Chapter 1  
Linear Systems

Chapter 1 Get Ready

Question 1  Page 4

a) \(3x + 4y = 3(-2) + 4(3)\)
   \[= -6 + 12\]
   \[= 6\]

b) \(2x - 3y + 5 = 2(-2) - 3(3) + 5\)
   \[= -4 - 9 + 5\]
   \[= -8\]

c) \(4x - y = 4(-2) - (3)\)
   \[= -8 - 3\]
   \[= -11\]

d) \(-x - 2y = -(2) - 2(3)\)
   \[= 2 - 6\]
   \[= -4\]

e) \(\frac{1}{2}x + y = \frac{1}{2}(-2) + (3)\)
   \[= -1 + 3\]
   \[= 2\]

f) \(2y - \frac{1}{2}x = 2(3) - \frac{1}{2}(-2)\)
   \[= 6 + 1\]
   \[= 3\]

Chapter 1 Get Ready

Question 2  Page 4

a) \(a + b - 3 = (4) + (-1) - 3\)
   \[= 0\]

b) \(-2a - 3b + 7 = -2(4) - 3(-1) + 7\)
   \[= -8 + 3 + 7\]
   \[= 2\]

c) \(3b - 5 + a = 3(-1) - 5 + (4)\)
   \[= -3 - 5 + 4\]
   \[= -4\]

d) \(1 + 2a - 3b = 1 + 2(4) - 3(-1)\)
   \[= 1 + 8 + 3\]
   \[= 12\]

e) \(\frac{3}{4}a + b = \frac{3}{4}(4) + (-1)\)
   \[= 3 - 1\]
   \[= 2\]

f) \(b - \frac{1}{2}a = (-1) - \frac{1}{2}(4)\)
   \[= -1 - 2\]
   \[= -3\]

Chapter 1 Get Ready

Question 3  Page 4

a) \(5x + 2(x - y) = 5x + 2x - 2y\)
   \[= 7x - 2y\]

c) \(2(x - y) + 3(x - y) = 2x - 2y + 3x - 3y\)
   \[= 5x - 5y\]
Chapter 1 Get Ready Question 4 Page 4

a) \[5(2x + 3y) - 4(3x - 5y) = 10x + 15y - 12x + 20y\]
   \[= -2x + 35y\]

b) \[x - 2(x + 3y) - (2x + 3y) - 4(x + y) = x - 2x - 6y - 2x - 3y - 4x - 4y\]
   \[= -7x - 13y\]

c) \[3(a + 2b - 2) - 2(2a - 5b - 1) = 3a + 6b - 6 - 4a + 10b + 2\]
   \[= -a + 16b - 4\]

Chapter 1 Get Ready Question 5 Page 5

a) 

\[y = x + 2\]

b) 

\[y = 2x + 3\]

c) 

\[y = \frac{1}{2}x - 5\]

d) 

\[y = -\frac{2}{5}x + 6\]
Chapter 1 Get Ready  Question 6  Page 5

a) 
\[ y = x + 1 \]

b) 
\[ y = -2x + 3 \]

c) 
\[ y = -x + 7 \]

d) 
\[ y = \frac{-5}{2}x - 1 \]
Chapter 1 Get Ready  Question 7  Page 5

a) $x$-intercept 3, $y$-intercept 3

![Graph a]

b) $x$-intercept 3, $y$-intercept $-5$

![Graph b]

c) $x$-intercept 3, $y$-intercept $-7$

![Graph c]

d) $x$-intercept 4, $y$-intercept $-2$

![Graph d]
Chapter 1 Get Ready  Question 8  Page 5

a) 

\[ -x - y - 1 = 0 \]

b) 

\[ 2x - 5y = 20 \]

Chapter 1 Get Ready  Question 9  Page 6

a) 

\[ y = x + 2 \]

b) 

\[ y = 2x + 3 \]

c) 

\[ y = \frac{1}{2}x - 5 \]

d) 

\[ y = -\frac{2}{5}x + 6 \]
a) $0.35 \times 12 = 4.2$

There are 4.2 L of pure antifreeze in 12 L of a 35% antifreeze solution.

b) $0.24 \times 3 = 0.72$

There are 0.72 kg of pure gold in 3 kg of a 24% gold alloy.

c) $0.11 \times 400 = 44$

There are 44 g of silver in 400 g of an 11% silver alloy.
a) \[ I = 2000 \times 0.04 = 80 \]
$2000 will earn $80 in interest after 1 year at 4%/year.

b) \[ I = 1200 \times 0.029 = 34.8 \]
$1200 will earn $34.80 in interest after 1 year at 2.9%/year.

c) \[ I = 1500 \times 0.031 = 46.5 \]
$1500 will earn $46.50 in interest after 1 year at 3.1%/year.

d) \[ I = 12500 \times 0.045 = 562.5 \]
$12500 will earn $562.50 in interest after 1 year at 4.5%/year.

a) \[ 2x + 1 = 2(3) + 1 \]
\[ = 6 + 1 \]
\[ = 7 \]

b) \[ 4x - 2 = 4(1) - 2 \]
\[ = 4 - 2 \]
\[ = 2 \]

c) \[ 3y - 5 = 3(1) - 5 \]
\[ = 3 - 5 \]
\[ = -2 \]
Chapter 1 Get Ready  

Question 14  

(a)  

\[
\begin{align*}
3x + 4y & = -2 \\
4y - 6 & = 0 \\
\end{align*}
\]

\[\text{Solution:} \quad x = -2, \quad y = \frac{3}{2}\]

(b)  

\[
\begin{align*}
2x - 3y + 5 & = -2 \\
1 - 3y & = 3 \\
\end{align*}
\]

\[\text{Solution:} \quad y = -\frac{2}{3}\]

(c)  

\[
\begin{align*}
4x - y & = 2 \\
y - 0 & = 3 \\
\end{align*}
\]

\[\text{Solution:} \quad x = \frac{11}{4}, \quad y = 3\]

(d)  

\[
\begin{align*}
-x - 2y & = -2 \\
2 - 2y & = 1 \\
\end{align*}
\]

\[\text{Solution:} \quad y = \frac{3}{2}, \quad x = -5\]

(e)  

\[
\begin{align*}
\frac{1}{2}x + y & = -2 \\
y - 1 & = 3 \\
\end{align*}
\]

\[\text{Solution:} \quad x = -6, \quad y = 4\]

(f)  

\[
\begin{align*}
\frac{2}{3}y - \frac{1}{2}x & = 0 \\
y - 1 & = 3 \\
\end{align*}
\]

\[\text{Solution:} \quad y = \frac{10}{3}, \quad x = 5\]

Question 15  

(a)  

\[
\begin{align*}
x - y + 1 = 0 \\
(x - y + 1) - x - 1 & = 0 \\
-1 & = -x - 1 \\
y & = x + 1 \\
\end{align*}
\]

\[\text{Solution:} \quad x = -\frac{2}{3}, \quad y = \frac{5}{3}\]

(b)  

\[
\begin{align*}
x - y + 7 & = 0 \\
x - y + 7 = 0 & = x - 7 \\
y & = -x - 7 \\
\end{align*}
\]

\[\text{Solution:} \quad x = -\frac{2}{3}, \quad y = -5\]

(c)  

\[
\begin{align*}
5x + 2y + 2x = 5 \\
(5x + 2y + 2x) - 5x - 2 & = 0 \\
2y & = -5x - 2 \\
\end{align*}
\]

\[\text{Solution:} \quad y = -\frac{5}{2}, \quad x \text{ is undefined}\]

(d)  

\[
\begin{align*}
5x + 2y - 2 & = 0 \\
(5x + 2y - 2) - 5x & = 0 \\
2y & = 5x - 2 \\
\end{align*}
\]

\[\text{Solution:} \quad y = \frac{5x - 2}{2}, \quad x \text{ is undefined}\]
Chapter 1 Section 1: Connect English With Mathematics and Graphing Lines

Chapter 1 Section 1  Question 1  Page 17

a) $2x - 7$  

b) $\frac{1}{2}x + 4$  

c) $(x - 6)y$  

d) $x + \frac{2}{3}$

Chapter 1 Section 1  Question 2  Page 17

a) $2d$  

b) $0.2n$  

c) $2l$  

\[d) 0.07p\]

Chapter 1 Section 1  Question 3  Page 17

a) $\frac{1}{5}n - 17 = 41$  

b) $5 - 2n = 7n + 3$  

c) $5n = 825$  

\[d) l + w = 96\]

Chapter 1 Section 1  Question 4  Page 17

a) The opposite of increased is decreased.

b) The opposite of added is subtracted.

c) The opposite of plus is minus.

d) The opposite of greater than is less than.

Chapter 1 Section 1  Question 5  Page 17

a) All of the words and phrases in question 4 are represented by addition.

b) Answers will vary.

Chapter 1 Section 1  Question 6  Page 17

Answers will vary. A sample answer is shown.

An expression is a combination of numbers, operations, and/or variables that can be evaluated.

An equation equates two expressions.
Chapter 1 Section 1  Question 7  Page 17

Substitute each pair of coordinates into both equations. Answer C (1, 4) satisfies both equations simultaneously.

\[
\begin{align*}
y &= 3x + 1 \\
\text{L.S.} &= 3(1) + 1 \\
\text{R.S.} &= 3(1) + 1 \\
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

\[
\begin{align*}
y &= -2x + 6 \\
\text{L.S.} &= -2(1) + 6 \\
\text{R.S.} &= -2(1) + 6 \\
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

Chapter 1 Section 1  Question 8  Page 17

a) Graph the lines to find the point of intersection (2, 7).

In \( y = 2x + 3 \):

\[
\begin{align*}
\text{L.S.} &= y \\
\text{R.S.} &= 2x + 3 \\
\text{L.S.} &= 2(2) + 3 \\
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

The point (2, 7) is on the line \( y = 2x + 3 \).

In \( y = 4x - 1 \):

\[
\begin{align*}
\text{L.S.} &= y \\
\text{R.S.} &= 4x - 1 \\
\text{L.S.} &= 4(2) - 1 \\
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

The point (2, 7) is on the line \( y = 4x - 1 \).

The coordinates of the point of intersection are (2, 7).

b) Graph the lines to find the point of intersection (–3, –4).

In \( y = -x - 7 \):

\[
\begin{align*}
\text{L.S.} &= y \\
\text{R.S.} &= -x - 7 \\
\text{L.S.} &= -(3) - 7 \\
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

The point (–3, –4) is on the line \( y = -x - 7 \).

In \( y = 3x + 5 \):

\[
\begin{align*}
\text{L.S.} &= y \\
\text{R.S.} &= 3x + 5 \\
\text{L.S.} &= 3(-3) + 5 \\
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

The point (–3, –4) is on the line \( y = 3x + 5 \).

The coordinates of the point of intersection are (–3, –4).
c) Graph the lines to find the point of intersection \((-20, -12)\).

In \(y = \frac{1}{2}x - 2\):

\[
\text{L.S.} = y = \frac{1}{2}x - 2
\]
\[
\text{R.S.} = \frac{1}{2}(-20) - 2 = -12
\]

\(\text{L.S.} = \text{R. S.}\)

The point \((-20, -12)\) is on the line \(y = \frac{1}{2}x - 2\).

In \(y = \frac{3}{4}x + 3\):

\[
\text{L.S.} = y = \frac{3}{4}x + 3
\]
\[
\text{R.S.} = \frac{3}{4}(-20) + 3 = -12
\]

\(\text{L.S.} = \text{R. S.}\)

The point \((-20, -12)\) is on the line \(y = \frac{3}{4}x + 3\).

The coordinates of the point of intersection are \((-20, -12)\).

d) Graph the lines to find the point of intersection \((3, 7)\).

In \(y = 4x - 5\):

\[
\text{L.S.} = y = 4x - 5
\]
\[
\text{R.S.} = 4(3) - 5 = 7
\]

\(\text{L.S.} = \text{R. S.}\)

The point \((3, 7)\) is on the line \(y = 4x - 5\).

In \(y = \frac{2}{3}x + 5\):

\[
\text{L.S.} = y = \frac{2}{3}x + 5
\]
\[
\text{R.S.} = \frac{2}{3}(3) + 5 = 7
\]

\(\text{L.S.} = \text{R. S.}\)

The point \((3, 7)\) is on the line \(y = \frac{2}{3}x + 5\).

The coordinates of the point of intersection are \((3, 7)\).
Chapter 1 Section 1       Question 9    Page 17

a) Graph the lines to find the point of intersection (2, 1).
In \( x + 2y = 4 \):
\[
\text{L.S.} = x + 2y \quad \text{R.S.} = 4 \\
= 2 + 2(1) \\
= 4
\]
L.S. = R.S.
The point (2, 1) is on the line \( x + 2y = 4 \).

In \( 3x - 2y = 4 \):
\[
\text{L.S.} = 3x - 2y \quad \text{R.S.} = 4 \\
= 3(2) - 2(1) \\
= 4
\]
L.S. = R.S.
The point (2, 1) is on the line \( 3x - 2y = 4 \).

The coordinates of the point of intersection are (2, 1).

b) Graph the lines to find the point of intersection (−2, −1).
In \( y + 2x = -5 \):
\[
\text{L.S.} = y + 2x \quad \text{R.S.} = -5 \\
= -1 + 2(-2) \\
= -5
\]
L.S. = R.S.
The point (−2, −1) is on the line \( y + 2x = -5 \).

In \( y - 3x = 5 \):
\[
\text{L.S.} = y - 3x \quad \text{R.S.} = 5 \\
= -1 - 3(-2) \\
= 5
\]
L.S. = R.S.
The point (−2, −1) is on the line \( y - 3x = -5 \).

The coordinates of the point of intersection are (−2, −1).
c) Graph the lines to find the point of intersection (2, –3).

In $3x - 2y = 12$:

$L.S. = 3x - 2y$  
$R.S. = 12$

$= 3(2) - 2(-3)$

$= 12$

$L.S. = R.S.$

The point (2, –3) is on the line $3x - 2y = 12$.

In $2y - x = -8$:

$L.S. = 2y - x$  
$R.S. = -8$

$= 2(-3) - 2$

$= -8$

$L.S. = R.S.$

The point (2, –3) is on the line $2y - x = -8$.

The coordinates of the point of intersection are (2, –3).

d) Graph the lines to find the point of intersection (2, 1).

In $x - y = 1$:

$L.S. = x - y$  
$R.S. = 1$

$= 2 - 1$

$= 1$

$L.S. = R.S.$

The point (2, 1) is on the line $x - y = 1$.

In $x + 2y = 4$:

$L.S. = x + 2y$  
$R.S. = 4$

$= 2 + 2(1)$

$= 4$

$L.S. = R.S.$

The point (2, 1) is on the line $x + 2y = 4$.

The coordinates of the point of intersection are (2, 1).
a) The coordinates of the point of intersection are \((3, -2)\).

b) The coordinates of the point of intersection are \((-4.67, 8)\).

c) The coordinates of the point of intersection are \((1.45, 4.73)\).

d) The coordinates of the point of intersection are \((-1.29, 7.86)\).
e) The coordinates of the point of intersection are (–1.49, 0.62).

f) The coordinates of the point of intersection are (1.26, –4.75).

Chapter 1 Section 1 Question 11 Page 18

Let $C$ represent the cost of a membership. Let $n$ represent the number of months of membership.

a) The cost of membership at CanFit is represented by $C = 150 + 20n$.

b) The cost of membership at Fitness 'R' Us is represented by $C = 100 + 30n$.

c)  

d) The point of intersection is (5, 250).

e) The point of intersection represents the number of months before the costs are the same at both clubs.

f) If you are planning to join for 1 year, you should join CanFit to obtain a cheaper cost.
Chapter 1 Section 1   Question 12   Page 18

Let $C$ represent the total cost of renting a game machine and video games. Let $n$ represent the number of video games rented.

a) The total cost of renting a game machine and some games from LC Video is represented by $C = 10 + 3n$.

b) The total cost of renting a game machine and some games from Big Vid is represented by $C = 7 + 4n$.

c) The point of intersection is (3, 19).

d) The point of intersection represents the fact that the cost is the same at both stores, $19, if you rent 3 games.

Chapter 1 Section 1   Question 13   Page 18

Let $C$ represent the charge for clearing a driveway for the season. Let $h$ represent the number of hours spent clearing a driveway.

a) Jeff's charges are represented by $C = 15h$.

b) Hesketh's charges are represented by $C = 150$.

c) The point of intersection is (10, 150).

d) Jeff charges the same amount for 10 h of work as Hesketh charges for the season, $150.
Chapter 1 Section 1    Question 14    Page 18

Let \( C \) represent the cost to hold the reception. Let \( n \) represent the number of guests.

a) The cost of Limestone Hall is represented by \( C = 5000 + 75n \).

b) The cost of Frontenac Hall is represented by \( C = 7500 + 50n \).

c) The point of intersection is (100, 12 500). The hall charges are the same, $12 500, if there are 100 guests.

d) Limestone Hall is less expensive if fewer than 100 guests are invited.

e) Answers will vary. Some possible factors are convenience of the location, availability of parking, reputation for good food, or attractiveness of the hall.

Chapter 1 Section 1    Question 15    Page 18

Let \( E \) represent earnings for 1 day. Let \( n \) represent the number of pairs of jeans made.

a) Gina's earnings are represented by \( E = 80 + 1.50n \).

b) Dexter's earnings are represented by \( E = 110 \).

c) Gina must make 20 pairs of jeans to make as much in a day as Dexter.

Chapter 1 Section 1    Question 16    Page 18

Let \( x \) represent the amount invested at 5%/year, and \( y \) represent the amount invested at 7.2%/year.

\[
0.05x + 0.072y = 349
\]

The point of intersection is (500, 4500). Ramona invested $500 at 5%/year, and $4500 at 7.2%/year.
a) The cost to rent from the Cool Car Company is represented by \( C = 525 + 0.20d \).

b) The cost to rent from the Classy Car Company is represented by \( C = 500 + 0.30d \).

c) The cost is the same for a distance of 250 km.

d) The Clarkes will pay the same cost of $575 if they rent from either of the companies and drive 250 km.
Chapter 1 Section 1       Question 18       Page 19

a) i) $E = 25000$

ii) $E = 40n$

iii) $E = 15000 + 25n$

b)

![Graph showing three linear equations: $E = 15000 + 25n$, $E = 25000$, and $E = 40n$.]

If Alain is going to give fewer than 400 h of instruction, then package (i) is best. For 400 h, packages (i) and (iii) pay the same amount, $25 000. For more than 400 h but fewer than 1000 h, package (iii) pays more. For 1000 h, packages (ii) and (iii) pay the same, $40 000. For more than 1000 h, package (ii) pays the most. It would not make sense for him to work more than 1250 h (25 h per week for 50 weeks), because that is the most he can work for packages (ii) and (iii). If he did work more than 1250 h, he would have to go with package (i), the flat rate of $25 000.

Chapter 1 Section 1       Question 19       Page 19

The lines $3x - y + 1 = 0$, $y = 4$, and $2x + y - 6 = 0$ all intersect at the point (1, 4).
Chapter 1 Section 1       Question 20    Page 19

a) Put both equations in standard form. They represent the same line, and intersect everywhere.

b) Put both equations in standard form. They have the same slope, but different \( y \)-intercepts. The lines are parallel, and do not intersect.

c) Put the equations in standard form. If the slopes and \( y \)-intercepts are the same, the lines are coincident, and there is an infinite number of solutions. If the slopes are the same, but the \( y \)-intercepts are different, the lines are parallel, and there is no solution. If the slopes are different, there is one solution.

