Answers

1A EXPONENT NOTATION

1 **a** 32 **b** 64 **c** 300 **d** 550

2 **a** $2^3 \times 3 \times 7$ **b** $3^2 \times 5 \times 11^3$ **c** $5^2 \times 7^3 \times 13^2$

3 **a** 343 **b** -200 **c** -1600

4 **a** 161 051 **b** 2.863 288 **c** 0.268 738 56

5 **a** 7^2 **b** 7^3 **c** 7^5

1B THE FUNDAMENTAL THEOREM OF ARITHMETIC

1 **a** $42 = 2 \times 3 \times 7$ **b** $96 = 2^5 \times 3$

c $520 = 2^3 \times 5 \times 13$ **d** $784 = 2^4 \times 7^2$

e $1600 = 2^6 \times 5^2$ **f** $1008 = 2^4 \times 3^2 \times 7$

2 **a** 14 **b** 120

1C ORDER OF OPERATIONS

1 **a** 13 **b** 29 **c** 3 **d** 23 **e** -1 **f** -12

2 **a** $4 \times 2 \times 6 - 3 = 45$ **b** $33 \div 11 + 2 \times 7 = 17$

c $7 + 21 \div 3 - 14 = 0$

3 **a** 3 **b** 7 **c** 72 **d** 18 **e** 8 **f** -36

4 **a** 8 **b** $\frac{6}{5}$ **c** $\frac{3}{4}$ **d** $\frac{8}{3}$ **e** 5 **f** $\frac{29}{9}$

1D ABSOLUTE VALUE

1 **a** 3 **b** 5 **c** 7 **d** 11

2 **a** $|2| < |5|$ **b** $|6| = |-6|$ **c** $|-8| > |4|$

3 **a** 56 **b** 10 **c** 22 **d** 17 **e** 9 **f** 40

g 3 **h** $\frac{1}{10}$ **i** -1

REVIEW OF CHAPTER 1

1 **a** 144 **b** 125

2 **a** $2 \times 3^3 \times 5^2$ **b** $2 \times 3^2 \times 5^2 \times 7$

3 **a** 5^3 **b** 2^8

4 **a** $88 = 2^3 \times 11$ **b** $490 = 2 \times 5 \times 7^2$

5 126 **6** **a** 14 **b** 16 **c** 99

7 **a** 1 **b** 33 **c** $\frac{4}{9}$

2A ALGEBRAIC NOTATION

1 **a** $4x$ **b** $r - st$ **c** $8g + 9h$

d $3 + 4k + n$ **e** $3d + 4e$ **f** $4 + 2j - 4k$

g $xy + 2z$ **h** $7(m + n)$ **i** $5a(b - 2)$

2 **a** c^3 **b** $11w^4$ **c** $5cd^3$

3 **a** $x \times x$ **b** $3 \times t \times t \times t \times t \times t$

c $3 \times q \times 3 \times q$ **d** $x \times x \times x - 4 \times y \times y \times z$

4 **a** $2abc - ab^2$ **b** $k^2 - 3k$ **c** $2m + 2m^2n$

d $2u^2v - u^3v$

2B WRITING EXPRESSIONS

1 **a** b minus 3 **b** p minus the square of q

c the sum of 5 times m and the square root of n

d the sum of x and y, all squared

2 **a** $c + 2d$ **b** $\sqrt{y} - 8$ **c** j^3k^3 **d** $\frac{d + e + f}{3}$

3 $(4x - 3)^2$ **4** **a** $\$2x$ **b** $\$(2x + 100)$

2C ALGEBRAIC SUBSTITUTION

1 **a** -12 **b** 9 **c** -13 **d** $-\frac{2}{3}$ **e** 3 **f** 2

2 **a** 21 **b** 25 **c** -192 **d** 3 **e** $\sqrt{12} \approx 3.46$

f 8

3 **a** $\frac{13}{7}$ **b** -33

4 **a** **i** $3g$ blue pens **ii** $(3g - 5)$ red pens

b **i** 12 blue pens **ii** 25 red pens

2D THE LANGUAGE OF ALGEBRA

1 **a** equation **b** expression **c** expression **d** equation

2 **a** 2 terms **b** 3 terms **c** 5 terms

3 **a** 8 **b** $-\frac{1}{2}$ **c** -5 **d** 2

4 **a** 6 **b** -1 **c** $\frac{1}{4}$ **d** -3 and 7

5 **a** 2 **b** 5 **c** -1 **d** 4

6 **a** $5x$ and $-2x$ **b** $-x^2$ and $-3x^2$ **c** $-x^2y$ and $2x^2y$

2E COLLECTING LIKE TERMS

1 **a** $b + 1$ **b** $-3q$ **c** $9z^2 - 7$

d cannot be simplified **e** $11a^2b$ **f** $-6x$

g cannot be simplified **h** $6pq - 2p$

2 **a** $5y + 1$ **b** cannot be simplified **c** $18x^2 - 10x$

d st **e** cannot be simplified **f** $6ab - 5a^2b$

2F ALGEBRAIC PRODUCTS

1 **a** $12t$ **b** $20q^2$ **c** $10x^4$ **d** $-22x^3$

e $-6v^4$ **f** $25a^2$

2 **a** $23x$ **b** $15s + 14t$ **c** $30ab$ **d** $-9xy$

e $-x^2$ **f** $12gh + 4g^2h^2 - g^3$

2G ALGEBRAIC QUOTIENTS

1 **a** $\frac{1}{5x}$ **b** $\frac{4}{3}$ **c** $\frac{1}{3k^2}$ **d** $\frac{5t^2}{2}$

2 **a** $\frac{x}{2y}$ **b** $\frac{12a}{b}$ **c** $\frac{3}{y}$ **d** $\frac{5q}{7p}$

2H ALGEBRAIC COMMON FACTORS

1 **a** x **b** $3k$ **c** $4x$ **d** $4m$

2 **a** 2 **b** xy **c** $5a$ **d** $2pq^2r$

3 **a** x **b** $x - 1$ **c** $3x$ **d** $2(x + 1)$

REVIEW OF CHAPTER 2

1 **a** $9k^3$ **b** $5a^2b$ **c** $3c - c^2d^2$ **2** $\sqrt{p+q}$

3 **a** the sum of a and the cube of b

b the sum of a and b, all cubed

4 **a** -23 **b** 4 **c** 5

5 **a** 5 terms **b** **i** -1 **ii** 4 **iii** -3

6 **a** $7 - 3q$ **b** $2b - 2c + 2d - cd$ **c** $-6x^2 - 5xy + y$

7 **a** $8x^2$ **b** $49d^2$ **c** $-15y^2$ **d** $-20bc$

8 **a** $\frac{1}{5m}$ **b** $\frac{2y}{x}$ **c** $\frac{3q}{2p}$

9 **a** $5x$ **b** ab **c** $x(x-2)$

3A EXPONENT LAWS

1 **a** 2^6 **b** x^{a+3} **c** q^{13} **d** 5^2 **e** k^{12-n}

f y^3 **g** b^{35} **h** a^{6b} **i** t^{12k} **j** z^{3b+4}

k d^{mn-1} **l** x^{3-2n}

2 **a** $x^3 \times x^8 = x^{11}$ **b** $(b^4)^6 = b^{24}$ **c** $s^7 \div s^6 = s$

3 **a** $24a^6$ **b** $3a^3b$ **c** $4p^9q$

4 **a** 2^6 **b** 3^6 **c** 7^{4-x} **d** 5^{4k} **e** $3^{2(y-2)}$

f 2^{2x+4} **g** 2^{2y-4} **h** 7^{2k-2}

5 **a** c^7d^7 **b** $125z^3$ **c** $\frac{h^{11}}{k^{11}}$ **d** $\frac{e^2}{9f^2}$ **e** $8x^9$

f $\frac{s^7}{t^{28}}$ **g** $81a^8b^{12}$ **h** $\frac{25p^{10}q^6}{4r^2}$

3B ZERO AND NEGATIVE EXPONENTS

1 **a** 1 **b** $1,\ y \neq 0$ **c** 1 **d** $7,\ x \neq 0$

e $1,\ x \neq 0$ **f** 4 **g** 1 **h** $2q^2$

2 **a** $\frac{1}{4}$ **b** $\frac{1}{36}$ **c** $1\frac{1}{5}$ **d** $2\frac{26}{27}$

3 **a** 7 **b** $\frac{3}{2}$ **c** $\frac{144}{169}$ **d** $\frac{64}{27}$

4 **a** $\frac{1}{k}$ **b** $\frac{1}{6d}$ **c** $\frac{6}{d}$ **d** $\frac{1}{16s^2}$

e $\frac{m^2}{25}$ **f** $\frac{p^3}{2}$ **g** $\frac{2}{b^3c^3}$ **h** $\frac{2b}{c^3}$

