*make observations 1st!
which is more suitable → elimination or substitution?

1. Solve:

a.

$$x - 7y = -11$$
$$5x + 2y = -18$$
$$x + y + z = 3$$

notice 2 variable system here → can solve for x & y

$$x - 7y = -11 \rightarrow x = 7y - 11$$
$$5x + 2y = -18$$

*substitute

$$5(7y - 11) + 2y = -18$$
$$35y - 55 + 2y = -18$$
$$37y = 37$$
$$\boxed{y = 1}$$

$$x = 7(1) - 11$$
$$\boxed{x = -4}$$

$$x + y + z = 3$$
$$-4 + 1 + z = 3$$
$$\boxed{z = 6}$$

$$\boxed{(-4, 1, 6)}$$

b.

elimination best
↳ select one variable to eliminate
*x

$$x + 2y - 3z = 50$$
$$2x + y + 2z = 3$$
$$2x - 5y + 4z = -79$$

$$-2(x + 2y - 3z = 50)$$
$$2x + y + 2z = 3$$

$$-1(2x - 5y + 4z = -79)$$
$$2x + y + 2z = 3$$

$$-2x - 4y + 6z = -100$$
$$2x + y + 2z = 3$$
$$\overline{}$$
$$-3y + 8z = -97$$

$$2x + y + 2z = 3$$
$$-2x + 5y - 4z = 79$$
$$\overline{}$$
$$6y - 2z = 82$$

$$2(-3y + 8z = -97) \longrightarrow -6y + 16z = -194$$
$$6y - 2z = 82$$
$$\overline{6y - 2z = 82}$$
$$14z = -112$$
$$\boxed{z = -8}$$

$$6y - 2(-8) = 82$$
$$6y = 66$$
$$\boxed{y = 11}$$

$$x + 2(11) - 3(-8) = 50$$
$$x + 22 + 24 = 50$$
$$\boxed{x = 4}$$

$$\boxed{(4, 11, -8)}$$

c. Wearing night vision goggles at the zoo's night animal exhibit, Nate, Alec, and Seth saw opossums, owls, and snakes. Nate noticed that there were twice as many opossums as snakes. Alec counted a total of 64 legs on the creatures. Seth counted 27 animals. The boys saw at least one of each type of animal. How many of each type were in the exhibit?

p = opossums

w = owls

s = snakes

$p = 2s$ $\rightarrow$ $\frac{1}{2}p = s$

$4p + 2w + 0s = 64 \rightarrow 4p + 2w = 64$

$p + w + s = 27$

* notice 2nd eqt has p & w
3rd eqt has $p, w, \& s$
can substitute out
s using 1st eqt
to get 2 variable
system of p & w

$4p + 2w = 64$

$- (3p + 2w = 54)$

$\overline{}$

$p \qquad = 10$

$\frac{1}{2}(10) = s$

$5 = s$

$10 + w + 5 = 27$

$w = 12$

10	opossums
5	owls
12	snakes

$p + w + \frac{1}{2}p = 27$

$2\left(\frac{3}{2}p + w = 27\right)$

$3p + 2w = 54$

d.

$-2(x + y - z = -1)$

$2x - 2y + 3z = 8$

$2x - y + 2z = 9$

eliminate x

$-2x - 2y + 2z = 2$

$2x - 2y + 3z = 8$

$\overline{}$

$-4y + 5z = 10$

$-2x - 2y + 2z = 2$

$2x - y + 2z = 9$

$\overline{}$

$-3y + 4z = 11$

$(-2, 15, 14)$

$-3(-4y + 5z = 10)$

$4(-3y + 4z = 11)$

$12y - 15z = -30$

$-12y + 16z = 44$

$\overline{}$

$z = 14$

$-3y + 4(14) = 11$

$-3y = -45$

$y = 15$

$x + 15 - 14 = -1$

$x + 1 = -1$

$x = -2$

e.

★ substitution

$x + 3z = -5 \longrightarrow x = -3z - 5$

$5x - 2y = -22$

$5y - 6z = 36$

$5(-3z - 5) - 2y = -22$

$-15z - 25 - 2y = -22$

$5(-2y - 15z = 3)$

$-2y - 15z = 3$

$2(5y - 6z = 36)$

$\begin{array}{l} -10y - 75z = 15 \\ \underline{10y - 12z = 72} \\ \qquad -87z = 87 \\ \qquad z = -1 \end{array}$

$x = -3(-1) - 5$

$x = -2$

$\boxed{(-2, 6, -1)}$

$5(-2) - 2y = -22$

$-2y = -12$

$y = 6$

f. Carly is training for a triathlon. In her training routine each week, she runs 7 times as far as she swims, and she bikes 3 times as far as she runs. One week she trained a total of 232 miles. How far did she run that week?

$r = \text{runs}$

$b = \text{bikes}$

$s = \text{swims}$

$r = 7s \longrightarrow s = \frac{1}{7}r$

$b = 3r$

$r + b + s = 232$

$r + 3r + \frac{1}{7}r = 232$

$\frac{29}{7}r = 232$

$r = 56$

$s = \frac{1}{7}(56)$

$s = 8$

$b = 3(56)$

$b = 168$

$\boxed{\begin{array}{l} 56 \text{ miles} \rightarrow \text{run} \\ 8 \text{ miles} \rightarrow \text{swim} \\ 168 \text{ miles} \rightarrow \text{bike} \end{array}}$