ANSWERS

Chapter 7 ALGEBRAIC EXPRESSIONS

Exercise 7A Read and Write Algebraic Expressions (I)

1. **(a)** $x + 3$

(b) $w - 4$

(c) $15 - n$

2. D

3. **(a)** $k + 8$

(b) $10 - y$

(c) $w - 6$

(d) $j + 2$

(e) $p - q$

(f) $g - 11$

(g) $h - 9$

(h) $w + 13$

4. **(a)** $b \xrightarrow{+7} b + 7 \xrightarrow{+b} b + 7 + b$

(b) $w \xrightarrow{-5} w - 5 \xrightarrow{+9} w - 5 + 9$

5. $p - 10$

6. $y + 6$

7. $17 - k$

8. $s + 5$

9. $m - 3$

10. $5 + h$

Exercise 7A Read and Write Algebraic Expressions (2)

1. **(a)** $5k$

(b) $\frac{w}{4}$

(c) $\frac{30}{b}$

2. **(a)** $7g$

(b) $\frac{h}{8}$

(c) $\frac{x}{3}$

(d) $\frac{3k}{4}$

(e) $7m$

(f) $4d$

(g) $\frac{7a}{3}$

(h) $\frac{7}{t}$

3. **(a)** $m \xrightarrow{\times 4} 4m$

(b) $d \xrightarrow{\div 3} \frac{d}{3} \xrightarrow{\times 8} \frac{8d}{3}$

(c) $y \xrightarrow{\times 6} 6y \xrightarrow{\div 7} \frac{6y}{7}$

4. $3p$

5. $2y$

6. $\frac{m}{4}$

7. $7k$

8. $45z$

9. $\frac{32}{b}$

10. $6w$

Exercise 7A Read and Write Algebraic Expressions (3)

1. **(a)** $5w - 6$

(b) $2j + 2k + 16$

2. **(a)** $7z + 10$

(b) $4h - 15$

(c) $\frac{6y}{7}$

(d) $8 + \frac{w}{3}$

(e) $\frac{s}{9} + 5$

(f) $10 - \frac{k}{3}$

(g) $7(z - 5)$ or $(z - 5) \times 7$

(h) $e(8 + f)$

3. **(a)** $y \xrightarrow{\times 3} 3y \xrightarrow{-4} 3y - 4 \xrightarrow{+z} 3y - 4 + z$

(b) $n \xrightarrow{\div 5} \frac{n}{5} \xrightarrow{\times 2} \frac{2n}{5} \xrightarrow{-8} \frac{2n}{5} - 8$

4. $3g + 10 + 3g$ or $6g + 10$

5. $\frac{5s}{3} - 2$

6. $2b - 6$

7. $\frac{50}{x + 2}$

8. $y - \frac{y}{3} - 7$

9. $\frac{4p}{3} - 5$

10. $8w - 8$

Exercise 7B Simplify Algebraic Expressions (I)

1. **(a)** $6x$

(b) $5u$

(c) $21k$

(d) $2a$

(e) $10g$

(f) $3u$

(g) $11m$

(h) $16x$

(i) $13q$

(j) $7e$

2. **(a)** $6h + 3$

(b) $3g + 3$

(c) $m - 6$

(d) $12n - 9$

(e) $5x - 8$

(f) $3p + 16$

(g) $4 + 6x$

(h) $14x + 7$

3. **(a)** $2p + \frac{2}{3}$

(b) $\frac{w}{4} + \frac{3}{5}$

Exercise 7B Simplify Algebraic Expressions (2)

1. **(a)** $2x + 10y$

(b) $6a + b$

(c) $6k + 8h$

(d) $9p + q$

2. **(a)** $9w + 2 + 2z$

(b) $9m + 5n + 2$

(c) $5a + 7b - 10$

(d) $2 + 5w + 12y$

3. **(a)** $4a + \frac{3b}{4} - 9$

(b) $13 + 8f + b$

(c) $\frac{2g}{5} + 4h + 2$

(d) $\frac{2}{k} + \frac{2g}{3} + 5$

Exercise 7B Simplify Algebraic Expressions (3)

1. **(a)** $3(2w - 2) = (6w - 6)$

(b) $4(3p + 5) = 12p + 20$

2. **(a)** $12w + 15$

(b) $30 - 15y$

(c) $14a - 49$

(d) $27p + 45$

(e) $30 - 40d$

(f) $40r + 24$

3. **(a)** $8(5m - 3) + 6m = 40m - 24 + 6m$
$= 46m - 24$

(b) $9(2k + 3) + 6 - 2k = 18k + 27 + 6 - 2k$
$= 16k + 33$

(c) $18 + 3z + 3(7z - 4) = 18 + 3z + 21z - 12$
$= 6 + 24z$

(d) $5(5b + 3) + 2(4 - 6b) = 25b + 15 + 8 - 12b$
$= 13b + 23$

4. **(a)** $3(3x - 2 + 4y) + 5x + y = 9x - 6 + 12y + 5x + y$
$= 14x - 6 + 13y$

(b) $21k + 9 + 4(7 + j - 3k) = 21k + 9 + 28 + 4j - 12k$
$= 9k + 37 + 4j$

(c) $7(5 - 4w + 2v) + 8v - 3 = 35 - 28w + 14v + 8v - 3$
$= 32 - 28w + 22v$

(d) $36 + 9f + 7(6g - 3 + f) = 36 + 9f + 42g - 21 + 7f$
$= 15 + 16f + 42g$

Exercise 7B Simplify Algebraic Expressions (4)

1. **(a)** $7(y + 3)$

(b) $4(3 - k)$

(c) $2(8d - 5)$

(d) $3(5g + 3)$

(e) $6(3 - 2h)$

(f) $5(4w + 3)$

2. **(a)** $2(7 - 4x + 5y)$

(b) $3(8p - 5 + 4q)$

(c) $7(x - 3y + 5)$

(d) $4(3a + b - 2c)$

3. **(a)** $20y + 10 - 6x - 6y = 14y + 10 - 6x$
$= 2(7y + 5 - 3x)$

(b) $25n - 5m - 5n + 15 = 20n - 5m + 15$
$= 5(4n - m + 3)$

(c) $9h + 30 + 12h - 2 = 21h + 28$
$= 7(3h + 4)$

(d) $20k + 7 - 2k - 6j + 8 = 18k + 15 - 6j$
$= 3(6k + 5 - 2j)$

(e) $16f + 10 - 8f + 11 - 24g = 8f + 21 - 24g$

(f) $49h + 20g - 42h - 6g - 63 = 7h + 14g - 63$
$= 7(h + 2g - 9)$

(g) $12p + 14q - 8q - 6 + 6p = 18p + 6q - 6$
$= 6(3p + q - 1)$

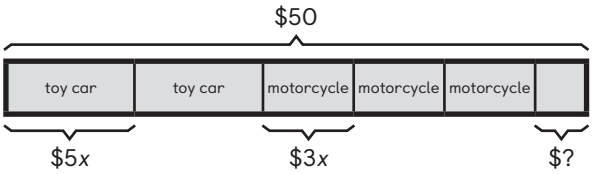
(h) $10c + 40k + 25 - 4 - 3c - 5k = 7c + 35k + 21$
$= 7(c + 5k + 3)$

(i) $2(2 + 4x) + 13y - 2x - 1 - 4y$
$= 4 + 8x + 13y - 2x - 1 - 4y$
$= 3 + 6x + 9y$
$= 3(1 + 2x + 3y)$

(j) $6(p + 8) - 2p - 16 - 12q$
$= 6p + 48 - 2p - 16 - 12q$
$= 4p + 32 - 12q$
$= 4(p + 8 - 3q)$

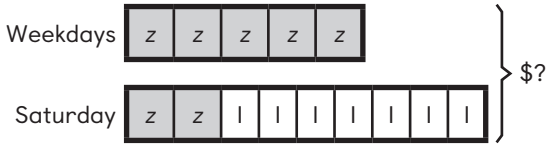
Exercise 7B Simplify Algebraic Expressions (5)

1.



Cost of 2 toy cars = $2 \times \$5x$
$= \$10x$
Cost of 3 motorcycles = $3 \times \$3x$
$= \$9x$
Total cost = $\$(10x + 9x)$
$= \$19x$
Change received = $\$(50 - 19x)$
Peggy gets $\$(50 - 19x)$ change.

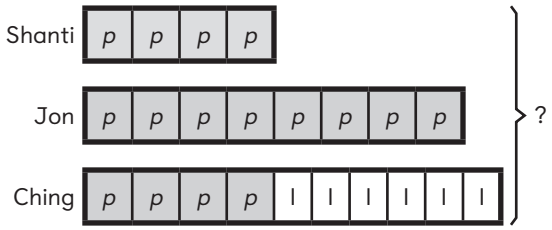
2.



Number of hours on weekdays = $5 \times z$
$= 5z$
Total number of hours in one week = $5z + (2z + 7)$
$= 7z + 7$
Kevin works $(7z + 7)$ hours in one week.

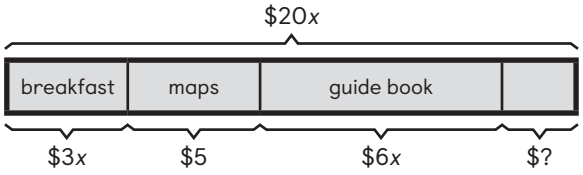
3. Length of the figure = $3w \times 4$
$= 12w$ cm
Perimeter of the figure = $12w + 3w + 12w + 3w$
$= 30w$ cm
The perimeter of the figure is $30w$ cm.

4.



Number of croissants Jon baked = $4p \times 2$
$= 8p$
Number of croissants Ching baked = $4p + 6$
Total number of croissants baked = $4p + 8p + 4p + 6$
$= 16p + 6$
They baked $(16p + 6)$ croissants altogether.

5.



Amount of money left = $\$20x - \$3x - \$5 - \$6x$
$= \$(11x - 5)$
Bryan had $\$(11x - 5)$ left.

6. Total distance cycled = $4y + (3y + 9) + (5w + 7)$
$= 7y + 5w + 16$
Kelly cycles $(7y + 5w + 16)$ miles.

7. Number of girls = $(16x + 30) + (5x - 12)$
$= 21x + 18$
Total number of students = $(16x + 30) + (21x + 18)$
$= (37x + 48)$
There are $(37x + 48)$ students in the school.

8. Cost of the chicken = $6 \times \$(3p + 5)$
$= \$(18p + 30)$
Cost of the beef = $12 \times \$(5p - 2)$
$= \$(60p - 24)$

Total cost = $\$(18p + 30) + \$(60p - 24)$
$= \$(78p + 6)$
Ms. Robinson pays $\$(78p + 6)$.

Exercise 7C Evaluate Algebraic Expressions

1. **(a)** $9y - 10 = 9 \times 8 - 10$
$= 62$

(b) $30 - 3y + 8 = 30 - 3 \times 8 + 8$
$= 14$

(c) $25 - \frac{5y}{4} = 25 - \frac{5 \times 8}{4}$
$= 25 - \frac{40}{4}$
$= 25 - 10$
$= 15$

(d) $50 - \frac{5 + 2y}{3} = 50 - \frac{5 + 2 \times 8}{3}$
$= 50 - \frac{21}{3}$
$= 50 - 7$
$= 43$

2. **(a)** $5g - 28 + 3g = 5g + 3g - 28$
$= 8g - 28$
$= 8 \times 6 - 28$
$= 20$

(b) $4 + 6g + 7 - g = 4 + 7 + 6g - g$
$= 11 + 5g$
$= 11 + 5 \times 6$
$= 41$

(c) $\frac{g + 3 + 7g}{3} = \frac{g + 7g + 3}{3}$
$= \frac{8g + 3}{3}$
$= \frac{8 \times 6 + 3}{3}$
$= 17$

(d) $\frac{8g - 2 - 4g}{2} + 3 = \frac{8g - 4g - 2}{2} + 3$
$= \frac{4g - 2}{2} + 3$
$= \frac{4 \times 6 - 2}{2} + 3$
$= 11 + 3$
$= 14$

3. **(a)** $3(p - 1) - 4 = 3(4 - 1) - 4$
$= 3 \times 3 - 4$
$= 5$

or

$3(p - 1) - 4 = 3p - 3 - 4$
$= 3 \times 4 - 3 - 4$
$= 5$

(b) $7 + 5(3 + 4p) = 7 + 5(3 + 4 \times 4)$
$= 7 + 5 \times 19$
$= 102$

or

$7 + 5(3 + 4p) = 7 + 15 + 20p$
$= 22 + 20 \times 4$
$= 102$

(c) $4(5p - 10) - 6p = 4(5 \times 4 - 10) - 6 \times 4$
$= 4 \times 10 - 24$
$= 16$

or

$4(5p - 10) - 6p = 20p - 40 - 6p$
$= 14p - 40$
$= 14 \times 4 - 40$
$= 16$

(d) $3(2p + 6) + 4(20 + 3p)$
$= 3(2 \times 4 + 6) + 4(20 + 3 \times 4)$
$= 3 \times 14 + 4 \times 32$
$= 170$

or

$3(2p + 6) + 4(20 + 3p) = 6p + 18 + 80 + 12p$
$= 6p + 12p + 18 + 80$
$= 18p + 98$
$= 18 \times 4 + 98$
$= 170$

4. **(a)** $4(2w + 20) - 60 = 8w + 80 - 60$
$= 8 \times \frac{1}{4} + 80 - 60$
$= 22$

(b) $5(3w + 5) - 11w = 15w + 25 - 11w$
$= 15w - 11w + 25$
$= 4w + 25$
$= 4 \times \frac{1}{4} + 25$
$= 26$

(c) $4w + 4(5w + 3) - 9 = 4w + 20w + 12 - 9$
$= 24w + 3$
$= 24 \times \frac{1}{4} + 3$
$= 9$

(d) $2(6w + 8) + 6(4 - w) = 12w + 16 + 24 - 6w$
$= 12w - 6w + 16 + 24$
$= 6w + 40$
$= 6 \times \frac{1}{4} + 40$
$= 41\frac{1}{2}$

5. **(a)** $6a + 6 + 5b - 4 - 2a = 6a - 2a + 6 - 4 + 5b$
$= 4a + 2 + 5b$
$= 4 \times 4 + 2 + 5 \times 7$
$= 53$

(b) $2(3m + 8) + 5(20 - 2n)$
$= 6m + 16 + 100 - 10n$
$= 6 \times 9 + 16 + 100 - 10 \times 3$
$= 140$

Exercise 7D Real-World Problems: Algebraic Expressions (I)

1. **(a)** 2 hours = $6z$ cars
1 hour = $6z \div 2$
$= 3z$
5 hours = $5 \times 3z$
$= 15z$

The machine can produce $15z$ toy cars in 5 hours.

(b) $15z = 15 \times 18$
$= 270$

The machine can produce 270 toy cars in 5 hours.

2. (a) $2 \times (15y - 7) = 30y - 14$

The distance between the two towns is $(30y - 14)$ kilometers.

(b) $30y - 14 = 30 \times 6 - 14$
$= 166$ km

The distance is 166 kilometers.

3. (a) $\frac{80}{100} \times 5(7m - 4) = 4(7m - 4)$
$= 28m - 16$

Kenny pays $\$(28m - 16)$.

(b) $28m - 16 = 28 \times 93 - 16$
$= 2{,}588$

Kenny pays \$2,588 for the furniture.

4. (a) Afternoon $= \frac{3}{4} \times 16p$
$= 12p$
Evening $= 12p + 20$

Total $= 16p + 12p + (12p + 20)$
$= 40p + 20$

Adam sold $(40p + 20)$ apples in all.

(b) $40p + 20 = 40 \times 19 + 20$
$= 780$

Adam sold 780 apples in all.

5. (a) Cost of 5 gallons of unleaded petrol
$= 5 \times \left(\frac{g}{4} + 3\right)$
Cost 10 gallons of leaded petrol
$= 10 \times (13 - 3h)$
Total cost $= 5\left(\frac{g}{4} + 3\right) + 10(13 - 3h)$
$= \frac{5g}{4} + 15 + 130 - 30h$
$= \frac{5g}{4} + 145 - 30h$

The total cost of the petrol is $\$\left(\frac{5g}{4} + 145 - 30h\right)$.