5 **a** 3^3 **b** 3^{-3} **c** 5^{-4} **d** $2^{-3} \times 3^{-2}$

e $2^4 \times 5^{-3}$ **f** $3^4 \times 5^{-2}$ **g** 2^{-2a} **h** $2^{-2t} \times 5^{-t}$

3C SCIENTIFIC NOTATION

1 **a** 3.79×10^2 **b** 7.25×10^{-2} **c** 8.91×10^6

d 4.11×10^{-5}

2 **a** 8×10^{-3} mm **b** 1.36×10^{10} years

3 **a** 5000 **b** 0.000 137 1 **c** 0.000 000 748 **d** 6 150 000 000

4 **a** 400 000 ants **b** 0.000 25 m

5 **a** 2.03×10^5 **b** 6.27×10^{-6}

6 **a** 2.9×10^9 **b** 1.4×10^{-6} **c** 5.0062×10^{-4}

7 **a** 3×10^{13} **b** 1.6×10^{11} **c** 2×10^5 **d** 6×10^2

e 2.7×10^{-11} **f** 5×10^6

8 **a** China **b** 2.5 times greater

9 **a** 7.02×10^6 **b** $\approx 8.60 \times 10^{-15}$ **c** 1.28×10^{-13}

10 **a** 4.27×10^6 cm **b** $\approx 2.31 \times 10^{-5}$ days

11 **a** $\approx 6.64 \times 10^{-24}$ grams **b** $\approx 5.42 \times 10^{21}$ atoms

3D INTERNATIONAL SYSTEM (SI) UNITS

1 **a** 5×10^{-3} m **b** 1.6×10^{-8} m **c** 7.2×10^{-4} s

d 4.3×10^{-2} s **e** 5.7×10^9 L **f** 2.6×10^7 L

2 **a** 4.9 nm **b** 6.1 ms **c** 73 μm **d** 146 ns

e 50.4 kL **f** 327 ML

3 **a** 10^6 times larger **b** 10^3 times larger **c** 10^{12} times larger

4 **a** hair: 2.5×10^{-5} m, fingernail: 4.8×10^{-4} m

b 19.2 times thicker

5 **a** 5×10^{-4} s **b** 0.5 ms **c** 500 μs

REVIEW OF CHAPTER 3

1 **a** p^8 **b** x^9 **c** t^{21x} **d** 1

2 **a** $3f^3g^2$ **b** $\frac{81b^8}{c^{20}}$ **c** $7q$

3 **a** $\frac{1}{49}$ **b** $1\frac{1}{8}$ **c** $\frac{6}{25}$

4 **a** $\frac{2}{g^2}$ **b** $\frac{1}{25r^2}$ **c** $\frac{b^3}{a^3}$

5 **a** 2^{-4} **b** 3^{-3t} **c** $2^2 \times 3^2 \times 5^{-1}$

6 $\$(1.82 \times 10^{11})$

7 **a** 2 600 000 **b** 0.000 104 **c** 0.000 000 071 4

8 **a** 1.2×10^{10} **b** 3×10^{13} **c** 2.5×10^{-15}

9 $\approx 4.59 \times 10^{23}$ gold atoms

10 **a** 2×10^{-3} s **b** 3.2×10^{-5} m **c** 1.5×10^5 L

11 **a** 2.4 nm **b** 36.2 ML **c** 938 μs

12 **a** 4×10^{-3} s **b** 500 times

4A CONVERTING PERCENTAGES INTO DECIMALS AND FRACTIONS

1 **a** 0.62 **b** 0.395 **c** 0.02 **d** 5

e 0.0775 **f** 0.003

2 **a** $\frac{4}{5}$ **b** $\frac{3}{20}$ **c** $\frac{21}{10}$ or $2\frac{1}{10}$ **d** $\frac{7}{500}$ **e** $\frac{1}{125}$ **f** $\frac{3}{8}$

4B CONVERTING DECIMALS AND FRACTIONS INTO PERCENTAGES

1 **a** 17% **b** 4% **c** 190% **d** 47.6% **e** 410.2%

f 0.5%

2 **a** 45% **b** 52% **c** 110% **d** 72.5% **e** 11.2%

f 380%

3 **a** $16\frac{2}{3}\%$ **b** $44\frac{4}{9}\%$

4 **a** $\approx 15.38\%$ **b** $\approx 63.16\%$ **c** $\approx 52.38\%$

4C EXPRESSING ONE QUANTITY AS A PERCENTAGE OF ANOTHER

1 **a** 82% **b** 72% **c** 67.5% **d** 35% **e** 15%

f 7.5%

2 **a** 12.5% **b** 87.5% **3** 95%

4D FINDING A PERCENTAGE OF A QUANTITY

1 **a** 15 mL **b** 45 m **c** 90 kg **d** \$23.75 **e** 78 mL

2 25.5 L **3** **a** \$6 **b** \$44

4E THE UNITARY METHOD FOR PERCENTAGES

1 **a** 500 kg **b** \$300 **c** 215 mL **d** 5000 m
2 \$20 **3** **a** \$280 **b** 84 km
4 63 seats **5** **a** 25.2 g **b** $\approx$ 310 g

4F PERCENTAGE INCREASE OR DECREASE

1 **a** 70 m **b** \$51 **2** **a** 3 minutes **b** 28 minutes
3 **a** 1.09 **b** 0.77 **c** 0.935
4 **a** 168 cm **b** 330 mL **5** \$117 **6** 216 apples

4G FINDING A PERCENTAGE CHANGE

1 **a** 45% increase **b** 38% decrease **c** 120% increase
d 15.5% decrease
2 **a** 10% increase **b** 40% decrease
3 **a** 4.5% increase **b** 525% increase **c** 21.5% decrease
4 **a** **i** $\approx 3.47\%$ **ii** $\approx 4.70\%$ **iii** $\approx 5.13\%$ **b** $\approx 18.1\%$

4H ABSOLUTE AND PERCENTAGE ERROR

1 **a** \$15 000 **b** 37.5% **2** **a** 28 m^2 **b** $\approx 5.93\%$
3 $\approx 0.005\,10\%$ **4** 132 or 168 lollies

4I FINDING THE ORIGINAL AMOUNT

1 **a** \$60 **b** 96 kg **2** 112 members **3** \$275

4J SIMPLE INTEREST

1 **a** \$1560 **b** \$4593.75 **2** **a** \$200 **b** \$67 062.50
3 \$30 030 **4** **a** \$12 395 **b** \$258.23

REVIEW OF CHAPTER 4

1 **a** 0.135 **b** $\frac{27}{200}$
2 **a** 5.5% **b** 86% **c** 260%
3 **a** 75% **b** 15% **4** 15 episodes
5 **a** 640 mL **b** 2000 mL or 2 L **6** \$2.59
7 **a** 35% decrease **b** 37.5% increase
8 **a** 1.6 kg **b** $\approx 15.4\%$ **9** 480 car thefts
10 **a** \$3125.50 **b** \$173.64

5A THE DISTRIBUTIVE LAW

1 **a** $8m + 4n$ **b** $-7a - 7$ **c** $x^2 + 6x$ **d** $-3 + y$
e $a^2 + 2ab$ **f** $-15x + 10x^2$
2 **a** $6x - 3y + 21$ **b** $4x^3 + 20x^2 - 4x$
3 **a** $-3a$ **b** $-x - 4$ **c** $2ab - a^2$ **d** $-x^2 - 28x$
4 **a** $8x + 2$ **b** $4x + 6y$ **c** $4 - 6a$
d $n^2 + 9n - 24$ **e** $-3x^2 + 6x$ **f** $5x^2 - 23x$

5B THE PRODUCT $(a + b)(c + d)$

1 **a** $x^2 + 9x + 18$ **b** $x^2 - 3x - 10$ **c** $x^2 - 2x - 3$
d $3x^2 - 14x + 8$ **e** $28x^2 + 43x + 10$ **f** $-6x^2 + 17x + 3$
2 **a** $x^2 - 25$ **b** $4a^2 - 9$ **c** $16 - 36x^2$ **d** $a^2 - y^2$
3 **a** $x^2 + 4x + 4$ **b** $9 - 6x + x^2$ **c** $16x^2 - 16x + 4$
d $25x^2 - 10xy + y^2$
4 **a** $x^2 + 12x + 11$ **b** $23a^2 + 5a - 6$ **c** $2x^2 - 73$
d $-2x^2 + 9x + 26$

5C THE DIFFERENCE BETWEEN TWO SQUARES

1 **a** $x^2 - 16$ **b** $25 - x^2$ **c** $a^2 - 49$
d $36 - n^2$ **e** $x^2 - y^2$ **f** $9 - b^2$
2 **a** $25b^2 - 9$ **b** $81 - 4x^2$ **c** $16x^2 - y^2$
d $n^2 - 4m^2$ **e** $49x^2 - 36y^2$ **f** $16a^2 - 9b^2$

