5. Solve each system by elimination. Check each solution. If there is not exactly one solution, does the system have no solution or infinitely many solutions?

a) $x + 2y = -3$
$2x + 3y = -4$

b) $8c - 3d = -10$
$2c - 5d = 6$

c) $4x + 3y = 15$
$8x - 9y = 15$

d) $3r + 2s = 5$
$9r + 6s = 7$

e) $2x - 3y = 2$
$5x + 6y = 5$

f) $4x - 3y = 5$
$8x - 6y = 10$

g) $3a + 2b = 16$
$2a + 3b = 14$

h) $3m + 4n = -1$
$4m - 5n = -22$

i) $5p + 3q = -19$
$2p - 5q = 11$

6. Solve by elimination. Check each solution.

a) $38 = 2x - 5y$
$75 = 7x - 3y$

b) $6x + 5y = 22$
$3y = 4x + 36$

c) $3a - 7b - 13 = 0$
$4a - 5b - 13 = 0$

d) $6x - 5y = -3$
$2y - 9x = -1$

e) $3s + 4 = -4t$
$7s + 6t + 11 = 0$

f) $3c = 2 - 3d$
$5c = 3 - 2d$

g) $2d = 10 + 4e$
$3d = 6e + 15$

h) $10x = 17 - 15y$
$15x = 25y - 3$

i) $4x - 5 = 2y$
$1 = 5y - 10x$

7. Solve by elimination.

a) $0.3x - 0.5y = 1.2$
$0.7x - 0.2y = -0.1$

b) $1.7x + 3.5y = 0.01$
$0.6x + 1.2y = 0$

c) $0.2x - 0.3y = -0.1$
$0.5x - 0.4y = 0.8$

d) $0.2x - 0.3y = -0.6$
$0.5x + 0.2y = 2.3$

e) $4x + 5y = -0.5$
$3x + 7y = 0.6$

f) $0.5x - 1.3y = 1.23$
$4x - 2y = 0.6$

8. Solve by elimination.

a) $\frac{x}{3} - \frac{y}{2} = -3$
$\frac{x}{6} + \frac{y}{5} = 3$

b) $\frac{x}{3} + \frac{y}{4} = 2$
$\frac{2x}{3} - \frac{y}{2} = 0$

c) $\frac{4a}{3} - \frac{b}{4} = 9$
$\frac{5a}{6} + b = 1$

d) $x - y = 6$
$\frac{2x}{3} + \frac{y}{3} = 1$

e) $\frac{x}{3} - \frac{y}{6} = -\frac{2}{3}$
$\frac{x}{12} - \frac{y}{4} = 1\frac{1}{2}$

f) $\frac{1}{3}m - \frac{1}{6}n = \frac{1}{2}$
$\frac{m}{5} - \frac{3n}{10} = \frac{1}{2}$

Applications and Problem Solving

9. **Communication** State the method you would use to solve each system. Explain why you would choose each method.

a) $y = 6 - 3x$
$y = 2x + 1$

b) $2x - 5y = -1$
$3x + 5y = -14$

c) $4x + 3y = 15$
$x - 2y = 1$

d) $2x - 5y = 1$
$3x - 2y = -4$

e) $87x + 68y = 99$
$64x - 55y = 81$

f) $6x = 5y - 1$
$5x = 4y - 1$

B

10. Names of provinces Some provinces have names with First Nations origins. For example, "Ontario" comes from an Iroquois word meaning "beautiful water" or "beautiful lake." If the number of provincial names with First Nations origins is a, and the number with other origins is b, the numbers are related by the following equations.

$$a + b = 10$$
$$3a - 2b = 0$$

a) Communication Interpret each equation in words.

b) Find the number of provinces that have names with First Nations origins.

11. Sub prices At Lisa's Sub Shop, two ham subs and four roast-beef subs cost \$34. Five ham subs and 6 roast-beef subs cost \$61. If one ham sub costs \$$x$ and one roast-beef sub costs \$$y$, the information can be modelled by the following system of equations.

$$2x + 4y = 34$$
$$5x + 6y = 61$$

Solve the system of equations to find the cost of each type of sub.