(b) $\frac{5g}{4} + 145 - 30h = \frac{5 \times 2}{4} + 145 - 30 \times 3$
$= \frac{5 \times 2}{4} + 145 - 30 \times 3$
$= 55\frac{1}{2} = 55.50$

The total cost of the petrol is \$55.50.

6. (a) Devi's age in 2 years' time $= (3d + 1) + 2$
Ryan's age in 2 years' time $= 2(3d + 1) + 2$
Sum of Devi and Ryan's ages in 2 years' time $= (3d + 1) + 2 + 2(3d + 1) + 2$
$= 3d + 1 + 2 + 6d + 2 + 2$
$= 9d + 7$

The sum of their ages will be $(9d + 7)$ years in 2 years' time.

(b) Devi's age 4 year ago $= (3d + 1) - 4$
$= (3 \times 5 + 1) - 4$
$= 12$
Ryan's age 4 years ago $= 2(3d + 1) - 4$
$= 2 \times (3 \times 5 + 1) - 4$
$= 28$

Devi was 12 years old and Ryan was 28 years old.

7. (a) $4h + (4h + 3) + 4h + (4h + 3) - 5 = 16h + 1$

The length of the fence is $(16h + 1)$ meters.

(b) Cost of the fencing $= \$28(16h + 1)$
$= \$28 \times (16 \times 5 + 1)$
$= \$2{,}268$

The cost is \$2,268.

8. (a) $\left(\frac{5s - 2}{4} + 3\right) \times 4 = 4\left(\frac{5s - 2}{4} + 3\right)$

The perimeter of the square is $4\left(\frac{5s - 2}{4} + 3\right)$ yards.

(b) $(s + 9) + (s + 9) + (3s - 5) + (3s - 5) = 8s + 8$

The perimeter of the rectangle is $(8s + 8)$ yards.

(c) $(8s + 8) - 4\left(\frac{5s - 2}{4} + 3\right)$
$= (8 \times 2 + 8) - 4\left(\frac{5 \times 2 - 2}{4} + 3\right)$
$= 24 - 4(2 + 3)$
$= 24 - 4(5)$
$= 24 - 20$
$= 4$

The difference between the perimeters of the two figures is 4 yards.

Exercise 7D Real-World Problems: Algebraic Expressions (2)

1. **(a)** $(30 \times 2) + (j \times 2) + (4 \times k) + 50$
$= 60 + 2j + 4k + 50$
$= 110 + 2j + 4k$

The total length of ribbon is $(110 + 2j + 4k)$ centimeters.

(b) $110 + 2j + 4k = 110 + 2 \times 20 + 4 \times 12$
$= 198$

Evelyn has enough ribbon to tie the box. 198 centimeters of ribbon is needed.

2. **(a)** $20 \times 12 \times (4q - p - 2)$
$= 240 \times (4q - p - 2)$
$= (960q - 240p - 480)$ in^3

$(960q - 240p - 480)$ cubic inches of water has to be added.

(b) $960q - 240p - 480 = 960 \times 4 - 240 \times 8 - 480$
$= 3{,}840 - 1{,}920 - 480$
$= 1{,}440$ in^3

1,440 cubic inches of water is needed.

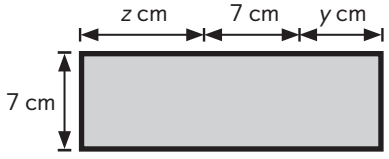
3. **(a)** No. of squares painted $= 14 \times 2 = 28$
Total surface area $= 28 \times w^2$
$= 28w^2$ in^2

The total area of the solid is $28w^2$ square inches.

(b) Total surface area $= 28 \times 4^2$
$= 448$ in^2

The total surface area of the solid is 448 square inches.

4. **(a)** Length $= z + y + 7$
$= z + y + 7$
Perimeter $= 2 \times (z + y + 7 + 7)$
$= 2z + 2y + 28$ cm
The perimeter is $(2z + 2y + 28)$ centimeters.



(b) $7 \times (z + y + 7) = 7z + 7y + 49$ cm^2

The area is $(7z + 7y + 49)$ square centimeters.

(c) $7z + 7y + 49 = 7 \times 9 + 7 \times 6 + 49$
$= 63 + 42 + 49$
$= 154$ cm^2

The area is 154 square centimeters.

Chapter Practice

1. A

2. B

3. C

4. B

5. D

6. **(a)** $3a + 5b + 10$

(b) $6f + 5 - 7e$

(c) $m \times 4^2$

(d) $\frac{9k}{2}$

7. **(a)** $12x + 4$

(b) $4t + 5$

(c) $6w + 3y$

(d) $13m + 8n$

8. **(a)** $\frac{7g}{5} + 7h - 5$

(b) $2k + \frac{2s}{3}$

9. **(a)** $4(q + 3)$

(b) $8(1 + 2b)$

10. **(a)** $10 + \frac{8k - 3}{7} = 10 + \frac{8 \times 3 - 3}{7}$
$= 13$

(b) $5m + \frac{8}{m} - 11 = 5 \times 4 + \frac{8}{4} - 11$
$= 11$

11. **(a)** $3 \times y = 3y$ cm^2

The area of rectangle *ABEF* is $3y$ square centimeters.

(b) $3 + y + y + y + 3 + y = 4y + 6$
$= 4 \times 8 + 6$
$= 38$ cm

The perimeter of the *ACDF* is 38 centimeters.

(c) area of rectangle *ACDF* $= (3 + y) \times y$
$= (3 + 8) \times 8$
$= 88$ cm^2

The area of rectangle *ACDF* is 88 square centimeters.

12. **(a)** Samuel $= w$
Irene $= 4 \times w$
$= 4w$
Peter $= 4w + 28$
Ann $= w + 2w$
$= 3w$

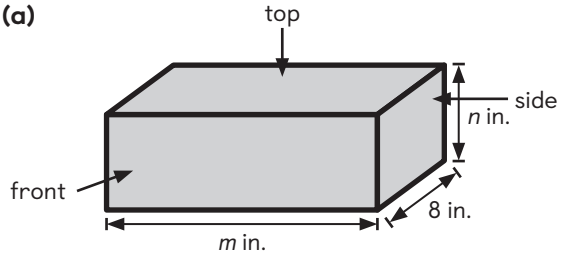
Total $= w + 4w + 4w + 28 + 3w$
$= 12w + 28$

The children have $(12w + 28)$ stamps in all.

(b) $12w + 28 = 12 \times 6 + 28$
$= 100$

They have 100 stamps in all.

13. **(a)**



Top area $= 8 \times m$
$= 8m$ in^2
Front area $= m \times n$
$= mn$ in^2
Side area $= 8 \times n$
$= 8n$ in^2

Total area $= 2 \times (8m + 8n + mn)$
$= (16m + 16n + 2mn)$ in^2

The total surface area of the prism is $(16m + 16n + 2mn)$ square inches.

(b) $16m + 16n + 2mn$
$= 16 \times 12 + 16 \times 6 + 2 \times (12 \times 6)$
$= 432$ in^2

The total area of shaded faces of the prism is 432 square inches.

14. **(a)** John can paint $\frac{1}{3y + 2}$ of the house in 1 day.

(b) $\frac{2}{3y + 2 + 5} = \frac{2}{3y + 7}$

George can paint $\frac{2}{3y + 7}$ of the house in 2 days.

(c) John and George can paint $3\left(\frac{1}{3y + 2} + \frac{1}{3y + 7}\right)$ of the house in 3 days.

Chapter 8 EQUATIONS AND INEQUALITIES

Exercise 8A Algebraic Equations

1. **(a)** $k + 12 = 20$

(b) $5m = 35$

(c) $\frac{4y}{3} = 20$

(d) $3w - 8 = 7$

2. **(a)** $x + 8 = 14$
$14 - x = 8$

(b) $7 + m = 20$
$20 - m = 7$

3. **(a)** $y + 6 = 10 + 6 = 16$
So, $y = 10$ makes $y + 6 = 20$ untrue.

(b) $k - 15 = 35 - 15 = 20$
So, $k = 35$ makes $k - 15 = 20$ true.

(c) $9m = 9 \times 12 = 108$
So, $m = 12$ makes $9m = 108$ true.

(d) $6w = 6 \times 13 = 78$
So, $w = 13$ makes $6w = 72$ untrue.

(e) $\frac{1}{8}e = \frac{1}{8} \times 56 = 7$
So, $e = 56$ makes $\frac{1}{8}e = 7$ true.

(f) $\frac{1}{10}g = \frac{1}{10} \times 120 = 12$
So, $g = 120$ makes $\frac{1}{10}g = 12$ true.

Exercise 8B Solve Algebraic Equations by Adding or Subtracting

1. **(a)**
$$a + 14 = 20$$
$$a + 14 - 14 = 20 - 14$$
$$a = 6$$

(b)
$$b + 18 = 34$$
$$b + 18 - 18 = 34 - 18$$
$$b = 16$$

(c)
$$p + 63 = 91$$
$$p + 63 - 63 = 91 - 63$$
$$p = 28$$

(d)
$$k + 25 = 40$$
$$k + 25 - 25 = 40 - 25$$
$$k = 15$$

(e)
$$s - 12 = 18$$
$$s - 12 + 12 = 18 + 12$$
$$s = 30$$

(f)
$$h - 15 = 9$$
$$h - 15 + 15 = 9 + 15$$
$$h = 24$$

(g)
$$y - 35 = 29$$
$$y - 35 + 35 = 29 + 35$$
$$y = 64$$

(h)
$$k - 15 = 18$$
$$k - 15 + 15 = 18 + 15$$
$$k = 33$$

2. **(a)**
$$7x - 7 = 47 + 6x$$
$$7x - 7 + 7 = 47 + 6x + 7$$
$$7x = 54 + 6x$$
$$7x - 6x = 54 + 6x - 6x$$
$$x = 54$$

(b)
$$3x - 14 = 18 + 2x$$
$$3x - 14 + 14 = 18 + 2x + 14$$
$$3x - 2x = 32 + 2x - 2x$$
$$x = 32$$

(c)
$$5x + 8 = 2x + 26$$
$$5x + 8 - 8 = 2x + 26 - 8$$
$$5x = 2x + 18$$
$$5x - 2x = 2x + 18 - 2x$$
$$3x = 18$$
$$x = 6$$

(d)
$$6x - 12 = 58 - 4x$$
$$6x - 12 + 12 = 58 - 4x + 12$$
$$6x = 70 - 4x$$
$$6x + 4x = 70 - 4x + 4x$$
$$10x = 70$$
$$10 \times x = 10 \times 7$$
$$x = 7$$

(e)
$$6x - 3x + 24 - 19 = 40 - 4x$$
$$3x + 5 = 40 - 4x$$
$$3x + 5 - 5 = 40 - 4x - 5$$
$$3x + 4x = 35 - 4x + 4x$$
$$7x = 35$$
$$7 \times x = 7 \times 5$$
$$x = 5$$

(f) $8x - 15 = 54 - 7x + 10x - 9$
$8x - 15 = 45 + 3x$
$8x - 15 + 15 = 45 + 3x + 15$
$8x = 60 + 3x$
$8x - 3x = 60 + 3x - 3x$
$5x = 60$
$5 \times x = 5 \times 12$
$x = 12$

Exercise 8C Real-World Problems: Solve Algebraic Equations by Adding or Subtracting

1. $x + 36 = 80$
$x + 36 - 36 = 80 - 36$
$x = 44$
The number, x, is 44.

2. $y - 18 = 17$
$y = 17 + 18$
$y = 35$
The number, y, is 35.

3. $2k - k = \frac{1}{3} \times 54$
$k = 18$
The smaller number, k, is 18.

4. Let b be the number of storybooks at first.
$b - 28 = 35$
$b = 35 + 28$
$b = 63$
63 storybooks were in the class library at first.

5. Let m be the amount of money Yong Kang has at first.
$m + 35 = 60$
$m + 35 - 35 = 60 - 35$
$m = 25$
Yong Kang has $25 at first.

6. Let c be the number of cupcakes that Joanne bakes.
$c - 8 \times 4 = 18$
$c - 32 + 32 = 18 + 32$
$c = 50$
Joanne bakes 50 cupcakes.

7. The length is $(w + 7)$ inches.
Half of the perimeter = $50 \div 2 = 25$ inches
$w + (w + 7) = 25$
$2w + 7 - 7 = 25 - 7$
$2w = 18$
$2 \times w = 2 \times 9$
$w = 9$
$w + 7 = 9 + 7$
$= 16$
The length of the rectangle is 16 inches.

8. Perimeter of the square = $4 \times p = 4p$
Perimeter of the rectangle = $p + 2p + p + 2p$
$= 6p$
$6p - 4p = 24$
$2p = 24$
$2 \times p = 2 \times 12$
$p = 12$
The width of the rectangle is 12 centimeters.

Exercise 8D Solve Algebraic Equations by Multiplying or Dividing

1. (a) $6h = 162$
$6h \div 6 = 162 \div 6$
$h = 27$

(b) $5d = 475$
$5d \div 5 = 475 \div 5$
$d = 95$

(c) $7k = 84$
$7k \div 7 = 84 \div 7$
$k = 12$

(d) $\frac{m}{6} = 16$
$\frac{m}{6} \times 6 = 16 \times 6$
$m = 96$

(e) $72 = 6k$
$\frac{1}{6} \times 72 = \frac{1}{6} \times 6k$
$12 = k$

(f) $6 = \frac{q}{7}$
$6 \times 7 = \frac{q}{7} \times \frac{1}{7}$
$42 = q$

2. (a) $3k \div 7 = 6$
$\frac{3k}{7} = 6$
$\frac{3k}{7} \times \frac{7}{3} = 6 \times \frac{7}{3}$
$k = 14$

(b) $3y \div 4 = 15$
$\frac{3y}{4} = 15$
$\frac{3y}{4} \times \frac{4}{3} = 15 \times \frac{4}{3}$
$y = 20$

(c) $3y \div 10 = 9$

$$\frac{3y}{10} = 9$$

$$\frac{3y}{10} \times \frac{10}{3} = 9 \times \frac{10}{3}$$

$$y = 30$$

(d) $2w \div 3 = 6$

$$\frac{2w}{3} = 6$$

$$\frac{2w}{3} \times \frac{3}{2} \times = 6 \times \frac{3}{2}$$

$$w = 9$$

3. (a) $3p \div 5 = 3$

$$\frac{3a}{5} = \frac{3}{1}$$

$$3p = 15$$

$$p = 5$$

(b) $3a \div 4 = 12$

$$\frac{3a}{4} = \frac{12}{1}$$

$$3a = 48$$

$$a = 16$$

(c) $2 = 5m \div 15$

$$\frac{2}{1} = \frac{5m}{15}$$

$$30 = 5m$$

$$6 = m$$

(d) $20 = 10g \div 7$

$$\frac{20}{1} = \frac{10g}{7}$$

$$140 = 10g$$

$$14 = g$$

(e) $10 = 270 \div 9e$

$$\frac{10}{1} = \frac{270}{9e}$$

$$90e = 270$$

$$e = 3$$

(f) $3 = 12 \div 4s$

$$\frac{3}{1} = \frac{12}{4s}$$

$$12s = 12$$

$$s = 1$$

Exercise 8E Real-World Problems: Solve Algebraic Equations by Multiplying or Dividing

1. $2x = 48$

$x = 24$

The number is 24.

2. Mass of 5 boxes of chocolate = $5p$ kg

Mass of 5 empty boxes = 5×200

= 1000 g

= 1 kg

Mass of 5 boxes of chocolates = $9 + 1$

= 10 kg

$5p = 10$

$p = 10 \div 5$

$p = 2$

3. Shorter length = w

Longer length = $w + 50$

$w + w + 50 = 300$

$2w = 250$

$w = 125$

4. Let Don's present age be d years, then Jason is $3d$ years old.

In 4 years' time, Don will be $(d + 4)$ and Jason will be $(3d + 4)$.

$(3d + 4) \div 2 = (d + 4)$

$$\frac{3d + 4}{2} = (d + 4)$$

$3d + 4 = 2d + 8$

$3d - 2d = 8 - 4$

$d = 4$ (Don)

5. Perimeter of the square = 18×4

= 72 in.

Perimeter of the rectangle = $72 - 12$

= 60 in.

Length and width of the rectangle = $60 \div 2$

= 30 in.

Let the width be y inches.

The length is $(30 - y)$ inches.