Chapter 1 Section 1       Question 21    Page 19

The points of intersection are \((2, -2)\) and \((-2, -6)\). The second equation is not linear. It contains an \( x^2 \)-term.

Chapter 1 Section 1       Question 22    Page 19

a) The boat must make 31 trips. To carry across the 15 explorers, 30 trips are required. On the last trip, the boat carries the two children, and does not need to return, for a total of 31 trips. This assumes that the first adult across ties a rope (or whatever the group can string together to make a rope) so the boat can be pulled back.

b) If there are \( n \) explorers and 2 children, \( 2n + 1 \) trips are required.
Chapter 1 Section 1       Question 23       Page 19

Use an organizer, like a table, to test the first 25 whole numbers.

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There are 7 cute numbers in the first 25 whole numbers, or 28%.

Chapter 1 Section 1       Question 24       Page 19

Since the integers are consecutive, the middle integer must be the same as the average, 162. There are 6 integers on either side of 162. The largest integer is \(162 + 6 = 168\), or answer C.
Chapter 1 Section 2  The Method of Substitution

Chapter 1 Section 2  Question 1  Page 26

a) \( y = 3x - 4 \)  \( \quad \) ①
\( x + y = 8 \)  \( \quad \) ②

Substitute \( 3x - 4 \) for \( y \) into equation ②.

\[
\begin{align*}
x + (3x - 4) &= 8 \\
4x &= 12 \\
x &= 3
\end{align*}
\]

Substitute \( x = 3 \) into equation ①.

\[
\begin{align*}
y &= 3(3) - 4 \\
&= 5
\end{align*}
\]

Check by substituting \( x = 3 \) and \( y = 5 \) into both original equations.

In \( y = 3x - 4 \): In \( x + y = 8 \):

\[
\begin{align*}
\text{L.S.} &= y & \text{R.S.} &= 3x - 4 \\
&= 5 & &= 3(3) - 4 \\
&&= 5 & = 3 + 5 \\
&&&= 8 \\
\text{L.S.} &= \text{R.S.} & \text{L.S.} &= \text{R.S.}
\end{align*}
\]

The solution checks in both equations.

The solution is \( x = 3, y = 5 \).
b) \( x = -4y + 5 \)  \( \text{①} \)
\( x + 2y = 7 \)  \( \text{②} \)
Substitute \(-4y + 5\) for \( x \) into equation ②.
\[
-4y + 5 + 2y = 7
\]
\[
-2y = 2
\]
\[
y = -1
\]

Substitute \( y = -1 \) into equation ①.
\[
x = -4y + 5
\]
\[
= -4(-1) + 5
\]
\[
= 9
\]

Check by substituting \( x = 9 \) and \( y = -1 \) into both original equations.

In \( x = -4y + 5 \):

\[
\text{L.S.} = x \quad \text{R.S.} = -4y + 5
\]
\[
= 9 \quad = -4(-1) + 5
\]
\[
= 9 \quad = 7 \quad \text{L.S.} = \text{R.S.}
\]

In \( x + 2y = 7 \):

\[
\text{L.S.} = x + 2y \quad \text{R.S.} = 7
\]
\[
= 9 + 2(-1) \quad = 9 + 2(-1)
\]
\[
= 7 \quad = 7 \quad \text{L.S.} = \text{R.S.}
\]

The solution checks in both equations.

The solution is \( x = 9, y = -1 \).
c) \( y = -2x + 3 \)  \( \textcircled{1} \)

\[ 4x - 3y = 1 \]  \( \textcircled{2} \)

Substitute \(-2x + 3\) for \(y\) into equation \(\textcircled{2}\).

\[ 4x - 3(-2x + 3) = 1 \]

\[ 4x + 6x - 9 = 1 \]

\[ 10x = 10 \]

\[ x = 1 \]

Substitute \(x = 1\) into equation \(\textcircled{1}\).

\[ y = -2x + 3 \]

\[ = -2(1) + 3 \]

\[ = 1 \]

Check by substituting \(x = 1\) and \(y = 1\) into both original equations.

In \( y = -2x + 3 \):

\[ \text{L.S.} = y \quad \text{R.S.} = -2x + 3 \]

\[ = 1 \quad = -2(1) + 3 \]

\[ \text{L.S.} = \text{R.S.} \]

In \( 4x - 3y = 1 \):

\[ \text{L.S.} = 4x - 3y \quad \text{R.S.} = 1 \]

\[ = 4(1) - 3(1) \]

\[ = 1 \]

\[ \text{L.S.} = \text{R.S.} \]

The solution checks in both equations.

The solution is \(x = 1, y = 1\).
d) $2x + 3y = -1$  
$x = 1 - y$  
Substitute $1 - y$ for $x$ into equation $\text{c}$.

\[ 2x + 3y = -1 \]
\[ 2(1 - y) + 3y = -1 \]
\[ 2 - 2y + 3y = -1 \]
\[ y = -3 \]

Substitute $y = -3$ into equation $\text{c}$.

\[ x = 1 - y \]
\[ = 1 - (-3) \]
\[ = 4 \]

Check by substituting $x = 4$ and $y = -3$ into both original equations.

In $2x + 3y = -1$:  
In $x = 1 - y$:

\[
\begin{align*}
\text{L.S.} & = 2x + 3y & \text{R.S.} & = -1 \\
& = 2(4) + 3(-3) & & = 4 \\
& = -1 & & = 1 - (-3)
\end{align*}
\]

$L.S. = R.S.$

$L.S. = R.S.$

The solution checks in both equations.

The solution is $x = 4$, $y = -3$.

Chapter 1 Section 2  Question 2  Page 26

a) Solve the first equation for $x$: $x = 5 - 2y$.

b) Solve the first equation for $y$: $y = 6 - 2x$.

c) Solve the second equation for $x$: $x = 3y - 2$.

d) Solve the first equation for $y$: $y = 3x - 5$.

e) Solve either equation for $y$.

From the first equation: $y = 2x - 2$.

From the second equation: $y = -4x + 16$. 
Check by substituting $x = 3$ and $y = -5$ into both equations.

In $2x + 5y = -19$:

$L.S. = 2x + 5y$

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

$= -19$

$R.S. = -19$

In $6y - 8x = 54$:

$L.S. = 6y - 8x$

$= 6(-5) - 8(3)$

$= -54$

$L.S. = R.S.$

$L.S. ≠ R.S.$

Since $(3, -5)$ satisfies only one of the equations in the linear system, it is not the solution.
Chapter 1 Section 2 Question 4 Page 26

a) \( x + 2y = 3 \) ①  
5\( x + 4y = 8 \) ②

Rearrange equation ①.
\( x + 2y = 3 \)
\( x = 3 - 2y \)

Substitute 3 – 2\( y \) for \( x \) into equation ②.
5\( x + 4y = 8 \)
5(3 – 2\( y \)) + 4\( y = 8 \)
15 – 10\( y \) + 4\( y = 8 \)
\(-6y = -7\)
\( y = \frac{7}{6} \)

Substitute \( y = \frac{7}{6} \) into equation ①.
\( x + 2y = 3 \)
\( x + 2 \left( \frac{7}{6} \right) = 3 \)
\( x + \frac{14}{6} = 3 \)
\( x = \frac{18}{6} - \frac{14}{6} \)
\( x = \frac{2}{3} \)

Check by substituting \( x = \frac{2}{3} \) and \( y = \frac{7}{6} \) into both original equations.

In \( x + 2y = 3 \):

L.S. = \( x + 2y \)  
R.S. = 3

\[ \begin{align*}
\text{L.S.} &= \frac{2}{3} + 2 \left( \frac{7}{6} \right) \\
&= \frac{4}{6} + \frac{14}{6} \\
&= \frac{18}{6} \\
&= 3
\end{align*} \]

L.S. = R.S.

The solution checks in both equations.

The solution is \( x = \frac{2}{3}, \ y = \frac{7}{6} \).
b) \(6x + 5y = 7\) \(\text{①}\)
\(x - y = 3\) \(\text{②}\)

Rearrange equation \(\text{②}\).
\(x - y = 3\)
\(x = y + 3\)

Substitute \(y + 3\) for \(x\) into equation \(\text{①}\).
\(6x + 5y = 7\)
\(6(y + 3) + 5y = 7\)
\(6y + 18 + 5y = 7\)
\(11y = -11\)
\(y = -1\)

Substitute \(y = -1\) into equation \(\text{②}\).
\(x - y = 3\)
\(x - (-1) = 3\)
\(x = 2\)

Check by substituting \(x = 2\) and \(y = -1\) into both original equations.
In \(6x + 5y = 7\):  
\(\text{L.S.} = 6x + 5y\)  
\(= 6(2) + 5(-1)\)  
\(= 12 - 5\)  
\(= 7\)

\(\text{R.S.} = 7\)

In \(x - y = 3\):
\(\text{L.S.} = x - y\)  
\(= 2 - (-1)\)  
\(= 3\)

\(\text{R.S.} = 3\)

The solution checks in both equations.

The solution is \(x = 2, \ y = -1\).
e) \(2m + n = 2 \quad \odot \)
\(3m - 2n = 3 \quad \odot \)

Rearrange equation \(\odot\).
\(2m + n = 2\)
\[n = 2 - 2m\]
Substitute \(2 - 2m\) for \(n\) into equation \(\odot\).
\(3m - 2n = 3\)
\(3m - 2(2 - 2m) = 3\)
\(3m - 4 + 4m = 3\)
\(7m = 7\)
\(m = 1\)

Substitute \(m = 1\) into equation \(\odot\).
\(2m + n = 2\)
\(2(1) + n = 2\)
\(n = 0\)

Check by substituting \(m = 1\) and \(n = 0\) into both original equations.
In \(2m + n = 2\):
\[\text{L.S.} = 2m + n \quad \text{R.S.} = 2\]
\[= 2(1) + 0 \quad = 3\]
\[= 2 \quad = 3\]
\[\text{L.S.} = \text{R.S.}\]
In \(3m - 2n = 3\):
\[\text{L.S.} = 3m - 2n \quad \text{R.S.} = 3\]
\[= 3(1) - 2(0) \quad = 3\]
\[= 3 \quad = 3\]
\[\text{L.S.} = \text{R.S.}\]
The solution checks in both equations.

The solution is \(m = 1, n = 0\).
\[ \begin{align*}
\text{d)} \quad 3a + 2b &= 4 \\
2a + b &= 6
\end{align*} \]

Rearrange equation ②.
2a + b = 6

\[ b = 6 - 2a \]

Substitute 6 - 2a for b into equation ①.
3a + 2b = 4
3a + 2(6 - 2a) = 4
3a + 12 - 4a = 4
- a = -8
a = 8

Substitute a = 8 into equation ②.
2a + b = 6
2(8) + b = 6
b = -10

Check by substituting a = 8 and b = -10 into both original equations.
In 3a + 2b = 4:
L.S. = 3a + 2b \\
= 3(8) + 2(-10)
= 24 - 20
= 4 \\
R.S. = 4

In 2a + b = 6:
L.S. = 2a + b \\
= 2(8) + (-10)
= 16 - 10
= 6 \\
R.S. = 6

L.S. = R.S. \\
L.S. = R.S.

The solution checks in both equations.

The solution is \( a = 8, \ b = -10 \).
e) $2x + y = 4$ \hspace{0.5cm} ①
$4x - y = 2$ \hspace{0.5cm} ②

Rearrange equation ①.
$2x + y = 4$
$\quad y = 4 - 2x$

Substitute $4 - 2x$ for $y$ into equation ②.
$4x - y = 2$
$4x - (4 - 2x) = 2$
$4x - 4 + 2x = 2$
$6x = 6$
$x = 1$

Substitute $x = 1$ into equation ①.
$2x + y = 4$
$2(1) + y = 4$
$y = 2$

Check by substituting $x = 1$ and $y = 2$ into both original equations.
In $2x + y = 4$:
$\text{L.S.} = 2x + y$
$= 2(1) + 2$
$= 4$

$\text{R.S.} = 4$

In $4x - y = 2$:
$\text{L.S.} = 4x - y$
$= 4(1) - 2$
$= 2$

$\text{R.S.} = 2$

$L.S. = R.S.$
$L.S. = R.S.$

The solution checks in both equations.

The solution is $x = 1$, $y = 2$. 

Chapter 1 Section 2  Question 5  Page 26

a) \(2x = y + 5\)  \(\textcircled{1}\)
\(3x + y = -9\)  \(\textcircled{2}\)

Rearrange equation \(\textcircled{2}\).
\[3x + y = -9\]
\[y = -9 - 3x\]
Substitute \(-9 - 3x\) for \(y\) into equation \(\textcircled{1}\).
\[2x = y + 5\]
\[2x = -9 - 3x + 5\]
\[5x = -4\]
\[x = \frac{-4}{5}\]

Substitute \(x = \frac{-4}{5}\) into equation \(\textcircled{2}\).
\[3x + y = -9\]
\[3\left(\frac{-4}{5}\right) + y = -9\]
\[-\frac{12}{5} + y = -9\]
\[y = \frac{-45 + 12}{5}\]
\[y = \frac{-33}{5}\]

The point of intersection is \(\left(\frac{-4}{5}, \frac{-33}{5}\right)\).
b) \(4x + 2y = 7\) \(\text{①}\)
\[-x - y = 6\] \(\text{②}\)

Rearrange equation ②.
\[-x - y = 6\]
\[y = -x - 6\]

Substitute \(-x - 6\) for \(y\) into equation ①.
\[4x + 2y = 7\]
\[4x + 2(-x - 6) = 7\]
\[4x - 2x - 12 = 7\]
\[2x = 19\]
\[x = \frac{19}{2}\]

Substitute \(x = \frac{19}{2}\) into equation ②.

\[-x - y = 6\]
\[-\left(\frac{19}{2}\right) - y = 6\]
\[-y = \frac{12}{2} + \frac{19}{2}\]
\[y = -\frac{31}{2}\]

The point of intersection is \(\left(\frac{19}{2}, -\frac{31}{2}\right)\).
c) \( p + 4q = 3 \)  \( \quad \) \( \textcircled{1} \)
\( 5p = -2q + 3 \)  \( \quad \) \( \textcircled{2} \)

Rearrange equation \( \textcircled{1} \).

\[ p + 4q = 3 \]
\[ p = 3 - 4q \]

Substitute \( 3 - 4q \) for \( p \) into equation \( \textcircled{2} \).

\[ 5p = -2q + 3 \]
\[ 5(3 - 4q) = -2q + 3 \]
\[ 15 - 20q = -2q + 3 \]
\[ -18q = -12 \]
\[ q = \frac{-12}{-18} \]
\[ q = \frac{2}{3} \]

Substitute \( q = \frac{2}{3} \) into equation \( \textcircled{1} \).

\[ p + 4q = 3 \]
\[ p + 4\left(\frac{2}{3}\right) = 3 \]
\[ p = 3 - \frac{8}{3} \]
\[ p = \frac{9}{3} - \frac{8}{3} \]
\[ p = \frac{1}{3} \]

The point of intersection is \( \left(\frac{1}{3}, \frac{2}{3}\right) \).
d) \( a + b + 6 = 0 \) ①
2\( a - b - 3 = 0 \) ②

Rearrange equation ①.
\( a + b + 6 = 0 \)
\[ a = -b - 6 \]

Substitute \(-b - 6\) for \( a \) into equation ②.
\( 2a - b - 3 = 0 \)
\[ 2(-b - 6) - b - 3 = 0 \]
\[-2b - 12 - b - 3 = 0 \]
\[-3b = 15 \]
\[ b = -5 \]

Substitute \( b = -5 \) into equation ①.
\( a + b + 6 = 0 \)
\[ a + (-5) + 6 = 0 \]
\[ a = -1 \]

The point of intersection is \((-1, -5)\).

e) \( x - 2y - 2 = 0 \) ①
3\( x + 4y - 16 = 0 \) ②

Rearrange equation ①.
\( x - 2y - 2 = 0 \)
\[ x = 2y + 2 \]

Substitute \( 2y + 2 \) for \( x \) into equation ②.
3\( x + 4y - 16 = 0 \)
\[ 3(2y + 2) + 4y - 16 = 0 \]
\[ 6y + 6 + 4y - 16 = 0 \]
\[ 10y = 10 \]
\[ y = 1 \]

Substitute \( y = 1 \) into equation ①.
\( x - 2y - 2 = 0 \)
\[ x - 2(1) - 2 = 0 \]
\[ x = 4 \]

The point of intersection is \((4, 1)\).
Chapter 1 Section 2  Question 6  Page 27

a) Let $S$ represent the number of hours that Samantha works. Let $A$ represent the number of hours that Adriana works.

b) $S = 2A$  

c) $S + A = 39$  

d) Substitute $2A$ for $S$ into equation ②.

\[ S + A = 39 \]
\[ 2A + A = 39 \]
\[ 3A = 39 \]
\[ A = 13 \]

Substitute $A = 13$ into equation ①.

\[ S = 2A \]
\[ = 2(13) \]
\[ = 26 \]

Samantha worked 26 h and Adriana worked 13 h.

Chapter 1 Section 2  Question 7  Page 27

Let $J$ represent the number of T-shirts bought by Jeff. Let $S$ represent the number of T-shirts bought by Stephen.

a) $J + S = 15$  

c) $J = 6$  

Substitute $J = 6$ into equation ②.

\[ S = 2J - 3 \]
\[ = 2(6) - 3 \]
\[ = 9 \]

Jeff bought 6 T-shirts and Stephen bought 9 T-shirts.

d) Jeff spent $8.99 \times 6 = $53.94 and Stephen spent $8.99 \times 9 = $80.91, before tax.
Let $g$ represent the number of goals. Let $a$ represent the number of assists.

a) $2g + a = 86$  
$g = a - 17$

b) Substitute $a - 17$ for $g$ into equation 1.

$2g + a = 86$
$2(a - 17) + a = 86$
$2a - 34 + a = 86$
$3a = 120$
$a = 40$

Substitute $a = 40$ into equation 2.

$g = a - 17$
$= 40 - 17$
$= 23$

The solution is $a = 40, g = 23$.

c) Ugo scored 23 goals and had 40 assists.

Let $C$ represent the cost of renting a hall. Let $n$ represent the number of meals.

a) $C = 500 + 15n$  
$C = 350 + 18n$

b) Substitute $500 + 15n$ for $C$ into equation 2.

$C = 350 + 18n$
$500 + 15n = 350 + 18n$
$-3n = -150$
$n = 50$

The cost of the halls is the same for 50 guests, assuming that each quest eats one meal.

Let $C$ represent the charge for a quilt. Let $h$ represent the number of hours to make a quilt.

$C = 25 + 50h$  
$C = 100 + 20h$

Substitute $25 + 50h$ for $C$ into equation 2.