5D THE PERFECT SQUARES EXPANSION

1 **a** $x^2 + 6x + 9$ **b** $a^2 + 16a + 64$ **c** $16 + 8y + y^2$
2 **a** $x^2 - 2x + 1$ **b** $x^2 - 12x + 36$ **c** $81 - 18a + a^2$
3 **a** $9x^2 + 6x + 1$ **b** $25y^2 - 20y + 4$ **c** $49 + 56a + 16a^2$
d $100 - 60x + 9x^2$
4 **a** $x^4 + 8x^2 + 16$ **b** $16 - 24a^2 + 9a^4$ **c** $a^4 - 4a^2b^2 + 4b^4$
d $4x^4 + 4x^2y^2 + y^4$
5 **a** $-x^2 - 2x - 7$ **b** $2x^2 + 4x - 21$ **c** $26x^2 - 58x + 33$
d $6x - 33$

5E FURTHER EXPANSION

1 **a** $x^3 + 6x^2 + 2x - 15$ **b** $x^3 - 4x^2 + 4x - 3$
c $2x^3 + 3x^2 + 13x + 6$ **d** $9x^3 - 9x^2 - 19x + 20$
2 **a** $x^3 + 12x^2 + 48x + 64$ **b** $x^3 - 9x^2 + 27x - 27$
c $8x^3 - 60x^2 + 150x - 125$
3 **a** $x^3 + 7x^2 + 12x$ **b** $2x^3 + 8x^2 - 10x$
c $9x^3 - 21x^2 + 6x$ **d** $4x^4 + 40x^3 + 100x^2$
4 **a** $x^3 + 10x^2 + 31x + 30$ **b** $x^3 - 6x^2 - x + 6$
c $3x^3 + 8x^2 - 5x - 6$ **d** $-7x^3 + 65x^2 - 158x + 40$

REVIEW OF CHAPTER 5

1 **a** $2x - 14$ **b** $-4x - x^2$ **c** $3x^3 - 3x^2 + 15x$
2 **a** $6x - 16$ **b** $2x - x^2$ **c** $2a^2 + a + 12$
3 **a** $x^2 - 2x - 15$ **b** $4x^2 + 27x - 7$
4 **a** $x^2 - 64$ **b** $4a^2 - 25$ **c** $9x^2 - 49y^2$
5 **a** $x^2 + 10x + 25$ **b** $4 - 4a + a^2$ **c** $16x^2 - 8x + 1$
6 **a** $16x^4 + 40x^2 + 25$ **b** $9 - 12y^2 + 4y^4$
7 **a** $a^2 + 12a$ **b** $18x - 1$
8 **a** $2x^3 + 9x^2 + 9x + 7$ **b** $a^2 + 9a + 40$
9 **a** $4x^3 - 32x^2 + 60x$ **b** $x^3 + 9x^2 + 8x - 60$

6A SETS

1 **a** $F = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$, $n(F) = 9$
b $Q = \{\text{K, A, N, G, R, O}\}$, $n(Q) = 6$
2 **a** $P = \{2, 3, 5, 7, 11, 13, 17, 19\}$
$Q = \{1, 3, 5, 7, 9, 11, 13, 15, 17, 19\}$

b **i** true **ii** false

c **i** $n(P) = 8$ **ii** $n(Q) = 10$ **d** no

3 **a** no **b** yes

4 $\varnothing$, {green}, {blue}, {red}, {green, blue}, {green, red}, {blue, red}, {green, blue, red}

5 **a** $x = 2, 5, 11$, or 13 **b** $x = 1, 2, -2$, or -4

6B COMPLEMENT OF A SET

1 **a** $A' = \{2, 3, 6, 7\}$ **b** $B' = \{1, 2, 3, 4, 5, 7\}$ **c** $C' = \{3\}$

2 $W' = \{$January, February, March, April, May, September, October, November, December$\}$

This set represents the months of the year which are not in winter.

3 **a** **i** $F = \{1, 2, 3, 6, 9, 18\}$

ii $F' = \{4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17\}$

iii $M = \{4, 8, 12, 16\}$

iv $M' = \{1, 2, 3, 5, 6, 7, 9, 10, 11, 13, 14, 15, 17, 18\}$

b **i** $n(F) = 6$ **ii** $n(F') = 12$ **iii** $n(M) = 4$

iv $n(M') = 14$

4 **a** **i** true **ii** true **iii** false **b** A and B

6C INTERSECTION AND UNION

1 **a** $A \cap B = \{2, 4, 6\}$, $A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8, 10\}$

b $A \cap B = \{$blue$\}$

$A \cup B = \{$blue, red, white, green, orange, yellow$\}$

2 **a** $R \cap S = \varnothing$ **b** yes

3 **a** $A = \{$M, A, T, H, E, I, C, S$\}$, $B = \{$A, E, I, O, U$\}$

b **i** $A \cap B = \{$A, E, I$\}$

This set represents the letters in the word MATHEMATICS which are vowels.

ii $A \cup B = \{$M, A, T, H, E, I, C, S, O, U$\}$

This set represents the letters which are either in the word MATHEMATICS or are vowels.

iii $(A \cup B)' = \{$B, D, F, G, J, K, L, N, P, Q, R, V, W, X, Y, Z$\}$

This set represents the letters which are neither in the word MATHEMATICS nor are vowels.

c **i** $n(A \cap B) = 3$ **ii** $n(A \cup B) = 10$

iii $n((A \cup B)') = 16$

4 P and Q, Q and R

5 **a** **i** $A = \{10, 12, 14, 15, 16\}$ **ii** $B = \{12, 15\}$

iii $A \cap B = \{12, 15\}$ **iv** $A \cup B = \{10, 12, 14, 15, 16\}$

b $A = A \cup B$ and $B = A \cap B$

This has occurred because $B \subseteq A$.

6D SPECIAL NUMBER SETS

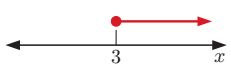
1 **a** true **b** false **c** true **d** false

2 **a** true **b** true **c** true **d** true

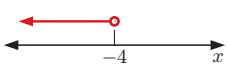
3 **a** $\mathbb{Z}^+$ **b** $\mathbb{Z}$ **c** $\mathbb{R}$ **d** $\mathbb{Z}$

6E INTERVAL NOTATION

1 **a**



b



c

d

e

f

2 **a** $\{x \mid x > 1\}$ **b** $\{x \mid x \leqslant -3\}$

c $\{x \mid 7 \leqslant x \leqslant 10\}$ **d** $\{x \mid -2 \leqslant x < -1\}$

e $\{x \mid x < 5 \text{ or } x > 11\}$ **f** $\{x \mid x < -3 \text{ or } x \geqslant 2\}$

3 **a** The set of real numbers less than or equal to 5.

b The set of integers greater than -3 and less than or equal to 0.

c The set of natural numbers less than or equal to 3, or greater than 15.

4 **a** $\{1, 2, 3, 4\}$ **b** $\{\ldots, -10, -9, -8, -7\}$

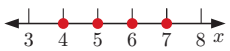
c $\{0, 1, 2, 3, 4\}$

5 **a** $\{x \in \mathbb{N} \mid 3 \leqslant x \leqslant 7\}$ **b** $\left\{x \in \mathbb{Z}^- \mid -7 \leqslant x \leqslant -4\right\}$

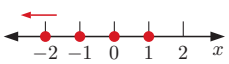
c $\{x \in \mathbb{Z} \mid x \geqslant -1\}$ **d** $\{x \in \mathbb{Z} \mid -4 \leqslant x \leqslant 0\}$

e $\{x \in \mathbb{N} \mid 7 \leqslant x \leqslant 11\}$ **f** $\{x \in \mathbb{Z} \mid -3 \leqslant x \leqslant 3\}$

6 **a**



b



c

7 **a** infinite **b** finite **c** infinite

8 **a** **i** $A \cap B = \{x \in \mathbb{Z} \mid 4 \leqslant x \leqslant 6\}$

ii $A \cup B = \{x \in \mathbb{Z} \mid 1 \leqslant x \leqslant 13\}$

iii $A' = \{x \in \mathbb{Z} \mid 7 \leqslant x \leqslant 20\}$

iv $B' = \{x \in \mathbb{Z} \mid 1 \leqslant x \leqslant 3 \text{ or } 14 \leqslant x \leqslant 20\}$

b **i** $n(A) = 6$ **ii** $n(B) = 10$ **iii** $n(A \cap B) = 3$

iv $n(A \cup B) = 13$

REVIEW OF CHAPTER 6

1 **a** $C = \{$red, orange, yellow, green, blue, indigo, violet$\}$

b $n(C) = 7$ **c** **i** true **ii** true

2 Yes, the empty set $\varnothing$ is a subset of all other sets.

3 **a** $A' = \{1, 2, 3, 5, 7, 11, 13, 17, 19, 23\}$

b $B' = \{1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20, 22, 23, 25\}$