12. Solve by elimination. Check each solution.

a) $3(x + 2) - (y + 7) = -1$
$5(x + 1) + 4(y - 3) = -24$

b) $5(m - 3) + 2(n + 4) = 10$
$3(m + 4) - 4(n + 3) = -21$

c) $2(a - 4) + 5(b + 1) = 8$
$3(a - 1) - 2(b - 2) = -11$

d) $4(x - 1) - 3(y + 4) = -11$
$3(x + 4) + 5(y - 6) = -7$

13. Literal coefficients Solve for x and y.

a) $x - y = a + b$
$x + y = a - b$

b) $bx + ay = 2ab$
$bx - ay = 4ab$

14. Coordinate geometry Find the coordinates of the vertices of a triangle whose sides lie on the following three lines.

$$2x + 5y - 16 = 0$$
$$4x - 3y - 6 = 0$$
$$3x + y + 2 = 0$$

15. For what values of the coefficients a and b is $(2, -1)$ the solution to the following linear system?

$$ax + by = -7$$
$$2ax - 3by = 1$$

C

16. Solve this system of equations for x and y by letting $a = \frac{1}{x}$ and $b = \frac{1}{y}$.

$$\frac{1}{x} + \frac{3}{y} = \frac{3}{4}$$
$$\frac{3}{x} - \frac{2}{y} = \frac{5}{12}$$

Answers

Chapter 1

Getting Started p. 2

1. 10; The check digit will be 0. **2. a)** 9 **b)** 9 **c)** 2 **d)** 8 **3. a)** No, the check digit should be 6. **b)** Yes, the check digit is correct. **c)** Yes, the check digit is correct. **4.** Answers may vary. 123 456 717; 223 456 740 **5. a)** $10 - m$ **b)** 0 **c)** The check digit is equal to $10 - m$ if $m \neq 0$ and 0 if $m = 0$.

Review of Prerequisite Skills p. 3

1. a) $x + 2$ **b)** $2x + 8$ **c)** $3y - 5$ **d)** $-5a + 3$ **e)** $6x + 14$ **f)** $5z - 8$ **g)** $7t + 41$ **h)** $2x - 9$ **2. a)** $6x$ **b)** $-2c$ **c)** x **d)** $3n$ **e)** $x + 2y$ **f)** $3p - r$ **3. a)** 8 **b)** 2 **c)** -6 **d)** -5 **4. a)** 7 **b)** -3 **c)** 2 **d)** 12 **e)** $-\frac{1}{2}$ **f)** $\frac{3}{2}$ **g)** 4 **h)** -5 **i)** $-\frac{5}{2}$ **j)** -4 **k)** -1 **l)** 2 **5. a)** $x = 11 - 3y$ **b)** $x = 5y - 8$ **c)** $x = 2y - 4$ **d)** $x = \frac{5 - 3y}{2}$ **6. a)** $y = 3 - 2x$ **b)** $y = x - 2$ **c)** $y = \frac{-1 - 2x}{4}$ **d)** $y = \frac{3x - 4}{2}$ **10. a)** (3, 1) **b)** (5, −2) **c)** (−1, 6) **d)** (4, 8) **e)** (−4, −5) **f)** (2, −1) **11. a)** $9x - 4y + 1$ **b)** $13m^2 - 6m - 19$ **c)** $-a - 3b - 10$ **d)** $-e - 2$ **12. a)** $x - 8y + 10$ **b)** $-t^2 - 5t - 11$ **c)** $-9a + 3b + 1$ **d)** $12e - 1$

Section 1.1 pp. 4–5

1 Ordered Pairs and One Equation **1. a)** (1, 13), (24, −10) **b)** (−2, −4), (−12, 0) **c)** (2, 3) **d)** (0.5, −2.5) **2. a)** 3, 9, 10, −2 **b)** 2, −9, 11, −2 **c)** −1, 5, 13, 10 **d)** 5, 3, −4, −7

2 Ordered Pairs and Two Equations **1. a)** (1, 2) **b)** (−3, 1) **c)** (2, 3) **d)** (6, −8) **e)** (−2, −5) **f)** (−4, 7) **2. a)** (4, −3) **b)** (6, 3) **c)** (−1, 0) **d)** Answers may vary. (0, 0)

3 Problem Solving **1. a)** 55 **b)** 3 days **c)** $55 **2. a)** The equations represent the same graph. **b)** Answers may vary. (−1, 2), (−2, 3) **3.** The equations represent parallel and distinct lines. The lines never intersect.

Section 1.2 pp. 12–14

Practice **1. a)** (5, 4) **b)** (−1, 2) **c)** (−3, −5) **d)** (2, −3) **2. a)** (−2, 3) **b)** (2, 0) **c)** (2, −3) **d)** (−3, −2) **3. a)** (3, −1) **b)** (−1, 6) **c)** (4, −1) **d)** infinitely many solutions **e)** (6, 0) **f)** (−3, 4) **g)** no solution **h)** (−2, −1) **i)** (2, −1) **j)** (−3, −2) **k)** (4, 1) **l)** no solution **m)** (5, −1) **n)** infinitely many solutions **o)** (−1, −2) **p)** (2, 2) **4. a)** (0.5, 2) **b)** (2, 1.5) **c)** (−1, 0.5) **d)** (1.5, −2.5) **5. a)** (1.5, −0.8) **b)** (6.7, 1.7) **c)** (3.9, −0.3) **d)** (−2.7, 0.3) **e)** (2.3, 3) **f)** (−2.6, 5.1) **6. a)** one solution **b)** no solution **c)** infinitely many solutions **d)** one solution **e)** no solution **f)** no solution **7.** Austria: 9, Germany: 16 **8. a)** (20, 500) **b)** 20 months **c)** Champion **9.** (−6, 3) **10.** (2, 4), (−1, −2), (8, −2) **11.** $(3, -1), (5, -\frac{1}{3}), (4, 0)$ **12.** parallelogram **13.** Answers may vary. **a)** $x + y = 5$ **b)** $2x + 2y = 8$ **c)** $x + 2y = 4$ **14.** Answers may vary. **a)** $x + y = 5$, $x - y = 1$ **b)** $x - y = 1$, $2x - 2y = 2$ **15.** The system has infinitely many solutions: all points on the line $x - 2y + 6 = 0$. **17. a)** (−12.5, 9); (48, 24); (−16, −18)