$y = (30 - y) \div 4$

$$y = \frac{(30 + y)}{4}$$

$4y = 30 - y$

$5y = 30$

$y = 6$

The width of the rectangle is 6 inches.

6. Let x be the number of \$10 notes.

Value of \$10 notes = \$10x

Value of \$20 notes = \$20 × $(6 + x)$

= \$120 + \$20x

Total value is $10x + 20x$ + \$120 = \$330

$30x$ + \$120 = \$330

$30x$ = \$330 − \$120

$30x$ = \$210

$x = 7$

Michael has 7 \$10 notes.

Exercise 8F Solve Algebraic Equations Involving Rational Numbers

1. (a)
$$x + 1.8 = 3.4$$
$$x + 1.8 - 1.8 = 3.4 - 1.8$$
$$x = 1.6$$

(b)
$$y - 0.4 = 0.3$$
$$y - 0.4 + 0.4 = 0.3 + 0.4$$
$$y = 0.7$$

(c)
$$2.9 = 5.2 - r$$
$$2.9 + r = 5.2 - r + r$$
$$2.9 - 2.9 + r = 5.2 - 2.9$$
$$r = 2.3$$

(d)
$$p - 1.75 = 5.375$$
$$p - 1.75 + 1.75 = 5.375 + 1.75$$
$$p = 7.125$$

(e)
$$e + \frac{3}{8} = 1\frac{3}{4}$$
$$e + \frac{3}{8} - \frac{3}{8} = 1\frac{3}{8} - \frac{3}{8}$$
$$e = 1\frac{3}{8}$$

(f)
$$a - \frac{1}{3} = 2\frac{5}{12}$$
$$a - \frac{1}{3} + \frac{1}{3} = 2\frac{5}{12} + \frac{1}{3}$$
$$a = 2\frac{3}{4}$$

(g)
$$\frac{5}{6} = x + \frac{1}{3}$$
$$\frac{5}{6} - \frac{1}{3} = x + \frac{1}{3} - \frac{1}{3}$$
$$\frac{1}{2} = x$$

(h)
$$\frac{2}{3} = 2\frac{5}{6} - w$$
$$\frac{2}{3} + w = 2\frac{5}{6} - w + w$$
$$\frac{2}{3} + w - \frac{2}{3} = 2\frac{5}{6} - \frac{2}{3}$$
$$w = 2\frac{1}{6}$$

2. (a)
$$18m = 60$$
$$18m \div 18 = 60 \div 18$$
$$m = 3\frac{1}{3}$$

(b)
$$15y = 58 - 13$$
$$15y \div 15 = 45 \div 15$$
$$y = 3$$

(c)
$$3.2k = 40$$
$$3.2k \div 3.2 = 40 \div 3.2$$
$$k = 12.5$$

(d)
$$2.4p = 36$$
$$2.4p \div 2.4 = 36 \div 2.4$$
$$p = 15$$

(e)
$$8h = 3\frac{1}{5}$$
$$8h \div 8 = \frac{16}{5} \div 8$$
$$h = \frac{2}{5}$$

(f)
$$\frac{5}{6}v = \frac{3}{4}$$
$$\frac{5}{6}v \times \frac{6}{5} = \frac{3}{4} \times \frac{6}{5}$$
$$v = \frac{9}{10}$$

(g)
$$\frac{2}{3}z = 1\frac{4}{5}$$
$$\frac{2}{3}z \times \frac{3}{2} = \frac{9}{5}z \times \frac{3}{2}$$
$$z = 2\frac{7}{10}$$

(h)
$$\frac{1}{2}b = 3\frac{7}{8}$$
$$\frac{1}{2}b \times 2 = \frac{31}{8} \times 2$$
$$b = 7\frac{3}{4}$$

Exercise 8G Real-World Problems: Solve Algebraic Equations Using the Four Operations

1. Let x be the number of Aaron's game cards.
$$x + 2x + x + 10 = 106$$
$$4x + 10 - 10 = 106 - 10$$
$$4x = 96$$
$$x = 24$$
Aaron has 24 game cards.

2. Let x be Jasmine's age.
Pauline's age $= x + 2$
Bryan's age $= x + 2 + 3$
$= x + 5$
$$x + x + 2 + x + 5 = 31$$
$$3x + 7 = 31$$
$$3x + 7 - 7 = 31 - 7$$
$$3x = 24$$
$$x = 8$$
Jasmine is 8 years old.

3. Remainder $= 80 - 4p$
Each sister $= 40 - 2p$
$$30 = 40 - 2p$$
$$30 + 2p = 40 - 2p + 2p$$
$$30 + 2p = 40$$
$$30 + 2p - 30 = 40 - 30$$
$$2p = 10$$
$$p = 5$$
$$4p = 4 \times 5$$
$$= 20$$
Celina gives her friend 20 stickers.

4. Let $\$x$ be the price of each hat, then each T-shirt costs $\$(x + 3)$

$6x + 7(x + 3) = 86$
$6x + 7x + 21 = 86$
$13x + 21 - 21 = 86 - 21$
$13x = 65$
$x = 5$

Mrs. Jones pays \$5 for a hat.

5. Let x be the number.

$2x + 15 = 39$
$2x + 15 - 15 = 39 - 15$
$2x = 24$
$x = 12$

The number is 12.

6. Let x be the first number,
The second number is $(2x - 6)$.

$x + 2x - 6 = 84$
$3x - 6 + 6 = 84 + 6$
$3x = 90$
$x = 30$
$84 - 30 = 54$

The two numbers are 30 and 54.

7. Let k be Tom's weekly allowance.
Jerry's allowance = $\$3k$
Denny's allowance = $\$(3k + 20)$
Total = $k + 3k + 3k + 20 = 104$

$7k + 20 - 20 = 104 - 20$
$7k = 84$
$k = 12$

Tom's weekly allowance is \$12.

8. Let y be the number of apples that Ernie buys.

$0.4y + 0.7(y + 6) = 17.4$
$0.4y + 0.7y + 4.2 = 17.4$
$1.1y + 4.2 - 4.2 = 17.4 - 4.2$
$1.1y = 13.2$
$y = 12$

Ernie buys 12 apples.

9. Let s be the number of stamps Samuel has
Total number of stamps = $38 \times 3 = 114$

Samuel = s
Irene = $4s$
Peter = $4s - 21$
} 114

$s + 4s + 4s - 21 = 114$
$9s - 21 + 21 = 114 + 21$
$9s = 135$
$s = 15$

Samuel has 15 stamps.

10. Let x be her daughter's age now.
Difference in age = $4x - x = 3x$

$3x = 27$
$x = 9$
$x + 27 = 9 + 27$
$= 36$

Mrs. Tan is 36 years old now.

11. Let c be Chandra's mass.
Then, Alan is $3c$ pounds, and Ben is $(c + 10)$ pounds.

$c + 3c + c + 10 = 250$
$5c + 10 - 10 = 250 - 10$
$5c = 240$
$c = 48$

Chandra is 48 pounds.

Exercise 8H Linear Equations

1. **(a)** the price of food and the cost of the bill for dinner

(b) the amount of milk left in the fridge and the amount of milk consumed daily

(c) the length and breadth of the frame and the area of a photo frame

(d) the floor area of the house and the cost of a house

2.

(a) $y = 4x - 3$

x	y
2	5
4	13
5	17

(b) $q = \frac{p}{5}$

p	q
10	2
30	6
40	8

3. **(a)** $y = 5x + 3$

(b) $y = x \div 3$

4. **(a)** $k = p + 3p$
$k = 4p$

(b) $k = 4 \times 4$
$= 16$

5. **(a)** $g = k - 20$

(b)

Monthly Earning (\$$k$)	100	120	140	150
Savings (\$$g$)	80	100	120	130

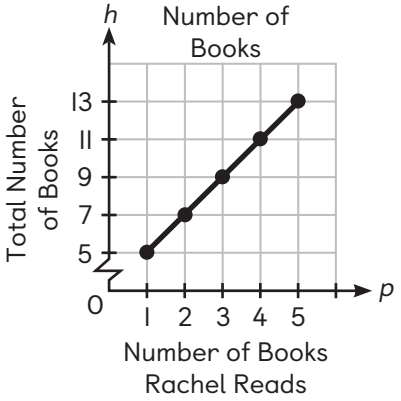
Exercise 8I Real-World Problems: Linear Equations

1. **(a)** $h = 2p + 3$

(b)

Number of Books Rachel Reads	1	2	3	4	5
Total Number of Books	5	7	9	11	13

(c)



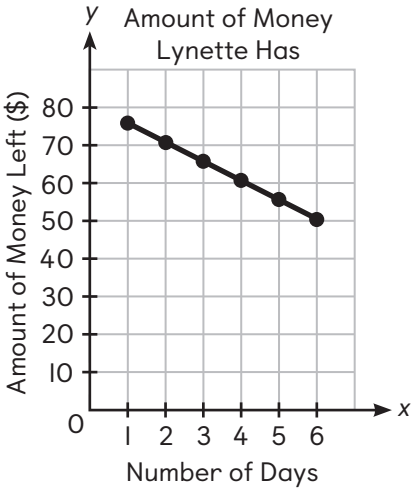
(d) Rachel reads 6 books.

2. **(a)** $y = 80 - 5x$

(b)

Number of Days	1	2	3	4	5	6
Amount of Money Left ($)	75	70	65	60	55	50

(c)



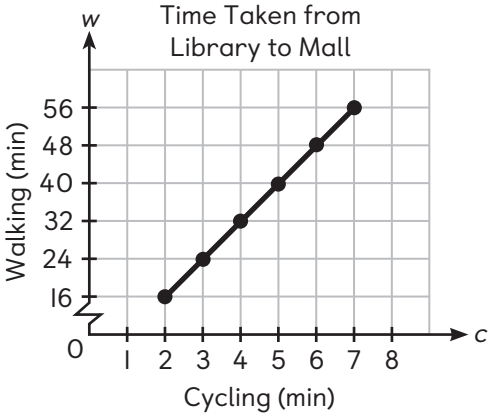
(d) $y = 80 - 5x$
When $x = 8$,
$y = 80 - 5 \times 8$
$= 40$
Yes, it indicates that Lynette has $40 left after 8 days.

3. **(a)** $w = 8c$

(b)

Cycling (min)	2	3	4	5	6	7
Walking (min)	16	24	32	40	48	56

(c)



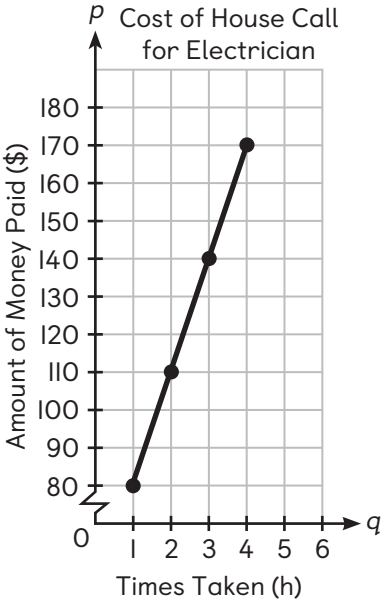
(d) Yes, it indicates that cycling time is 4.5 minutes and the walking time is 36 minutes.

4. **(a)** $p = 30q + 50$

(b)

Number of Hours Spent (h)	1	2	3	4
Amount of Money Paid ($)	80	110	140	170

(c)



(d) The house owner pays $125.

Exercise 8J Simple Inequalities

1. **(a)** −3, −1, 4

(b) 10, 18

(c) 4, 5, 10, 18

(d) −3, −1, 4, 5

2. **(a)** $g \geq 11$

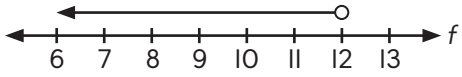
(b) $-4 < x \leq 1$

(c) $n \geq 7$

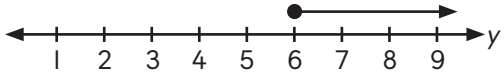
(d) $m < 9$

(e) $w \leq 11$

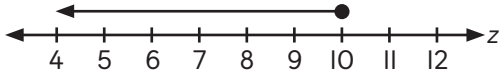
3. **(a)**



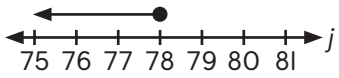
(b)



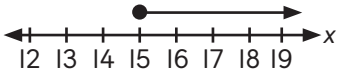
(c)



(d)

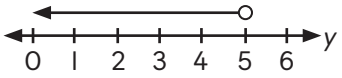


4.



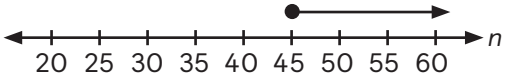
5. $3y < 15$

$y < 5$



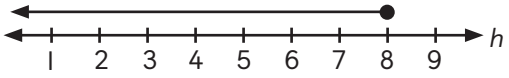
Exercise 8K Real-World Problems: Simple Inequalities

1.



$n \geq 45$

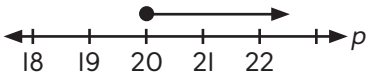
2.



$h \leq 8$

3. $11p \geq 220$

$\frac{11p}{7} \geq \frac{220}{11}$



$p \geq 20$

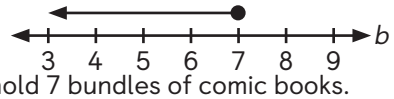
At least 20 liters of petrol must be filled.

4. $8b + 4 \leq 60$

$8b + 4 - 4 \leq 60 - 4$

$8b \leq 56$

$b \leq 7$

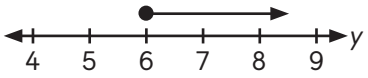


The box can hold 7 bundles of comic books.

5. $15y \geq 95 - 5$

$15y \geq 90$

$y \geq 6$



6 teachers are needed.

6. The length is $(2w + 5)$ inches.

Perimeter of the rectangle

$= w + 2w + w + 2w + 5 + 5$

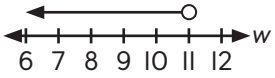
$= (6w + 10)$ inches

$6w + 10 < 76$

$6w + 10 - 10 < 76 - 10$

$6w < 66$

$w < 11$



Its maximum width is 10 inches.

Chapter Practice

1. A

2. C

3. D

4. A

5. C

6. **(a)** $7m - 17 = 19 - 5m$

$7m - 17 + 17 = 19 - 5m + 17$

$7m = 36 - 5m$

$7m + 5m = 36 - 5m + 5m$

$12m = 36$

$m = 3$

(b) $\frac{3h}{8} = 15$

$h = \frac{15 \times 8}{3}$

$= 40$

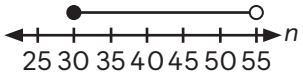
7. **(a)** Width of the rectangle = $6p \div 2 = 3p$
Perimeter of the rectangle
$= 6p + 3p + 6p + 3p$
$= 18p$
Perimeter of the square $= 2 \times 18p$
$= 36p$
Side length of the square $= 36p \div 4$
$= 9p$
The side length of the square is $9p$ inches.

(b) $9p = 9 \times 3$
$= 27$
The side length of the square is 27 inches.

8. **(a)** His mother is $(y + 30)$ years old now.
$n = y + y + 30$
$n = 2y + 30$

(b) $n = 2 \times 18 + 30$
$= 66$
Their total age will be 66 years.

9. $30 \leq n < 55$



10. Hebe has x bracelets, then Joyce has $3x$ bracelets.
Gina has $(75 - x)$ or $(129 - 3x)$.
$75 - x = 129 - 3x$
$75 - x - 75 = 129 - 3x - 75$
$-x = 54 - 3x$
$-x + 3x = 54 - 3x + 3x$
$2x = 54$
$x = 27$
Hebe has 27 bracelets.

11. Jaden buys x muffins, then he buys $(30 - x)$ doughnuts.

	Number	Value	Total	
Muffins	x	\$3	$\$3x$	\$72
Doughnuts	$30 - x$	\$2	$\$(60 - 2x)$	

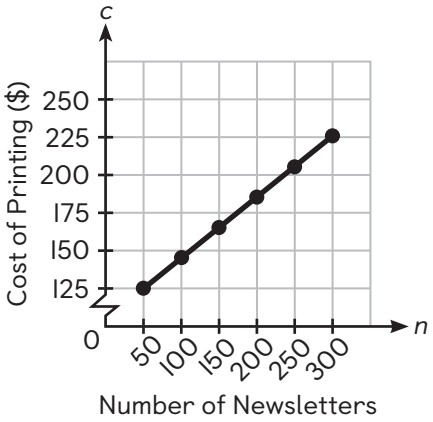
$3x + 60 - 2x = 72$
$x + 60 = 72$
$x + 60 - 60 = 72 - 60$
$x = 12$
Jaden buys 12 muffins.