$C = 100 + 20h$
$25 + 50h = 100 + 20h$
$30h = 75$
$h = 2.5$

The costs are the same for 2.5 h.
Chapter 1 Section 2  Question 11  Page 27
Let $C$ represent the cost to rent a truck for 1 day. Let $d$ represent the number of kilometres driven.

\begin{align*}
C &= 80 + 0.22d & (\text{1}) \\
C &= 100 + 0.12d & (\text{2}) \\
\end{align*}

Substitute $80 + 0.22d$ for $C$ into equation (2).

\begin{align*}
C &= 100 + 0.12d \\
80 + 0.22d &= 100 + 0.12d \\
0.10d &= 20 \\
d &= 200
\end{align*}

The costs are the same for 200 km. If Pietro plans to drive less than 200 km, he should rent from Joe's Garage to obtain a lower cost.

Chapter 1 Section 2  Question 12  Page 27

This linear system is not easy to solve by substitution because it is not easy to isolate either of the variables.

Chapter 1 Section 2  Question 13  Page 27

It is easy to solve this system by substitution since one of the variables is already isolated in the second equation. Both lines are also easy to graph.
Chapter 1 Section 2   Question 14   Page 27

a) \( y = x + 1 \)  

\[ 2x + y = 4 \]  

Substitute \( x + 1 \) for \( y \) into equation \( \circled{2} \).

\[ 2x + (x + 1) = 4 \]

\[ 3x = 3 \]

\[ x = 1 \]

Substitute \( x = 1 \) into equation \( \circled{1} \).

\[ y = x + 1 \]

\[ = 1 + 1 \]

\[ = 2 \]

The line intersect at (1, 2).

\[ y = x + 1 \]  

\[ x + y = 5 \]  

Substitute \( x + 1 \) for \( y \) into equation \( \circled{3} \).

\[ x + (x + 1) = 5 \]

\[ 2x = 4 \]

\[ x = 2 \]

Substitute \( x = 2 \) into equation \( \circled{1} \).

\[ y = x + 1 \]

\[ = 2 + 1 \]

\[ = 3 \]

The line intersect at (2, 3).

\[ 2x + y = 4 \]  

\[ x + y = 5 \]  

Rearrange equation \( \circled{2} \).

\[ 2x + y = 4 \]

\[ y = 4 - 2x \]

Substitute \( 4 - 2x \) for \( y \) into equation \( \circled{3} \).

\[ x + (4 - 2x) = 5 \]

\[ -x = 1 \]

\[ x = -1 \]

Substitute \( x = -1 \) into equation \( \circled{2} \).

\[ 2x + y = 4 \]

\[ 2(-1) + y = 4 \]

\[ y = 6 \]

The lines intersect at (–1, 6).
b) Write the equations in standard form: 
\[ y = x + 1 \]
\[ y = -2x + 4 \]
\[ y = -x + 5 \]

The slopes of the first and third lines are negative reciprocals. They meet at a right angle. The triangle is a right triangle.

**Chapter 1 Section 2 Question 15 Page 27**

Let \( w \) represent the number of wins. Let \( t \) represent the number of ties.

\[ 5w + 2t = 48 \]  \( \text{①} \)
\[ w + t = 15 \]  \( \text{②} \)

Rearrange equation ②.
\[ w + t = 15 \]
\[ w = 15 - t \]

Substitute 15 – \( t \) for \( w \) into equation ①.
\[ 5w + 2t = 48 \]
\[ 5(15-t) + 2t = 48 \]
\[ 75 - 5t + 2t = 48 \]
\[ -3t = -27 \]
\[ t = 9 \]

Substitute \( t = 9 \) into equation ②.
\[ w + t = 15 \]
\[ w + 9 = 15 \]
\[ w = 6 \]

Jeremy won 6 grapples.

**Chapter 1 Section 2 Question 16 Page 28**

Let \( C \) represent the cost of renting a car for 1 day. Let \( d \) represent the number of kilometres driven.

a) \( C = 90 \)  \( \text{①} \)

b) \( C = 40 + 0.25d \)  \( \text{②} \)

c) Substitute 90 for \( C \) into equation ②.
\[ C = 40 + 0.25d \]
\[ 90 = 40 + 0.25d \]
\[ 50 = 0.25d \]
\[ d = 200 \]

The costs of the two cars are the same if 200 km are driven.

d) The mid-size car costs less if less than 200 km are driven.

e) A round trip to Parksville will cost \( 40 + 0.25 \times 240 \), or $100 for the mid-size car, and $90 for the full-size car. The full size car costs $10 less.
Chapter 1 Section 2   Question 17   Page 28

Solutions for Achievement Checks are shown in the Teacher Resource.

Chapter 1 Section 2   Question 18   Page 28
Let \( a \) represent the number of adults that attended the concert. The \( s \) represent the number of students that attended the concert.

\[
a + s = 15000 \quad \odot \\
12.5a + 8.5s = 162500 \quad \ominus
\]

Rearrange equation \( \odot \).

\[
a + s = 15000 \\
\Rightarrow s = 15000 - a
\]

Substitute \( 15000 - a \) for \( s \) into equation \( \ominus \).

\[
12.5a + 8.5(15000 - a) = 162500 \\
12.5a + 127500 - 8.5a = 162500 \\
4a = 35000 \\
a = 8750
\]

The adult attendance was 8750.

Chapter 1 Section 2   Question 19   Page 28

a) \( 4x - 2y = 9 \quad \odot \\
y = 2x + 1 \quad \ominus \)

Substitute \( 2x + 1 \) for \( y \) into equation \( \odot \).

\[
4x - 2y = 9 \\
4x - 2(2x + 1) = 9 \\
4x - 4x - 2 = 9 \\
-2 = 9
\]

This is not possible. There is no solution.
The lines are parallel. There is no solution.
Chapter 1 Section 2 Question 20 Page 28

a) \(2(x - 4) + y = 6\)  
\(3x - 2(y - 3) = 13\)

Simplify and then rearrange equation \(\circled{1}\).

\[2(x - 4) + y = 6\]
\[2x - 8 + y = 6\]
\[y = -2x + 14\]

Simplify equation \(\circled{2}\). Then, substitute \(-2x + 14\) or \(y\) into the simplified equation.

\[3x - 2(y - 3) = 13\]
\[3x - 2y + 6 = 13\]
\[3x - 2y = 7\]
\[3x - 2(-2x + 14) = 7\]
\[3x + 4x - 28 = 7\]
\[7x = 35\]
\[x = 5\]

Substitute \(x = 5\) into equation \(\circled{1}\).

\[2(x - 4) + y = 6\]
\[2(5 - 4) + y = 6\]
\[2 + y = 6\]
\[y = 4\]

The solution is \(x = 5, y = 4\).
\( b) \quad 2(x - 1) - 4(2y + 1) = -1 \quad \text{(1)} \\
x + 3(3y + 2) - 2 = 0 \quad \text{(2)} \\
\) Simplify and then rearrange equation \( \text{(2)} \).
\[
x + 3(3y + 2) - 2 = 0 \\
x + 9y + 6 - 2 = 0 \\
x = -9y - 4 
\]
Simplify equation \( \text{(1)} \). Then, substitute \(-9y - 4\) or \(x\) into the simplified equation.
\[
2(x - 1) - 4(2y + 1) = -1 \\
2x - 2 - 8y - 4 = -1 \\
2x - 8y = 5 \\
2(-9y - 4) - 8y = 5 \\
-18y - 8 - 8y = 5 \\
-26y = 13 \\
y = -0.5 
\]
Substitute \(y = -0.5\) into equation \( \text{(2)} \).
\[
x + 3(3y + 2) - 2 = 0 \\
x + 3(3(-0.5) + 2) - 2 = 0 \\
x + 3(0.5) - 2 = 0 \\
x = 0.5 
\]
The solution is \(x = 0.5, y = -0.5\).
Chapter 1 Section 2   Question 21   Page 28

2x + 3y = 7  \( \text{①} \)

x + 4y = 16  \( \text{②} \)

4x – ky = 9  \( \text{③} \)

Rearrange equation ②.

\[
x + 4y = 16
\]

\[
x = 16 - 4y
\]

Substitute 16 – 4y for x into equation ①.

\[
2x + 3y = 7
\]

\[2(16 - 4y) + 3y = 7\]

\[32 - 8y + 3y = 7\]

\[-5y = -25\]

\[y = 5\]

Substitute y = 5 into equation ②.

\[
x + 4y = 16
\]

\[
x + 4(5) = 16
\]

\[x = -4\]

The lines intersect at (–4, 5).

Substitute x = –4 and y = 5 into equation ③ and solve for k.

\[
4x - ky = 9
\]

\[4(-4) - k(5) = 9\]

\[-16 - 5k = 0\]

\[-5k = 25\]

\[k = -5\]

The value of k is –5.

Chapter 1 Section 2   Question 22   Page 28

The number of golf balls in the pyramid results in the sequence 1, 4, 10, 20, ...

Try combinations of n, n +1, n + 2.

The correct formula is \( \frac{n}{6}(n+1)(n+2) \).
The sum of the middle row is $x - 2 - 3x = -2x - 2$.

Solve for $x$ using each of the answers. Determine which value of $x$ correctly predicts the other known numbers. Answer A: $-6$. 
Chapter 1 Section 3 Investigate Equivalent Linear Relations and Equivalent Linear Systems

Chapter 1 Section 3 Question 1 Page 32

Equations A and C are equivalent. Multiply A by 2 to obtain C.

Chapter 1 Section 3 Question 2 Page 32

C is not equivalent. There is no number that C can be multiplied by to obtain A, B, or D.

Chapter 1 Section 3 Question 3 Page 32

Answers will vary. Sample answers are shown.

a) \[2y = 6x - 4\]
\[3y = 9x - 6\]

b) \[x + 2y = 4\]
\[2x + 4y = 8\]

c) \[5y = 3x + 10\]
\[10y = 6x + 20\]

d) \[4x + 2y = 5\]
\[2x + y = 2.5\]

Chapter 1 Section 3 Question 4 Page 32

\[2l + 2w = 24\]
\[l + w = 12\]

Chapter 1 Section 3 Question 5 Page 32

\[0.05n + 0.10d = 0.70\]
\[5n + 10d = 70\]

Chapter 1 Section 3 Question 6 Page 33

The systems are equivalent. If you divide equation ① by 3, you obtain the first equation. If you multiply the equation ② by 2, you obtain the second equation.
Chapter 1 Section 3   Question 7   Page 33

a) Both systems have the solution (2, 4). They are equivalent systems.

b) The third equation is obtained by adding the first two equations.

c) The fourth equation is obtained by subtracting the second equation from the first equation.

Chapter 1 Section 3   Question 8   Page 33

a) Equation ③ was obtained by multiplying both sides of equation ① by 3, and then, subtracting 2x from both sides.

Equation ④ was obtained by multiplying both sides of the equation ② by 3, and then, adding x to both sides.

Equations ③ and ④ form a system equivalent to equations ① and ②.

b) If you graph the four equations, you see only two distinct lines intersecting at the point (3, 1).
Chapter 1 Section 3   Question 9   Page 33

Answers will vary.

Chapter 1 Section 3   Question 10   Page 33

Use technology such as a spreadsheet to investigate sums of cubes.

\[1729 = 1^3 + 12^3\]
\[1729 = 9^3 + 10^3\]

Chapter 1 Section 3   Question 11   Page 33

Use a tree diagram or a table to investigate the possible outcomes. There are 6 × 8, or 48 possible outcomes.

To have an even outcome, both spinners must show odd numbers or even numbers. This can happen in 2 × 3 × 4, or 24 ways.

To have a sum that is a multiple of 3, the sum must be 3 or 9, since you have already counted the even multiples of 6 and 12.

There are 2 ways to get a 3.
There are 6 ways to get a 9.

The total number of ways to get a 3 or 9 is 8.

The total number of ways to get an even sum or a multiple of 3 is 32.

The probability of getting an even sum or a multiple of 3 is \(\frac{32}{48}\), or \(\frac{2}{3}\). Answer B.
Chapter 1 Section 4  The Method of Elimination

Chapter 1 Section 4  Question 1  Page 40

a) \[ x + y = 2 \] \[ 3x - y = 2 \] 
\[ 4x = 4 \] \[ \Rightarrow x = 1 \] 
Substitute \( x = 1 \) into equation 1.
\[ x + y = 2 \] 
\[ 1 + y = 2 \] 
\[ y = 1 \] 
The solution is \( x = 1, y = 1 \).

b) \[ x - y = -1 \] \[ 3x + y = -7 \] 
\[ 4x = -8 \] \[ \Rightarrow x = -2 \] 
Substitute \( x = -2 \) into equation 1.
\[ x - y = -1 \] 
\[ -2 - y = -1 \] 
\[ -y = 1 \] 
\[ y = -1 \] 
The solution is \( x = -2, y = -1 \).

c) \[ x + 3y = 7 \] \[ x + y = 3 \] 
\[ 2y = 4 \] \[ \Rightarrow y = 2 \] 
Substitute \( y = 2 \) into equation 2.
\[ x + y = 3 \] 
\[ x + 2 = 3 \] 
\[ x = 1 \] 
The solution is \( x = 1, y = 2 \).

d) \[ 5x + 2y = -11 \] \[ 3x + 2y = -9 \] 
\[ 2x = -2 \] \[ \Rightarrow x = -1 \] 
Substitute \( x = -1 \) into equation 1.
\[ 5x + 2y = -11 \] 
\[ 5(-1) + 2y = -11 \] 
\[ -5 + 2y = -11 \] 
\[ 2y = -6 \] 
\[ y = -3 \] 
The solution is \( x = -1, y = -3 \).
Chapter 1 Section 4  Question 2  Page 40

a) \[2x + y = -5 \quad \text{①}\]
\[-2x + y = -1 \quad \text{②}\]
\[2y = -6 \quad \text{① + ②}\]
\[y = -3\]
Substitute \(y = -3\) into equation ①.
\[2x + y = -5\]
\[2x + (-3) = -5\]
\[2x = -2\]
\[x = -1\]
Check by substituting \(x = -1\) and \(y = -3\) into both original equations.
In \(2x + y = -5\):
\[
\text{L.S.} = 2x + y \\
= 2(-1) + (-3) \\
= -5
\]
\[
\text{R.S.} = -5
\]
\[\text{L.S.} = \text{R.S.}\]
In \(-2x + y = -1\):
\[
\text{L.S.} = -2x + y \\
= -2(-1) + (-3) \\
= -1
\]
\[\text{L.S.} = \text{R.S.}\]
The solution checks in both equations.

The solution is \(x = -1, y = -3\).

b) \[4x - y = -1 \quad \text{①}\]
\[-4x - 3y = -19 \quad \text{②}\]
\[-4y = -20 \quad \text{① + ②}\]
\[y = 5\]
Substitute \(y = 5\) into equation ①.
\[4x - y = -1\]
\[4x - (5) = -1\]
\[4x = 4\]
\[x = 1\]
Check by substituting \(x = 1\) and \(y = 5\) into both original equations.
In \(4x - y = -1\):
\[
\text{L.S.} = 4x - y \\
= 4(1) - (5) \\
= -1
\]
\[\text{L.S.} = \text{R.S.}\]
In \(-4x - 3y = -19\):
\[
\text{L.S.} = -4x - 3y \\
= -4(1) - 3(5) \\
= -19
\]
\[\text{L.S.} = \text{R.S.}\]
The solution checks in both equations.

The solution is \(x = 1, y = 5\).
c) \[2x + y = 8 \quad ① \]
\[4x - y = 4 \quad ② \]
\[6x = 12 \quad ① + ② \]
\[x = 2 \]

Substitute \(x = 2\) into equation ①.
\[2x + y = 8 \]
\[2(2) + y = 8 \]
\[4 + y = 8 \]
\[y = 4 \]

Check by substituting \(x = 2\) and \(y = 4\) into both original equations.
In \(2x + y = 8\):
\[\text{L.S.} = 2x + y \quad \text{R.S.} = 8 \]
\[= 2(2) + 4 \quad = 4 \]
\[= 8 \quad = 4 \]
\[\text{L.S.} = \text{R.S.} \]

In \(4x - y = 4\):
\[\text{L.S.} = 4x - y \quad \text{R.S.} = 4 \]
\[= 4(2) - (4) \quad = 4 \]
\[= 4 \quad = 4 \]
\[\text{L.S.} = \text{R.S.} \]

The solution checks in both equations.

The solution is \(x = 2, y = 4\).

d) \[3x + 2y = -1 \quad ① \]
\[-3x + 4y = 7 \quad ② \]
\[6y = 6 \quad ① + ② \]
\[y = 1 \]

Substitute \(y = 1\) into equation ①.
\[3x + 2y = -1 \]
\[3x + 2(1) = -1 \]
\[3x = -3 \]
\[x = -1 \]

Check by substituting \(x = -1\) and \(y = 1\) into both original equations.
In \(3x + 2y = -1\):
\[\text{L.S.} = 3x + 2y \quad \text{R.S.} = -1 \]
\[= 3(-1) + 2(1) \quad = -1 \]
\[= -1 \quad = -1 \]
\[\text{L.S.} = \text{R.S.} \]

In \(-3x + 4y = 7\):
\[\text{L.S.} = -3x + 4y \quad \text{R.S.} = 7 \]
\[= -3(-1) + 4(1) \quad = 7 \]
\[= 4 \quad = 7 \]
\[\text{L.S.} = \text{R.S.} \]

The solution checks in both equations.

The solution is \(x = -1, y = 1\).
a) \( x + 2y = 2 \) \( \quad \) \( 3x + 5y = 4 \)

\[
\begin{align*}
3x + 6y &= 6 \quad 3 \times \text{ i} \\
3x + 5y &= 4 \quad \text{ ii} \\
y &= 2 \quad 3 \times \text{ i} - \text{ ii}
\end{align*}
\]

Substitute \( y = 2 \) into equation \( \text{i} \).

\[
\begin{align*}
x + 2y &= 2 \\
x + 2(2) &= 2 \\
x + 4 &= 2 \\
x &= -2
\end{align*}
\]

The point of intersection of the lines is \((-2, 2)\).

b) \( 3x + 5y = 12 \) \( \quad \) \( 2x - y = -5 \)

\[
\begin{align*}
3x + 5y &= 12 \quad \text{i} \\
10x - 5y &= -25 \quad 5 \times \text{ ii} \\
13x &= -13 \quad 1 \times \text{ i} + 5 \times \text{ ii} \\
x &= -1
\end{align*}
\]

Substitute \( x = -1 \) into equation \( \text{ ii} \).

\[
\begin{align*}
2x - y &= -5 \\
2(-1) - y &= -5 \\
-2 - y &= -5 \\
y &= -3
\end{align*}
\]

The point of intersection of the lines is \((-1, 3)\).

c) \( 3x + y = 13 \) \( \quad \) \( 2x + 3y = 18 \)

\[
\begin{align*}
9x + 3y &= 39 \quad 3 \times \text{ i} \\
2x + 3y &= 18 \quad \text{ ii} \\
7x &= 21 \quad 3 \times \text{ i} - \text{ ii} \\
x &= 3
\end{align*}
\]

Substitute \( x = 3 \) into equation \( \text{i} \).

\[
\begin{align*}
3x + y &= 13 \\
3(3) + y &= 13 \\
9 + y &= 13 \\
y &= 4
\end{align*}
\]

The point of intersection of the lines is \((3, 4)\).
d) \[6x + 5y = 12 \quad \text{①} \]
\[3x - 4y = 6 \quad \text{②} \]

\[
\begin{align*}
6x + 5y &= 12 \quad \text{①} \\
6x - 8y &= 12 \quad 2 \times \text{②} \\
13y &= 0 & \text{①} - 2 \times \text{②} \\
y &= 0
\end{align*}
\]

Substitute \( y = 0 \) into equation ②.
\[3x - 4y = 6 \]
\[3x - 4(0) = 6 \]
\[3x = 6 \]
\[x = 2 \]

The point of intersection of the lines is (2, 0).
Chapter 1 Section 4  Question 4  Page 40

a) \(4x + 3y = 4\) ①
\[8x - y = 1\] ②

\[
\begin{align*}
4x + 3y &= 4 \quad \text{①} \\
24x - 3y &= 3 \quad 3 \times ② \\
28x &= 7 \\
\therefore x &= \frac{1}{4} 
\end{align*}
\]

Substitute \(x = \frac{1}{4}\) into equation ②.

\[
\begin{align*}
8x - y &= 1 \\
8\left(\frac{1}{4}\right) - y &= 1 \\
2 - y &= 1 \\
\therefore y &= 1
\end{align*}
\]

Check by substituting \(x = \frac{1}{4}\) and \(y = 1\) into both original equations.