4 **a** $F = \{1, 2, 3, 4, 6, 12\}$ **b** $G = \{2, 4, 6, 8, 10, 12\}$

c $F \cap G = \{2, 4, 6, 12\}$

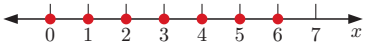
d $F \cup G' = \{1, 2, 3, 4, 5, 6, 7, 9, 11, 12\}$

5 **a** false **b** false **c** false

6 **a** The set of natural numbers less than 7.

b $\{0, 1, 2, 3, 4, 5, 6\}$ **c** $n(P) = 7$

d



7 **a** $\{x \mid x \leqslant -6\}$ **b** $\{x \mid x < -9 \text{ or } x \geqslant -6\}$

c $\left\{x \in \mathbb{Z}^- \mid -7 \leqslant x \leqslant -4\right\}$

8 **a** yes

b **i** $P \cap Q = \left\{x \in \mathbb{Z}^- \mid -6 \leqslant x \leqslant -4\right\}$

ii $P \cup Q = \left\{x \in \mathbb{Z}^- \mid x \geqslant -6\right\}$

iii $P' = \left\{x \in \mathbb{Z}^- \mid -10 \leqslant x \leqslant -7 \text{ or } x \geqslant -3\right\}$

iv $Q' = \left\{x \in \mathbb{Z}^- \mid -10 \leqslant x \leqslant -7\right\}$

7A LINEAR EQUATIONS

1 **a** $x = -4$ **b** $x = -9$ **c** $x = 14$ **d** $x = -36$

2 **a** $x = 4$ **b** $x = -2$ **c** $x = -1$ **d** $x = 5$
e $x = -6$ **f** $x = \frac{1}{2}$

3 **a** $x = 21$ **b** $x = 123$ **c** $x = 9$ **d** $x = 4$

4 **a** $x = 9$ **b** $x = -4$

5 **a** $x = 3$ **b** $x = -5$ **c** $x = 6$ **d** $x = 1$

6 **a** $x = 8$ **b** $x = 3$ **c** $x = -4$ **d** $x = -2$

7 The equation reduces to $-4 = -6$ which is impossible.
$\therefore$ there are no solutions.

7B EQUATIONS WITH FRACTIONS

1 **a** $x = 2$ **b** $x = \frac{9}{5}$ **c** $x = 1$

2 **a** $x = 60$ **b** $x = -\frac{15}{4}$ **c** $x = -\frac{19}{3}$ **d** $x = 4$
e $x = -3$ **f** $x = -\frac{16}{33}$

3 **a** $x = 14$ **b** $x = -\frac{10}{3}$ **c** $x = \frac{20}{27}$

4 **a** $x = 7$ **b** $x = \frac{17}{2}$ **c** $x = 5$ **d** $x = 7$
e $x = 18$ **f** $x = \frac{53}{11}$

7C PROBLEM SOLVING

1 **a** The number is -8. **b** The number is -10.

2 13 boxes **3** 50 pins **4** The number is 11.

5 Marissa is 30 years old now. **6** John has 5 notes.

7 Roman used 5 kg of Panama beans and 10 kg of Colombian beans.

8 $1\frac{1}{5}$ L of water must be added.

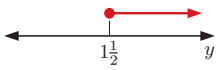
9 $2\frac{2}{3}$ L of 12% lacquer mixture needs to be added.

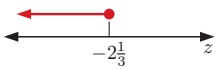
7D LINEAR INEQUALITIES

1 **a** $l \geqslant 3$ **b** $p < 6$ **c** $k \leqslant -2$

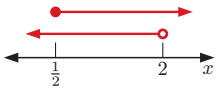
2 **a** $b \geqslant 17$ **b** $m > 5$ **c** $r < -13$ **d** $s \leqslant 2$

3 **a**


b


c


4 **a** yes **b** no **c** yes **d** no

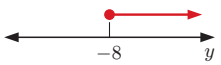
5 **a**


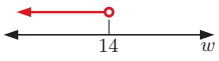
b $x = 1$

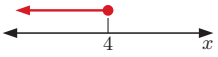
6 $ab = 77$ when $a = 7$ and $b = 11$

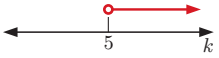
7E SOLVING LINEAR INEQUALITIES

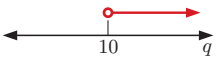
1 **a** $x < 3$

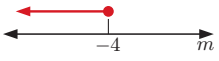

b $y \geqslant -8$


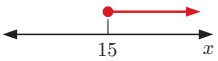
c $w < 14$


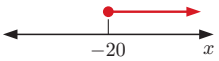
2 **a** $x \leqslant 4$


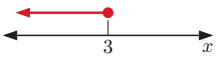
b $k > 5$


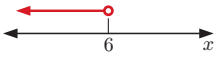
c $q > 10$


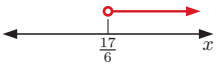
d $m \leqslant -4$


e $x \geqslant 15$


f $x \geqslant -20$


g $x \leqslant 3$


h $x < 6$


i $x > \frac{17}{6}$


3 **a** $x > -\frac{3}{2}$ **b** $x \leqslant 3$

4 **a** $x \leqslant 5$ **b** $x < 3$ **c** $x \geqslant -2$ **d** $x > \frac{8}{5}$
e $x < \frac{10}{3}$ **f** $x \geqslant \frac{29}{21}$

REVIEW OF CHAPTER 7

1 **a** $x = 6$ **b** $x = -12$ **c** $x = 2$

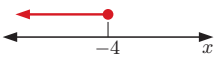
2 **a** $x = 10$ **b** $x = -2$ **3** The number is $\frac{1}{2}$.

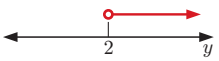
4 **a** $x = 4$ **b** $x = -4$ **c** $x = -\frac{32}{27}$

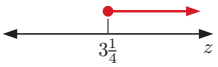
5 **a** $x = -33$ **b** $x = 13$ **6** The fraction is $\frac{12}{40}$.

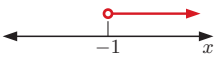
7 Riley has 16 60 cent stamps and 29 10 cent stamps.

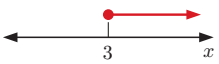
8 0.5 L of pure detergent concentrate must be added to the 15% detergent mixture.

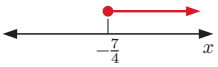
9 **a**


b


c


10 **a** $x > -1$


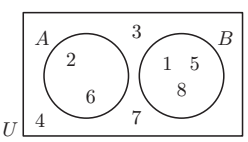
b $x \geqslant 3$


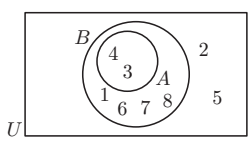
c $x \geqslant -\frac{7}{4}$


11 **a** $x \leqslant -3$ **b** $x > -\frac{2}{5}$

8A VENN DIAGRAMS

1 **a** $P = \{a, b, d, g, i\}$ **b** $Q = \{a, d, e, f, k\}$
c $P \cup Q = \{a, b, d, e, f, g, i, k\}$
d $P \cap Q = \{a, d\}$ **e** $P' = \{c, e, f, h, j, k\}$
f $Q' = \{b, c, g, h, i, j\}$
g $U = \{a, b, c, d, e, f, g, h, i, j, k\}$

2 **a**


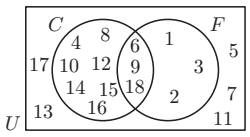
b


3 **a** **i** $C = \{4, 6, 8, 9, 10, 12, 14, 15, 16, 18\}$

ii $F = \{1, 2, 3, 6, 9, 18\}$ **iii** $C \cap F = \{6, 9, 18\}$

iv $C \cup F = \{1, 2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16, 18\}$

b



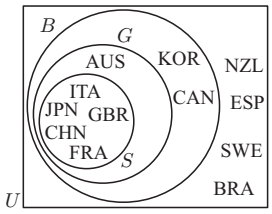
4 **a** $G = \{\text{Australia, Italy, Japan, Great Britain, China, France}\}$

$S = \{\text{Italy, Japan, Great Britain, China, France}\}$

$B = \{\text{Australia, South Korea, Italy, Japan, Great Britain, Canada, China, France}\}$

b **i** $S \subseteq G$ **ii** $G \subseteq B$ **iii** $S \subseteq B$

c



d $B \cap G' = \{\text{South Korea, Canada}\}$

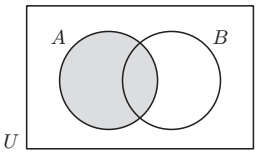
This set represents the countries which scored 10 or more bronze medals but less than 10 gold medals.

e $S \cup B' = \{\text{Italy, Japan, Great Britain, China, France, Spain, New Zealand, Sweden, Brazil}\}$

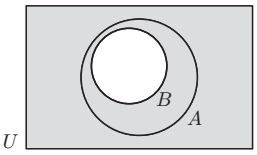
This set represents the countries which scored 10 or more silver medals, or less than 10 bronze medals.