12. **(a)** $c = 0.50n + 100$

(b)

Number of Newsletters	50	100	150	200	250	300
Cost of Printing (\$)	125	150	175	200	225	250

(c)

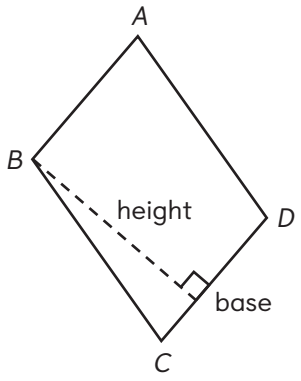


(d) $c = 0.50n + 100$
$= 0.50 \times 500 + 100$
$= 350$
Yes, it indicates that Josiah pays \$350 for printing 500 newsletters.

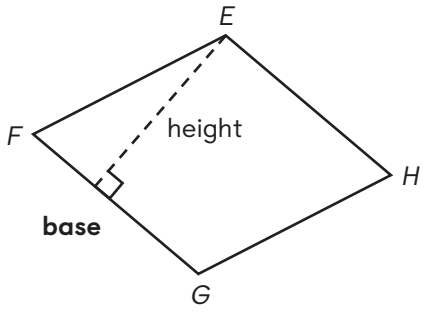
Chapter 9 AREA OF POLYGONS

Exercise 9A Area of Parallelograms

1. **(a)**



(b)



2. **(a)** Area of parallelogram $ABCD$ = 26 × 18
= 468 in^2

(b) Area of parallelogram $EFGH$ = 14 × 23
= 322 ft^2

(c) Area of parallelogram $JKLM$ = 15 × 20`
= 300 cm^2

(d) Area of parallelogram $PQRS$ = 12 × 14
= 168 cm^2

3. Area of parallelogram $ABCD$ = 6 × 4.5
= 27 cm^2

4. Area of the shaded parallelograms
= 3 × (6 × 9)
= 162 cm^2

5. 207 ÷ 9 = 23 in.
The length of GH is 23 inches.

6. Height of parallelogram $ABCD$ = 112 ÷ 16
= 7 in.
The height is 7 inches.

7. **(a)** Area of the parallelogram = 7 × 8
= 56cm^2

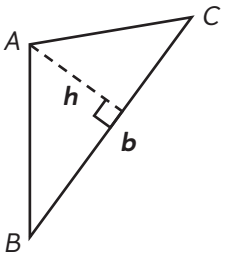
(b) 6 × h = 56
$h = 9\frac{1}{3}$

8. **(a)** Area of the parallelogram = 12 × 15
= 180 cm^2

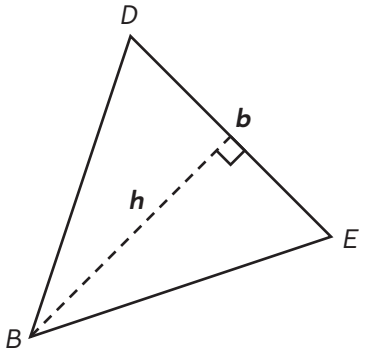
(b) Length of AB = 180 ÷ 10
= 18 cm

Exercise 9B Area of Triangles

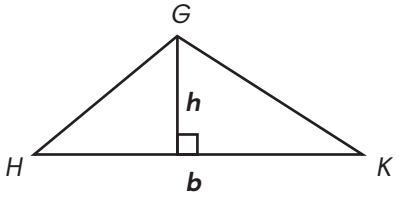
1. **(a)**



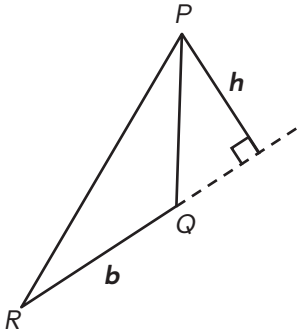
(b)



2. **(a)**



(b)



3. **(a)** Area of triangle $BCD = \frac{1}{2} \times 14 \times 8$
$= 56 \text{ in}^2$

(b) Area of triangle $XYZ = \frac{1}{2} \times 7 \times 18$
$= 63 \text{ cm}^2$

4. Area of the triangle $= \frac{1}{2} \times 26 \times 12$
$= 156 \text{ ft}^2$
Its area is 156 square feet.

5. Area of triangle $XYZ = \frac{1}{2} \times 18 \times 12$
$= 108 \text{ in}^2$
Area of triangle $WZY = \frac{1}{2} \times 12 \times (18 - 13)$
$= 30 \text{ in}^2$
Area of triangle $WXY = 108 - 30$
$= 78 \text{ in}^2$
OR
Area of triangle $WXY = \frac{1}{2} \times 13 \times 12$
$= 78 \text{ in}^2$
The area of triangle WXY is 78 square inches.

6. **(a)** Height $= \frac{96 \times 2}{16}$
$= 12$ in.

(b) Height $= \frac{96 \times 2}{8}$
$= 24$ in.

7. **(a)** $EF = \frac{135 \times 2}{15}$
$= 18$ yd

(b) $JK = \frac{135 \times 2}{27}$
$= 10$ yd

8. $BC = \frac{120 \times 2}{20}$
$= 12$ cm

Section 9C Area of Trapezoids

1. **(a)** Area $= 15 \times 12 + \frac{1}{2} \times 2.5 \times 13 + \frac{1}{2} \times 2.5 \times 13$
$= 210 \text{ in}^2$

(b) Area $= 14 \times 11 + \frac{1}{2} \times 2 \times 11 + \frac{1}{2} \times 2 \times 11$
$= 176 \text{ cm}^2$

2. Area $= 10 \times 8 + \frac{1}{2} \times 8.5 \times 8 + \frac{1}{2} \times 8.5 \times 8$
$= 108 \text{ cm}^2$

3. Let h be the height of triangle ACD.
$\frac{20 \times h}{2} = 130$
$h = 13$ ft
Height of trapezoid $ABCD = 13$ ft
Area of trapezoid $ABCD = 130 + \frac{1}{2} \times 28 \times 13$
$= 312 \text{ ft}^2$
The area of trapezoid $ABCD$ is 312 square feet.

4. **(a)** $EC = \frac{48 \times 2}{8}$
$= 12$ in.

(b) Length of $AE = 17 + 8$
$= 25$ in.
Area of trapezoid $AECD = 48 + 17 \times 12$
$= 252 \text{ in}^2$

5. **(a)** Let h be the height of figure $AGSJ$.

Area of rectangle $ABKJ$: Area of parallelogram $CDNM$: Area of triangle EQP
$= 6 \times h : 8 \times h : \frac{1}{2} \times 14 \times h$
$= 6 : 8 : 7$

(b) Height of triangle $EQP = \frac{56 \times 2}{14}$
$= 8$ in.
Area of trapezoid $FGSR$
$= 6 \times 8 + \frac{1}{2} \times 4.5 \times 8 + \frac{1}{2} \times 4.5 \times 8$
$= 84 \text{ in}^2$

Section 9D Area of Other Polygons

1. **(a)** Area of a triangle $= \frac{1}{2} \times 17.5 \times 12$
$= 105 \text{ cm}^2$
Area of the pentagon $= 5 \times 105$
$= 525 \text{ cm}^2$

(b) Area of a triangle $= \frac{1}{2} \times 12 \times 10.3$
$= 61.8 \text{ in}^2$
Area of the hexagon $= 6 \times 61.8$
$= 370.8 \text{ in}^2$

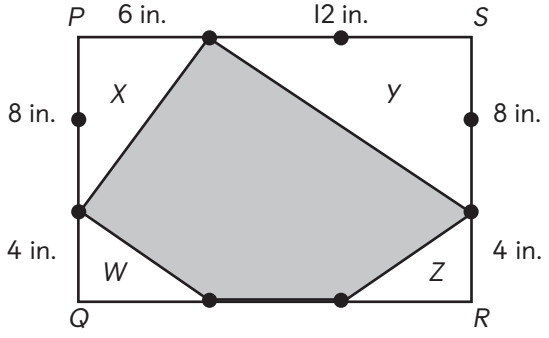
2. Area of a rhombus = 7 × 6
= 42 in^2
Area of the hexagon = 42 × 3
= 126 in^2

3. Area of trapezoid *ABGH*
= 10 × 7 + $\frac{1}{2}$ × 7 × 7 + $\frac{1}{2}$ × 7 × 7
= 119 cm^2
Area of rectangle *BCGF* = 24 × 10
= 240 cm^2
Area of the polygon *ABCDEFGH*
= 119 × 2 + 240
= 478 cm^2

4. Area of triangle *OAB* = $\frac{1}{2}$ × 26 × 18
= 234 cm^2
Area of the pentagon = 234 × 5
= 1,170 cm^2
Area of triangle *AEF* = $\frac{1}{2}$ × 42.3 × 24.7
= 522.405 cm^2
Area of the figure *FDCB* = 1,170 + 522.405
= 1,692.405 cm^2

5. Area of square *CDEF* = 7 × 7
= 49 in^2
Area of trapezoid *ABCF*
= 7 × (16 − 7) + $\frac{1}{2}$ × (19 − 7) × (16 − 7)
= 7 × 12 + $\frac{1}{2}$ × 9 × 12
= 138 in^2
Area of figure *ABCDE* = 49 + 138
= 187 in^2

6.

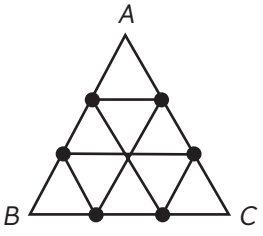


18 ÷ 3 = 6 in.
12 ÷ 3 = 4 in.
Area of rectangle *PQRS* = 18 × 12
= 216 in^2
Area of triangle *X* = $\frac{1}{2}$ × 6 × 8
= 24 in^2
Area of triangle *Y* = $\frac{1}{2}$ × 12 × 8
= 48 in^2
Area of triangle *W* = $\frac{1}{2}$ × 6 × 4
= 12 in^2
Area of triangle *Z* = $\frac{1}{2}$ × 6 × 4
= 12 in^2
Area of the shaded region
= 216 − (24 + 48 + 12 + 12)
= 120 in^2

7. Area of parallelogram *PQTU* = 10 × 13
= 130 yd^2
Area of trapezoid *QRST* = 10 × 12 + $\frac{1}{2}$ × 8 × 12
= 168 yd^2
Area of the field = 130 + 168
= 298 yd^2
The area of the field is 298 square yards.

8. Area of trapezoid *BEDC*
= 20 × 20 + $\frac{1}{2}$ × 20 × (36 − 20)
= 560 in^2
Area of triangle *BFE* = $\frac{1}{2}$ × 36 × 36
= 648 in^2
Area of triangle *CDF* = $\frac{1}{2}$ × 20 × (36 + 20)
= 560 in^2
Area of shaded region
= Area of *BEDC* + Area of *BFE* − Area of *CDF*
= 560 + 648 − 560
= 648 in^2
The shaded region of the figure is 648 square inches.

9. **(a)**



Each equilateral triangle can be divided into 9 smaller equilateral triangles.
Area of each smaller triangle = 72 ÷ 9
= 8
Area of the shaded region is formed by 6 smaller equilateral triangles.
6 × 8 = 48

(b) Area of the combined figure
= 72 × 2 − 48
= 96

Chapter Practice

1. C

2. A

3. C

4. D

5. $h = \frac{60 \times 2}{8}$
$= 15$
Area of trapezoid
$= 8 \times 15 + \frac{1}{2} \times 8 \times 15 + \frac{1}{2} \times 8 \times 15$
$= 240$ cm

6. Side length of square *MFGH*
= base of triangle *EMF*
$= \sqrt{64}$
= 8 in.
Side length of square *AHED*
= height of triangle *EMF*
$= \sqrt{144} - 8$
= 4 in.
Area of triangle $EMF = \frac{1}{2} \times 8 \times 4$
$= 16$ in^2
Area of the figure = 144 + 64 + 16
$= 224$ in^2

7. Area of triangle *ROS* = 950 ÷ 5
$= 192$ in^2
Height of $OM = \frac{192 \times 2}{24}$
= 16 in.
Length of *POM* = 16 × 2
= 32 in.

8. Length of the smaller square = 16 − 12
= 4 in.
Area of smaller square = 4 × 4
$= 16$ in^2
Area of I triangle $= \frac{1}{2} \times 16 \times 12$
$= 96$ in^2
Area of the big square = 4 × 96 + 16
= 400
Side length of the big square $= \sqrt{400}$
= 20 in.

9. **(a)** 18 ÷ 3 = 6 12 ÷ 3 = 4
Area of *PQRS* = 18 × 12
$= 216$ in^2
Area of $X = \frac{1}{2} \times 6 \times 8$
$= 24$ in^2
Area of $Y = \frac{1}{2} \times 12 \times 8$
$= 48$ in^2
Area of *W* = area of $Z = \frac{1}{2} \times 6 \times 4$
$= 12$ in^2
Shaded region = 216 − (24 + 48 + 12 + 12)
$= 120$ in^2
The shaded region of pentagon is 120 square inches.

(b) Equal area of shaded portion = 120 ÷ 2
$= 60$ in^2
Area of triangle *MBA*
$= \frac{1}{2} \times 12 \times 6$
$= 36$ in^2 (Base = *AM*, Height = *SA*)
Area of triangle *AMN* = 60 − 36
$= 24$ in^2
Base $AN = \frac{24 \times 2}{12}$
= 4 in. (Height = *AM*)
Length of *SN* = 6 + 4
= 10 in.

Chapter 10 THE COORDINATE PLANE

Exercise 10A Points on the Coordinate Plane

1.

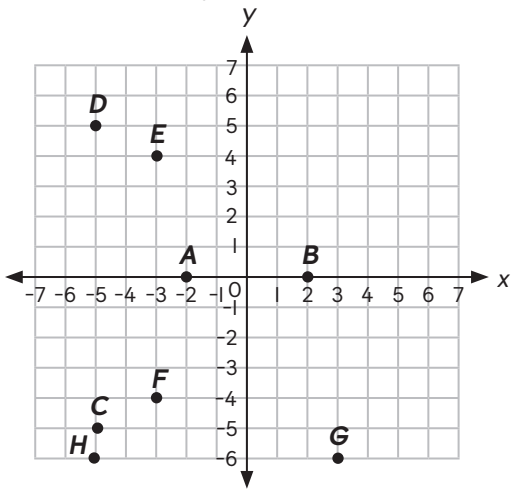
Points	Quadrant	Points	Quadrant
$P(-4, 2)$	II	$T(0, -3)$	Between III and IV
$Q(-3, 0)$	Between II and III	$U(7, -2)$	IV
$R(-4, -1)$	III	$V(2, 2)$	I
$S(-3, -2)$	III	$W(4, 1)$	I

2. **(a)** Points *A* and *B* are reflections of each other about the *y*-axis.

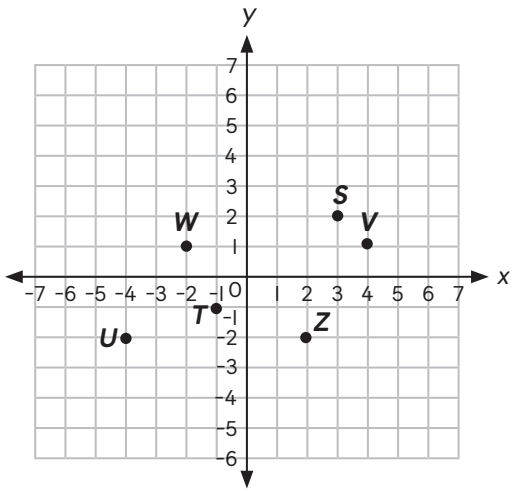
(b) Points *C* and *D* are reflections of each other about the *x*-axis.

(c) Points *E* and *F* are reflections of each other about the *x*-axis.

(d) Points *G* and *H* are reflections of each other about the *y*-axis.