In \(4x + 3y = 4\):

\[
\begin{align*}
\text{L.S.} &= 4x + 3y \\
&= 4\left(\frac{1}{4}\right) + 3(1) \\
&= 1 + 3 \\
&= 4
\end{align*}
\]

\[
\begin{align*}
\text{R.S.} &= 4 \\
\therefore \text{L.S.} &= \text{R.S.}
\end{align*}
\]

In \(8x - y = 1\):

\[
\begin{align*}
\text{L.S.} &= 8x - y \\
&= 8\left(\frac{1}{4}\right) - 1 \\
&= 2 - 1 \\
&= 1 \\
\therefore \text{L.S.} &= \text{R.S.}
\end{align*}
\]

The solution checks in both equations.

The solution is \(x = \frac{1}{4}, y = 1\).
b) $5x - 3y = 25$  \( \text{①} \)

\[
\begin{align*}
10x + 3y & = 5 \quad \text{②} \\
15x & = 30 \quad \text{① + ②} \\
x & = 2
\end{align*}
\]

Substitute $x = 2$ into equation ①.

$5x - 3y = 25$

$5(2) - 3y = 25$

$10 - 3y = 25$

$-3y = 15$

$y = -5$

Check by substituting $x = 2$ and $y = -5$ into both original equations.

In $5x - 3y = 25$:

\[
\begin{align*}
\text{L.S.} & = 5x - 3y \\
& = 5(2) - 3(-5) \\
& = 10 + 15 \\
& = 25
\end{align*}
\]

The solution checks in both equations.

The solution is $x = 2, y = -5$.

c) $5x + 2y = 48$  \( \text{①} \)

\[
\begin{align*}
x + y & = 15 \quad \text{②} \\
5x + 2y & = 48 \quad \text{①} \\
2x + 2y & = 30 \quad 2 \times ② \\
3x & = 18 \quad ① - 2 \times ② \\
x & = 6
\end{align*}
\]

Substitute $x = 6$ into equation ②.

$x + y = 15$

$(6) + y = 15$

$y = 9$

Check by substituting $x = 6$ and $y = 9$ into both original equations.

In $5x + 2y = 48$:

\[
\begin{align*}
\text{L.S.} & = 5x + 2y \\
& = 5(6) + 2(9) \\
& = 48 \\
\text{R.S.} & = 48
\end{align*}
\]

The solution checks in both equations.

The solution is $x = 6, y = 9$.  

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d) \(2x + 3y = 8\) \(\text{①}\)  
\(x - 2y = -3\) \(\text{②}\)

\[
\begin{align*}
2x + 3y &= 8 \quad \text{①} \\
2x - 4y &= -6 \quad \text{②} \\
7y &= 14 & 1 \times -2 \times \text{②} \\
y &= 2
\end{align*}
\]

Substitute \(y = 2\) into equation \(\text{②}\).

\[
\begin{align*}
x - 2y &= -3 \\
x - 4 &= -3 \\
x &= 1
\end{align*}
\]

Check by substituting \(x = 1\) and \(y = 2\) into both original equations.

In \(2x + 3y = 8\):  
\[
\begin{align*}
\text{L.S.} &= 2x + 3y \\
&= 2(1) + 3(2) \\
&= 8 \\
\text{R.S.} &= 8
\end{align*}
\]

\[
\begin{align*}
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

In \(x - 2y = -3\):  
\[
\begin{align*}
\text{L.S.} &= x - 2y \\
&= 1 - 2(2) \\
&= -3 \\
\text{R.S.} &= -3
\end{align*}
\]

\[
\begin{align*}
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

The solution checks in both equations.

The solution is \(x = 1, y = 2\).

Chapter 1 Section 4       Question 5       Page 40

a) \(3x - 2y = 5\) \(\text{①}\)  
\(2x + 3y = 12\) \(\text{②}\)

\[
\begin{align*}
9x - 6y &= 15 & 3 \times \text{①} \\
4x + 6y &= 24 & 2 \times \text{②} \\
13x &= 39 & 3 \times \text{①} + 2 \times \text{②} \\
x &= 3
\end{align*}
\]

Substitute \(x = 3\) into equation \(\text{①}\).

\[
\begin{align*}
3x - 2y &= 5 \\
3(3) - 2y &= 5 \\
9 - 2y &= 5 \\
-2y &= -4 \\
y &= 2
\end{align*}
\]

Check by substituting \(x = 3\) and \(y = 2\) into both original equations.

In \(3x - 2y = 5\):  
\[
\begin{align*}
\text{L.S.} &= 3x - 2y \\
&= 3(3) - 2(2) \\
&= 5 \\
\text{R.S.} &= 5
\end{align*}
\]

\[
\begin{align*}
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

In \(2x + 3y = 12\):  
\[
\begin{align*}
\text{L.S.} &= 2x + 3y \\
&= 2(3) + 3(2) \\
&= 12 \\
\text{R.S.} &= 12
\end{align*}
\]

\[
\begin{align*}
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

The solution checks in both equations.

The solution is \(x = 3, y = 2\).
b) \[ 5m + 2n = 5 \quad \text{(1)} \]
\[ 2m + 3n = 13 \quad \text{(2)} \]
\[
\begin{align*}
10m + 4n &= 10 & \text{\(2 \times \text{(1)}\)} \\
10m + 15n &= 65 & \text{\(5 \times \text{(2)}\)} \\
-11n &= -55 & \text{\(2 \times \text{(1)} - 5 \times \text{(2)}\)}
\end{align*}
\]
\[ n = 5 \]
Substitute \( n = 5 \) into equation (1).
\[ 5m + 2n = 5 \]
\[ 5m + 2(5) = 5 \]
\[ 5m = -5 \]
\[ m = -1 \]
Check by substituting \( m = -1 \) and \( n = 5 \) into both original equations.
In \( 5m + 2n = 5 \):
\[ \text{L.S.} = 5m + 2n \quad \text{R.S.} = 5 \]
\[ = 5(-1) + 2(5) \quad = 2(-1) + 3(5) \]
\[ = 5 \quad = 13 \]
\[ \text{L.S.} = \text{R.S.} \quad \text{L.S.} = \text{R.S.} \]
The solution checks in both equations.

The solution is \( m = -1, n = 5 \).

c) \[ 3a - 4b = 10 \quad \text{(1)} \]
\[ 5a - 12b = 6 \quad \text{(2)} \]
\[
\begin{align*}
9a - 12b &= 30 & \text{\(3 \times \text{(1)}\)} \\
5a - 12b &= 6 & \text{\(\text{(2)}\)} \\
4a &= 24 & \text{\(3 \times \text{(1)} - \text{(2)}\)}
\end{align*}
\]
\[ a = 6 \]
Substitute \( a = 6 \) into equation (1).
\[ 3a - 4b = 10 \]
\[ 3(6) - 4b = 10 \]
\[ 18 - 4b = 10 \]
\[ -4b = -8 \]
\[ b = -2 \]
Check by substituting \( a = 6 \) and \( b = 2 \) into both original equations.
In \( 3a - 4b = 10 \):
\[ \text{L.S.} = 3a - 4b \quad \text{R.S.} = 10 \]
\[ = 3(6) - 4(2) \quad = 10 \]
\[ \text{L.S.} = \text{R.S.} \]
In \( 5a - 12b = 6 \):
\[ \text{L.S.} = 5a - 12b \quad \text{R.S.} = 6 \]
\[ = 5(6) - 12(2) \quad = 6 \]
\[ \text{L.S.} = \text{R.S.} \]
The solution checks in both equations.

The solution is \( a = 6, b = 2 \).
\[
\begin{align*}
\text{d)} \ 3h - 4k &= 5 & (1) \\
5h + 3k &= -11 & (2)
\end{align*}
\]
\[
\begin{align*}
9h - 12k &= 15 & 3 \times (1) \\
20h + 12k &= -44 & 4 \times (2) \\
29h &= -29 & 3 \times (1) + 4 \times (2)
\end{align*}
\]
\[h = -1\]

Substitute \(h = -1\) into equation (1).
\[3h - 4k = 5\]
\[3(-1) - 4k = 5\]
\[-3 - 4k = 5\]
\[-4k = 8\]
\[k = -2\]

Check by substituting \(h = -1\) and \(k = -2\) into both original equations.

In \(3h - 4k = 5\):
\[
\begin{align*}
\text{L.S.} &= 3h - 4k \\
&= 3(-1) - 4(-2) \\
&= 5
\end{align*}
\]

In \(5h + 3k = -11\):
\[
\begin{align*}
\text{L.S.} &= 5h + 3k \\
&= 5(-1) + 3(-2) \\
&= -11
\end{align*}
\]
\[
\text{L.S.} = \text{R.S.} \quad \text{L.S.} = \text{R.S.}
\]

The solution checks in both equations.

The solution is \(h = -1, k = -2\).
Chapter 1 Section 4  Question 6  Page 40

a) \(3x + y = 13\)  \(\odot\)
\(2x + 3y = 18\)  \(\odot\)

\(9x + 3y = 39\)  \(3 \times \odot\)
\(2x + 3y = 18\)  \(\odot\)
\[7x = 21\]  \(3 \times \odot - \odot\)
\[x = 3\]

Substitute \(x = 3\) into equation \(\odot\).
\(3x + y = 13\)
\(3(3) + y = 13\)
\(9 + y = 13\)
\[y = 4\]

Check by substituting \(x = 3\) and \(y = 4\) into both original equations.

In \(3x + y = 13\):
\[\text{L.S.} = 3x + y\]
\[= 3(3) + 4\]
\[= 13\]
\[\text{R.S.} = 13\]
\[\text{L.S.} = \text{R.S.}\]

In \(2x + 3y = 18\):
\[\text{L.S.} = 2x + 3y\]
\[= 2(3) + 3(4)\]
\[= 18\]
\[\text{R.S.} = 18\]
\[\text{L.S.} = \text{R.S.}\]

The solution checks in both equations.

The point of intersection of the lines is \((3, 4)\).

b) \(2x + 3y = -18\)  \(\odot\)
\(3x - 5y = 11\)  \(\odot\)

\(10x + 15y = -90\)  \(5 \times \odot\)
\(9x - 15y = 33\)  \(3 \times \odot\)
\[19x = -57\]
\[5 \times \odot + 3 \times \odot\]
\[x = -3\]

Substitute \(x = -3\) into equation \(\odot\).
\(2x + 3y = -18\)
\(2(-3) + 3y = -18\)
\[-6 + 3y = -18\]
\[3y = -12\]
\[y = -4\]

Check by substituting \(x = -3\) and \(y = -4\) into both original equations.

In \(2x + 3y = -18\):
\[\text{L.S.} = 2x + 3y\]
\[= 2(-3) + 3(-4)\]
\[= -18\]
\[\text{R.S.} = -18\]
\[\text{L.S.} = \text{R.S.}\]

In \(3x - 5y = 11\):
\[\text{L.S.} = 3x - 5y\]
\[= 3(-3) - 5(-4)\]
\[= 11\]
\[\text{R.S.} = 11\]
\[\text{L.S.} = \text{R.S.}\]

The solution checks in both equations.

The point of intersection of the lines is \((-3, -4)\).
c) \[3x - 2y + 2 = 0\] \[7x - 6y + 11 = 0\]

\[
\begin{align*}
9x - 6y + 6 &= 0 \\
7x - 6y + 11 &= 0 \\
2x - 5 &= 0 \\
2x &= 5 \\
x &= \frac{5}{2}
\end{align*}
\]

Substitute \(x = \frac{5}{2}\) into equation \(c\).

\[
3\left(\frac{5}{2}\right) - 2y + 2 = 0
\]

\[
\frac{15}{2} - 2y + 2 = 0
\]

\[-2y = \frac{15}{2} - \frac{4}{2}
\]

\[-2y = \frac{11}{2}
\]

\[-y = \frac{11}{4}
\]

\[y = \frac{19}{4}\]

Check by substituting \(x = \frac{5}{2}\) and \(y = \frac{19}{4}\) into both original equations.

In \(3x - 2y + 2 = 0\):

\[
\begin{align*}
\text{L.S.} &= 3\left(\frac{5}{2}\right) - 2\left(\frac{19}{4}\right) + 2 \\
&= \frac{15}{2} - \frac{19}{2} + \frac{4}{2} \\
&= 0
\end{align*}
\]

\[\text{L.S.} = \text{R.S.}\]

In \(7x - 6y + 11 = 0\):

\[
\begin{align*}
\text{L.S.} &= 7\left(\frac{5}{2}\right) - 6\left(\frac{19}{4}\right) + 11 \\
&= \frac{35}{2} - \frac{57}{2} + \frac{22}{2} \\
&= 0
\end{align*}
\]

\[\text{L.S.} = \text{R.S.}\]

The solution checks in both equations.

The point of intersection of the lines is \(\left(\frac{5}{2}, \frac{19}{4}\right)\).
d) \(2a - 3b = -10\) \hspace{1cm} \(4a + b = 1\)

\[
\begin{align*}
2a - 3b &= -10 \\
12a + 3b &= 3 \\
14a &= -7 \\
a &= -\frac{1}{2}
\end{align*}
\]

Substitute \(a = -\frac{1}{2}\) into equation \(\textcircled{2}\).

\[
4a + b = 1
\]

\[
4\left(-\frac{1}{2}\right) + b = 1
\]

\[
-2 + b = 1 \\
b = 3
\]

Check by substituting \(a = -\frac{1}{2}\) and \(b = 3\) into both original equations.

In \(2a - 3b = -10\):

\[
\begin{align*}
\text{L.S.} &= 2a - 3b \\
&= 2\left(-\frac{1}{2}\right) - 3(3) \\
&= -10
\end{align*}
\]

\[
\text{R.S.} = -10
\]

In \(4a + b = 1\):

\[
\begin{align*}
\text{L.S.} &= 4a + b \\
&= 4\left(-\frac{1}{2}\right) + 3 \\
&= 1
\end{align*}
\]

\[
\text{R.S.} = 1
\]

The solution checks in both equations.

The point of intersection of the lines is \(\left(-\frac{1}{2}, 3\right)\).
Chapter 1 Section 4    Question 7    Page 40

a) \(4x - 9y = 4\) \(\text{①}\)
\(6x + 15y = -13\) \(\text{②}\)

\[
\begin{align*}
12x - 27y &= 12 \quad 3 \times \text{①} \\
12x + 30y &= -26 \quad 2 \times \text{②} \\

d &= -57y = 38 \quad 3 \times \text{②} - 2 \times \text{②} \\
\end{align*}
\]
\[y = \frac{-2}{3}\]

Substitute \(y = \frac{-2}{3}\) into equation ①.

\[4x - 9\left(\frac{-2}{3}\right) = 4\]
\[4x + 6 = 4\]
\[4x = -2\]
\[x = \frac{-1}{2}\]

Check by substituting \(x = \frac{-1}{2}\) and \(y = \frac{-2}{3}\) into both original equations.

In \(4x - 9y = 4\):
\[
L.S. = 4x - 9y \\
R.S. = 4
\]
\[
\begin{align*}
L.S. &= 4\left(-\frac{1}{2}\right) - 9\left(-\frac{2}{3}\right) \\
&= -2 + 6 \\
&= 4 \\
R.S. &= 4
\end{align*}
\]
\[L.S. = R.S.\]

In \(6x + 15y = -13\):
\[
L.S. = 6x + 15y \\
R.S. = -13
\]
\[
\begin{align*}
L.S. &= 6\left(-\frac{1}{2}\right) + 15\left(-\frac{2}{3}\right) \\
&= -3 - 10 \\
&= -13 \\
R.S. &= -13
\end{align*}
\]
\[L.S. = R.S.\]

The solution checks in both equations.

The solution is \(x = \frac{-1}{2}, y = \frac{-2}{3}\).
b) \[ 2x + 9y = -4 \]  \( \quad \)  \( \odot \)
\[ 5x - 2y = 39 \]  \( \quad \)  \( \Box \)
\[ 10x + 45y = -20 \]  \( 5 \times \odot \)
\[ 10x - 4y = 78 \]  \( 2 \times \Box \)
\[ 49y = -98 \]  \( 5 \times \odot - 2 \times \Box \)
\[ y = -2 \]
Substitute \( y = -2 \) into equation \( \odot \).
\[ 2x + 9y = -4 \]
\[ 2x + 9(-2) = -4 \]
\[ 2x - 18 = -4 \]
\[ 2x = 14 \]
\[ x = 7 \]
Check by substituting \( x = 7 \) and \( y = -2 \) into both original equations.
In \( 2x + 9y = -4 \):
\[ \text{L.S.} = 2x + 9y \]
\[ = 2(7) + 9(-2) \]
\[ = -4 \]
\[ \text{R.S.} = -4 \]
\[ \text{L.S. = R.S.} \]
In \( 5x - 2y = 39 \):
\[ \text{L.S.} = 5x - 2y \]
\[ = 5(7) - 2(-2) \]
\[ = 39 \]
\[ \text{R.S. = 39} \]
\[ \text{L.S. = R.S.} \]
The solution checks in both equations.

The solution is \( x = 7, y = -2 \).

c) \[ 3a - 2b + 4 = 0 \]  \( \odot \)
\[ 2a - 5b - 1 = 0 \]  \( \Box \)
\[ 6a - 4b + 8 = 0 \]  \( 2 \times \odot \)
\[ 6a - 15b - 3 = 0 \]  \( 3 \times \Box \)
\[ 11b + 11 = 0 \]  \( 2 \times \odot - 3 \times \Box \)
\[ 11b = -11 \]
\[ b = -1 \]
Substitute \( b = -1 \) into equation \( \odot \).
\[ 3a - 2b + 4 = 0 \]
\[ 3a - 2(-1) + 4 = 0 \]
\[ 3a = -6 \]
\[ a = -2 \]
Check by substituting \( a = -2 \) and \( b = -1 \) into both original equations.
In \( 3a - 2b + 4 = 0 \):
\[ \text{L.S.} = 3a - 2b + 4 \]
\[ = 3(-2) - 2(-1) + 4 \]
\[ = 0 \]
\[ \text{R.S. = 0} \]
\[ \text{L.S. = R.S.} \]
In \( 2a - 5b - 1 = 0 \):
\[ \text{L.S.} = 2a - 5b - 1 \]
\[ = 2(-2) - 5(-1) - 1 \]
\[ = 0 \]
\[ \text{R.S. = 0} \]
\[ \text{L.S. = R.S.} \]
The solution checks in both equations.