8B VENN DIAGRAM REGIONS

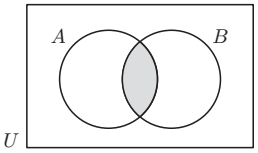
1 **a**



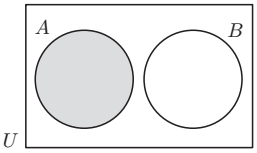
b



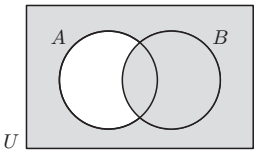
c



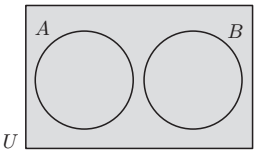
d



e

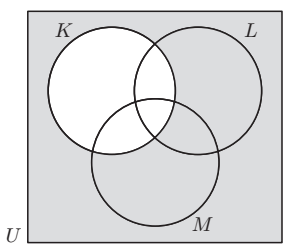


f

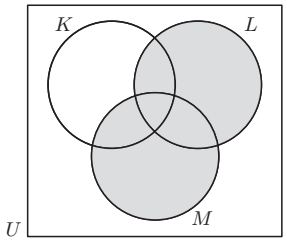


2 **a** in P or not in Q **b** in either P or Q, but not both

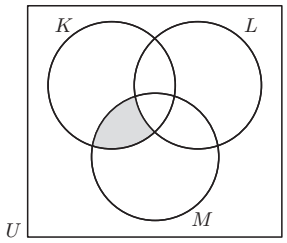
3 **a**



b



c



8C NUMBERS IN REGIONS

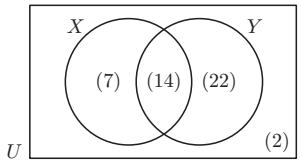
1 **a** 7 elements **b** 5 elements **c** 16 elements

d 3 elements **e** 9 elements **f** 14 elements

2 **a** **i** $4a - 11$ **ii** $5a - 4$ **iii** $5a - 8$ **iv** $7a - 4$

b $a = 5$

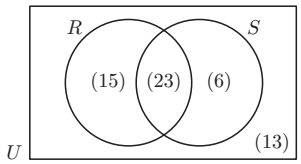
3 **a**



b **i** 24 elements

ii 43 elements

4 **a**

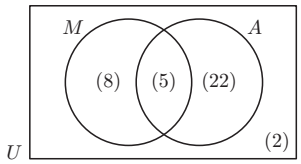


b **i** 23 elements

ii 21 elements

8D PROBLEM SOLVING WITH VENN DIAGRAMS

1 **a**

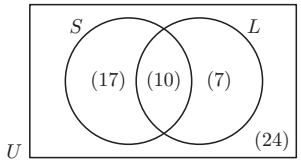


b **i** 8 cars

ii 22 cars

iii 2 cars

2 **a**

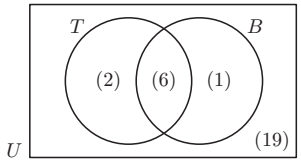


b **i** 24 members

ii 24 members

iii 34 members

3 **a**



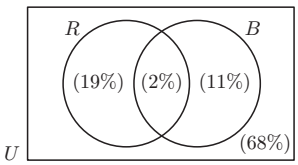
b **i** 20 students

ii 1 student

iii 6 students

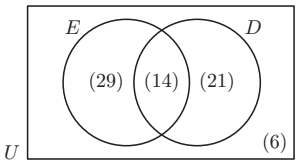
iv 3 students

4 a



b **i** 2%
ii 32%
iii 11%

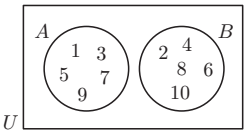
5 a



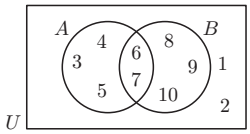
b **i** 14 people
ii 6 people
iii 29 people
iv 21 people

REVIEW OF CHAPTER 8

1 a



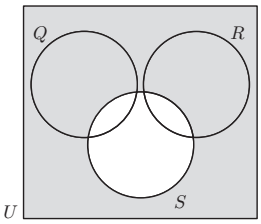
b



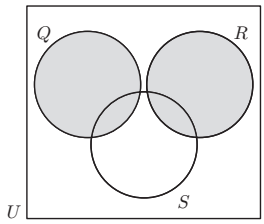
2 a $X = \{b, c, d, g\}$ **b** $Y = \{b, d, e, f\}$
c $X \cap Y = \{b, d\}$ **d** $X \cup Y = \{b, c, d, e, f, g\}$
e $X \cap Y' = \{c, g\}$ **f** $X' \cap Y' = \{a, h\}$

3 a in both A and B or in neither A nor B
b in A but not in B

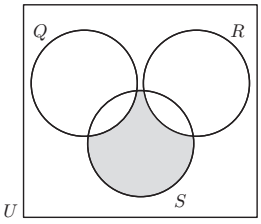
4 a



b

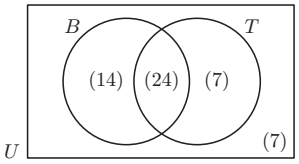


c



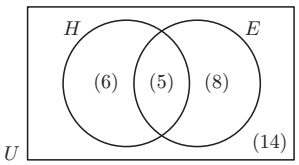
5 a 27 elements **b** 39 elements **c** 5 elements
d 41 elements

6 a



b **i** 7 houses
ii 14 houses

7 a



b **i** 5 students
ii 8 students

9A SQUARE ROOTS

1 a 7 **b** 8 **c** $\frac{1}{6}$ **d** $\frac{5}{8}$

2 a ≈ 2.83 **b** ≈ 31.62 **c** ≈ 2.18 **d** ≈ 0.82

3 a surd, ≈ 3.87 **b** not a surd, 5 **c** surd, ≈ 0.35
d not a surd, $\frac{4}{9}$

4 a 8 and 9 **b** 6 and 7 **c** 5 and 6 **d** 11 and 12

5 a 3 **b** 26 **c** 28 **d** 99 **e** 20 **f** 120

9B PROPERTIES OF RADICALS

1 a $\sqrt{30}$ **b** $\sqrt{88}$ **c** $\sqrt{72}$ **d** $\sqrt{7}$ **e** $\sqrt{14}$ **f** $\sqrt{30}$

2 a $\frac{2}{7}$ **b** $\frac{9}{10}$ **c** $\frac{11}{3}$ **3 a** $\frac{4}{5}$ **b** $\frac{7}{2}$ **c** $\frac{10}{3}$

9C SIMPLEST SURD FORM

1 a $2\sqrt{6}$ **b** $2\sqrt{11}$ **c** $3\sqrt{7}$ **d** $6\sqrt{2}$
e $3\sqrt{6}$ **f** $5\sqrt{10}$ **g** $11\sqrt{2}$ **h** $4\sqrt{7}$

2 a $\sqrt{20} \times \sqrt{5} = \sqrt{20 \times 5} = \sqrt{100} = 10$
b $\sqrt{20} \times \sqrt{5} = 2\sqrt{5} \times \sqrt{5} = 2 \times 5 = 10$

9D CUBE AND HIGHER ROOTS

1 a 3 **b** -5 **c** 10 **d** -8 **e** 4 **f** 2

2 a ≈ 2.154 **b** ≈ -6.503 **c** ≈ -4.160 **d** ≈ 5.012

3 a real number **b** not a real number **c** real number

4 a $-\frac{1}{2}$ **b** $\frac{3}{4}$ **c** $-\frac{7}{6}$

9E POWER EQUATIONS

1 a $x = \pm 5$ **b** no real solutions **c** $x = \pm 8$
d $x = \pm\sqrt{19}$ **e** $x = 0$ **f** no real solutions

2 a $x = -3$ **b** $x = 5$ **c** $x = \sqrt[3]{-74}$ (≈ -4.20)

3 a $x = \pm 10$ **b** $x = \pm 4$ **c** $x = 0$
d $x = \pm\sqrt{15}$ **e** $x = \pm 6$ **f** $x = \pm\sqrt{54}$

4 a $x = 4$ **b** $x = -1$ **c** $x = \sqrt[3]{-200}$ (≈ -5.85)

5 a $x = \pm 3$ **b** $x = \pm 5$ **c** $x = \pm\sqrt{8}$

REVIEW OF CHAPTER 9

1 a not a surd, 13 **b** surd, ≈ 7.810 **c** not a surd, $\frac{1}{10}$
d surd, ≈ 1.761