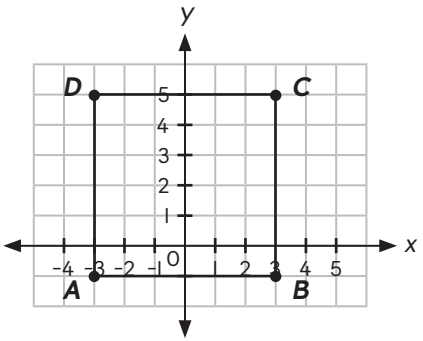


3. **(a)**



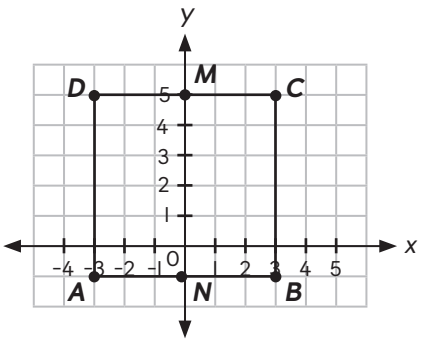
(b) The four points are *W*, *V*, *Z* and *U*.

4. **(a)**



(b) The figure formed is a square.

(c)

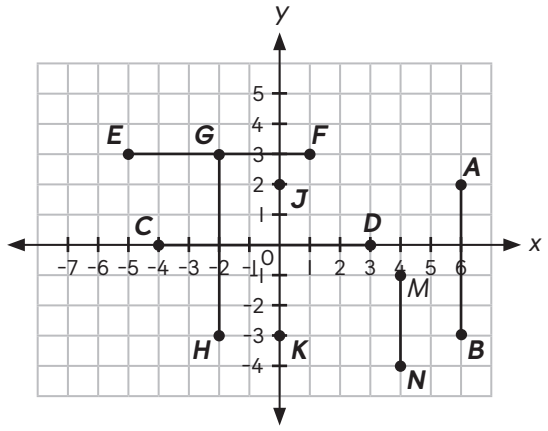


The two rectangles are of the same size and are reflections of each other.
OR
The two rectangles are of the same size and symmetrical with *y*-axis as the symmetry line.

Exercise 10B Distance and Area on the Coordinate Plane (I)

1. **(a)** 5
(b) 7
(c) 6
(d) 6
(e) 5

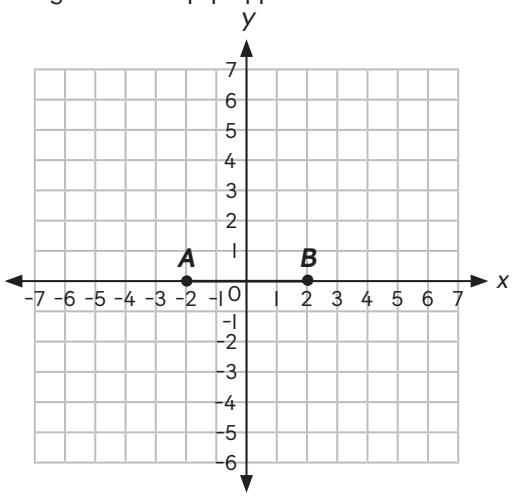
(f) 3



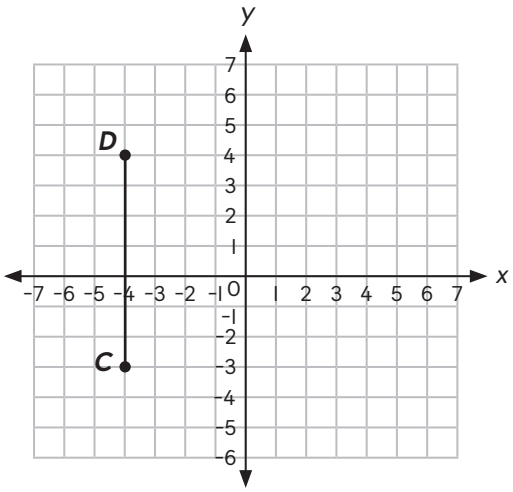
2.

Coordinates		Length of Line Segment
P (3, 5)	Q (3, −1)	$PQ = \|5\| + \|-1\| = 5 + 1 = 6$ units
R (−4, 2)	S (2, 2)	$RS = \|-4\| + \|2\| = 4 + 2 = 6$ units
T (−6, 0)	V (−1, 0)	$TV = \|-6\| - \|-1\| = 6 - 1 = 5$ units
M (−3, 2)	N (−3, −5)	$MN = \|2\| + \|-5\| = 2 + 5 = 7$ units
X (3, −3)	Y (7, −3)	$XY = \|7\| - \|3\| = 7 - 3 = 4$ units

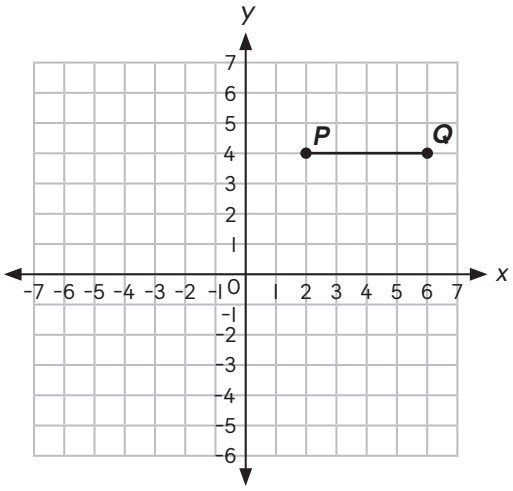
3. **(a)** Length of $AB = |4| - |1| = 3$ units



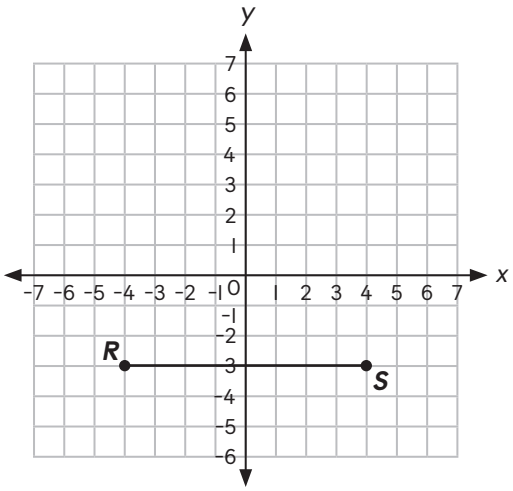
(b) Length of $CD = |-3| + |4| = 7$ units



(c) Length of $PQ = |6| - |2| = 4$ units



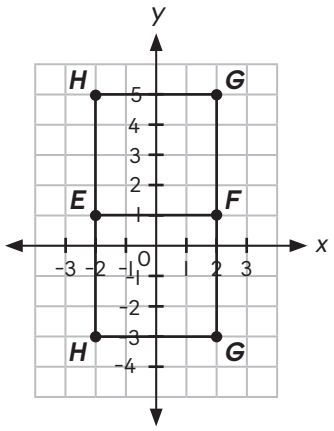
(d) Length $RS = |-4| + |4| = 8$ units



4. **(a)** G_1 (2, 5) and H_1 (−2, 5)

(b) G_2 (2, −3) and H_2 (−2, −3)

(c) Line *EF*



Exercise 10B Distance and Area on the Coordinate Plane (2)

1. Coordinates of $A = (0, 4)$
Coordinates of $B = (0, -2)$
Coordinates of $C = (5, -2)$

Base of triangle $ABC = 5$ units

Height of triangle $ABC = 6$ units

Area of triangle $ABC = \frac{1}{2} \times 6 \times 5$
$= 15$ unit^2

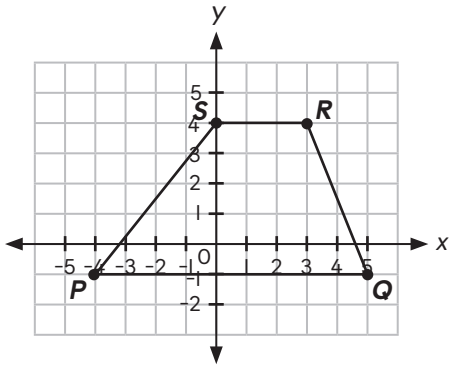
2. Perpendicular distance from *S* to *RQ* = 4 units

Length of $PQ = |-4| + |3| = 7$ units

Length of $SP = |-2| + |1| = 3$ units

Area of trapezoid *PQRS*
$= 3 \times 4 + \frac{1}{2} \times 2 \times 4 + \frac{1}{2} \times 2 \times 4$
$= 20$ unit^2

3. **(a)**



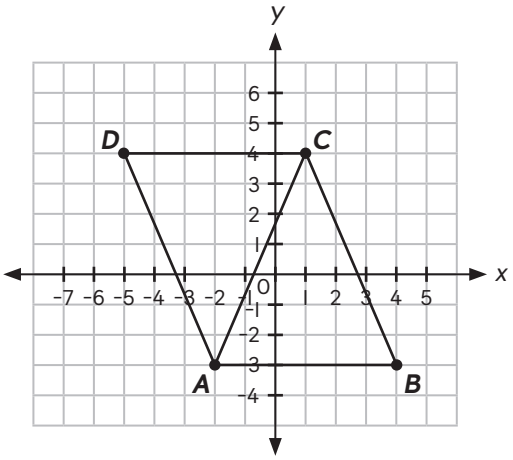
Perpendicular distance from *S* to *PQ* = 5 units

Length of $PQ = |-4| + |5| = 9$ units

Length of $SR = |0| + |3| = 3$ units

Area of trapezoid *PQRS*
$= 3 \times 5 + \frac{1}{2} \times 4 \times 5 + \frac{1}{2} \times 2 \times 5$
$= 30$ unit^2

4. **(a)**

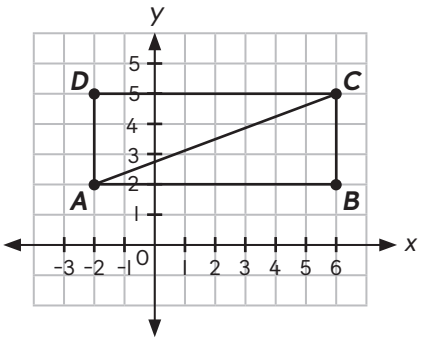


(b) ABC is an isosceles triangle.

(c) The coordinates of point *D* are (−5, 4).

(d) Base of triangle $ABC = 6$ units
Height of triangle $ABC = 7$ units
Area of triangle $ABC = \frac{1}{2} \times 6 \times 7$
$= 21$ unit^2
Area of parallelogram $ABCD = 21 \times 2$
$= 42$ unit^2

5. **(a)**

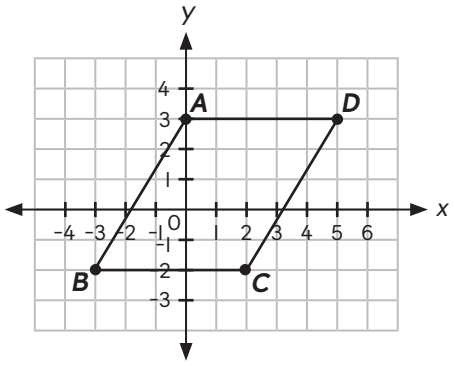


(b) *ABC* is a right-angled triangle.

(c) The coordinates of point *D* are (−2, 5).

(d) Length of $AB = |-2| + |6| = 8$ units
Length of $BC = |5| - |2| = 3$ units
Area of rectangle $ABCD = 8 \times 3$
$= 24$ unit^2

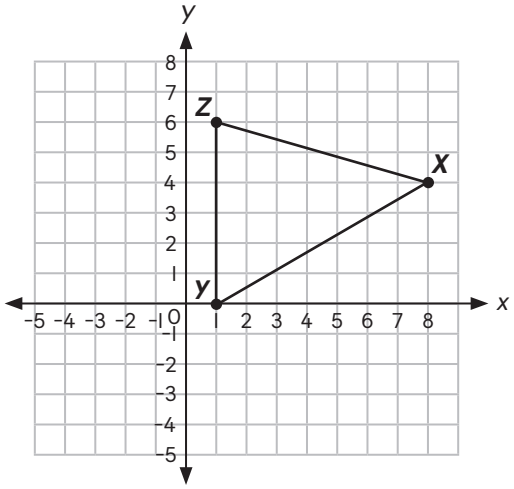
6. (a)



(b) The coordinates of point C are (2, −2).

(c) Perpendicular distance from A to BC
= 5 units
Length of BC = |−3| + |2| = 5 units
Area of parallelogram $ABCD$ = 5 × 5
= 25 unit^2

7. (a)

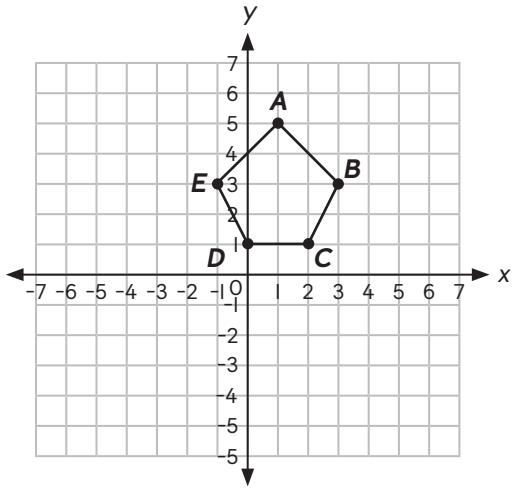


(b) Base of triangle XYZ = 6 units
Height of triangle XYZ = 7 units
Area of triangle $XYZ = \frac{1}{2} \times 7 \times 6$
= 21 unit^2

(c) Point W (8, 0)

(d) Area of trapezoid $YZXW$
= Area of triangle XYZ
+ Area of triangle XYW
$= 21 + \frac{1}{2} \times 7 \times 4$
= 35 unit^2

8. (a)



(b) Area of pentagon $ABCDE$
= Area of triangle ABE
+ Area of trapezoid $BCDE$
$= \frac{1}{2} \times 2 \times 4 + 2 \times 2 + \frac{1}{2} \times 1 \times 2 + \frac{1}{2} \times 1 \times 2$
= 10 unit^2

Exercise 10C Real-World Problems: Polygons

1. (a) P (−20, 10) Q (5, 10) R (5, −15) S (25, −15)
T (25, −25) U (−20, −25) V (10, −15)
W (15, −15)

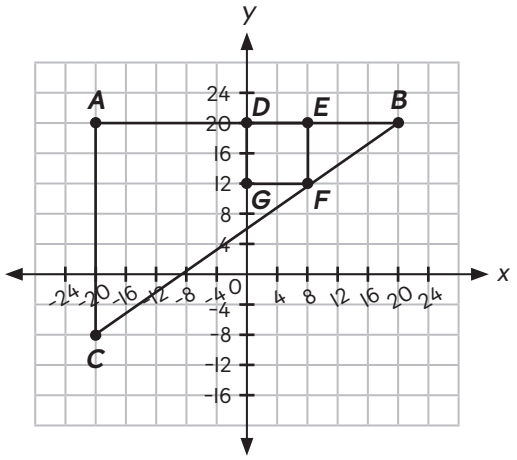
(b) Length of PU = 7 units × 5
= 35 ft
Length of PQ = 5 units × 5
= 25 ft
Length of QR = 5 units × 5
= 25 ft
Length of RS = 4 units × 5
= 20 ft
Length of ST = 2 units × 5
= 10 ft
Length of TU = 9 units × 5
= 45 ft
Perimeter of the field
= 35 + 25+ 25 + 20 + 10 + 45
= 160 ft
160 − 5 = 155 ft
The perimeter of the field is 160 feet.

(c) Cost of fencing = \$29 × 155 + \$480
= \$4,975
James needs to pay \$4,975.

(d) Decompose the figure into rectangle *UPQV* and rectangle *RSTV*.
Length of *UP* = 35 ft
Length of *PQ* = 25 ft
Area of rectangle *UPQV* = 35 × 25
= 875 ft²
Length of *RS* = 20 ft
Length of *ST* = 10 ft
Area of rectangle *RSTV* = 20 × 10
= 200 ft²
Area of the field = 875 + 200
= 1,075 ft²
The area of the field is 1,075 square feet.