Modelling Math p. 14

a) $(t, d) = (50, 1000)$ **b)** 50 **c)** less than 50 **d)** greater than 50

Career Connection p. 15

1. south: 5000, north: 125 000

Section 1.3 pp. 21–23

Practice **1. a)** $x = 8 - 3y$ **b)** $x = -4y - 13$ **c)** $x = 7y + 7$ **d)** $x = 2y - 1$ **2. a)** $y = 11 - 6x$ **b)** $y = -5x - 9$ **c)** $y = x + 2$ **d)** $y = 3x + 4$ **3. a)** (2, 2) **b)** (−1, 1) **c)** (2, −1) **d)** (−2, −3) **e)** (3, 0) **f)** (3, 2) **g)** (4, −5) **h)** (5, 0) **i)** (−2, 3) **j)** (−2, −2) **k)** (−1, 1) **l)** (−3, −4) **m)** (1, 0) **n)** (1, 3) **o)** no solution **p)** (3, −1) **q)** infinitely many solutions **r)** (−1, −5) **s)** no solution **t)** (1, 1) **u)** (−1, 1) **4. a)** $(\frac{1}{2}, -1)$ **b)** $(\frac{7}{11}, -\frac{1}{11})$ **c)** $(3, -\frac{6}{5})$ **d)** $(1, -\frac{1}{3})$ **e)** $(-1, \frac{2}{7})$

f) $(\frac{4}{3}, \frac{11}{3})$ **g)** $(-\frac{32}{5}, -\frac{18}{5})$ **h)** $(-\frac{3}{4}, \frac{1}{2})$ **i)** $(\frac{1}{7}, -\frac{4}{5})$

Applications and Problem Solving **5. a)** (24, −18) **b)** (−3, 2) **c)** $(\frac{3}{2}, 2)$ **d)** $(-\frac{5}{3}, \frac{1}{6})$ **6. a)** Fairweather Mountain is 3970 m higher than Ishpatina Ridge. Fairweather Mountain is 188 m less than seven time higher than Ishpatina Ridge. **b)** Fairweather Mountain: 4663 m, Ishpatina Ridge: 693 m **7. a)** The angles are complementary. Six degrees less than $\angle y$ is three times $\angle x$. **b)** $\angle x = 21°$, $\angle y = 69°$ **8. a)** The total number of tickets sold is 550. The total revenue from tickets is $9184. **b)** adult tickets: 323, student tickets: 227 **9.** (1, 2), (9, −14), (−3, −2) **10. a)** (5, 4) **b)** (4, 5) **c)** (−1, −5) **d)** $(\frac{1}{2}, -\frac{1}{2})$ **11.** A = 3, B = 2 **12. a)** (1, 4, −2) **b)** (2, −1, 3) **13.** $m = -1$ **14.** $n = \frac{1}{2}$

Modelling Math p. 23

a) $(h, C) = (4, 270)$ **b)** Quality is cheaper for less than 4 h. ABC is cheaper for more than 4 h. **c)** 10 h of work

Section 1.4 pp. 24–25

1 Equivalent Forms **1.** Answers may vary. (0, 6), (1, 5), (2, 4) **2. a)** $2x + 2y = 12$ **b)** yes **3. a)** $-3x - 3y = -18$ **b)** yes **4.** Yes, they all have the same solution. **5.** Answers may vary. **a)** $2x + 2y = 4$, $-x - y = -2$, $-2x - 2y = -4$ **b)** $2x - 2y = 8$, $-x + y = -4$, $-2x + 2y = -8$ **c)** $-2x - y = -7$, $-4x - 2y = -14$, $4x + 2y = 14$ **d)** $2y = 8x - 6$, $3y = 12x - 9$, $4y = 16x - 12$

2 Equivalent Systems **1.** (5, 2) **2.** (5, 2) **3. a)** $2x - 2y = 6$, $-x - y = -7$ **b)** (5, 2) **4.** They all have the same solution. **5.** Answers may vary. $x + y = 3$, $x - y = 1$

3 Adding Equations **1.** (2, 1) **2. a)** $2x + y$ **b)** 5 **c)** $2x + y = 5$ **3.** They all pass through (2, 1). **4.** They are equivalent systems. They have the same solution. **5.** They are equivalent systems. They have the same solution.