2 a 14 **b** 45 **c** 42

3 a $\sqrt{84}$ **b** $\sqrt{3}$ **c** $\sqrt{55}$

4 a $\frac{3}{8}$ **b** $\frac{12}{7}$ **c** $\frac{2}{5}$

5 a $2\sqrt{7}$ **b** $6\sqrt{10}$ **c** $9\sqrt{2}$

6 a -4 **b** 10 **c** $\frac{2}{5}$

7 a ≈ 1.913 **b** ≈ -3.420 **c** ≈ 2.943

8 a $x = \pm 9$ **b** $x = \sqrt[3]{30}$ (≈ 3.11) **c** $x = \pm\sqrt{13}$

10A PYTHAGORAS' THEOREM

1 a 20 cm **b** 6.5 m **c** 29 cm

2 a ≈ 4.90 m **b** ≈ 10.58 cm **c** ≈ 6.42 cm

3 a $\sqrt{58}$ cm **b** $4\sqrt{5}$ m **c** $3\sqrt{21}$ cm

4 a $x = \sqrt{7}$ **b** $x = 2\sqrt{5}$ **c** $x = 4\sqrt{3}$

5 a $x = \sqrt{34}$, $y = \sqrt{38}$ **b** $x = 8$, $y = 3\sqrt{5}$

10B PYTHAGOREAN TRIPLES

1 a no **b** yes **c** no

2 **a** $k = 12$ **b** $k = 26$ **c** $k = 15$

3 **a** $(6m)^2 + (m^2 - 9)^2 = 36m^2 + m^4 - 18m^2 + 81$
$= m^4 + 18m^2 + 81$
$= (m^2 + 9)^2$

$\therefore \ \{6m,\ m^2 - 9,\ m^2 + 9\}$ is a Pythagorean triple for any $m \in \mathbb{Z}^+,\ m > 3$.

b $\{60, 91, 109\}$

10C PROBLEM SOLVING

1 **a** $9\sqrt{2}$ m **b** ≈ 12.73 m **2** ≈ 22.9 m

3 ≈ 16.6 cm **4** 9.6 km **5** ≈ 13.4 cm and ≈ 26.8 cm

6 ≈ 7.42 cm **7** ≈ 8.02 m

10D THE CONVERSE OF PYTHAGORAS' THEOREM

1 **a** no **b** yes **c** no **2** yes

REVIEW OF CHAPTER 10

1 **a** $x = 6\sqrt{5}$ **b** $x = 3\sqrt{5}$ **c** $x = 5\sqrt{5},\ y = 2\sqrt{5}$

2 **a** $x = \sqrt{14}$ **b** $x = 2\sqrt{2}$ **3** $k = 25$ **4** ≈ 122 m

5 AB ≈ 11.6 m **6** **a** no **b** yes **7** ≈ 6.40 m

11A FORMULA CONSTRUCTION

1 **a** $F = 25 + 20 \times 3$ **b** $F = 25 + 20h$

2 **a** $M = 40 + 100 \times 12$ **b** $M = 40 + 12c$

c $M = 40 + cw$ **d** $M = p + cw$

3 **a** $B = \dfrac{20 - 2}{3}$ **b** $B = \dfrac{b - 4}{f}$ **c** $B = \dfrac{b - k}{f}$

11B SUBSTITUTING INTO FORMULAE

1 **a** $R = 6$ **b** $t = -4$

2 **a** $H = 1$ **b** $j = 13$ **c** $k = -3$

3 **a** 24 000 joules **b** 720 seconds or 12 minutes

4 **a** **i** $P = 1$ **ii** $P = 46$ **iii** $P = 73$

b **i** $n = \pm 2$ **ii** $n = \pm 3$ **iii** $n = \pm 6$

5 **a** n must be a positive integer.

b **i** $S = 4$ **ii** $S = 25$ **iii** $S = 144$

c **i** $n = 3$ **ii** $n = 6$ **iii** $n = 9$

d No, as no integer value of n exists such that $n^2 = 72$.

11C REARRANGING FORMULAE

1 **a** $x = y - 4$ **b** $x = \dfrac{y + 5}{2}$ **c** $x = 3y - 12$

2 **a** $x = \dfrac{Q - y}{4}$ **b** $x = \dfrac{D}{3a}$ **c** $x = \dfrac{8 - M}{b}$

3 **a** $a = \dfrac{p}{E}$ **b** $a = 3 - bY$ **c** $a = \dfrac{3dW - c}{2}$

4 **a** $d = st$ **b** $t = \dfrac{d}{s}$

5 **a** $r = \dfrac{21}{q}$ **b** $r = \dfrac{qs}{p}$ **c** $r = \dfrac{2p^2}{3s}$

6 **a** $a = \sqrt{B + 3}$ **b** $a = \sqrt{c^2 - b^2}$ **c** $a = \sqrt{\dfrac{3b}{G}}$

7 $r = \sqrt{\dfrac{Gm_1m_2}{F}}$

11D REARRANGEMENT AND SUBSTITUTION

1 **a** $b = \dfrac{c^2D}{2}$ **b** **i** $b = 6$ **ii** $b = \frac{99}{2}$

2 **a** $a = \dfrac{F}{m}$ **b** **i** 10 m/s^2 **ii** 7.5 m/s^2

c $m = \dfrac{F}{a}$ **d** **i** 30 kg **ii** ≈ 2.71 kg

3 **a** $v = \sqrt{\dfrac{2E}{m}}$ **b** **i** 12 m/s **ii** ≈ 36.5 m/s

REVIEW OF CHAPTER 11

1 **a** $V = 20 - 5 \times 1.5$ **b** $V = 20 - 1.5p$

c $V = A - 1.5p$ **d** $V = A - dp$

2 $b = 11$ **3** **a** ≈ 173 cm^2 **b** ≈ 0.495 m

4 **a** $q = y - px$ **b** $q = \dfrac{Z + x}{2p}$ **c** $q = \sqrt{\dfrac{a + b}{2D}}$

5 **a** ≈ 45 **b** $R \approx \dfrac{15M}{V}$

c Cameron's resting heart rate decreased by about 15 beats per minute.

12A UNITS OF LENGTH

1 **a** 890 mm **b** 4.27 km **c** 96 000 cm

2 39 cm **3** 60 cm **4** 300 cars

5 **a** 18.75% **b** $\approx 6.81\%$

12B PERIMETER

1 **a** 10 km **b** 160 mm **c** 24 m

2 **a** ≈ 37.7 cm **b** ≈ 15.4 m **c** ≈ 46.7 cm

3 **a** 1.4 cm **b** ≈ 3.18 cm

4 **a** 9.2 m **b** ≈ 12.6 cm **c** ≈ 44.6 m **d** ≈ 32.6 cm

5 **a** $P = 4x - 1$ **b** $P = 18x$ **c** $P = 2r + \frac{11}{36}\pi r$

6 **a** 6.4 m **b** 76.8 m

7 **a** $r \approx 25.5$ **b** 40%

12C UNITS OF AREA

1 **a** 9200 mm^2 **b** 6810 m^2 **c** 2 300 000 mm^2

d 0.57 km^2 **e** 2.7 m^2 **f** 0.62 km^2

2 **a** 28% **b** $\approx 0.857\%$ **3** 625 cm^2

12D AREA OF POLYGONS

1 **a** 6.4 m^2 **b** 63 cm^2 **c** 1.98 km^2 **d** 200 mm^2

e 44 cm^2 **f** 54 cm^2

2 $h = 6.25$ **3** $\approx 50.6\%$ **4** ≈ 266 cm^2 **5** 192 cm^2

6 **a** $A = x(x + 5)$ **b** $A = \frac{\sqrt{3}}{2}x^2$ **c** $A = (a + b)\sqrt{c^2 - b^2}$

7 **a** 102 cm^2 **b** 44 m^2 **c** 120 cm^2 **8** \$12 060

12E AREA OF CIRCLES AND SECTORS

1 **a** ≈ 346 mm^2 **b** ≈ 38.5 cm^2 **c** ≈ 33.2 m^2

2 $\approx 942\ \text{cm}^2$ **3** **a** $\approx 3.09\ \text{m}$ **b** $\approx 91.7°$

4 **a** $\approx 2.72\ \text{m}^2$ **b** $\approx 3.14\ \text{m}^2$ **c** $\approx 15.6\%$

5 **a** $\approx 70.7\ \text{cm}^2$ **b** $\approx 1630\ \text{mm}^2$

6 $\approx 82.0\ \text{mm}^2$ **7** $\approx 15.5\%$ **8** $A = \pi x^2$

REVIEW OF CHAPTER 12

1 **a** 2.3 cm **b** 45 000 ha **c** $0.63\ \text{m}^2$

2 **a** 24 cm **b** $\approx 8.61\ \text{m}$ **c** $\approx 18.7\ \text{cm}$

3 **a** $\approx 34.6\ \text{m}$ **b** $\approx 2.23\ \text{cm}$

4 **a** 7.5% **b** 0.7%

5 **a** $2.4\ \text{m}^2$ **b** $255\ \text{cm}^2$ **c** $21\ \text{cm}^2$

6 1.72 ha **7** **a** $\approx 154\ \text{cm}^2$ **b** $\approx 22.3\ \text{m}^2$