The solution is \( a = -2, b = -1 \).
d) \(2u + 5v = 46\)  
\(3u - 2v = 12\)

\[
\begin{align*}
4u + 10v &= 92 \\
15u - 10v &= 60
\end{align*}
\]

\[
\begin{align*}
2 \times (1) \\
5 \times (2)
\end{align*}
\]

\[
19u = 152 
\]

\[
2 \times (1) + 5 \times (2)
\]

\[
u = 8
\]

Substitute \(u = 8\) into equation (1).

\[
2u + 5v = 46
\]

\[
2(8) + 5v = 46
\]

\[
16 + 5v = 46
\]

\[
5v = 30
\]

\[
v = 6
\]

Check by substituting \(u = 8\) and \(v = 6\) into both original equations.

In \(2u + 5v = 46\):

\[
\text{L.S.} = 2u + 5v \\
\text{R.S.} = 46
\]

\[
= 2(8) + 5(6) \\
= 46
\]

\[
\text{L.S.} = \text{R.S.}
\]

In \(3u - 2v = 12\):

\[
\text{L.S.} = 3u - 2v \\
\text{R.S.} = 12
\]

\[
= 3(8) - 2(6) \\
= 12
\]

\[
\text{L.S.} = \text{R.S.}
\]

The solution checks in both equations.

The solution is \(u = 8, v = 6\).
Chapter 1 Section 4  Question 8  Page 40
Let $g$ represent the number of gloves sold. Let $b$ represent the number of bats sold.

a) $g + b = 28$ \hspace{1cm} 
$29g + 14b = 647$ \hspace{1cm} 

$29g + 29b = 812$ \hspace{1cm} 29 \times ① \hspace{1cm}$

$29g + 14b = 647$ \hspace{1cm} ②

$15b = 165$ \hspace{1cm} 29 \times ① - ②

$b = 11$

Mehrab sold 11 bats.

b) Substitute $b = 11$ into equation ①.

$g + b = 28$

$g + 11 = 28$

$g = 17$

Mehrab sold 17 gloves.

Chapter 1 Section 4  Question 9  Page 40
Let $l$ represent the number of large bottles of water sold. Let $s$ represent the number of small bottles of water sold.

a) $l + s = 37$ \hspace{1cm} ①

$5l + 3s = 131$ \hspace{1cm} ②

$3l + 3s = 111$ \hspace{1cm} 3 \times ①

$5l + 3s = 131$ \hspace{1cm} ②

$-2l = -20$ \hspace{1cm} 3 \times ① - ②

$l = 10$

Liz sold 10 large bottles of water.

b) Substitute $l = 10$ into equation ①.

$l + s = 37$

$10 + s = 37$

$s = 27$

Liz sold 27 small bottles of water.
Chapter 1 Section 4       Question 10       Page 40

a) \[2x - 3y = 5 \quad \text{(1)}\]
\[4x + y = 8 \quad \text{(2)}\]

\[\begin{align*} 
2x - 3y &= 5 \quad \text{(1)} \\
12x + 3y &= 24 \quad 3 \times \text{(2)} \\
14x &= 29 \quad \text{(1)} + 3 \times \text{(2)} \\
x &= \frac{29}{14}
\end{align*}\]

Substitute \(x = \frac{29}{14}\) into equation (2).
\[4x + y = 8\]
\[4 \left( \frac{29}{14} \right) + y = 8\]
\[\frac{58}{7} + y = 8\]
\[y = \frac{56}{7} - \frac{58}{7}\]
\[y = -\frac{2}{7}\]

The solution is \(x = \frac{29}{14}, y = -\frac{2}{7}\).
b) Rearrange equation \( \mathbb{Q} \).

\[ 4x + y = 8 \]
\[ y = 8 - 4x \]

Substitute \( 8 - 4x \) for \( y \) into equation \( \mathbb{Q} \).

\[ 2x - 3y = 5 \]
\[ 2x - 3(8 - 4x) = 5 \]
\[ 2x - 24 + 12x = 5 \]
\[ 14x = 29 \]
\[ x = \frac{29}{14} \]

Substitute \( x = \frac{29}{14} \) into equation \( \mathbb{Q} \).

\[ 4x + y = 8 \]
\[ 4(\frac{29}{14}) + y = 8 \]
\[ \frac{58}{7} + y = 8 \]
\[ y = \frac{56 - 58}{7} \]
\[ y = -\frac{2}{7} \]

The solution is \( x = \frac{29}{14}, y = -\frac{2}{7} \).

e) Answers will vary.
Answers will vary. You could multiply the first equation by 4, the second equation by 3, and then, subtract the equations. Solve for $y$. Substitute this value of $y$ into the first equation, and then solve for $x$.

Chapter 1 Section 4 Question 12 Page 40

\[ a) 2(3x - 1) - (y + 4) = -7 \]  
\[ 4(1 - 2x) - 3(3 - y) = -12 \]

Simplify equation ①.
\[ 2(3x - 1) - (y + 4) = -7 \]
\[ 6x - 2 - y - 4 = -7 \]
\[ 6x - y = -1 \] ③

Simplify equation ②.
\[ 4(1 - 2x) - 3(3 - y) = -12 \]
\[ 4 - 8x - 9 + 3y = -12 \]
\[ -8x + 3y = -7 \] ④

\[ 18x - 3y = -3 \] ⑤
\[ -8x + 3y = -7 \] ⑥
\[ 10x = -10 \]
\[ x = -1 \]

Substitute $x = -1$ into equation ③.
\[ 6x - y = -1 \]
\[ 6(-1) - y = -1 \]
\[ -6 - y = 5 \]
\[ y = -5 \]

The solution is $x = -1, y = -5$. 
b) \(3(a - 1) - 3(b - 3) = 0\)  \(\text{(1)}\)
\(3(a + 2) - (b - 7) = 20\)  \(\text{(2)}\)

Simplify equation \(\text{(1)}\).
\(3(a - 1) - 3(b - 3) = 0\)
\(3a - 3b + 9 = 0\)
\(3a - 3b = -6\)  \(\text{(3)}\)

Simplify equation \(\text{(2)}\).
\(3(a + 2) - (b - 7) = 20\)
\(3a + 6 - b + 7 = 20\)
\(3a - b = 7\)  \(\text{(4)}\)

\(3a - 3b = -6\)  \(\text{(3)}\)
\(3a - b = 7\)  \(\text{(4)}\)
\(-2b = -13\)  \(\text{\(\text{(3)}\) – \(\text{(4)}\)}\)
\(b = 6.5\)

Substitute \(b = 6.5\) into equation \(\text{(4)}\).
\(3a - b = 7\)
\(3a - 6.5 = 7\)
\(3a = 13.5\)
\(a = 4.5\)

The solution is \(a = 4.5, b = 6.5\).

c) \(5(k + 5) - 2(n - 3) = 62\)  \(\text{(1)}\)
\(4(k - 7) - (n + 4) = -9\)  \(\text{(2)}\)

Simplify equation \(\text{(1)}\).
\(5(k + 5) - 2(n - 3) = 62\)
\(5k + 25 - 2n + 6 = 62\)
\(5k - 2n = 31\)  \(\text{(3)}\)

Simplify equation \(\text{(2)}\).
\(4(k - 7) - (n + 4) = -9\)
\(4k - 28 - n - 4 = -9\)
\(4k - n = 23\)  \(\text{(4)}\)

\(5k - 2n = 31\)  \(\text{(3)}\)
\(8k - 2n = 46\)  \(\text{\(\times \text{(3)}\)}\)
\(-3k = -15\)  \(\text{\(\text{\(\text{(3)}\) – \(\times \text{(4)}\)}\)}\)
\(k = 5\)

Substitute \(k = 5\) into equation \(\text{(4)}\).
\(4k - n = 23\)
\(4(5) - n = 23\)
\(20 - n = 23\)
\(-n = 3\)
\(n = -3\)

The solution is \(k = 5, n = -3\).
Chapter 1 Section 4       Question 13       Page 41

Brent multiplied each equation by 10 to write equivalent equations without decimals to make them easier to manipulate.

\[3x - 5y = 12 \quad \text{①}\]
\[7x - 2y = -1 \quad \text{②}\]

\[6x - 10y = 24 \quad 2 \times \text{①}\]
\[35x - 10y = -5 \quad 5 \times \text{②}\]
\[-29x = 29 \quad 2 \times \text{①} - 5 \times \text{②}\]
\[x = -1\]

Substitute \(x = -1\) into equation ①.
\[3x - 5y = 12\]
\[3(-1) - 5y = 12\]
\[-3 - 5y = 12\]
\[-5y = 15\]
\[y = -3\]

The solution is \(x = -1, y = -3\).

Chapter 1 Section 4       Question 14       Page 41

a) Multiply each equation by 10.
\[2x - 3y = 13 \quad \text{①}\]
\[5x + 2y = 23 \quad \text{②}\]

\[4x - 6y = 26 \quad 2 \times \text{①}\]
\[15x + 6y = 69 \quad 3 \times \text{②}\]
\[19x = 95 \quad 2 \times \text{①} + 3 \times \text{②}\]
\[x = 5\]

Substitute \(x = 5\) into equation ①.
\[2x - 3y = 13\]
\[2(5) - 3y = 13\]
\[10 - 3y = 13\]
\[-3y = 3\]
\[y = -1\]

The solution is \(x = 5, y = -1\).
b) Multiply each equation by 10.
\[ a - 4b = 19 \]  \( \text{\textcircled{1}} \)
\[ 4a + 5b = -8 \]  \( \text{\textcircled{2}} \)

\[ 4a - 16b = 76 \] \( 4 \times \text{\textcircled{1}} \)
\[ 4a + 5b = -8 \] \( \text{\textcircled{2}} \)

\[ -21b = 84 \] \( 4 \times \text{\textcircled{1}} - \text{\textcircled{2}} \)

\[ b = -4 \]

Substitute \( b = -4 \) into equation \( \text{\textcircled{1}} \).
\[ a - 4(-4) = 19 \]
\[ a + 16 = 19 \]
\[ a = 3 \]

The solution is \( a = 3, \ b = -4 \).

Chapter 1 Section 4 Question 15 Page 41

Let \( b \) represent the number of roast beef sandwiches purchased. Let \( v \) represent the number of vegetarian sandwich purchased.

\[ 5b + 3v = 27.5 \] \( \text{\textcircled{1}} \)
\[ 2b + 6v = 23 \] \( \text{\textcircled{2}} \)

\[ 10b + 6v = 55 \] \( 2 \times \text{\textcircled{1}} \)
\[ 2b + 6v = 23 \] \( \text{\textcircled{2}} \)

\[ 8b = 32 \] \( 2 \times \text{\textcircled{1}} - \text{\textcircled{2}} \)

\[ b = 4 \]

A roast beef sandwich costs $4.

Chapter 1 Section 4 Question 16 Page 41

Let \( d \) represent the cost per day for a rental car. Let \( k \) represent the cost per kilometre driven.

a) \[ 3d + 150k = 180 \] \( \text{\textcircled{1}} \)
\[ 2d + 400k = 180 \] \( \text{\textcircled{2}} \)

\[ 6d + 300k = 360 \] \( 2 \times \text{\textcircled{1}} \)
\[ 6d + 1200k = 540 \] \( 3 \times \text{\textcircled{2}} \)

\[ -900k = -180 \] \( 2 \times \text{\textcircled{1}} - 3 \times \text{\textcircled{2}} \)

\[ k = 0.2 \]

Substitute \( k = 0.2 \) into equation \( \text{\textcircled{1}} \).
\[ 3d + 150(0.2) = 180 \]
\[ 3d + 30 = 180 \]
\[ 3d = 150 \]
\[ d = 50 \]

The cost per day was $50.

b) The cost per kilometre was $0.20.
Chapter 1 Section 4      Question 17    Page 41

Let $C$ represent the cost to rent a car for a week. Let $d$ represent the number of kilometres driven.

a) $C = 250 + 0.22d$  

b) $C = 96 + 0.50d$

c) $C = 250 + 0.22d$  

\[
\begin{align*}
C &= 96 + 0.50d \\
0 &= 154 - 0.28d \\
0.28d &= 154 \\
d &= 550
\end{align*}
\]

The cars will cost the same if the Clarkes drive 550 km.

d) If the Clarkes plan to drive only 500 km, the daughter's suggestion is less expensive.

Chapter 1 Section 4      Question 18    Page 41

\[
\begin{align*}
2x + 3y &= 6 \\
6x + 9y &= 0 \\
6x + 9y &= 18 \\
6x + 9y &= 0 \\
0 &= 18
\end{align*}
\]

This is not possible. There is no solution.

The lines are parallel.

Chapter 1 Section 4      Question 19    Page 41

Solutions for Achievement Checks are shown in the Teacher Resource.
Chapter 1 Section 4   Question 20   Page 41

a) \( \frac{1}{2} m + n = -4 \)  \( \text{①} \)

\[ \frac{m}{2} - \frac{3n}{2} = 1 \]  \( \text{②} \)

\[ m + 2n = -8 \]  \( 2 \times \text{①} \)

\[ m - 3n = 2 \]  \( 2 \times \text{②} \)

\[ 5n = -10 \]  \( 2 \times \text{①} - 2 \times \text{②} \)

\[ n = -2 \]

Substitute \( n = -2 \) into equation ①.

\[ \frac{1}{2} m + n = -4 \]

\[ \frac{1}{2} m + ( -2 ) = -4 \]

\[ \frac{1}{2} m = -2 \]

\[ m = -4 \]

The solution is \( m = -4, n = -2 \).

b) \( \frac{4a}{3} - \frac{b}{4} = 6 \)  \( \text{①} \)

\[ \frac{5a}{6} + b = 13 \]  \( \text{②} \)

\[ 32a - 6b = 144 \]  \( 24 \times \text{①} \)

\[ 5a + 6b = 78 \]  \( 6 \times \text{②} \)

\[ 37a = 222 \]  \( 24 \times \text{①} + 6 \times \text{②} \)

\[ a = 6 \]

Substitute \( a = 6 \) into equation ②.

\[ \frac{5a}{6} + b = 13 \]

\[ \frac{5(6)}{6} + b = 13 \]

\[ 5 + b = 13 \]

\[ b = 8 \]

The solution is \( a = 6, b = 8 \).
c) \[
\frac{t - 5}{3} + \frac{w + 1}{2} = 1 \tag{1}
\]

\[
\frac{t - 1}{5} + \frac{w + 2}{3} = 2 \tag{2}
\]
Multiply equation (1) by 6 and simplify.

\[
2(t - 5) + 3(w + 1) = 6
\]

\[
2t - 10 + 3w + 3 = 6
\]

\[
2t + 3w = 13 \tag{3}
\]

Multiply equation (2) by 15 and simplify.

\[
3(t - 1) + 5(w + 2) = 30
\]

\[
3t - 3 + 5w + 10 = 30
\]

\[
3t + 5w = 23 \tag{4}
\]

\[
6t + 9w = 39 \quad 3 \times \tag{3}
\]

\[
6t + 10w = 46 \quad 2 \times \tag{4}
\]

\[
-w = -7 \quad 3 \times (3) - 2 \times (4)
\]

\[
w = 7
\]
Substitute \( w = 7 \) into equation (3).

\[
2t - 3w = 13
\]

\[
2t + 3(7) = 13
\]

\[
2t + 21 = 13
\]

\[
2t = -8
\]

\[
t = -4
\]
The solution is \( t = -4, w = 7 \).

---

**Chapter 1 Section 4**

**Question 21**

\[
ax + by = c \tag{1}
\]

\[
dx + ey = f \tag{2}
\]

\[
aex + bey = ce \quad e \times \tag{1}
\]

\[
bdx + bey = bf \quad b \times \tag{2}
\]

\[
aex - bdx = ce - bf \quad e \times (1) - b \times (2)
\]

\[
x = \frac{ce - bf}{ae - bd}
\]

\[
adx + bdy = cd \quad d \times \tag{1}
\]

\[
adx + aey = af \quad a \times \tag{2}
\]

\[
bdy - aey = cd - af \quad d \times (1) - a \times (2)
\]

\[
y = \frac{cd - af}{bd - ae}
\]
The solution is \((x, y) = \left( \frac{ce - bf}{ae - bd}, \frac{cd - af}{bd - ae} \right)\), where \( ae \neq bd \).
Chapter 1 Section 4       Question 22    Page 41

\[ x + 3y - z = -14 \]  \hspace{4mm} ①
\[ 7x + 6y + z = 1 \]  \hspace{4mm} ②
\[ 4x - 2y - 5z = 11 \]  \hspace{4mm} ③

First, eliminate \( z \) from two pairs of equations. Number the new equations ④ and ⑤.

\[ x + 3y - z = -14 \]  \hspace{4mm} ①
\[ 7x + 6y + z = 1 \]  \hspace{4mm} ②
\[ 8x + 9y = -13 \]  \hspace{4mm} ① + ② = ④

\[ 35x + 30y + 5z = 5 \]  \hspace{4mm} ⑤
\[ 4x - 2y - 5z = 11 \]  \hspace{4mm} ③
\[ 39x + 28y = 16 \]  \hspace{4mm} 5 × ② + ③ = ⑥

\[ 312x + 351y = -507 \]  \hspace{4mm} 39 × ④
\[ 312x + 224y = 128 \]  \hspace{4mm} 8 × ⑥
\[ -127y = 635 \]  \hspace{4mm} 39 × ④ - 8 × ⑥
\[ y = -5 \]

Substitute \( y = -5 \) into equation ⑥.
\[ 8x + 9(-5) = -13 \]
\[ 8x - 45 = -13 \]
\[ 8x = 32 \]
\[ x = 4 \]

Substitute \( x = 4 \) and \( y = -5 \) into equation ①.
\[ x + 3y - z = -14 \]
\[ 4 + 3(-5) - z = -14 \]
\[ 4 - 15 - z = -14 \]
\[ -z = -3 \]
\[ z = 3 \]

The solution is \( x = 4, y = -5, z = 3 \).
Chapter 1 Section 5  Solve Problems Using Linear Systems

Chapter 1 Section 5  Question 1  Page 46

Let \( c \) represent the number of crocus bulbs to be planted. Let \( t \) represent the number of tulip bulbs to be planted.

\[ c + t = 32 \quad (1) \]
\[ c = 3t \quad (2) \]

Substitute \( 3t \) for \( c \) in equation \( 1 \).

\[ c + t = 32 \]
\[ 3t + t = 32 \]
\[ 4t = 32 \]
\[ t = 8 \]

Substitute \( t = 8 \) into equation \( 2 \).

\[ c = 3t \]
\[ = 3(8) \]
\[ = 24 \]

Leanne should plant 24 crocus bulbs and 8 tulip bulbs.