2. (a) *A* (−20, 20), *B* (20, 20), *C* (−20, −8)

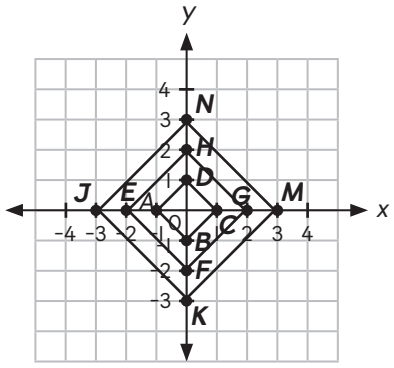
(b)



(c) Length of *BC* = 49 yd
Length of *AC* = 7 units × 4
= 28 yd
Length of *AB* = 10 units × 4
= 40 yd
Perimeter of the playground
= 40 + 49 + 28
= 117 yd
The perimeter of the playground is 117 yards.

(d) Length of *EB* = 3 units × 4
= 12 yd
117 − 12 = 105
105 ÷ 5 = 21
It will take her 21 seconds to get from point *E* to point *B*.

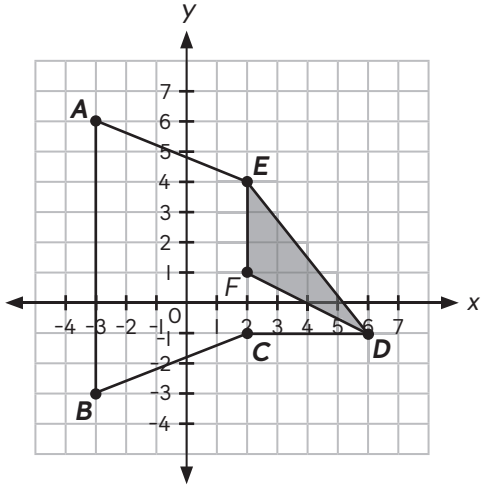
3. (a)



(b) The figures formed are squares.

(c) Area of triangle *ADC* = $\frac{1}{2}$ × 2 × 1
= 1 cm²
Area of figure *ABCD* = 1 × 2
= 2 cm²
The area of figure *ABCD* is 2 square centimeters.
Area of triangle *EHG* = $\frac{1}{2}$ × 4 × 2
= 4 cm²
Area of figure *EFGH* = 4 × 2
= 8 cm²
The area of figure *EFGH* is 8 square centimeters.
Area of triangle *JNM* = $\frac{1}{2}$ × 6 × 3
= 9 cm²
Area of figure *JKMN* = 9 × 2
= 18 cm²
The area of figure *JKMN* is 18 square centimeters.

4. (a)



(b) Decompose the figure into trapezoid *ABCE* and triangle *ECD*.
Perpendicular distance from *E* to *BC* = 5 units
Length of *AB* = |−3| + |6| = 9 units
Length of *EC* = |−1| + |4| = 5 units

Area of trapezoid *ABCE*

$= 5 \times 5 + \frac{1}{2} \times 2 \times 5 + \frac{1}{2} \times 2 \times 5$

$= 35$ unit²

Area of triangle *ECD* $= \frac{1}{2} \times 4 \times 5$

$= 10$ unit²

Area of figure *ABCDE* = 35 + 10

= 45 unit²

The area of figure *ABCDE* is 45 square units.

(c) There are five units along *EC*, so point *F* is three units from point *E*.
The coordinates of point *F* are (2, 1).

Chapter Practice

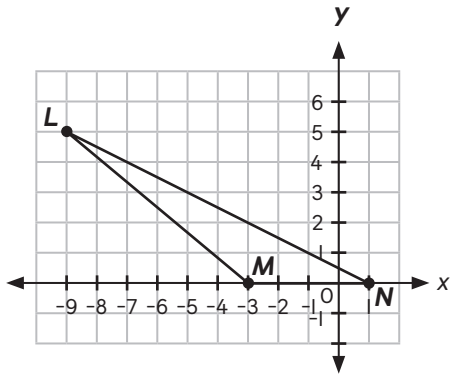
1. D

2. B

3. D

4. B

5.

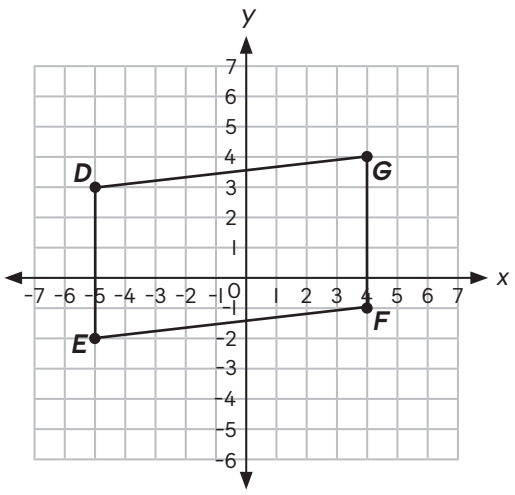


Base of triangle *LMN* = 4 units
Height of triangle *LMN* = 5 units

Area of triangle *LMN* $= \frac{1}{2} \times 4 \times 5$

$= 10$ unit²

6.

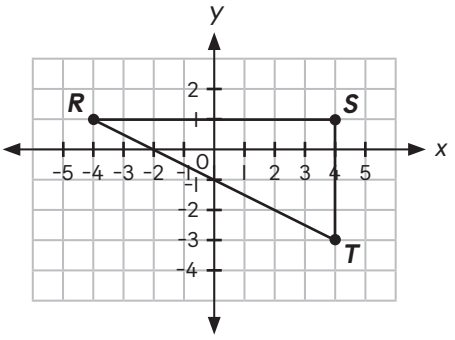


Perpendicular distance from *F* to *DE* = 9 units
Length of *DE* = |−2| + |3| = 5 units
Area of parallelogram *DEFG* = 9 × 5

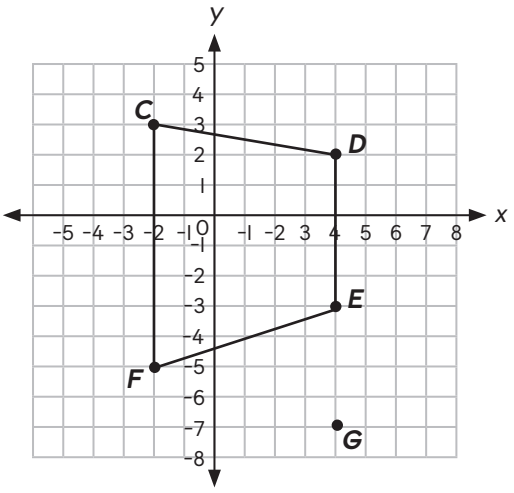
= 45 unit²

7. **(a)** *S* (4, 1)

(b) *T* (4, −3)



8. **(a)**



(b) Perpendicular distance from E to CF
= 6 units
Length of CF = |3| + |−5| = 8 units
Length of DE = |2| + |−3| = 5 units

Area of trapezoid $CDEF$

$= 5 \times 6 + \frac{1}{2} \times 2 \times 6 + \frac{1}{2} \times 1 \times 6$

$= 39 \text{ unit}^2$

The area of trapezoid $CDEF$ is 39 square units.

(c) Area of triangle $EGF = 12 \text{ unit}^2$

$$= \frac{1}{2} \times EG \times 6$$

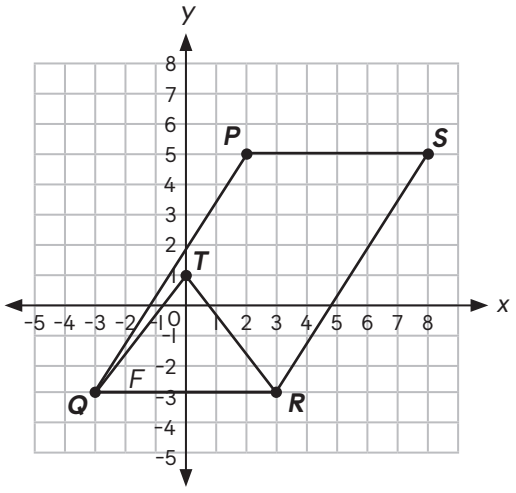
$$12 \text{ unit}^2 = EG \times 3$$

$$EG = \frac{12}{3}$$

$$= 4 \text{ units}$$

The coordinates of G is (4, −7).

9.



(a) Perpendicular distance from S to QR
= 8 units
= 8 units × 5
= 40 m
Length of QR = |−3| + |3| = 6 units
= 6 units × 5
= 30 m
Area of parallelogram $PQRS$ = 40 × 30
= 1,200 m^2
The area of the playground $PQRS$ is 1,200 square meters.

(b) Area of triangle $QTR = \frac{1}{4} \times 6 \times 8$

$= 12 \text{ unit}^2$

$12 \text{ unit}^2 = \frac{1}{2} \times QT \times 6$

$12 \text{ unit}^2 = QT \times 3$

$QT = \frac{12}{3}$

$= 4 \text{ units}$

The x-coordinate of point T is x-axis and is 4 units above line QR.
So, the coordinates of point T are (0, 1).

Chapter 11 VOLUME AND SURFACE AREA

Exercise 11A Volume

1. Length of the container $= 4 \times 1\frac{1}{2}$
$= 6$ in.
Width of the container $= 3 \times 1\frac{1}{2}$
$= 4\frac{1}{2}$ in.
Height of the container $= 3 \times 1\frac{1}{2}$
$= 4\frac{1}{2}$ in.
Volume of the container $= 6 \times 4\frac{1}{2} \times 4\frac{1}{2}$
$= 121\frac{1}{2}$ in^3
Volume of the rectangular container is $121\frac{1}{2}$ cubic inches.

2. Volume of the rectangular prism
$= 10\frac{2}{5} \times 8\frac{1}{3} \times 5\frac{5}{8}$
$= 487\frac{1}{2}$ cm^3

3. Number of cubes along the length $= 3\frac{1}{4} \div \frac{1}{4}$
$= 13$
Number of cubes along the width $= 2\frac{3}{4} \div \frac{1}{4}$
$= 11$
Number of cubes along the height $= 1\frac{1}{2} \div \frac{1}{4}$
$= 6$
Total number of cubes $= 13 \times 11 \times 6$
$= 858$

4. **(a)** Volume of prism A $= 7\frac{1}{5} \times 4\frac{9}{10} \times 3\frac{4}{7}$
$= 126$ cm^3

(b) Length $= 7\frac{1}{5} \times 3$
$= 21\frac{3}{5}$ cm
Breadth $= 4\frac{9}{10} \times 3$
$= 14\frac{7}{10}$ cm
Height $= 3\frac{4}{7} \times 3$
$= 10\frac{5}{7}$ cm
Volume of prism B $= 21\frac{3}{5} \times 14\frac{7}{10} \times 10\frac{5}{7}$
$= 3402$ cm^3
$3402 \div 126 = 27$
Volume of prism B is 27 times of volume of prism A.

(c) Each side of prism B is 3 times the sides of prism A.
$3 \times 3 \times 3 = 27$
We can multiply 27 to the volume of prism A to get the volume of prism B.

Exercise 11B Real-World Problems: Volume

1. Number of cubes along the length
$= 28\frac{3}{4} \div 2\frac{1}{2}$
$= 11\frac{1}{2}$
≈ 11
Number of cubes along the width $= 17\frac{1}{2} \div 2\frac{1}{2}$
$= 7$
Number of cubes along the height $= 8\frac{1}{3} \div 2\frac{1}{2}$
$= 3\frac{1}{3}$
≈ 3
Number of cubes that can be cut out
$= 11 \times 7 \times 3$
$= 231$ cubes

2. Number of cubes along the length
$= 42\frac{1}{2} \div 8\frac{1}{2}$
$= 5$
Number of cubes along the width $= 34 \div 8\frac{1}{2}$
$= 4$
Number of cubes along the height
$= 25\frac{1}{2} \div 8\frac{1}{2}$
$= 3$
Number of cubed watch boxes $= 5 \times 4 \times 3$
$= 60$ boxes

3. Volume of 1 cuboid $= 10\frac{4}{5} \times 5\frac{1}{2} \times 7\frac{2}{3}$
$= 455\frac{2}{5}$ cm^3
Volume of the tank $= 455\frac{2}{5} \times 2$
$= 910\frac{4}{5}$ cm^3

4. Number of cubes = 6 × 2 = 12

Volume of a cube = $2\frac{1}{4} \times 2\frac{1}{4} \times 2\frac{1}{4}$

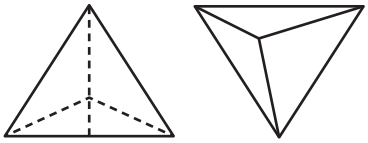
$= 11\frac{25}{64}$

Volume of the stairs = $11\frac{25}{64} \times 12$

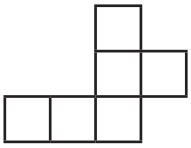
$= 136\frac{11}{16}$ ft^3

Exercise IIC Solids, Nets, and Surface Area (1)

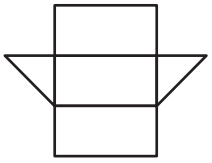
1.



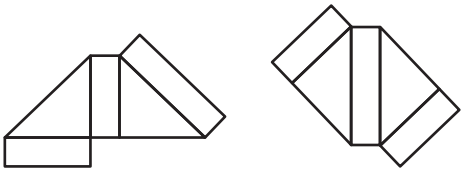
2.



3.

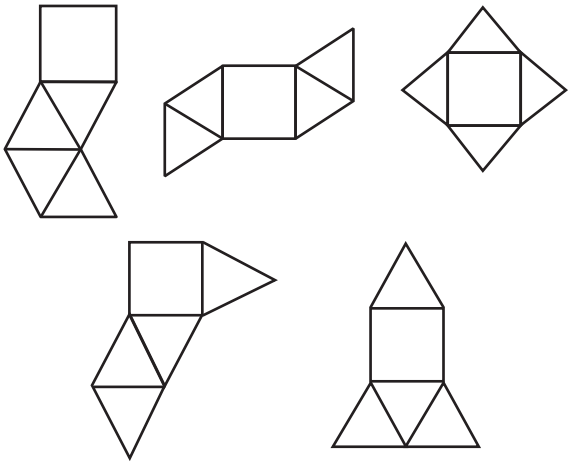


4.



5.

6. All possible nets:



Exercise IIC Solids, Nets, and Surface Area (2)

1. Area of 1 square face = 9 × 9

= 81 in^2

Surface area of the cube = 6 × 81

= 486 in^2

2. Area of the top face = Area of the bottom face

= 20 × 8

= 160 ft^2

Area of the front face = Area of the back face

= 20 × 6

= 120 ft^2

Area of the left face = Area of the right face

= 8 × 6

= 48 ft^2

Surface area of the container

= (160 × 2) + (120 × 2) + (48 × 2)

= 656 ft^2

The surface area of the container is 656 square feet.

3. Area of 1 triangular face = $\frac{1}{2} \times 16 \times 12$

= 96 cm^2

Area of front rectangular face = 20 × 4

= 80 cm^2

Area of left rectangular face = 16 × 4

= 64 cm^2

Area of right rectangular face = 12 × 4

= 48 cm^2

Surface area of the triangular prism

= (2 × 96) + 80 + 64 + 48

= 384 cm^2

4. 2 side length of square + 2 width of rectangle

= 32 cm

1 side length of square + 2 width of rectangle

= 20 cm

1 side length of square = 32 − 20

= 12 cm

1 width of rectangle = (20 − 12) ÷ 2

= 4 cm

Surface area of the box

= (12 × 12) × 2 + (4 × 12) × 4

= 144 × 2 + 48 × 4

= 480 cm^2

Exercise IIC Solids, Nets, and Surface Area (3)

1. Area of one triangular face = $\frac{1}{2} \times 120 \times (19 - 8)$

= 660 ft^2

Area of front rectangular face = 120 × 8

= 960 ft^2

Area of right rectangular face = 125 × 8
= 1,000 ft²
Total surface area of walls
= (660 × 2) + (960 × 2) + (1000 × 2)
= 5,240 ft²
Surface area excluding doors and windows
= 5,240 − 225
= 5,015 ft²
The total area of the walls that need to be painted is 5,015 square feet.

