

Developing Systems of Equations

1. During a clothing sale, 2 jackets and 2 sweaters cost \$228. A jacket costs \$44 more than a sweater.

- a) Identify some variables to represent the unknown quantities in the problem.

Let $x \rightarrow$ jackets
 $y \rightarrow$ sweaters

- b) Create a linear system to model this situation.

$$2x + 2y = 228$$
$$x = y + 44$$

2. A store has 80 packages of wheels for inline skates and roller skates. The store sells wheels for roller skates in packages of 4 and wheels for inline skates in packages of 8. The total number of wheels in all packages is 440.

- c) Identify some variables to represent the unknown quantities in the problem.

Let $x \rightarrow$ roller skates
 $y \rightarrow$ inline skates

- d) Create a linear system to model this situation.

$$4x + 8y = 440$$

$$x + y = 80$$

wheels + wheels = wheels

packages + packages = packages

3. A store display had packages of 8 batteries and packages of 4 batteries. The total number of batteries was 320. There 1.5 times as many packages of 4 batteries as packages of 8 batteries.

e) Identify some variables to represent the unknown quantities in the problem.

$$\begin{aligned} \text{let } x &\rightarrow 8 \text{ batteries} \\ y &\rightarrow 4 \text{ batteries} \end{aligned}$$

f) Create a linear system to model this situation.

$$8x + 4y = 320$$

$$1.5y = x$$

Remove (g)

~~g)~~ The store determined that there are 30 packages of 8 batteries and 20 packages of 4 batteries. Use the linear system you created to verify that the store is correct.

$$8x + 4y = 320$$

$$8(30) + 4(20) = 320$$

$$240 + 80 = 320$$

$$320 = 320$$

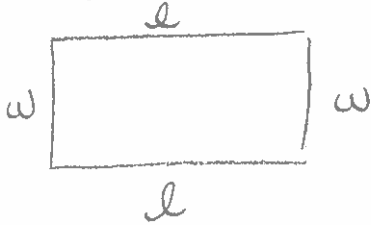
$$1.5y = x$$

$$1.5(20) = 30$$

$$30 = 30$$

4. The perimeter of a Nunavut flag is 16 ft. Its length is 2 ft. longer than its width.

h) Identify some variables to represent the unknown quantities in the problem.



Let $l \rightarrow$ length
 $w \rightarrow$ width

i) Create a linear system to model this situation.

$$2l + 2w = 16$$

$$l = w + 2$$

j) Hailey determined that the Nunavut flag is 5 ft. long and 3 ft. wide. Use the linear system you created to verify that Hailey is correct.

$$2l + 2w = 16$$

$$2(5) + 2(3) = 16$$

$$10 + 6 = 16$$

$$16 = 16$$

$$l = w + 2$$

$$(5) = (3) + 2$$

$$5 = 5$$

$$5¢ \rightarrow 0.05$$

$$20¢ \rightarrow 0.20$$

5. LCHS raised \$195 by collecting 3000 items for recycling. The school received 5 cents for each pop can and 20 cents for each large plastic bottle.

k) Identify some variables to represent the unknown quantities in the problem.

let $x \rightarrow$ pop can

$y \rightarrow$ large plastic bottle

l) Create a linear system to model this situation.

$$x + y = 3000$$

cans + cans = cans

$$0.05x + 0.20y = 195$$

money + money = money

m) The school collected 2700 pop cans and 300 plastic bottles. Use the linear systems you created to verify these numbers.

$$x + y = 3000$$

$$0.05(2700) + 0.20(300) = 195$$

$$2700 + 300 = 3000$$

$$135 + 60 = 195$$

$$3000 = 3000$$

$$195 = 195$$

6. Wolf Creek Schools has buses that carry 12 passengers and buses that carry 24 passengers. The total passenger capacity is 780. There are 20 more small buses than large buses. How many of each type of bus does WCPS own?

a) What are the unknown quantities?

let $x \rightarrow$ small buses
 $y \rightarrow$ large buses

Small buses
 large buses

b) Identify some variables to represent these unknown quantities.

c) Develop two equations that could be used to model the information given in the problem.

$$12x + 24y = 780$$

$$x = y + 20$$

d) Suppose you are told that there are 35 small buses and 15 large buses. Could this be a possible solution to the problem? How could you verify this answer?

$$12(35) + 24(15) = 780$$

$$420 + 360 = 780$$

$$x = y + 20$$

$$35 = 15 + 20$$

$$35 = 35$$

$$12x + 24y = 780$$

$$x - y = 20$$

$$x = 15 + 20$$

$$x = 35$$

$$\begin{array}{r} 12x + 24y = 780 \\ - 12x + 12y = -240 \\ \hline 36y = 540 \\ y = 15 \end{array}$$

35 small buses
 +
 15 large buses

(35, 15)

For the following problems, write a Let statement, write a system of equations and solve by elimination.