Chapter 1 Section 5  Question 2  Page 46

Let \( b \) represent the number of Beta tapes that James has. Let \( v \) represent the number of VHS tapes that James has.

\[ b + v = 17 \quad (1) \]
\[ b = v + 3 \quad (2) \]

Substitute \( v + 3 \) for \( b \) in equation \( 1 \).

\[ b + v = 17 \]
\[ v + 3 + v = 17 \]
\[ 2v = 14 \]
\[ v = 7 \]

Substitute \( v = 7 \) into equation \( 2 \).

\[ b = v + 3 \]
\[ = 7 + 3 \]
\[ = 10 \]

James has 10 Beta tapes and 7 VHS tapes.
Chapter 1 Section 5  Question 3  Page 46

Let $c$ represent the number of cars washed. Let $v$ represent the number of vans washed.

$\begin{align*}
c + v &= 44 \quad (1) \\
5c + 8v &= 262 \quad (2)
\end{align*}$

Rearrange equation \((1)\).

$\begin{align*}
c &= 44 - v \\
\text{Substitute } 44 - v \text{ for } c \text{ in equation } (2).
\end{align*}$

$\begin{align*}
5(44 - v) + 8v &= 262 \\
220 - 5v + 8v &= 262 \\
3v &= 42 \\
v &= 14
\end{align*}$

Substitute $v = 14$ into equation \((1)\).

$\begin{align*}
c + v &= 44 \\
c + 14 &= 44 \\
c &= 30
\end{align*}$

The team washed 30 cars and 14 vans.

Chapter 1 Section 5  Question 4  Page 46

Let $x$ represent the amount invested at 8%/year and $y$ represent the amount invested at 7.5%/year.

$\begin{align*}
y &= 3050 - x \quad (1) \\
0.08x + 0.075y &= 242 \quad (2)
\end{align*}$

Substitute $3050 - x$ for $y$ in equation \((2)\).

$\begin{align*}
0.08x + 0.075(3050 - x) &= 242 \\
0.08x + 228.75 - 0.075x &= 242 \\
0.005x &= 13.25 \\
x &= 2650
\end{align*}$

Substitute $x = 2650$ into equation \((1)\).

$\begin{align*}
y &= 3050 - x \\
&= 3050 - 2650 \\
&= 400
\end{align*}$

Rehman invested $2650 at 8%/year and $400 at 7.5%/year.

Chapter 1 Section 5  Question 5  Page 46

Answers will vary.

The numbers in questions 1 and 2 are smaller, and it is easier to isolate one variable in both equations.
Chapter 1 Section 5      Question 6    Page 46

Answers will vary. Sample solutions are shown.

a) Use elimination.

\[ 3x - y = 8 \quad (1) \]
\[ 4x - y = -15 \quad (2) \]
\[ -x = 23 \quad (1) - (2) \]

\[ x = -23 \]

Substitute \( x = -23 \) into equation \( (1) \).

\[ 3x - y = 8 \]
\[ 3(-23) - y = 8 \]
\[ -69 - y = 8 \]
\[ -y = 77 \]
\[ y = -77 \]

The solution is \((-23, -77)\).

b) 3\( x \) – \( y \) = 8  \( (1) \)
4\( x \) – \( y \) = -15 \( (2) \)

Use substitution. Rearrange equation \( (1) \).

\[ 3x - y = 8 \]
\[ y = 3x - 8 \]

Substitute \( 3x - 8 \) for \( y \) in equation \( (2) \).

\[ 4x - y = -15 \]
\[ 4x - (3x - 8) = -15 \]
\[ 4x - 3x + 8 = -15 \]
\[ x = -23 \]

Substitute \( x = -23 \) into equation \( (1) \).

\[ 3x - y = 8 \]
\[ 3(-23) - y = 8 \]
\[ -69 - y = 8 \]
\[ -y = 77 \]
\[ y = -77 \]

The solution is \((-23, -77)\).
Chapter 1 Section 5  Question 7  Page 46

Let \( r \) represent Tyler’s average rowing speed, in kilometres per hour. Let \( c \) represent the speed of the current, in kilometres per hour.

\[
10 = (r + c)^2 \quad \text{①} \\
8 = (r - c)^4 \quad \text{②}
\]

Simplify the equations by dividing equation ① by 2 and equation ② by 4.

\[
5 = r + c \\
\frac{1}{2} = r - c \\
7 = 2r \\

r = 3.5
\]

Substitute \( r = 3.5 \) into equation ①.

\[
10 = (3.5 + c)^2 \\
10 = 7 + 2c \\
3 = 2c \\

c = 1.5
\]

Tyler's average rowing speed is 3.5 km/h, and the speed of the current is 1.5 km/h.

Chapter 1 Section 5  Question 8  Page 46

Let \( p \) represent the plane’s average speed, in kilometres per hour. Let \( w \) represent the speed of the wind, in kilometres per hour.

\[
3000 = (p + w)^5 \quad \text{①} \\
3000 = (p - w)^6 \quad \text{②}
\]

Simplify the equations by dividing equation ① by 5 and equation ② by 6.

\[
600 = p + w \\
500 = p - w \\
1100 = 2p \\
p = 550
\]

Substitute \( p = 550 \) into equation ①.

\[
3000 = (550 + w)^5 \\
3000 = (550 + w) \times 5 \\
3000 = 2750 + 5w \\
250 = 5w \\
w = 50
\]

The speed of the plane was 550 km/h, and the speed of the wind was 50 km/h.
Chapter 1 Section 5       Question 9       Page 46

Let \( m \) represent the amount of 3% milk in 6% cream. Let \( c \) represent the amount of 15% cream in 6% cream.

\[
\begin{align*}
    m + c &= 20 \quad \text{(1)} \\
    0.03m + 0.15c &= 1.2 \quad \text{(2)}
\end{align*}
\]

Rearrange equation \( \text{(1)} \): \( c = 20 - m \)
Substitute into equation \( \text{(2)} \).

\[
\begin{align*}
    0.03m + 0.15(20 - m) &= 1.2 \\
    0.6 - 0.03c + 0.15c &= 1.2 \\
    0.12c &= 0.6 \\
    c &= 5
\end{align*}
\]

Substitute \( c = 5 \) into equation \( \text{(1)} \).

\[
\begin{align*}
    m + 5 &= 20 \\
    m &= 15
\end{align*}
\]

You need 15 L of 3% milk and 5 L of 15% cream.

Chapter 1 Section 5       Question 10       Page 46

Let \( w \) represent the amount of 30% sulphuric acid solution in 42% sulphuric acid solution. Let \( s \) represent the amount of 60% sulphuric acid solution in 42% sulphuric acid solution.

\[
\begin{align*}
    w + s &= 10 \quad \text{(1)} \\
    0.30w + 0.60s &= 4.2 \quad \text{(2)}
\end{align*}
\]

Rearrange equation \( \text{(1)} \): \( s = 10 - w \)
Substitute into equation \( \text{(2)} \).

\[
\begin{align*}
    0.30w + 0.60(10 - w) &= 4.2 \\
    0.30w + 6 - 0.60w &= 4.2 \\
    -0.30w &= -1.8 \\
    w &= 6
\end{align*}
\]

Substitute \( w = 6 \) into equation \( \text{(1)} \).

\[
\begin{align*}
    w + s &= 10 \\
    6 + s &= 10 \\
    s &= 4
\end{align*}
\]

Amy needs 6 L of 30% acid and 4 L of 60% acid.
Chapter 1 Section 5  Question 11  Page 46

Let \( c \) represent the cost of joining a karate club. Let \( m \) represent the number of months of a membership.

a) \( C = 200 + 25m \)  \( \text{①} \)
\( C = 100 + 35m \)  \( \text{②} \)

Substitute \( 200 + 25m \) for \( C \) in equation \( \text{②} \).

\[
C = 100 + 35m
\]
\[
200 + 25m = 100 + 35m
\]
\[
100 = 10m
\]
\[
m = 10
\]

The cost is the same at 10 months.

b) Kool Karate is cheaper for a 6-month membership.

c) Karate Klub is cheaper for a 1-year membership.

Chapter 1 Section 5  Question 12  Page 46

Let \( l \) represent the number of large T-shirts ordered. Let \( m \) represent the number of medium T-shirts ordered.

\[
l + m = 70 \quad \text{①}
\]
\[
5l + 4m = 320 \quad \text{②}
\]

Rearrange equation \( \text{①} \): \( l = 70 - m \)

Substitute into equation \( \text{②} \).

\[
5l + 4m = 320
\]
\[
5(70 - m) + 4m = 320
\]
\[
350 - 5m + 4m = 320
\]
\[
-m = -30
\]
\[
m = 30
\]

30 of the shirts are medium shirts.
Let $x$ represent the mass of granola with 30% nuts required, and let $y$ represent the mass of granola with 15% nuts required.

$x + y = 600$ \hspace{1cm} (1)

$0.30x + 0.15y = 126$ \hspace{1cm} (2)

Rearrange equation (1): $y = 600 - x$

Substitute into equation (2).

$0.30x + 0.15(600 - x) = 126$

$0.30x + 90 - 0.15x = 126$

$0.15x = 36$

$x = 240$

Substitute $x = 240$ into equation (1).

$x + y = 600$

$240 + y = 600$

$y = 360$

You need 240 g of the granola with 30% nuts, and 360 g of the granola with 15% nuts.

Let $x$ represent the mass of alloy with 25% copper needed, and $y$ represent the mass of alloy with 50% copper needed.

$x + y = 500$ \hspace{1cm} (1)

$0.25x + 0.50y = 225$ \hspace{1cm} (2)

Rearrange equation (1): $y = 500 - x$

Substitute into equation (2).

$0.25x + 0.50(500 - x) = 225$

$0.25x + 250 - 0.50x = 225$

$-0.25x = -25$

$x = 100$

Substitute $x = 100$ into equation (1).

$x + y = 500$

$100 + y = 500$

$y = 400$

You need 100 g of the alloy with 25% copper, and 400 g of the alloy with 50% copper.
Chapter 1 Section 5  Question 15  Page 46

Let $f$ represent the number of fruit pies sold. Let $m$ represent the number of meat pies sold.

$f + m = 52 \quad \text{(1)}$  
$7f + 10m = 424 \quad \text{(2)}$

Rearrange equation (1): $m = 52 - f$

Substitute into equation (2).

$7f + 10(52 - f) = 424$

$7f + 520 - 10f = 424$

$-3f = -96$

$f = 32$

Substitute $f = 32$ into equation (1).

$f + m = 52$

$32 + m = 52$

$m = 20$

The students sold 32 fruit pies and 20 meat pies.

Chapter 1 Section 5  Question 16  Page 46

Let $m$ represent the cost per meal for a 9-day trip. Let $a$ represent the cost per day for accommodations for a 9-day trip.

$18m + 9a = 630 \quad \text{(1)}$

$27m + 9a = 720 \quad \text{(2)}$

$-9m = -90 \quad \text{(1)} - \text{(2)}$

$m = 10$

Substitute $m = 10$ into equation (1).

$18m + 9a = 630$

$18(10) + 9a = 630$

$180 + 9a = 630$

$9a = 450$

$a = 50$

Accommodation is $50 per day, and meals are $10 each.
Chapter 1 Section 5  Question 17  Page 46

Let $b$ represent the best cruise speed for Ian’s plane. Let $e$ represent the economy cruise speed for Ian’s plane.

\[ 2b + 3e = 850 \quad \text{①} \]
\[ 3b + 2e = 900 \quad \text{②} \]

\begin{align*}
4b + 6e &= 1700 \quad 2 \times ① \\
9b + 6e &= 2700 \quad 3 \times ② \\
-5b &= -1000 \quad 2 \times ① - 3 \times ② \\
b &= 200
\end{align*}

Substitute $b = 200$ into equation ①.

\[ 2b + 3e = 850 \]

\[ 2(200) + 3e = 850 \]

\[ 400 + 3e = 850 \]

\[ 3e = 450 \]

\[ e = 150 \]

The best cruise speed is 200 km/h, and economy cruise speed is 150 km/h.

Chapter 1 Section 5  Question 18  Page 46

Let $t$ represent the speed of the Toronto train. Let $m$ represent the speed of Montréal train.

\[ m = t + 50 \quad \text{①} \]
\[ 2m + 2t = 500 \quad \text{②} \]

Substitute $t + 50$ for $m$ in equation ②.

\[ 2m + 2t = 500 \]

\[ 2(t + 50) + 2t = 500 \]

\[ 2t + 100 + 2t = 500 \]

\[ 4t = 400 \]

\[ t = 100 \]

Substitute $t = 100$ into equation ①.

\[ m = t + 50 \]

\[ = 100 + 50 \]

\[ = 150 \]

The Toronto train is travelling at 100 km/h. It has travelled $100 \times 2$, or 200 km when it passes the Montréal train.
Let $x$ represent the mass of 18-karat gold required, and $y$ represent the mass of 9-karat gold required.

\[ x + y = 600 \quad \text{(1)} \]

\[
\frac{18}{24} x + \frac{9}{24} y = 9000 \quad \text{(2)}
\]

Rearrange equation (1): $y = 600 - x$

Simplify equation (2) by multiplying by 24. Then, substitute $600 - x$ for $y$.

\[
18x + 9y = 9000
\]

\[
18x + 9(600 - x) = 9000
\]

\[
18x + 5400 - 9x = 9000
\]

\[
9x = 3600
\]

\[
x = 400
\]

Substitute $x = 400$ into equation (1).

\[
x + y = 600
\]

\[
400 + y = 400
\]

\[
y = 200
\]

Sam should use 400 g of 18-karat gold and 200 g of 9-karat gold.

Let $x$ represent the volume of 15% hydrochloric acid used, and let $y$ represent the volume of 90% hydrochloric acid used to make 20 L of 60% hydrochloric acid.

\[ x + y = 20 \quad \text{(1)} \]

\[
0.15x + 0.90y = 12 \quad \text{(2)}
\]

Rearrange equation (1): $y = 20 - x$

Substitute into equation (2).

\[
0.15x + 0.90\left(20 - x\right) = 12
\]

\[
0.15x + 18 - 0.90x = 12
\]

\[
-0.75x = -6
\]

\[
x = 8
\]

Substitute $x = 8$ into equation (1).

\[
x + y = 20
\]

\[
8 + y = 20
\]

\[
y = 12
\]

12 L have been removed from the 30 L of 90% hydrochloric acid, to be replaced by 5 L of 60% hydrochloric acid.

The amount of pure acid in the bottle is $0.90 \times 18 + 0.60 \times 5$, or 19.2 L, in a total volume of $18 + 5$, or 23 L.

The concentration is $\frac{19.2}{23}$, or about 83.5%.
Chapter 1 Review

Chapter 1 Review Question 1 Page 48

a) Let \( n \) represent the number of nickels, and \( d \) represent the number of dimes. The equation is \( 0.05n + 0.10d = 2.50 \).

b) Let \( M \) represent Maggie's age, and \( J \) represent Janice's age. The equation is \( M + 3 = 2J - 9 \).

c) Let \( n \) represent the number. The equation is \( 2n - 9 = \frac{1}{2}n + 6 \).

Chapter 1 Review Question 2 Page 48

The point of intersection is (4, –3).
Let $C$ represent the cost of the wedding anniversary dinner. Let $n$ represent the number of guests.

a) $C = 1500 + 25n$

b) $C = 1000 + 30n$

c) The cost is the same when there are 100 guests.

d) Allison should choose La Casa if she expects more than 100 guests. It will cost less.

e) Allison should choose Hastings Hall if she expects fewer than 100 guests. It will cost less.

Chapter 1 Review Question 4 Page 48

a) $x + y = -2$  \( \odot \)

$y = x + 6$  \( \odot \)

Substitute $x + 6$ for $y$ in equation \( \odot \).

$x + y = -2$

$x + x + 6 = -2$

$2x + 6 = -2$

$2x = -8$

$x = -4$

Substitute $x = -4$ into equation \( \odot \).

$y = x + 6$

$= -4 + 6$

$= 2$

The solution is $x = -4, y = 2$. 
b) \( x - y = -2 \) ①
\( y = -x + 3 \) ②
Substitute \(-x + 3\) for \(y\) in equation ①.
\( x - y = 9 \)
\( x - (-x + 3) = 9 \)
\( x + x - 3 = 9 \)
\( 2x = 12 \)
\( x = 6 \)
Substitute \(x = -4\) into equation ②.
\( y = -x + 3 \)
\( = -6 + 3 \)
\( = -3 \)
The solution is \(x = 6, y = -3\).

c) \( y = -2x + 2 \) ①
\( 3x + 2y = 5 \) ②
Substitute \(-2x + 2\) for \(y\) in equation ②.
\( 3x + 2y = 5 \)
\( 3x + 2(-2x + 2) = 5 \)
\( 3x - 4x + 4 = 5 \)
\( -x = 1 \)
\( x = -1 \)
Substitute \(x = -1\) into equation ①.
\( y = -2x + 2 \)
\( = -2(-1) + 2 \)
\( = 4 \)
The solution is \(x = -1, y = 4\).

d) \( 2x - 3y = 6 \) ①
\( 2x - y = 7 \) ②
Rearrange equation ②: \( y = 2x - 7 \)
Substitute into equation ①.
\( 2x - 3y = 6 \)
\( 2x - 3(2x - 7) = 6 \)
\( 2x - 6x + 21 = 6 \)
\( -4x = -15 \)
\( x = 3.75 \)
Substitute \(x = 3.75\) into equation ②.
\( 2x - y = 7 \)
\( 2(3.75) - y = 7 \)
\( 7.5 - y = 7 \)
\( -y = -0.5 \)
\( y = 0.5 \)
The solution is \(x = 3.75, y = 0.5\).
Chapter 1 Review       Question 5    Page 48

Let \( x \) represent the number of chickens, and \( y \) represent the number of cows.
\[
2x + 4y = 118 \quad \text{①} \\
y = 50 - x \quad \text{②}
\]
Substitute 50 – \( x \) for \( y \) in equation ①.
\[
2x + 4(50 - x) = 118 \\
2x + 200 - 4x = 118 \\
-2x = -82 \\
x = 41
\]

There are 41 chickens.

Chapter 1 Review       Question 6    Page 48

Let \( C \) represent the charge for Internet access. Let \( h \) represent the number of hours of use.
\[
C = 34.95 \quad \text{①} \\
C = 25 + 0.33h \quad \text{②}
\]
Substitute 34.95 for \( C \) in equation ②.
\[
34.95 = 25 + 0.33h \\
9.95 = 0.33h \\
h \geq 30
\]

Josie should choose the flat rate if she anticipates using the Internet for more than 30 h per month.

Chapter 1 Review       Question 7    Page 48

\[
m + f = 35 \quad \text{①} \\
m = f + 7 \quad \text{②}
\]
Substitute \( f + 7 \) for \( m \) in equation ①.
\[
m + f = 35 \\
f + 7 + f = 35 \\
2f = 28 \\
f = 14
\]
Substitute \( f = 14 \) into equation ②.
\[
m = f + 7 \\
= 14 + 7 \\
= 21
\]

There are 21 males and 14 females in the room.

Chapter 1 Review       Question 8    Page 48

\( B \) is not an equivalent equation for \( 9x - 3y = 18 \). There are no operations that result in conversion to this form.
Chapter 1 Review

Question 9

a) \( x - y = 3 \)
\( 2x + y = 3 \)
\( 3x = 6 \)

\( x = 2 \)

Substitute \( x = 2 \) into equation ①.

