$

Check $x + y = 2$

$$1 + 1 \stackrel{?}{=} 2$$
$$2 = 2 \checkmark$$

$2x + 7y = 9$

$$2(1) + 7(1) \stackrel{?}{=} 9$$
$$2 + 7 \stackrel{?}{=} 9$$
$$9 = 9 \checkmark$$

The solution is (1, 1).

11. Step 1

$$11x - 20y = 28$$
$$3x + 4y = 36$$

Multiply by 5.

Step 2

$$11x - 20y = 28$$
$$\underline{15x + 20y = 180}$$
$$26x + 0 = 208$$

Step 3

$$26x = 208$$
$$\frac{26x}{26} = \frac{208}{26}$$
$$x = 8$$

Step 4

$$3x + 4y = 36$$
$$3(8) + 4y = 36$$
$$24 + 4y = 36$$
$$\underline{-24} \qquad \underline{-24}$$
$$4y = 12$$
$$\frac{4y}{4} = \frac{12}{4}$$
$$y = 3$$

Check

$$11x - 20y = 28$$
$$11(8) - 20(3) \stackrel{?}{=} 28$$
$$88 - 60 \stackrel{?}{=} 28$$
$$28 = 28 \checkmark$$

$$3x + 4y = 36$$
$$3(8) + 4(3) \stackrel{?}{=} 36$$
$$24 + 12 \stackrel{?}{=} 36$$
$$36 = 36 \checkmark$$

The solution is (8, 3).

13. Step 1

$4x - 3y = 8$ — Multiply by 2.

$5x - 2y = -11$ — Multiply by -3.

Step 2

$$\begin{array}{r} 8x - 6y = 16 \\ -15x + 6y = 33 \\ \hline -7x + 0 = 49 \end{array}$$

Step 3

$$-7x = 49$$

$$\frac{-7x}{-7} = \frac{49}{-7}$$

$$x = -7$$

Step 4

$$4x - 3y = 8$$

$$4(-7) - 3y = 8$$

$$-28 - 3y = 8$$

$$\underline{+\,28} \qquad \underline{+\,28}$$

$$-3y = 36$$

$$\frac{-3y}{-3} = \frac{36}{-3}$$

$$y = -12$$

Check

$$4x - 3y = 8 \qquad 5x - 2y = -11$$

$$4(-7) - 3(-12) \stackrel{?}{=} 8 \qquad 5(-7) - 2(-12) \stackrel{?}{=} -11$$

$$-28 + 36 \stackrel{?}{=} 8 \qquad -35 + 24 \stackrel{?}{=} -11$$

$$8 = 8 \checkmark \qquad -11 = -11 \checkmark$$

The solution is $(-7, -12)$.

15. Step 1

$9x + 2y = 39$ — Multiply by 4.

$6x + 13y = -9$ — Multiply by -6.

Step 2

$$36x + 8y = 156$$
$$-36x - 78y = 54$$
$$0 - 70y = 210$$

Step 3

$$-70y = 210$$
$$\frac{-70y}{-70} = \frac{210}{-70}$$
$$y = -3$$

Step 4

$$9x + 2y = 39$$
$$9x + 2(-3) = 39$$
$$9x - 6 = 39$$
$$+6 \quad +6$$
$$9x = 45$$
$$\frac{9x}{9} = \frac{45}{9}$$
$$x = 5$$

Check

$9x + 2y = 39$

$9(5) + 2(-3) \stackrel{?}{=} 39$

$45 - 6 \stackrel{?}{=} 39$

$39 = 39$ ✓

$6x + 13y = -9$

$6(5) + 13(-3) \stackrel{?}{=} -9$

$30 - 39 \stackrel{?}{=} -9$

$-9 = -9$ ✓

The solution is $(5, -3)$.

17. **Words** | Oil change fee | + | Number of quarts of oil | • | Cost per quart | = | Total Cost |

Variables Let x be the fee for an oil change and y be the cost per quart.

System
$$x + 5y = 37.45$$
$$x + 7y = 46.45$$

Step 2
$$x + 5y = 37.45$$
$$\underline{x + 7y = 46.45}$$
$$0 - 2y = -9.00$$

Step 3
$$-2y = -9.00$$
$$\frac{-2y}{-2} = \frac{-9.00}{-2}$$
$$y = 4.50$$

Step 4
$$x + 5y = 37.45$$
$$x + 5(4.50) = 37.45$$
$$x + 22.50 = 37.45$$
$$x + 22.50 - 22.50 = 37.45 - 22.50$$
$$x = 14.95$$

The solution is (14.95, 4.50). So, the fee is \$14.95 and the cost per quart of oil is \$4.50.

19. The x-terms should have been added, not subtracted.

Step 2

$$\begin{array}{r} 5x - 7y = 16 \\ x + 7y = 8 \\ \hline 6x + 0 = 24 \end{array}$$

Step 3

$$\begin{aligned} 6x &= 24 \\ \frac{6x}{6} &= \frac{24}{6} \\ x &= 4 \end{aligned}$$

26. Step 1

$$\frac{1}{3}x + \frac{2}{3}y = 2 \quad \xrightarrow{\text{Multiply by 3.}} \quad x + 2y = 6$$

$$\frac{1}{2}x - \frac{1}{4}y = -\frac{3}{4} \quad \xrightarrow{\text{Multiply by 8.}} \quad 4x - 2y = -6$$

Step 2

$$\begin{array}{r} x + 2y = 6 \\ 4x - 2y = -6 \\ \hline 5x = 0 \end{array}$$

Step 3

$$5x = 0$$

$$\frac{5x}{5} = \frac{0}{5}$$

$$x = 0$$

Step 4

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

$$\frac{1}{3}(0) + \frac{2}{3} = 2$$

$$0 + \frac{2}{3}y = 2$$

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

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

$$y = 3$$

Check

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

$$\frac{1}{3}(0) + \frac{2}{3}(3) \stackrel{?}{=} 2 \qquad \frac{1}{2}(0) - \frac{1}{4}(3) \stackrel{?}{=} -\frac{3}{4}$$

$$0 + 2 \stackrel{?}{=} 2 \qquad 0 - \frac{3}{4} \stackrel{?}{=} -\frac{3}{4}$$

$$2 = 2 \checkmark \qquad -\frac{3}{4} = -\frac{3}{4} \checkmark$$

The solution is (0, 3). *Sample answer:* I chose elimination because both equations had like terms in the same respective positions, and I was able to multiply to eliminate fractions and rewrite so that coefficients were the same.