2. Area of one triangular face = $\frac{1}{2} \times 6 \times 4$
= 12 ft²
Area of right rectangular face = 5 × 7
= 35 ft²
Area of the rectangular base = 6 × 7
= 42 ft²
Surface area of the tent
= (2 × 12) + (2 × 35) + 42
= 136 ft²

3. Area of front & back faces
= (20 × 15) − (8 × 7) × 2
= 488 in²
Area of left & right faces = (10 × 15) × 2
= 300 in²
Area of top & bottom faces = (20 × 10) × 2
= 400 in²
Area of 2 smaller rectangular sides
= (10 × 7) × 2
= 140 in²
Area of the wood painted in green
= 488 + 300 + 400 + 140
= 1328 in²

4. **(a)** Number of cubes = 1 + 4 + 9 + 16 + 25
= 55
Volume of cube = 3 × 3 × 3
= 27 in³
Volume of the solid = 55 × 27
= 1485 in³

(b) Number of faces from the top view or bottom view = 25
Number of faces from the front view or back view = 15
Number of faces from the left view or right view = 15
Total number of faces of the solid
= (25 + 15 + 15) × 2
= 110
Area of the solid painted in red
= 110 × (3 × 3)
= 990 in²

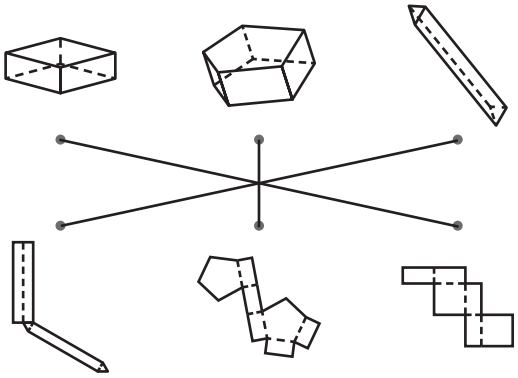
Chapter Practice

1. A

2. C

3. B

4.



5. Area of front square face = 12 × 12
= 144 in²
Area of rectangle face = 12 × 3
= 36 in²
Surface area of prism = (2 × 144) + (4 × 36)
= 288 + 144
= 432 in²
Volume of prism = 12 × 12 × 3
= 432 in³

6. Area of one triangular face = $\frac{1}{2} \times 7 \times 14$
= 49 cm²
Area of right rectangular base = 14 × 10
= 140 cm²
Area of the right rectangular face = 10.6 × 10
= 106 cm²
Area of the left rectangular face = 9.2 × 10
= 92 cm²
Surface area of the prism
= (2 × 49) + 140 + 106 + 92
= 436 cm²

7. Number of exposed square faces
= (4 × 4) + (1 × 2)
= 18

Total surface area covered by paint
= $\frac{2}{3} \times \frac{2}{3} \times 18$
= 8 in²

8. Volume of the top rectangular prism
$= 7 \times 6 \times (18 - 6 - 7)$
$= 210 \text{ cm}^3$
Volume of the bottom rectangular prism
$= 18 \times 7 \times 4$
$= 504 \text{ cm}^3$
Volume of the solid $= 210 + 504$
$= 714 \text{ cm}^3$

9. **(a)** Number of cubes to fill the tank completely $= 4 \times 3 \times 3$
$= 36$
Number of cubes needed $= 36 - 13$
$= 23$

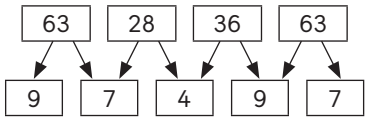
(b) Volume of the rectangular tank
$= \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times 36$
$= 20\frac{5}{6} \text{ in}^3$

10. Number of faces painted in pink $= 4 \times 9$
$= 36$
Total surface area covered by paint
$= \frac{3}{4} \times \frac{3}{4} \times 36$
$= 20\frac{1}{4} \text{ in}^2$

11. Maximum number of cubes along the length
$= 48 \div 4\frac{1}{2}$
$= 10$
Maximum number of cubes along the width
$= 25 \div 4\frac{1}{2}$
$= 5$
Maximum number of cubes along the height
$= 16 \div 4\frac{1}{2}$
$= 3$
Maximum number of boxes $= 10 \times 5 \times 3$
$= 150$

12. Area of the square base $= 12\frac{3}{4} \times 12\frac{3}{4}$
$= 162\frac{9}{16} \text{ in}^2$
Area of 4 triangular faces
$= (\frac{1}{2} \times 18 \times 12\frac{3}{4}) \times 4$
$= 459 \text{ in}^2$
Surface area of the square pyramid
$= 162\frac{9}{16} + 459$
$= 621\frac{9}{16} \text{ in}^2$

13.



(a) Volume of the of rectangular prism
$= 9 \times 7 \times 4$
$= 252 \text{ in}^3$

(b) Surface area of the rectangular prism
$= (63 + 28 + 36) \times 2$
$= 254 \text{ in}^2$

14. Number of cubes in prism A $= 4 \times 3 \times 5$
$= 60$
Prism A and figure X have the same volume as both are made up of 60 cubes.
Volume of prism A or figure X
$= (2 \times 2 \times 2) \times 60$
$= 480 \text{ in}^3$
Surface area of prism A
$= (20 \times 2 + 12 \times 2 + 15 \times 2) \times (2 \times 2)$
$= 376 \text{ in}^2$
Number of cubes in a layer of figure X
$= 5 \times 2$
$= 10$
Number of layers $= 60 \div 10$
$= 6$
Surface area of figure X
$= (30 \times 2 + 10 \times 2 + 12 \times 2) \times (2 \times 2)$
$= 416 \text{ in}^2$
Both solids are made up of 60 identical cubes and have the same volume of 480 cubic inches.
Their surface areas are different. The surface area of prism A is 376 square inches and the surface area of figure X is 416 square inches.

Chapter 12 STATISTICS

Exercise 12A Data Collection and Data Displays (1)

1. **(a)** Yes

(b) No

(c) No

(d) Yes

(e) Yes

2. Answer varies: What are the numbers that your classmates get when everyone spins one time?

3. **(a)**

Model	Tally	Frequency
A	𝍸 𝍸 //	12
B	𝍸 𝍸 /	11
C	𝍸 ////	9
D	𝍸 ///	8

(b) 40

(c) 12 − 8 = 4

(d) $\frac{12}{40} \times 100\% = 30\%$

4. **(a)**

Number of Hours	Tally	Frequency
0	//	2
1	𝍸	5
2	𝍸 𝍸 //	12
3	𝍸 ///	8
4	///	3

(b) 8 + 3 = 11

(c) $\frac{12}{30} \times 100\% = 40\%$

(d) Answer varies: Most students spend 2 hours on the Internet. 10% of the students spend more than 3 hours on the Internet. 2 students do not use the Internet.

5. **(a)**

Number of Pets	Tally	Frequency
0	𝍸 /	6
1	𝍸 ///	8
2	𝍸 ////	9
3	𝍸	5
4	//	2

(b) 9 + 5 + 2 = 16

(c) $\frac{9}{30} \times 100\% = 30\%$

6. **(a)**

Number of People in Each Car	Frequency
1	10
2	11
3	4
4	5

(b) 10 + 11 + 4 + 5 = 30

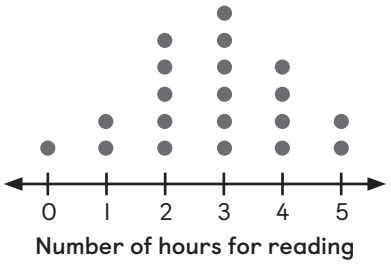
(c) $\frac{10 + 11}{30} \times 100\% = 70\%$

(d) $1 \times 10 + 2 \times 11 + 3 \times 4 + 4 \times 5 = 64$

$\frac{12 + 20}{64} \times 100\% = 50\%$

Exercise 12A Data Collection and Data Displays (2)

1. **(a)**

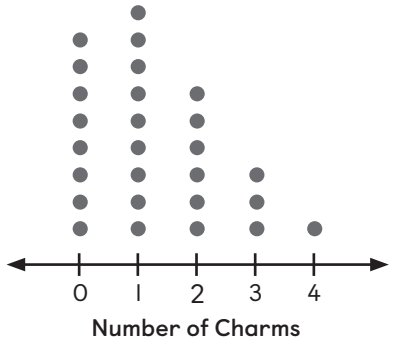


(b) 1 + 2 + 5 + 6 + 4 + 2 = 20

(c) The shape of the distribution of the dots can be described as symmetric.

(d) 5 − 0 = 5 hours

2. **(a)**



(b) 8 + 9 + 6 + 3 + 1 = 27

(c) 4 − 0 = 4 charms

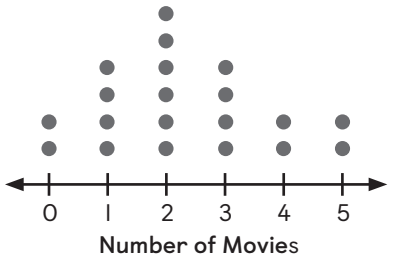
(d) The shape of the distribution is not symmetrical, it is said to be skewed to the left.

3. **(a)** How many movies did the students watch in the past three months?

(b)

Number of Movies	Tally	Frequency
0	//	2
1	////	4
2	~~////~~ /	6
3	////	4
4	//	2
5	//	2

(c)



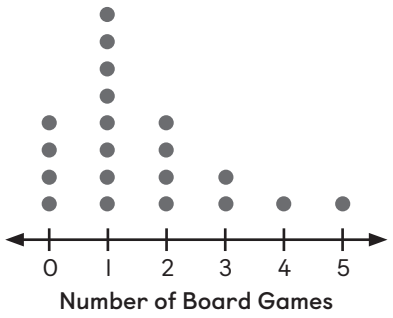
(d) 5 − 0 = 5

(e) The dot plot has a "tail" on the right.
Most of the data are from 1 to 3,
The shape of the distribution can be described as symmetric.

4. **(a)**

Number of Board Games	Tally	Frequency
0	////	4
1	~~////~~ ///	8
2	////	4
3	//	2
4	/	1
5	/	1

(b)

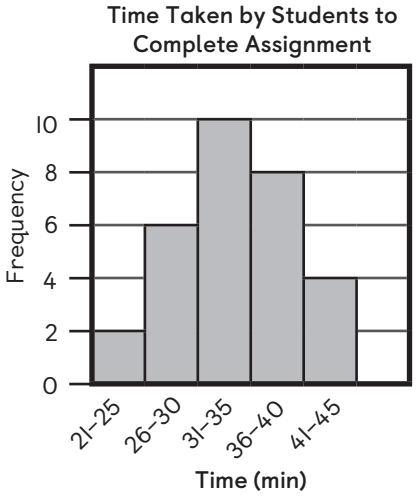


(c) 5 − 0 = 5

(d) The shape of the distribution is not symmetrical, it is said to be skewed to the left.

Exercise 12A Data Collection and Data Displays (3)

1. **(a)**

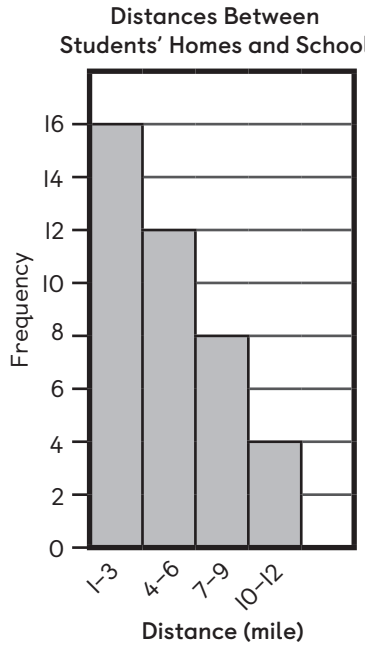


(b) Longest time taken = 45 minutes
Shortest time taken = 21 minutes
Range = 45 − 21
= 24 minutes

(c) The shape of the histogram is nearly symmetrical.

(d) $\frac{8+4}{30} \times 100\% = 40\%$

2. (a)

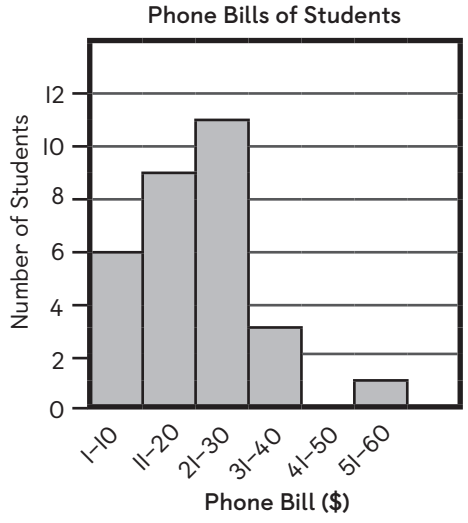


(b) Total = 16 + 12 + 8 + 4
= 40
40 students were surveyed.

(c) $\frac{16+12}{40} \times 100\% = 70\%$

(d) It is skewed to the left.

3. (a)



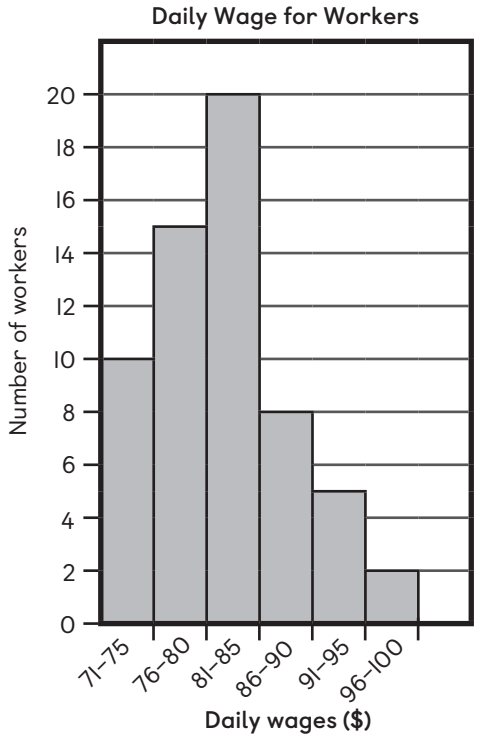
(b) 21–30

(c) 11–20

(d) Least amount = $1
Greatest amount = $60
Range = $60 − $1
= $59

(e) The histogram is left-skewed with a gap at the interval 41–50.

4. (a)



(b) 81–85

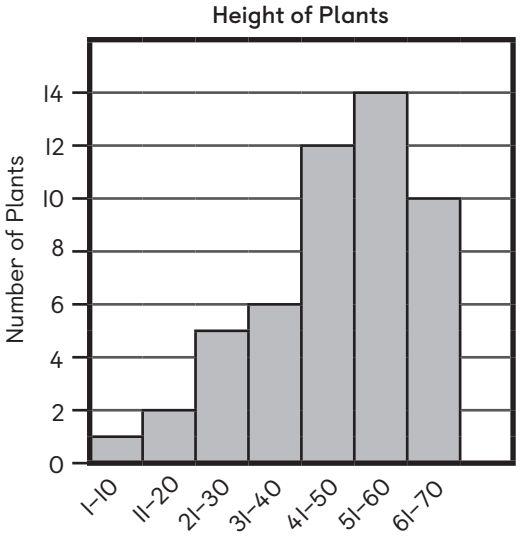
(c) 76–80

(d) Least amount = $71
Greatest amount = $100
Range = $100 − $71
= $39

(e) The histogram is left-skewed with the higher peak at the interval 81–85.

5. (a) 12 + y + 10 = 36
y = 14
1 + 2 + x + 6 + 12 + 14 + 10 = 50
x = 5

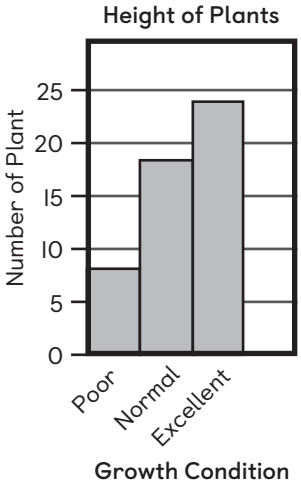
(b)



(c) Shortest height = 1 cm
Tallest height = 70 cm
Range = 70 − 1
= 69 cm

(d) The histogram is right-skewed with the higher peak at the interval 51–60.

(e)



(f) The first histogram, which uses more intervals, reveals more about the distribution of data. It shows the three intervals that contain the most data. This histogram will be more useful when you want to find out the height intervals of the tallest plants. The second histogram, which uses fewer intervals with greater width, categorizes the plants into poor, normal, and excellent growth. This histogram will be more useful when you want general information on whether the plants are growing well.

Exercise 12B Center of Distribution (1)

1. **(a)** Arrange the numbers from least to greatest: 18, 19, 20, 22, 25, 25, 27, 28, 30
The median is 25.