\( x - y = 3 \)
\( 2 - y = 3 \)
\( -y = 1 \)
\( y = -1 \)

The point of intersection is (2, -1).

b) \( 3x + 2y = 5 \)
\( x - 2y = -1 \)

\( 4x = 4 \)

\( x = 1 \)

Substitute \( x = 1 \) into equation ②.

\( x - 2y = -1 \)
\( 1 - 2y = -1 \)
\( -2y = -2 \)
\( y = 1 \)

The point of intersection is (1, 1).

c) \( 2x + 5y = 3 \)
\( 2x - y = -3 \)

\( 6y = 6 \)

\( y = 1 \)

Substitute \( y = 1 \) into equation ②.

\( 2x - y = -3 \)
\( 2x - 1 = -3 \)
\( 2x = -2 \)
\( x = -1 \)

The point of intersection is (−1, 1).
d) \(2x + y = 7\) \hspace{1cm} ①
\[
x - y = -1 \hspace{1cm} ②
\]
\[3x = 6 \hspace{1cm} ① + ②\]
\[x = 2\]
Substitute \(x = 2\) into equation ②.
\[x - y = -1\]
\[2 - y = -1\]
\[-y = -3\]
\[y = 3\]
The point of intersection is \((2, 3)\).

**Chapter 1 Review**

**Question 10**

**Page 48**

a) \(3x + 2y = 12\) \hspace{1cm} ①
\[2x + 3y = 13 \hspace{1cm} ②\]
\[
6x + 4y = 24 \hspace{1cm} 2 \times ①\]
\[
6x + 9y = 39 \hspace{1cm} 3 \times ②\]
\[-5y = -15 \hspace{1cm} 2 \times ① - 3 \times ②\]
\[y = 3\]
Substitute \(y = 3\) into equation ②.
\[2x + 3(3) = 13\]
\[2x + 9 = 13\]
\[2x = 4\]
\[x = 2\]
Check by substituting \(x = 2\) and \(y = 3\) into both original equations.
In \(3x + 2y = 12\): \hspace{1cm} In \(2x + 3y = 13\):
\[
\text{L.S.} = 3x + 2y \hspace{1cm} \text{R.S.} = 12 \hspace{1cm} \text{L.S.} = 2x + 3y \hspace{1cm} \text{R.S.} = 13\]
\[= 3(2) + 2(3) \hspace{1cm} = 2(2) + 3(3)\]
\[= 12 \hspace{1cm} = 13\]
\[
\text{L.S.} = \text{R.S.} \hspace{1cm} \text{L.S.} = \text{R.S.}\]
The solution checks in both equations.

The solution is \(x = 2, y = 3\).
b) \(3x + 2y = 34 \quad \text{①}
\)
\[5x - 3y = -13 \quad \text{②}\]

\[
\begin{align*}
9x + 6y &= 102 \\
10x - 6y &= -26 \\
19x &= 76 \\
3 \times \text{①} + 2 \times \text{②} \\
\end{align*}
\]
\[x = 4\]

Substitute \(x = 4\) into equation ①.
\[
3x + 2y = 34
\]
\[3(4) + 2y = 34\]
\[12 + 2y = 34\]
\[2y = 22\]
\[y = 11\]

Check by substituting \(x = 4\) and \(y = 11\) into both original equations.
In \(3x + 2y = 34\):
\[\text{L.S.} = 3x + 2y \quad \text{R.S.} = 34\]
\[= 3(4) + 2(11) \quad = 34\]

\[\text{L.S.} = \text{R.S.}\]

In \(5x - 3y = -13\):
\[\text{L.S.} = 5x - 3y \quad \text{R.S.} = -13\]
\[= 5(4) - 3(11) \quad = -13\]

\[\text{L.S.} = \text{R.S.}\]

The solution checks in both equations.

The solution is \(x = 4, y = 11\).

c) \(5a + 2b = 5 \quad \text{①}\n\)
\[2a + 3b = 13 \quad \text{②}\]

\[
\begin{align*}
15a + 6b &= 15 \\
4a + 6b &= 26 \\
11a &= -11 \\
3 \times \text{①} - 2 \times \text{②} \\
a &= -1
\end{align*}
\]

Substitute \(a = -1\) into equation ②.
\[2a + 3b = 13\]
\[2(-1) + 3b = 13\]
\[-2 + 3b = 13\]
\[3b = 15\]
\[b = 5\]

Check by substituting \(a = -1\) and \(b = 5\) into both original equations.
In \(5a + 2b = 5\):
\[\text{L.S.} = 5a + 2b \quad \text{R.S.} = 5\]
\[= 5(-1) + 2(5) \quad = 5\]

\[\text{L.S.} = \text{R.S.}\]

In \(2a + 3b = 13\):
\[\text{L.S.} = 2a + 3b \quad \text{R.S.} = 13\]
\[= 2(-1) + 3(5) \quad = 13\]

\[\text{L.S.} = \text{R.S.}\]

The solution checks in both equations.

The solution is \(a = -1, b = 5\).
d) \(4k + 5h = -0.5\) \(\quad \odot\)

\(3k + 7h = 0.6\) \(\quad \Box\)

\[
\begin{align*}
12k + 15h &= -1.5 \quad 3 \times \odot \\
12k + 28h &= 2.4 \quad 4 \times \Box \\
-13h &= -3.9 \quad 3 \times \odot - 4 \times \Box \\
\end{align*}
\]

\(h = 0.3\)

Substitute \(h = 0.3\) into equation \(\odot\).

\(4k + 5h = -0.5\)

\(4k + 5(0.3) = -0.5\)

\(4k + 1.5 = -0.5\)

\(4k = -2.0\)

\(k = -0.5\)

Check by substituting \(h = 0.3\) and \(k = -0.5\) into both original equations.

In \(4k + 5h = -0.5\):

\[
\begin{align*}
\text{L.S.} &= 4k + 5h \\
&= 4(-0.5) + 5(0.3) \\
&= -0.5 \\
\end{align*}
\]

In \(3k + 7h = 0.6\):

\[
\begin{align*}
\text{L.S.} &= 3k + 7h \\
&= 3(-0.5) + 7(0.3) \\
&= 0.6 \\
\end{align*}
\]

\(\text{L.S.} = \text{R.S.}\)

The solution checks in both equations.

The solution is \(k = -0.5, h = 0.3\).
a) One variable is isolated in the second equation. Use substitution.

\[ x + y = 7 \]  \hspace{1cm}  (1)
\[ x = y + 3 \]  \hspace{1cm}  (2)

Substitute \( y + 3 \) for \( x \) in equation (1).

\[ x + y = 7 \]
\[ y + 3 + y = 7 \]
\[ 2y = 4 \]
\[ y = 2 \]

Substitute \( y = 2 \) into equation (2).

\[ x = y + 3 \]
\[ = 2 + 3 \]
\[ = 5 \]

The solution is \( x = 5, y = 2 \).

b) It is difficult to isolate one variable. Use elimination.

\[ 4x + 3y = -1.9 \]  \hspace{1cm}  (1)
\[ 2x - 7y = 3.3 \]  \hspace{1cm}  (2)

\[ 8x + 6y = -3.8 \]  \hspace{1cm}  \[ 2 \times \text{①} \]
\[ 8x - 28y = 13.2 \]  \hspace{1cm}  \[ 4 \times \text{②} \]
\[ 34y = -17 \]  \hspace{1cm}  \[ 2 \times \text{①} - 4 \times \text{②} \]
\[ y = -0.5 \]

Substitute \( y = -0.5 \) into equation (1).

\[ 4x + 3y = -1.9 \]
\[ 4x + 3(-0.5) = -1.9 \]
\[ 4x = 0.4 \]
\[ x = 0.1 \]

The solution is \( x = 0.1, y = -0.5 \).
c) It is easy to isolate the \( y \) in the second equation. Use substitution.

\[
5x - 4y + 13 = 0 \quad \text{①} \\
7x - y + 9 = 0 \quad \text{②}
\]

Rearrange equation ②: \( y = 7x + 9 \)

Substitute into equation ①.

\[
5x - 4(7x + 9) + 13 = 0 \\
5x - 28x - 36 + 13 = 0 \\
-23x = 23 \\
x = -1
\]

Substitute \( x = -1 \) into equation ②.

\[
7x - y + 9 = 0 \\
7(-1) - y + 9 = 0 \\
y = -2
\]

The solution is \( x = -1, y = 2 \).

d) The equations are complex. Use elimination.

\[
2(x - 1) - 3(y - 3) = 0 \quad \text{①} \\
3(x + 2) - (y - 7) = 20 \quad \text{②}
\]

Simplify equation ①.

\[
2(x - 1) - 3(y - 3) = 0 \\
2x - 2 - 3y + 9 = 0 \\
2x - 3y = -7 \quad \text{③}
\]

Simplify equation ②.

\[
3(x + 2) - (y - 7) = 20 \\
3x + 6 - y + 7 = 20 \\
3x - y = 7 \quad \text{④}
\]

\[
2x - 3y = -7 \quad \text{③} \\
9x - 3y = 21 \quad 3 \times \text{④} \\
-7x = -28 \quad \text{③} - 3 \times \text{④} \\
x = 4
\]

Substitute \( x = 4 \) into equation ④.

\[
3x - y = 7 \\
3(4) - y = 7 \\
y = 5
\]

The solution is \( x = 4, y = 5 \).
Chapter 1 Review   Question 13   Page 49

Let $C$ represent the taxi charge. Let $d$ represent the number of kilometres of the taxi ride.

a) $C = 5.00 + 0.35d$  \(\Box\)

$C = 3.50 + 0.50d$  \(\Box\)

Substitute $5.00 + 0.35d$ for $C$ in equation 2.

$C = 3.50 + 0.50d$

$5.00 + 0.35d = 3.50 + 0.50d$

$-0.15d = -1.50$

$d = 10$

The charge is the same for a distance of 10 km.

b) For distances greater than 10 km, company A is cheaper.

Chapter 1 Review   Question 14   Page 49

Let $x$ represent the amount invested at 5%/year, and $y$ represent the amount invested at 3.5%/year.

$y = 10000 - x$  \(\Box\)

$0.05x + 0.035y = 413$  \(\Box\)

Substitute $10000 - x$ for $y$ in equation 2.

$0.05x + 0.035y = 413$

$0.05x + 0.035(10000 - x) = 413$

$0.05x + 350 - 0.035x = 413$

$0.015x = 63$

$x = 4200$

Substitute $x = 4200$ into equation 3.

$y = 10000 - x$

$= 10000 - 4200$

$= 5800$

Mengxi invested $4200 at 5%/year, and $5800 at 3.5%/year.
Chapter 1 Review       Question 15    Page 49

Let \( b \) represent the average speed of the boat, in kilometres per hour. Let \( r \) represent the speed of the current, in kilometres per hour.

\[
60 = (b - r)5 \quad \text{①} \\
60 = (b + r)3 \quad \text{②}
\]

Simplify the equations by dividing equation ① by 5 and equation ② by 3.

\[
12 = b - r \\
20 = b + r \\
32 = 2b \\
\]

\( b = 16 \)

Substitute \( b = 16 \) into equation ①.

\[
60 = (16 - r)5 \\
60 = 80 - 5r \\
-20 = -5r \\
\]

\( r = 4 \)

The average speed of the boat in still water was 16 km/h. The speed of the current was 4 km/h.

Chapter 1 Review       Question 16    Page 49

Let \( x \) represent the mass of 30% nitrogen fertilizer required, and \( y \) represent the mass of 15% nitrogen fertilizer required.

\[
x + y = 600 \quad \text{①} \\
0.30x + 0.15y = 120 \quad \text{②}
\]

Rearrange equation ①: \( y = 600 - x \)

Substitute into equation ②.

\[
0.30x + 0.15(600 - x) = 120 \\
0.30x + 90 - 0.15x = 120 \\
0.15x = 30 \\
x = 200
\]

Substitute \( x = 200 \) into equation ①.

\[
x + y = 600 \\
200 + y = 600 \\
y = 400
\]

You need 200 kg of 30% nitrogen fertilizer, and 400 kg of 15% nitrogen fertilizer.
Let $F$ represent Fran’s income. Let $W$ represent Winston’s income.

$F = 80 000 - W \quad \text{(1)}$

$
\frac{1}{4} W = \frac{1}{6} F \quad \text{(2)}
$

Simplify equation (2) by multiplying by 12. Then, substitute $80 000 - W$ for $F$.

$3W = 2F$

$3W = 2(80 000 - W)$

$3W = 160 000 - 2W$

$5W = 160 000$

$W = 32 000$

Substitute $W = 32 000$ into equation (1).

$F = 80 000 - W$

$= 80 000 - 32 000$

$= 48 000$

Fran earns $48 000, and Winston earns $32 000.
Chapter 1 Chapter Test

Chapter 1 Chapter Test  Question 1  Page 50

a) Let \( m \) represent the number of men. Let \( w \) represent the number of women.
\[
m + w = 20
\]
\[
m = w + 7
\]

b) Let \( n \) represent the number.
\[
2n + 7 = 3n
\]

Chapter 1 Chapter Test  Question 2  Page 50

Answers will vary.

Chapter 1 Chapter Test  Question 3  Page 50

a) 

The point of intersection is \((7, -1)\).

b) The solution is \(x = 7, y = -1\).
a) \( y = 2x - 13 \)  

\( x + 2y = -6 \)  

Substitute \( 2x - 13 \) for \( y \) in equation \( \circled{2} \).

\[
x + 2(2x - 13) = -6
\]

\[
x + 4x - 26 = -6
\]

\[
5x = 20
\]

\[
x = 4
\]

Substitute \( x = 4 \) into equation \( \circled{1} \).

\[
y = 2x - 13
\]

\[
= 2(4) - 13
\]

\[
= -5
\]

Check by substituting \( x = 4 \) and \( y = -5 \) into both original equations.

In \( y = 2x - 13 \):

\[
\text{L.S.} = y = -5
\]

\[
\text{R.S.} = 2x - 13 = 2(4) - 13 = 5 - 13 = -8
\]

In \( x + 2y = -6 \):

\[
\text{L.S.} = x + 2y = 4 + 2(-5) = 4 - 10 = -6
\]

\[
\text{R.S.} = -6
\]

\[
\text{L.S.} = \text{R.S.}
\]

The solution checks in both equations.

The solution is \( x = 4, y = -5 \).

b) \( a + b = 5 \)  

\( 3a + 4b = 15 \)  

Rearrange equation \( \circled{1} \): \( b = 5 - a \)

Substitute into equation \( \circled{2} \).

\[
3a + 4(5 - a) = 15
\]

\[
3a + 20 - 4a = 15
\]

\[
-a = -5
\]

\[
a = 5
\]

Substitute \( a = 5 \) into equation \( \circled{1} \).

\[
a + b = 5
\]

\[
5 + b = 5
\]

\[
b = 0
\]

Check by substituting \( a = 5 \) and \( b = 0 \) into both original equations.

In \( a + b = 5 \):

\[
\text{L.S.} = a + b = 5
\]

\[
\text{R.S.} = 5
\]

In \( 3a + 4b = 15 \):

\[
\text{L.S.} = 3a + 4b = 3(5) + 4(0) = 15
\]

\[
\text{R.S.} = 15
\]

\[
\text{L.S.} = \text{R.S.}
\]

The solution checks in both equations.

The solution is \( a = 5, b = 0 \).
c) \( x + 3y = 0 \) \( \text{①} \)
\( 3x - 6y = 5 \) \( \text{②} \)
Rearrange equation ①: \( x = -3y \)
Substitute into equation ②.
\[ 3x - 6y = 5 \]
\[ 3(-3y) - 6y = 5 \]
\[ -9y - 6y = 5 \]
\[ -15y = 5 \]
\[ y = -\frac{1}{3} \]
Substitute \( y = -\frac{1}{3} \) into equation ①.
\[ x + 3y = 0 \]
\[ x + 3 \left( -\frac{1}{3} \right) = 0 \]
\[ x = 1 \]
Check by substituting \( x = 1 \) and \( y = -\frac{1}{3} \) into both original equations.
In \( x + 3y = 0 \):
\[ \text{L.S.} = x + 3y \quad \text{R.S.} = 0 \]
\[ = 1 + 3 \left( -\frac{1}{3} \right) \]
\[ = 0 \]
\[ \text{L.S.} = \text{R.S.} \]
In \( 3x - 6y = 5 \):
\[ \text{L.S.} = 3x - 6y \quad \text{R.S.} = 5 \]
\[ = 3(1) - 6 \left( -\frac{1}{3} \right) \]
\[ = 5 \]
\[ \text{L.S.} = \text{R.S.} \]
The solution checks in both equations.
The solution is \( x = 1, y = -\frac{1}{3}. \)
d) \(3m - 2n = -12\) \(\quad \text{①}\)
\(m - 4n = 8\) \(\quad \text{②}\)
Rearrange equation ②: \(m = 4n + 8\)
Substitute into equation ①.
\[3m - 2n = -12\]
\[3(4n + 8) - 2n = -12\]
\[12n + 24 - 2n = -12\]
\[10n = -36\]
\[n = -3.6\]
Substitute \(n = -3.6\) into equation ②.
\[m - 4n = 8\]
\[m - 4(-3.6) = 8\]
\[m = -6.4\]
Check by substituting \(m = -6.4\) and \(n = -3.6\) into both original equations.
In \(3m - 2n = -12\):
\[\text{L.S.} = 3m - 2n\]
\[\text{R.S.} = -12\]
\[= 3(-6.4) - 2(-3.6)\]
\[= -12\]
\[\text{L.S.} = \text{R.S.}\]
In \(m - 4n = 8\):
\[\text{L.S.} = m - 4n\]
\[\text{R.S.} = 8\]
\[= -6.4 - 4(-3.6)\]
\[= 8\]
\[\text{L.S.} = \text{R.S.}\]
The solution checks in both equations.
The solution is \(m = -6.4, n = -3.6\).

Chapter 1 Chapter Test Question 5 Page 50

a) The second equation is 3 times \(y = \frac{2}{3}x - 3\), rearranged.

b) Both linear systems have the same point of intersection, \((-3, -5)\).

c) The first equation is 2 times \(y = 2x + 1\), rearranged. The second equation is 6 times \(y = \frac{2}{3}x - 3\), rearranged.
Chapter 1 Chapter Test  Question 6  Page 50

a) \(3x + 2y = 19\)  \(\text{①}\)

\[
\begin{align*}
5x - 2y &= 5 \quad \text{②} \\
8x &= 24 \quad \text{①} + \text{②} \\
\end{align*}
\]

\(x = 3\)

Substitute \(x = 3\) into equation ①.

\(3x + 2y = 19\)

\(3(3) + 2y = 19\)

\(9 + 2y = 19\)

\(2y = 10\)

\(y = 5\)

Check by substituting \(x = 3\) and \(y = 5\) into both original equations.

In \(3x + 2y = 19\):

\[
\begin{align*}
\text{L.S.} &= 3x + 2y \\
&= 3(3) + 2(5) \\
&= 19 \\
\end{align*}
\]

\[
\begin{align*}
\text{R.S.} &= 19 \\
\end{align*}
\]

L.S. = R.S.