1. A study recorded the reactions of 186 polar bears as they were approached by a tundra buggy. Some bears did not appear to respond, while others responded by sitting, standing, walking away, or running away. There were 94 more bears that did not respond than did respond. How many bears responded and how many bears did not respond? [5]

Let x - not responding bears
 y - responding bears

$$\begin{aligned} x + y &= 186 \\ x &= y + 94 \end{aligned}$$

$$\begin{array}{r} x + y = 186 \\ x - y = 94 \\ \hline 2x = 280 \\ \hline x = 140 \end{array}$$

$$x = 140$$

$$\begin{aligned} 140 &= y + 94 \\ -94 &\quad -94 \\ \hline 46 &= y \end{aligned}$$

140 not responding polar bears & 46 responding polar bears

2. Brad went to Wal-Mart, he found that two tapes and three CD's cost \$31.00. And three tapes and two CD's cost \$29.00. Find the cost of one tape and one CD. [5]

Let x → tapes
 y → CD's

$$\begin{aligned} 2x + 3y &= 31 \\ 3x + 2y &= 29 \end{aligned}$$

$$\begin{array}{r} 6x + 9y = 93 \\ -6x + 4y = -58 \\ \hline 5y = 35 \\ y = 7 \end{array}$$

$$2x + 3(7) = 31$$

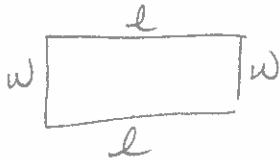
$$\begin{aligned} 2x + 21 &= 31 \\ -21 &\quad -21 \\ \hline 2x &= 10 \end{aligned}$$

$$\frac{2x}{2} = \frac{10}{2}$$

$$x = 5$$

\$5 for tapes & \$7 for CD's

3. Louise purchased a Metis flag whose length was 90 cm longer than its width. The perimeter of the flag was 540 cm. What are the dimensions of the flag? [5]



Let $w \rightarrow$ width
 $l \rightarrow$ length

$$2w + 2l = 540$$

$$l = w + 90$$

$$2w + 2l = 540$$

$$2w + 2(w + 90) = 540$$

$$2w + 2l = 540$$

$$-2w + 2l = 180$$

$$\hline 4l = 360$$

$$l = 90$$

$$l = 90 + 90$$

$$l = 180$$

90cm wide
 by 180cm
 in length

4. Sam scored 80% on part A of a math test and 92% on part B of the math test. His total mark for the test was 63. The total mark possible for the test was 74. How many marks is each part worth? [5]

Let $x \rightarrow$ part A of a math test
 $y \rightarrow$ part B of a math test

$$80\% \rightarrow 0.8$$

$$92\% \rightarrow .92$$

$$0.8x + .92y = 63$$

$$0.8x + 0.8y = 75$$

$$\begin{array}{r} 0.8x + .92y = 63 \\ - 0.8x + 0.8y = 60 \\ \hline \end{array}$$

$$.12y = \frac{3}{.12}$$

$$y = 25$$

50 marks on part A +
 25 marks on part B
 of a math test

$$\begin{array}{r} 0.8x + 25 = 75 \\ -25 \quad -25 \\ \hline \end{array}$$

$$x = 50$$

5. Melody surveyed the 76 grade 10 students in her school to find out who played games online. One-quarter of the girls and $\frac{3}{4}$ of the boys said they played online games with someone over the weekend. Thirty-nine students played online games that weekend. How many girls and how many boys did Melody survey? [5]

Let $x \rightarrow$ girls
 $y \rightarrow$ boys

$$x + \frac{1}{4}x + \frac{3}{4}y = 39$$

$$x + y = 76$$

$$x + 3y = 156$$

$$- x + y = 76$$

$$\frac{2y}{2} = \frac{80}{2}$$

$$y = 40$$

$$x + 40 = 76$$

$$-40 \quad -40$$

$$x = 36$$

36 girls + 40 boys

6. Five thousand dollars was invested in two savings bonds for one year. One bond earned interest at an annual rate of 2.5%. The other bond earned 3.75% per year. The total interest earned was \$162.50. How much money was invested in each bond? [5]

Let $x \rightarrow$ annual interest rate of 2.5%

$y \rightarrow$ annual interest rate of 3.75%

$$0.025x + 0.0375y = 162.50$$

$$\begin{matrix} \times 0.025 & \times 0.025 & \times 0.025 \\ x + y = 5000 \end{matrix}$$

$$x + 3000 = 5000$$

$$-3000 \quad -3000$$

$$x = 2000$$

$$0.025x + 0.0375y = 162.50$$

$$- 0.025x + 0.025y = 125.00$$

$$\frac{0.0125y}{0.0125} = \frac{37.5}{0.0125}$$

$$y = 3000$$

\$2000 at 2.5% +
 \$3000 at 3.75%