8 **a** $\approx 22.0\ \text{m}$ **b** $\approx 18.8\ \text{m}^2$

9 **a** $\approx 116\ \text{cm}^2$ **b** $\approx 183\ \text{cm}^2$

10 $P = (4 + 2\sqrt{2} + \pi)x + 6, \quad A = (4 + \frac{\pi}{2})x^2 + 6x$

13A SOLIDS WITH PLANAR FACES

1 **a** $184\ \text{cm}^2$ **b** $\approx 354\ \text{cm}^2$

2 **a** $340\ \text{cm}^2$ **b** $366\ \text{cm}^2$ **c** $244\ \text{cm}^2$

3 $A = a(a + 2b + b\sqrt{2})$ **4** $\approx 3.34\ \text{m}^2$

13B CYLINDERS

1 **a** $\approx 251\ \text{m}^2$ **b** $\approx 1550\ \text{cm}^2$ **c** $\approx 280\ \text{cm}^2$

2 $\approx 5.03\ \text{L}$ **3** $\approx 10.9\ \text{cm}$

13C CONES

1 **a** $\approx 138\ \text{cm}^2$ **b** $\approx 62.8\ \text{cm}^2$ **c** $\approx 46.4\ \text{m}^2$

2 **a** $\approx 47.1\ \text{m}^2$ **b** $\approx 7.94\ \text{m}$

13D SPHERES

1 **a** $100\pi\ \text{m}^2$ **b** $108\pi\ \text{cm}^2$

2 373 wooden balls **3** $\approx 4.37\ \text{cm}$

REVIEW OF CHAPTER 13

1 **a** $2520\ \text{m}^2$ **b** $\approx 273\ \text{cm}^2$ **2** $48.3\ \text{m}^2$

3 **a** $\approx 130\ \text{cm}^2$ **b** $\approx 208\ \text{cm}^2$ **4** 88 labels

5 **a** $\approx 50.3\ \text{cm}^2$ **b** $\approx 84.9\ \text{m}^2$ **6** $\approx 7.35\ \text{cm}$

7 **a** $\approx 360.5\ \text{m}^2$ **b** $\approx 513.3\ \text{cm}^2$

14A UNITS OF VOLUME

1 **a** $2600\ \text{mm}^3$ **b** $0.98\ \text{m}^3$ **c** $51\,000\ \text{cm}^3$ **d** $62.7\ \text{m}^3$

2 **a** 24% **b** 5%

3 $\approx 1\,500\,000$ sultanas **4** $1.715\ \text{m}^3$

14B VOLUME OF A SOLID OF UNIFORM CROSS-SECTION

1 **a** $84\ \text{m}^3$ **b** $216\ \text{cm}^3$ **c** $\approx 3530\ \text{cm}^3$

d $6\ \text{cm}^3$ **e** $\approx 9050\ \text{cm}^3$ **f** $51\,000\ \text{mm}^3$

2 **a** $2800\ \text{cm}^3$ **b** $\approx 16\,500\ \text{mm}^3$

3 **a** 6.5 m **b** $\approx 3.75\ \text{cm}$

4 **a** $V = \frac{xyz}{2}$ **b** $V = (\frac{3\pi}{4} + 1)r^2 l$

5 **a** $\approx 0.968\ \text{m}^3$ **b** \$50.32

14C VOLUME OF A TAPERED SOLID

1 **a** $21\ \text{cm}^3$ **b** $\approx 39.3\ \text{m}^3$ **c** $60\ \text{mm}^3$ **d** $32\ \text{cm}^3$

2 **a** $\approx 37.7\ \text{m}^3$ **b** $\approx 201\ \text{cm}^3$

3 **a** $\approx 0.323\ \text{m}^3$ **b** 522.72 kg

4 **a** $l = \sqrt[3]{6\sqrt{2}V}$ **b** $\approx 1.50\ \text{cm}$

5 **a** $\frac{\pi}{3}x(x-3)^2\ \text{mm}^3$ **b** $2x^2(x+4)\ \text{cm}^3$

14D VOLUME OF A SPHERE

1 **a** $\approx 268\ \text{cm}^3$ **b** $\approx 180\ \text{cm}^3$ **c** $\approx 32.7\ \text{mm}^3$

2 $4500\pi\ \text{cm}^3$ **3** **a** $\approx 59\,300\ \text{mm}^3$ **b** $\approx 59.3\ \text{cm}^3$

14E CAPACITY

1 **a** mL **b** L or kL **c** L

2 **a** 0.4 kL **b** 8.75 L **c** 9000 kL **d** 1.2 L

3 1250 ice creams **4** 19.71 kL

14F CONNECTING VOLUME AND CAPACITY

1 **a** 1.8 L **b** 2.7 kL

2 $\approx 452\ \text{mL}$ **3** 3.15 L **4** $\approx 23.9\ \text{mL}$

5 **a** $\approx 0.717\ \text{kL}$ **b** $\approx 75.3\ \text{cm}$

REVIEW OF CHAPTER 14

1 **a** $0.002\,75\ \text{m}^3$ **b** $770\ \text{mm}^3$ **c** $1\,804\,000\ \text{cm}^3$

2 **a** $123.75\ \text{cm}^3$ **b** $\approx 3.04\ \text{m}^3$

3 **a** $15\ \text{m}^3$ **b** $\approx 25.1\ \text{cm}^3$ **c** $\approx 42.7\ \text{mm}^3$

4 **a** $\approx 382\ \text{cm}^3$ **b** $\approx 5.15\ \text{m}^3$ **5** $\approx 3800\ \text{cm}^3$

6 **a** 20 L **b** 0.841 L **c** 2000 L

7 **a** 4.5 L **b** 3.375 kL

8 **a** 63.945 L **b** 16 times **9** 12.5 cm

15A COMMON FACTORS

1 **a** $5(x-3)$ **b** $12(x+3)$ **c** $x(y-z)$

d $q(p+1)$ **e** $x(6-y)$ **f** $h(j+7k)$

2 **a** $a(a-9)$ **b** $4y(y+2)$ **c** $6x(1+6x)$

d $d^2(1-3d)$ **e** $7ab(2a-3)$ **f** $2x(2x^2+2x-1)$

3 **a** $11(2y-x)$ **b** $a(3b-1)$ **c** $2x(5x-1)$

4 **a** $-15(x+3)$ **b** $-8(d+3f)$ **c** $-9x(2x+3)$

5 **a** $(d+7)(d+5)$ **b** $(y+2)(9-y)$ **c** $(t+12)(t+1)$

6 **a** $(x-3)(x+6)$ **b** $(x+7)(8-x)$

c $2(m+1)(4m-5)$ **d** $2(x-10)(3x+5)$

15B DIFFERENCE BETWEEN TWO SQUARES FACTORISATION

1 **a** $(s+t)(s-t)$ **b** $(t+s)(t-s)$
c $(x+8)(x-8)$ **d** $(12+w)(12-w)$
e $(2x+3)(2x-3)$ **f** $(9+4d)(9-4d)$

2 **a** $2(x+2)(x-2)$ **b** $5(3+q)(3-q)$
c $10(b+9)(b-9)$ **d** $x(x+6)(x-6)$
e $x^2(x+1)(x-1)$ **f** $ab(b+a)(b-a)$

3 **a** $(7m+n)(7m-n)$ **b** $(x+8y)(x-8y)$
c $(10p+3q)(10p-3q)$ **d** $(9a+4b)(9a-4b)$
e $(pq+2t)(pq-2t)$ **f** $12(1+2q)(1-2q)$

4 **a** $(x+12)(x+2)$ **b** $(x+1)(7-x)$
c $-5(2x-3)$ **d** $(3x+5)(x+1)$

15C PERFECT SQUARES FACTORISATION

1 **a** perfect square, $(x+7)^2$ **b** not a perfect square

2 **a** $(x-5)^2$ **b** $(x+9)^2$ **c** $(x-2)^2$
d $(x-6)^2$ **e** $(x+10)^2$ **f** $(p+q)^2$

3 **a** $(2x+5)^2$ **b** $(4x+7)^2$ **c** $(3x-5)^2$
d $(6x-1)^2$ **e** $(3x+8)^2$ **f** $(4a-3b)^2$

4 **a** $2(x+4)^2$ **b** $5(x-1)^2$ **c** $-(x-7)^2$
d $3(x+10)^2$ **e** $-2(x+9)^2$ **f** $x(x-3)^2$

5 529, $\sqrt{529}=23$

15D QUADRATIC TRINOMIALS

1 **a** 3 and 13 **b** -4 and -9 **c** -11 and 5

2 **a** $(x+3)(x+9)$ **b** $(x+2)(x+8)$ **c** $(x+4)(x+11)$
d $(x+1)(x+32)$

3 **a** $(x-2)(x-5)$ **b** $(x-3)(x-8)$ **c** $(x-8)(x-12)$
d $(x-9)(x-10)$

4 **a** $(x+5)(x-6)$ **b** $(x+10)(x-2)$ **c** $(x+5)(x-3)$
d $(x+2)(x-11)$ **e** $(x+9)(x-12)$ **f** $(x+20)(x-3)$