In \(5x - 2y = 5\):

\[
\begin{align*}
\text{L.S.} &= 5x - 2y \\
&= 5(3) - 2(5) \\
&= 5 \\
\end{align*}
\]

\[
\begin{align*}
\text{R.S.} &= 5 \\
\end{align*}
\]

L.S. = R.S.

The solution checks in both equations.

The solution is \(x = 3, y = 5\).
b) \(4x - 3y = 15\) \(\text{①}\)

\[\begin{align*}
4x + 3y &= 5 \quad \text{②} \\
8x &= 20 \\
x &= \frac{5}{2}
\end{align*}\]

Substitute \(x = \frac{5}{2}\) into equation ①.

\[\begin{align*}
4x - 3y &= 15 \\
4 \left(\frac{5}{2}\right) - 3y &= 15 \\
10 - 3y &= 15 \\
-3y &= 5 \\
y &= -\frac{5}{3}
\end{align*}\]

Check by substituting \(x = \frac{5}{2}\) and \(y = -\frac{5}{3}\) into both original equations.

In \(4x - 3y = 15\):

\[
\begin{align*}
\text{L.S.} &= 4x - 3y \\
&= 4 \left(\frac{5}{2}\right) - 3 \left(-\frac{5}{3}\right) \\
&= 15 \\
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

In \(4x + 3y = 5\):

\[
\begin{align*}
\text{L.S.} &= 4x + 3y \\
&= 4 \left(\frac{5}{2}\right) + 3 \left(-\frac{5}{3}\right) \\
&= 5 \\
\text{L.S.} &= \text{R.S.}
\end{align*}
\]

The solution checks in both equations.

The solution is \(x = \frac{5}{2}, y = -\frac{5}{3}\).
c) $6k + 5h = 20$  \(\text{①}\)

$3k - 4h = 23$  \(\text{②}\)

\[
\begin{align*}
6k + 5h &= 20 & \text{①} \\
6k - 8h &= 46 & \text{②} \\
\hline 
13h &= -26 & \text{①} - 2 \times \text{②} \\
\quad h &= -2 \\
\text{Substitute } h = -2 \text{ into equation ①.} \\
6k + 5(-2) &= 20 \\
6k - 10 &= 20 \\
6k &= 30 \\
\quad k &= 5 \\
\text{Check by substituting } h = -2 \text{ and } k = 5 \text{ into both original equations.} \\
\text{In } 6k + 5h = 20: & \quad \text{In } 3k - 4h = 23: \\
\text{L.S.} = 6k + 5h & \quad \text{L.S.} = 3k - 4h \\
\text{R.S.} = 20 & \quad \text{R.S.} = 23 \\
\quad = 6(5) + 5(-2) & \quad = 3(5) - 4(-2) \\
\quad = 20 & \quad = 23 \\
\quad \text{L.S.} = \text{R.S.} & \quad \text{L.S.} = \text{R.S.} \\
\text{The solution checks in both equations.} \\
\text{The solution is } k = 5, h = -2.
\]

d) $4p - 2q = 6$  \(\text{①}\)

$10p - 3q = -1$  \(\text{②}\)

\[
\begin{align*}
12p - 6q &= 18 & 3 \times \text{①} \\
20p - 6q &= -2 & 2 \times \text{②} \\
\hline 
-8p &= 20 & 3 \times \text{①} - 2 \times \text{②} \\
\quad p &= -2.5 \\
\text{Substitute } p = -2.5 \text{ into equation ①.} \\
4p - 2q &= 6 \\
4(-2.5) - 2q &= 6 \\
-10 - 2q &= 6 \\
-2q &= 16 \\
\quad q &= -8 \\
\text{Check by substituting } p = -2.5 \text{ and } q = -8 \text{ into both original equations.} \\
\text{In } 4p - 2q = 6: & \quad \text{In } 10p - 3q = -1: \\
\text{L.S.} = 4p - 2q & \quad \text{L.S.} = 10p - 3q \\
\text{R.S.} = 6 & \quad \text{R.S.} = -1 \\
\quad = 4(-2.5) - 2(-8) & \quad = 10(-2.5) - 3(-8) \\
\quad = 6 & \quad = -1 \\
\quad \text{L.S.} = \text{R.S.} & \quad \text{L.S.} = \text{R.S.} \\
\text{The solution checks in both equations.} \\
\text{The solution is } p = -2.5, q = -8.
Chapter 1 Chapter Test  Question 7  Page 50

a) One variable is already isolated in the second equation. Use substitution.

\[ y + 3x = 6 \hspace{1cm} \text{①} \]
\[ y = 2x + 1 \hspace{1cm} \text{②} \]

Substitute 2x + 1 for y in equation ①.

\[ y + 3x = 6 \]
\[ 2x + 1 + 3x = 6 \]
\[ 5x = 5 \]
\[ x = 1 \]

Substitute x = 1 into equation ②.

\[ y = 2x + 1 \]
\[ = 2(1) + 1 \]
\[ = 3 \]

Check by substituting x = 1 and y = 3 into both original equations.

In \[ y + 3x = 6 \]:
\[ \text{L.S.} = y + 3x \]
\[ = 3 + 3(1) \]
\[ = 6 \]
\[ \text{R.S.} = 6 \]

In \[ y = 2x + 1 \]:
\[ \text{L.S.} = y \]
\[ = 3 \]
\[ \text{R.S.} = 2x + 1 \]
\[ = 2(1) + 1 \]
\[ = 3 \]

\[ \text{L.S.} = \text{R.S.} \]
\[ \text{L.S.} = \text{R.S.} \]

The solution checks in both equations.

The solution is \[ x = 1, y = 3 \].

b) The y-term has the same coefficient in each equation. Use elimination.

\[ 2x - y = 3 \hspace{1cm} \text{①} \]
\[ 4x - y = 3 \hspace{1cm} \text{②} \]

\[ -2x + 4 = 0 \hspace{1cm} \text{①} - \text{②} \]
\[ x = -2 \]

Substitute \[ x = -2 \] into equation ①.

\[ 2x - y = 3 \]
\[ 2(-2) - y = 3 \]
\[ -4 - y = 3 \]
\[ -y = 7 \]
\[ y = -7 \]

Check by substituting \[ x = -2 \] and \[ y = -7 \] into both original equations.

In \[ 2x - y = 3 \]:
\[ \text{L.S.} = 2x - y \]
\[ = 2(-2) - (-7) \]
\[ = 3 \]
\[ \text{R.S.} = 3 \]

In \[ 4x - y = 3 \]:
\[ \text{L.S.} = 4x - y \]
\[ = 4(-2) - (-7) \]
\[ = 1 \]
\[ \text{R.S.} = -1 \]

\[ \text{L.S.} = \text{R.S.} \]
\[ \text{L.S.} = \text{R.S.} \]

The solution checks in both equations.

The solution is \[ x = -2, y = -7 \].
c) The \( y \)-terms have opposite coefficients in the two equations. Use elimination.

\[
\begin{align*}
2x - y &= -6 \quad \text{①} \\
4x + y &= -6 \quad \text{②}
\end{align*}
\]

\[6x = -12 \quad \text{① + ②} \]

\[x = -2\]

Substitute \( y = 2 \) into equation ①.

\[
2x - y = -6
\]

\[2(-2) - y = -6\]

\[-4 - y = -6\]

\[-y = -2\]

\[y = 2\]

Check by substituting \( x = -2 \) and \( y = 2 \) into both original equations.

In \( 2x - y = -6 \):

\[
\text{L.S.} = 2x - y \\
\text{R.S.} = -6
\]

\[
= 2(-2) - 2 \\
= -6
\]

\[
\text{L.S.} = \text{R.S.}
\]

In \( 4x + y = -6 \):

\[
\text{L.S.} = 4x + y \\
\text{R.S.} = -6
\]

\[
= 4(-2) + 2 \\
= -6
\]

\[
\text{L.S.} = \text{R.S.}
\]

The solution checks in both equations.

The solution is \( x = -2, y = 2 \).

d) The coefficients are complex. Use elimination.

\[
\begin{align*}
6x - 5y &= -1 \quad \text{①} \\
5x - 4y &= -1 \quad \text{②}
\end{align*}
\]

\[
\begin{align*}
24x - 20y &= -4 \quad 4 \times ① \\
25x - 20y &= -5 \quad 5 \times ②
\end{align*}
\]

\[-x = 1 \quad 4 \times ① - 5 \times ②\]

\[x = -1\]

Substitute \( x = -1 \) into equation ①.

\[
6x - 5y = -1
\]

\[6(-1) - 5y = -1\]

\[-6 - 5y = -1\]

\[-5y = 5\]

\[y = -1\]

Check by substituting \( x = -1 \) and \( y = -1 \) into both original equations.

In \( 6x - 5y = -1 \):

\[
\text{L.S.} = 6x - 5y \\
\text{R.S.} = -1
\]

\[
= 6(-1) - 5(-1) \\
= -1
\]

\[
\text{L.S.} = \text{R.S.}
\]

In \( 5x - 4y = -1 \):

\[
\text{L.S.} = 5x - 4y \\
\text{R.S.} = -1
\]

\[
= 5(-1) - 4(-1) \\
= -1
\]

\[
\text{L.S.} = \text{R.S.}
\]

The solution checks in both equations.

The solution is \( x = -1, y = -1 \).
Answers will vary.

\[
y = 3x - 1 \quad \text{①} \\
2x + y - 4 = 0 \quad \text{②}
\]

Substitute \(3x - 1\) for \(y\) in equation ②.
\[
2x + (3x - 1) - 4 = 0 \\
5x = 5 \\
x = 1
\]

Substitute \(x = 1\) into equation ①.
\[
y = 3(1) - 1 \\
= 2
\]

\[
y = 3x - 1 \quad \text{①} \\
x - 2y = -7 \quad \text{③}
\]

Substitute \(3x - 1\) for \(y\) in equation ③.
\[
x - 2(3x - 1) = -7 \\
x - 6x + 2 = -7 \\
-5x = -9 \\
x = 1.8
\]

Substitute \(x = 1.8\) into equation ①.
\[
y = 3(1.8) - 1 \\
= 4.4
\]

Rearrange equation ②, multiply by 2, and then add to equation ③.
\[
4x + 2y = 8 \\
x - 2y = -7 \\
5x = 1 \\
x = 0.2
\]

Substitute \(x = 0.2\) into equation ②.
\[
2x + y - 4 = 0 \\
2(0.2) + y - 4 = 0 \\
0.4 + y - 4 = 0 \\
y = 3.6
\]

The vertices of the triangle are \((1, 2), (1.8, 4.4),\) and \((0.2, 3.6)\).
Let $G$ represent the number of hours per week that Gregory works. Let $P$ represent the number of hours per week that Paul works.

a) $G = \frac{1}{2}P$  \(\Box\)

b) $G + P = 48$  \(\Box\)

c) Substitute $\frac{1}{2}P$ for $G$ in equation \(\Box\).

\[
\frac{1}{2}P + P = 48 \\
1.5P = 48 \\
P = 32
\]

Substitute $P = 32$ into equation \(\Box\).

\[
G = \frac{1}{2}P \\
= \frac{1}{2}(32) \\
= 16
\]

Gregory works 16 h, and Paul works 32 h.

Chapter 1 Chapter Test Question 11 Page 51

Let $r$ represent the number of questions answered correctly. Let $w$ represent the number of questions answered incorrectly.

\[
w = 30 - r \quad \Box\]
\[
4r - w = 55 \quad \Box\]

Substitute $30 - r$ for $w$ in equation \(\Box\).

\[
4r - (30 - r) = 55 \\
4r - 30 + r = 55 \\
5r = 85 \\
r = 17
\]

Rolly answered 17 questions correctly.
Let $l$ represent the length of the pool. Let $w$ represent the width of the pool.

\[ l = 2w + 3 \quad \text{①} \]
\[ 2l + 2w = 96 \quad \text{②} \]

Substitute $2w + 3$ for $l$ in equation ②.

\[ 2l + 2w = 96 \]
\[ 2(2w + 3) + 2w = 96 \]
\[ 4w + 6 + 2w = 96 \]
\[ 6w = 90 \]
\[ w = 15 \]

Substitute $w = 15$ into equation ①.

\[ l = 2w + 3 \]
\[ = 2(15) + 3 \]
\[ = 33 \]

The length of the pool is 33 m, and the width is 15 m.

Let $a$ represent the buffet price for an adult. Let $c$ represent the buffet price for a child under 12.

\[ 2a + 3c = 48.95 \quad \text{①} \]
\[ 3a + 2c = 52.05 \quad \text{②} \]

\[ 4a + 6c = 97.90 \quad 2 \times ① \]
\[ 9a + 6c = 156.15 \quad 3 \times ② \]
\[ -5a = -58.25 \quad 2 \times ① - 3 \times ② \]
\[ a = 11.65 \]

Substitute $a = 11.65$ into equation ①.

\[ 2a + 3c = 48.95 \]
\[ 2(11.65) + 3c = 48.95 \]
\[ 23.30 + 3c = 48.95 \]
\[ 3c = 25.65 \]
\[ c = 8.55 \]

The buffet price for an adult is $11.65, and the buffet price for a child is $8.55.
Chapter 1 Chapter Test  Question 14  Page 51

Let \( n \) represent the number of nickels in a wallet. Let \( d \) represent the number of dimes in a wallet.
\[
d = 27 - n \quad \text{(1)}
\]
\[
5n + 10d = 215 \quad \text{(2)}
\]
Substitute \( 27 - n \) for \( d \) in equation (2).
\[
5n + 10(27 - n) = 215
\]
\[
5n + 270 - 10n = 215
\]
\[
-5n = -55
\]
\[
n = 11
\]
Substitute \( n = 11 \) into equation (1).
\[
d = 27 - n
\]
\[
\begin{align*}
d &= 27 - 11 \\ &= 16
\end{align*}
\]
There are 16 dimes and 11 nickels in the wallet.

Chapter 1 Chapter Test  Question 15  Page 51

Let \( C \) represent the charge for computer repair services. Let \( h \) represent the number of hours the person works on the repair.
\[
C = 40 + 35h \quad \text{(1)}
\]
\[
C = 50 + 30h \quad \text{(2)}
\]
Substitute \( 40 + 35h \) for \( C \) in equation (2).
\[
C = 50 + 30h
\]
\[
40 + 35h = 50 + 30h
\]
\[
5h = 10
\]
\[
h = 2
\]
Substitute \( h = 2 \) into equation (1).
\[
C = 40 + 35h
\]
\[
\begin{align*}
\quad &\quad = 40 + 35(2) \\ &= 110
\end{align*}
\]
They charged \$110 for 2 h of work.
Chapter 1 Chapter Test  Question 16  Page 51

a) \(3(x + 1) - 4(y - 1) = 13\)
\(5(x + 2) + 2(y + 3) = 0\)

Simplify equation \(\textcircled{1}\).
\(3(x + 1) - 4(y - 1) = 13\)
\(3x + 3 - 4y + 4 = 13\)
\(3x - 4y = 6\)  \(\textcircled{3}\)

Simplify equation \(\textcircled{2}\).
\(5(x + 2) + 2(y + 3) = 0\)
\(5x + 10 + 2y + 6 = 0\)
\(5x + 2y = -16\)  \(\textcircled{4}\)

\[\begin{align*}
3x - 4y &= 6 \quad \textcircled{3} \\
10x + 4y &= -32 \quad 2 \times \textcircled{4} \\
13x &= -26 \quad \textcircled{3} + 2 \times \textcircled{4} \\
x &= -2 \\
\text{Substitute } x = -2 \text{ into equation } \textcircled{3}. \\
3x - 4y &= 6 \\
3(-2) - 4y &= 6 \\
6 - 4y &= 6 \\
-4y &= 12 \\
y &= -3
\end{align*}\]

The solution is \(x = -2, y = -3\).

b) \(3c + 0.8d = 1.4\)  \(\textcircled{1}\)
\(0.5c - 0.4d = 1.4\)  \(\textcircled{2}\)

\[\begin{align*}
3c + 0.8d &= 1.4 \quad \textcircled{1} \\
c - 0.8d &= 2.8 \quad 2 \times \textcircled{2} \\
4c &= 4.2 \quad \textcircled{1} + 2 \times \textcircled{2} \\
c &= 1.05
\end{align*}\]

Substitute \(c = 1.05\) into equation \(\textcircled{1}\).
\(3c + 0.8d = 1.4\)
\(3(1.05) + 0.8d = 1.4\)
\(3.15 + 0.8d = 1.4\)
\(0.8d = -1.75\)
\(d = -2.1875\)

The solution is \(c = 1.05, d = -2.1875\).
c) $x + y = 40$  
\[
\frac{x}{20} - \frac{y}{5} = 1
\]

\[
x + y = 40
\]
\[
\frac{x - 4y}{20} = \frac{5y}{20} - 20 \times \frac{2}{2}
\]

$y = 4$

Substitute $y = 4$ into equation 1.

$x + y = 40$

$x + 4 = 40$

$x = 36$

The solution is $x = 36, y = 4$.

Chapter 1 Chapter Test Question 17 Page 51

Let $x$ represent the amount invested at 5%/year, and $y$ represent the amount invested at 10%/year.

$y = 50000 - x$  

$0.05x + 0.010y = 4000$  

Substitute $50000 - x$ for $y$ in equation 2.

$0.05x + 0.10y = 4000$

$0.05x + 0.10(50000 - x) = 4000$

$0.05x + 5000 - 0.10x = 4000$

$-0.05x = -1000$

$x = 20000$

Substitute $x = 20000$ into equation 1.

$y = 50000 - x$

$= 50000 - 20000$

$= 30000$

Maya invested $20000 at 5%/year and $30000 at 10%/year.
Chapter 1 Chapter Test  Question 18  Page 51

Let $x$ represent the volume of 25% acid solution, and $y$ represent the volume of 50% acid solution.

\[ x + y = 500 \quad \text{①} \]
\[ 0.25x + 0.50y = 170 \quad \text{②} \]

Rearrange equation ①: \[ y = 500 - x \]
Substitute into equation ②.
\[ 0.25x + 0.50(500 - x) = 170 \]
\[ 0.25x + 250 - 0.50x = 170 \]
\[ -0.25x = -80 \]
\[ x = 320 \]

Substitute $x = 320$ into equation ①.
\[ x + y = 500 \]
\[ 320 + y = 500 \]
\[ y = 180 \]

You need 320 L of 25% acid solution and 180 L of 50% acid solution.

Chapter 1 Chapter Test  Question 19  Page 51

Let $b$ represent the number of kilometres Carl travelled by bus. Let $p$ represent the number of kilometres Carl travelled by plane.

\[ b + p = 1900 \quad \text{①} \]
\[ \frac{b}{60} + \frac{p}{700} = 7 \quad \text{②} \]

\[ 6b + 6p = 11400 \quad 6 \times ① \]
\[ 70b + 6p = 29400 \quad 4200 \times ② \]
\[ -64b = -18000 \quad 6 \times ① - 4200 \times ② \]
\[ b = 281.25 \]

Substitute $b = 281.25$ into equation ①.
\[ b + p = 1900 \]
\[ 281.25 + p = 1900 \]
\[ p = 1618.75 \]

Carl travelled 281.25 km by bus and 1618.75 km by airplane.

Chapter 1 Chapter Test  Question 20  Page 51

Solutions for Achievement Checks are shown in the Teacher Resource.