Section 1.5 pp. 30–33

Practice **1. a)** (5, 2) **b)** (3, 5) **c)** (1, 7) **d)** (1, 2) **2. a)** (2, 6) **b)** (−1, −3) **c)** (−4, 1) **d)** (3, −2) **e)** (−2, 1) **f)** (5, 3) **3. a)** (1, 1) **b)** (2, −1) **c)** (−6, −3) **d)** (−2, 0) **4. a)** −4, 17 **b)** −20, 7 **5. a)** (1, −2) **b)** (−2, −2) **c)** (3, 1) **d)** no solution **e)** (1, 0) **f)** infinitely many solutions **g)** (4, 2) **h)** (−3, 2) **i)** (−2, −3) **6. a)** (9, −4) **b)** (−3, 8) **c)** (2, −1) **d)** $(\frac{1}{3}, 1)$ **e)** $(-2, \frac{1}{2})$ **f)** $(\frac{5}{9}, \frac{1}{9})$ **g)** infinitely many solutions **h)** $(\frac{4}{5}, \frac{3}{5})$ **i)** no solution **7. a)** (−1, −3) **b)** (−0.2, 0.1) **c)** (4, 3) **d)** (3, 4) **e)** (−0.5, 0.3) **f)** (−0.4, −1.1) **8. a)** (6, 10) **b)** (3, 4) **c)** (6, −4) **d)** (3, −3) **e)** (−6, −8) **f)** (1, −1)

Applications and Problem Solving **9.** Answers may vary. **a)** substitution **b)** elimination **c)** substitution **d)** elimination **e)** elimination **f)** elimination **10. a)** There are 10 provinces. Three times the number of names with First Nations origins is equal to twice the number of names with other origins. **b)** 4 **11.** ham: $5, roast beef: $6 **12. a)** (−1, −3) **b)** (1, 6) **c)** (−2, 3) **d)** (2, 1) **13. a)** $x = a, y = -b$ **b)** $x = 3a, y = -b$ **14.** (3, 2), (−2, 4), (0, −2) **15.** $a = -2, b = 3$ **16.** (4, 6) **17. a)** 10 **b)** 6 **18. a)** −2 **b** 3 **19.** (2, 5) **20.** Answers may vary. $2x + 3y = -3$, $x - 2y = 16$ **21.** Answers may vary. **a)** $2x + 3y = 19$, $-2x + 3y = 11$ **b)** $3x + 2y = 2$, $4x + 5y = 19$ **c)** $2x + 3y = 0$, $-3x - 6y = 1$

Technology Extension pp. 34–35

1 Solving Systems Using a Graphing Calculator Program **1. b)** Each of the following systems has $AE - BD = 0$. In the system $ax + by = c$, $kax + kby = kc$, one equation is a multiple of the other. Thus, there are infinitely many solutions. $CE - BF = ckb - bkc = 0$. In the system $ax + by = c$, $ax + by = d$, the lines are parallel and distinct when $c \neq d$. There is no solution, and $CE - BF = cb - bd = b(c - d) \neq 0$, since $c \neq d$. **2. a)** (−1, −2) **b)** (7, 10) **c)** infinitely many solutions **d)** no solution

2 Solving Systems Using Preprogrammed Calculators **1. a)** (2, 4) **b)** (2, −3) **c)** $(\frac{1}{2}, -1)$ **2. a)** infinitely many solutions **b)** no solution

Section 1.6 pp. 36–37

1 Expressions in Two Variables **1. a)** $x + y$ **b)** $x - y$ **c)** $5y - x$ **d)** $6x + 2y$ **2. a)** $x - y$ **b)** $x + y$ **3. a)** $x + 7y$ **b)** $x + 15y$ **4. a)** $x + y$ **b)** $10x$ **c)** $5y$ **d)** $10x + 5y$ **5. a)** $x + y$ **b)** $0.07x$ **c)** $0.06y$ **d)** $0.07x + 0.06y$

2 Equations in Two Variables **1. a)** $x + y = 8$ **b)** $x - y = 5$ **c)** $y = 3x + 1$ **d)** $y = 2x - 1$ **2. a)** $l + w = 40$ **b)** $2b + 3t = 61$

3 Systems of Equations **1. a)** $x + y = 7$, $x - y = 3$ **b)** $y = 2x$, $y = x - 4$ **2. a)** $x + y = 256$ **b)** $5x + 2y = 767$ **3. a)** $p + r = 295$, $p = r + 11$ **b)** $l = w + 6$, $l + w = 46$