(b) Arrange the numbers from least to greatest: 2.4, 2.6, 3.5, 4.8, 5.6, 6.5, 8.4, 9.5

$$\text{The median} = \frac{4.8 + 5.6}{2}$$
$$= 5.2$$

(c) Arrange the numbers from least to greatest: $3\frac{1}{2}$, $3\frac{3}{4}$, $4\frac{1}{4}$, $4\frac{3}{4}$, $5\frac{7}{12}$, $6\frac{1}{4}$

$$\text{The median} = (4\tfrac{1}{4} + 4\tfrac{3}{4}) \div 2$$
$$= 4\tfrac{1}{2}$$

2. **(a)** The mode is 4.
(b) The mode is 12.
(c) The modes are 7.7 and 9.3.

3. Arrange the size in order: 8, 8, 10, 10, 10, 12, 14, 14, 16
Median size = 10
Mode size = 10

4. Arrange the numbers from the least to the greatest: 13, 34, 43, q, 52, 64

$$47 = \frac{43 + q}{2}$$
$$q = 51$$

5. **(a)** Median = 3
Mode = 1

(b) Median better describes the data set as the distribution is also uniform. Mode does not represent the data set well as more than half of the students visited more than two countries.

6. **(a)** Median = 102

(b) Mode = 102

7. **(a)** Total number of cars = 20
The middle values are the 10th and 11th values.
(61 + 90) ÷ 2 = 75.5
Median = 75.5

(b) Modal interval = 61–90

8. **(a)** There are 15 students.
The eighth student is in the middle.
Median = 2

(b) Mode = 1

(c) The mode is 1 mistake. Most of the students made more than 1 mistake. The median is 2 mistakes. It describes the data set better because most of the data cluster around 2 spelling mistakes.

Exercise 12B Center of Distribution (2)

1. **(a)** Sum = 9 + 10 + 11 + 16 + 12 + 12 + 14
= 84
Number of data points = 7
Mean = $\frac{84}{7}$
= 12

(b) Sum
= 20 + 21 + 22 + 23 + 24 + 25 + 26 + 27 + 28
= 216
Number of data points = 9
Mean = $\frac{216}{9}$
= 24

2. Sum of heights = 3.8 + 5.2 + 4.8 + 5.0 + 4.6
= 23.4
Number of peacocks = 5
Mean height = $\frac{23.4}{5}$
= 4.68 ft

3. Total amount of time
= 11.3 + 15.2 + 12 + 13.6 + 12.8 + 10.9 + 14.2 + 14
= 104
Number of airplanes = 8
Mean time = $\frac{104}{8}$
= 13 seconds

4. Sum of 8 numbers = 83 × 8
= 664
Sum of 4 numbers = 14 × 4
= 56
Total sum of 12 numbers = 664 + 56
= 720
Number of numbers = 12
Mean = $\frac{720}{12}$
= 60

5. Total height of 8 plants = 18 × 8
= 144 in.
Total height of 7 plants
= 12 + 13 + 15 × 2 + 17 + 23 + 24
= 119 in.
Height of 8th plant = 144 − 119
= 25 in.

6. Total score for 5 games = 280 × 5
= 1,400
Total score for 6 games = 300 × 6
= 1,800
His score in the sixth game = 1,800 − 1,400
= 400

7. Sum of 7 numbers = 21 × 7
= 147
Sum of 5 numbers = 18 + 23 + 21 + 17 + 19
= 98
Sum of 2 unknown numbers = 147 − 98
= 49
Let n be one of the numbers.
$n + \frac{3}{4}n = 49$
$4n + 3n = 49 \times 4$
$7n = 196$
$n = 28$
49 − 28 = 21
The two numbers are 28 and 21.

8. Sum of 12 sets of numbers = 5.5 × 12
= 66
Sum of set of 8 numbers = $8k$
Sum of combined set of 20 numbers = 8.5 × 20
= 170
$8k + 66 = 170$
$k = 13$

9. Total number of goals
= 1 + 2 + 5 × 3 + 2 × 4 + 4 × 5 + 3 × 6
= 64
Mean = $\frac{64}{16}$
= 4 goals

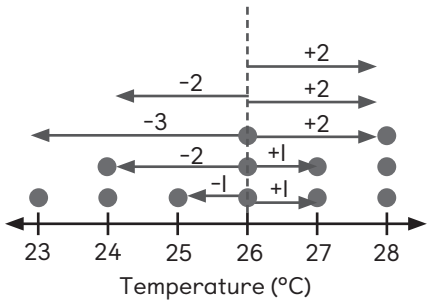
10. Total time taken by 15 students
= 2 × 6 + 3 × 7 + 5 × 8 + 3 × 9 + 2 × 10
= 120
Mean = $\frac{120}{15}$
= 8 minutes

Exercise 12C Variability of Distribution (1)

1. **(a)** The distribution is skewed to the left.

(b) The balance point (mean) of this dot plot is 2.

2. **(a)** The distribution is almost symmetrical and the balancing point is 26.



(b) The mean temperature is 26°C over this period in the town.

3. **(a)** Sum of deviation of data points below the mean = 2 + 2 + 1 + 1+ 1 = 7
Sum of deviation of data points above the mean = 1 + 1+ 1 + 2 = 5
7 − 5 = 2
4 + 2 = 6
The 15th student designed 6 pieces of art.

(b) The distribution is symmetrical and the balancing point is 4.

4. Distances of data points to the left of the mean = 8
Distances of data points to the right of the mean = 7
To balance the missing data is 8 − 7 = 1 above the mean.
6 + 1 = 7
The 18th student borrowed 7 books.

Exercise 12C Variability of Distribution (2)

1. **(a)** Mean $= \frac{10 + 8 + 7 + 12 + 6 + 2 + 18 + 9}{8}$
$= \frac{72}{8}$
$= 9$
Mean absolute deviation
$= \frac{1 + 1 + 2 + 3 + 3 + 7 + 9 + 0}{8}$
$= \frac{26}{8}$
$= 3.25$

(b) Mean $= \frac{19.6 + 6.5 + 28.5 + 12.4 + 14}{5}$
$= \frac{81}{5}$
$= 16.2$
Mean absolute deviation
$= \frac{(19.6 - 16.2) + (16.2 - 6.5) + (28.5 - 16.2) + (16.2 - 12.4) + (16.2 - 14)}{5}$
$= \frac{3.4 + 9.7 + 12.3 + 3.8 + 2.2}{5}$
$= \frac{31.4}{5}$
$= 6.28$

2. Mean $= \frac{84 + 108 + 124 + 132}{4}$
$= \frac{448}{4}$
$= 112$
Mean absolute deviation $= \frac{28 + 4 + 12 + 20}{4}$
$= \frac{64}{4}$
$= 16$

3. Mean $= \frac{8 + 2 + 5 + 4 + 6 + 5}{6}$
$= \frac{30}{6}$
$= 5$
Mean absolute deviation $= \frac{3 + 3 + 0 + 1 + 1 + 0}{6}$
$= \frac{8}{6}$
$= 1.3$

4. Mean $= \frac{23 + 27 + 11 + 25 + 14}{5}$
$= \frac{100}{5}$
$= 20$
Mean absolute deviation $= \frac{3 + 7 + 9 + 5 + 6}{5}$
$= \frac{30}{5}$
$= 6$

5. **(a)** Mean $= \frac{30 + 15 + 20 + 10 + 15}{5}$
$= \frac{90}{5}$
$= 18$
Mean absolute deviation $= \frac{12 + 3 + 2 + 8 + 3}{5}$
$= \frac{28}{5}$
$= 5.6$

(b) New mean $= \frac{15 + 20 + 10 + 15}{4}$
$= \frac{60}{4}$
$= 15$

New mean absolute deviation

$= \frac{0 + 5 + 5 + 0}{4}$

$= \frac{10}{4}$

$= 2.5$

The new mean for the remaining data would decrease and the mean absolute deviation would also decrease. The remaining data would be closer to the new mean.

6. (a) Mean $= \frac{8 + 12 + 10 + 20 + 16 + 21}{6}$

$= \frac{87}{6}$

$= 14.5$

Mean absolute deviation

$= \frac{6.5 + 2.5 + 4.5 + 5.5 + 1.5 + 6.5}{6}$

$= \frac{27}{6}$

$= 4.5$

(b) New mean $= \frac{12 + 10 + 20 + 16 + 21}{5}$

$= \frac{79}{5}$

$= 15.8$

New mean absolute deviation

$= \frac{3.8 + 5.8 + 4.2 + 0.2 + 5.2}{5}$

$= \frac{19.2}{5}$

$= 3.84$

The new mean for the remaining 5 pieces of ribbons would increase and the mean absolute deviation would decrease. The remaining data would be closer to the new mean.

Exercise 12D Box Plots (1)

1. (a) (i) 49, 50, 52, 60, 64, 71, 74, 82, 90

(ii) The minimum data value is 49 and maximum data value is 90.

(iii) Median = 64

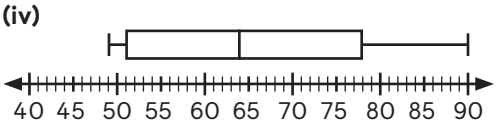
Lower (1st) quartile $= \frac{50 + 52}{2}$

$= 51$

Upper (3rd) quartile $= \frac{74 + 82}{2}$

$= 78$

(iv)



(v) Interquartile range $= 78 - 51$

$= 27$

(b) (i) 9, 10, 14, 22, 28, 35, 43, 48

(ii) The minimum data value is 9 and maximum data value is 48.

(iii) Median $= \frac{22 + 28}{2}$

$= 25$

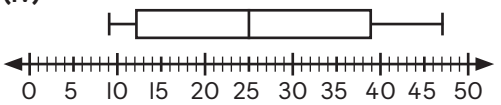
Lower (1st) quartile $= \frac{10 + 14}{2}$

$= 12$

Upper (3rd) quartile $= \frac{35 + 43}{2}$

$= 39$

(iv)



(v) Interquartile range $= 39 - 12$

$= 27$

2. (a) The minimum data value is 3 and maximum data value is 27.

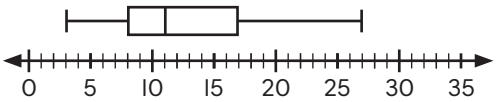
Median $= \frac{10 + 12}{2}$

$= 11$ marks

Lower (1st) quartile = 8 marks

Upper (3rd) quartile = 17 marks

(b)



(c) Interquartile range $= 17 - 8$

$= 9$ marks

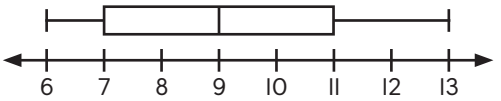
3. (a) The minimum data value is 6 and maximum data value is 13.

Median = 9 years old

Lower (1st) quartile = 7 years old

Upper (3rd) quartile = 11 years old

(b)



(c) Interquartile range $= 11 - 7$

$= 4$ years old

Exercise 12D Box Plots (2)

1. **(a)** Range = 22 − 2 = 20
Lower quartile = 8
Upper quartile = 18
Median = 13
Interquartile range = 18 − 8 = 10

(b) Range = 19 − 11= 8
Lower quartile = 13
Upper quartile = 16
Median = 15
Interquartile range = 16 − 13 = 3

(c) New York has a greater spread in temperatures during the 5-month period, i.e. the temperature in some months is higher while in some months it is much lower.

2. **(a)** Earbud A = 13.5 hours
Earbud B = 12.5 hours

(b)

	Earbud A	Earbud B
Lower (1st) quartile	12	11.5
Upper (3rd) quartile	14	13.5
Interquartile range	2 hours	2 hours

(c) Earbud B
Earbud B has a longer median battery life as the median is closer to the upper quartile. The minimum value is far away from the lower quartile, resulting in a long 'whisker'. The data is skewed left.

3. **(a)** Mathematics = 68
Science = 63

(b)

	Mathematics	Science
Lower (1st) quartile	64	59
Upper (3rd) quartile	78	67
Interquartile range	14	8

(c) The Mathematics examination performed better as the median score, maximum and minimum scores are higher than that of the Science examination. These scores are closer to the median in the Mathematics examination than that in the Science examination. So we can say that students perform better in the Mathematics examination. The Science examination is probably harder than the Mathematics examination to the students.

4. **(a)**

Year	2021	2022
Lower (1st) quartile	145	156
Median	156	161
Upper (3rd) quartile	161	166
Range	30	30
Interquartile range	16	10

(b) Disagree.
The median time, lower quartile, and the upper quartile in 2022 are higher than those in 2021.

(c) Agree.
The lower quartile in 2021 is lower than that in 2022.

Chapter Practice

1. B

2. C

3. C

4. D

5. Total number of pillows = 13 × 9 = 117
Number of pillows in the last box
= 117 − (12 × 2 + 10 + 11 + 15 × 2 + 13 × 2)
= 16

6. Mean $= \frac{(5 \times 2) + (6 \times 3) + (7 \times 4) + (8 \times 5) + (9 \times 6)}{20}$
$= \frac{150}{20}$
$= 7.5$
Mean absolute deviation
$= \frac{(2.5 \times 2) + (1.5 \times 3) + (0.5 \times 4) + (0.5 \times 5) + (1.5 \times 6)}{20}$
$= \frac{23}{20}$
$= 1.15$

7. **(a)** Range = 25 − 5
= 20 minutes
Total time = (2 × 5) + (4 × 10) + (4 × 15) + 20 + 25
= 155
Mean = $\frac{155}{12}$
= $12\frac{11}{12}$ minutes
= 12 minutes 55 seconds

(b) The shape of the distribution is not symmetrical, it is said to be skewed to the left.

8. **(a)** 10 + 2 + 8 + 20 = 40

(b) 2 + 8 = 10
The total of number of students who like soccer or hockey is the same as the number of students who like basketball.

(c) Answer varies.
(i) Most students like swimming.
(ii) $\frac{1}{4}$ of the students who were surveyed like basketball.

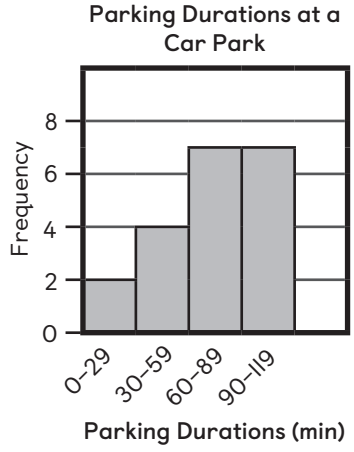
9. **(a)** Most students scored 6 points.

(b) The dot plot is nearly symmetrical, centered around 6. Most of the students scored between 5 and 7 points. The data spans from 3–10 and the range is 7.

10. **(a)**

Duration (min)	0–29	30–59	60–89	90–119
Frequency	2	4	7	7

(b)



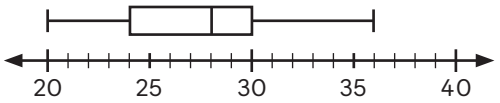
(c) $\frac{7+7}{20} \times 100\% = 70\%$

(d) Most of the parking durations are between 60 minutes and 119 minutes. The range of the data is 119. The histogram has a "tail" to the left. Most of the data is to the left of the interval 90–119, the shape of the histogram is left-skewed.

11. The minimum data value is 10 and maximum data value is 60.
Median = 28
Lower (1st) quartile = 14
Upper (3rd) quartile = 52

12. **(a)** The minimum data value is 20 and maximum data value is 36.
Median = $\frac{27+29}{2}$
= 28
Lower (1st) quartile = $\frac{23+25}{2}$
= 24
Upper (3rd) quartile = 30

(b)



(c) Interquartile range = 30 − 24 = 6

13. **(a)** Range = 84 − 20 = 64
Median = 56
Interquartile range = 66 − 40 = 26

(b) Range = 94 − 10 = 84
Median = 42
Interquartile range = 66 − 30 = 36

(c) English examination

The median of the English examination is higher by 56 − 42 = 14 marks than the Mathematics examination.
The range of the English examination is smaller by 84 − 64 = 20 marks than the Mathematics examination.
The interquartile range of 26 marks for the English examination is 36 − 26 = 10 marks lower than the interquartile range of 36 marks for the Mathematics examination.

We can say that students perform better in the English examination. The Mathematics examination is probably harder than the English examination to the students.