5 No two integers have a sum of -4 and a product of 6.

6 **a** $3(x+1)(x+6)$ **b** $10(x-1)(x-5)$
c $-(x+8)(x-5)$ **d** $-5(x+1)(x+2)$
e $2(x-4)(x-9)$ **f** $-4(x+3)(x-7)$

15E MISCELLANEOUS FACTORISATION

1 **a** $6a(a-2)$ **b** $(3x+1)(3x-1)$ **c** $(x-8)^2$
d $5(x-3)(x-4)$ **e** $4x(x-3y)$ **f** $2(x+1)(x-1)$
g $(x+17)(x-2)$ **h** $(a-b)(5+b)$ **i** $mn(n+m+2)$

2 **a** $-2k(2+3k)$ **b** $(3x+5)^2$ **c** $8(2+q)(2-q)$
d $(x+6)(x-8)$ **e** $xy(x-y)$ **f** $(x+7)(x-3)$
g $-(x+15)^2$ **h** $(x-1)(6-x)$ **i** $-4(x-3)(x-8)$

REVIEW OF CHAPTER 15

1 **a** $p(5-p)$ **b** $2x^2(x-3)$ **c** $(x-6)(9+x)$

2 **a** $(b+6)(b-6)$ **b** $(3b+4a)(3b-4a)$
c $2(5+2b)(5-2b)$

3 **a** $(x-4)^2$ **b** $(x+13)^2$ **c** $(3x-1)^2$

4 **a** $(x+12)(x-1)$ **b** $(x-9)(x-11)$
c $-2(x+2)(x-7)$

5 No two integers have a sum of 6 and a product of 11.

6 perfect square, $(7x-5)^2$

7 **a** $(7x+3)(x-5)$ **b** $-2(x-3)(x-6)$

8 **a** $-2(x-5)^2$ **b** $3(x+6)(x+11)$
c $-5(x+6)(x-3)$

16A EVALUATING ALGEBRAIC FRACTIONS

1 **a** 2 **b** 4 **c** $\frac{9}{2}$ **d** 18

2 **a** $\frac{1}{10}$ **b** $-\frac{5}{2}$ **c** -3 **d** -10 **e** $-\frac{6}{5}$ **f** $\frac{1}{5}$
g 24 **h** -25

16B SIMPLIFYING ALGEBRAIC FRACTIONS

1 **a** $\frac{5}{x}$ **b** $2y$ **c** $\frac{a}{2}$ **d** $\frac{5q}{p}$ **e** $\frac{3}{y}$ **f** $\frac{f}{3g}$

2 **a** $-\frac{1}{2x}$ **b** $-2a^2$ **c** $\frac{5q}{6}$

3 **a** $\frac{1}{c}$ **b** cannot be simplified **c** cannot be simplified
d $\frac{p}{r}$ **e** $\frac{4x}{y}$ **f** cannot be simplified

4 **a** $4x$ **b** $\frac{a}{7}$ **c** $\frac{36}{t}$

5 **a** $x+2$ **b** $3(a-2)$ **c** $\frac{1}{2(3-y)}$ **d** 4
e $\frac{5p}{p+3}$ **f** $\frac{x+3}{4}$

6 **a** $x+3$ **b** $\frac{2(x-2)}{5}$ **c** $4x+3$ **d** $\frac{4(x+3)}{3}$
e $\frac{x-4}{2}$ **f** $\frac{5x-4}{3}$

7 **a** $\frac{4}{5}$ **b** $\frac{5}{3}$ **c** 2 **d** $\frac{2}{3}$ **e** $\frac{1}{x}$ **f** x

8 **a** $x-2$ **b** $3x$ **c** $-x$ **d** $\frac{7}{3}$ **e** $\frac{x+2}{x-2}$
f $\frac{x}{2}$ **g** a^2 **h** $-\frac{1}{6}$ **i** $-\frac{c}{d}$

9 **a** $x-2$ **b** $\frac{3}{x+y}$ **c** $-\frac{b}{a}$

10 **a** $x+2$ **b** $x+5$ **c** $-\frac{1}{x+2}$ **d** $\frac{x+3}{x-3}$
e $\frac{x+6}{x+3}$ **f** $-\frac{x+7}{x+3}$

16C MULTIPLYING ALGEBRAIC FRACTIONS

1 **a** $\frac{3}{2}$ **b** $\frac{q^2}{10}$ **c** 1 **d** $\frac{12}{z}$ **e** $\frac{3s}{t}$ **f** $4b$
g $\frac{x^2}{4}$ **h** $\frac{1}{2}$

2 **a** $\frac{27}{b^3}$ **b** $\frac{k^2}{j^2}$ **c** $3q$ **d** $\frac{y^3}{3}$

16D DIVIDING ALGEBRAIC FRACTIONS

1 **a** $\frac{x}{2}$ **b** $\frac{p}{49}$ **c** 2 **d** $\frac{18}{a^2}$

2 **a** 10 **b** 25 **c** $\frac{12}{d}$ **d** $18k$

16E ADDING AND SUBTRACTING ALGEBRAIC FRACTIONS

1 **a** $\frac{2k}{5}$ **b** $\frac{2-x}{3}$ **c** $\frac{3a+1}{4}$ **d** $\frac{8c}{15}$
e $\frac{p}{8}$ **f** $\frac{3c+d}{9}$ **g** $\frac{9a+2b}{12}$ **h** $\frac{23x}{42}$

2 **a** $\frac{m+6}{2}$ **b** $\frac{30-e}{5}$ **c** $\frac{3d+2}{2}$ **d** $\frac{32-y}{4}$

3 **a** $\frac{5}{a}$ **b** $\frac{9-2b}{3b}$ **c** $\frac{2x+5}{x}$ **d** $\frac{7z-3y}{yz}$
e $\frac{9c-4}{3c}$ **f** $\frac{a+2c}{2b}$ **g** $\frac{2+15d}{3d}$ **h** $\frac{9x-2y}{3y}$

4 **a** $\frac{20b-3c}{12}$ **b** $\frac{13}{6x}$ **c** $\frac{7b}{3}$ **d** $\frac{17a}{6}$

5 **a** $\frac{2a+3}{a^2}$ **b** $\frac{3x-1}{x^2}$ **c** $\frac{2y^2+1}{y^2}$ **d** $\frac{4b^2-3}{b^2}$
e $\frac{4+3p^2}{p}$ **f** $\frac{7-2r^3}{r^2}$ **g** $\frac{2x^2+12}{3x}$ **h** $\frac{4x^2-1}{2x}$

6 **a** **i** $2x$ dollars **ii** $\frac{x}{2}$ dollars **b** $\frac{7x}{2}$ dollars
c first place: \$300, second place: \$150, third place: \$75

7 **a** $\frac{x}{3}+\frac{4}{9}$ **b** $2-\frac{5a}{3}$ **c** $\frac{x^2}{6}-\frac{x}{2}$ **d** $\frac{7}{x}+4x$

REVIEW OF CHAPTER 16

1 **a** $-\frac{2}{3}$ **b** $\frac{3}{2}$ **c** $\frac{4}{3}$ **d** $-\frac{9}{2}$

2 **a** $\frac{2}{c}$ **b** $\frac{1}{9x}$ **c** $\frac{3(m-3)}{2}$

3 **a** $\frac{2}{5}$ **b** $-\frac{3x}{2}$ **c** $\frac{x+2}{x+10}$

4 **a** 2 **b** 3 **c** $\frac{x^2y}{3}$ **d** $\frac{3n^2}{2}$

5 **a** $\frac{5x}{3}$ **b** $\frac{n}{6}$ **c** $\frac{2b+7a}{ab}$ **d** $\frac{3x^2-2}{x}$

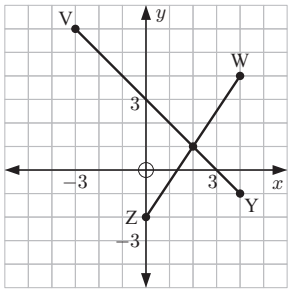
6 **a** $\frac{2x}{3}$ **b** $\frac{8-x}{4}$ **c** $\frac{16}{x^2}$ **d** $\frac{2x+9}{3x^2}$

7 **a** $\frac{x}{2}-\frac{1}{5}$ **b** $\frac{5x^2}{3}+2x$ **c** $2-\frac{3}{x^2}$ **d** $2x+\frac{1}{2x}$

17A THE DISTANCE BETWEEN TWO POINTS

1 **a** 3 units **b** $\sqrt{17}$ units **c** $\sqrt{29}$ units

2 **a**



b X(2, 1)
c VX $= 5\sqrt{2}$ units

3 **a** $\sqrt{74}$ units **b** $\sqrt{73}$ units **c** $2\sqrt{13}$ units

4 isosceles

5 **a** $BC^2 + AC^2 = 40 + 10 = 50 = AB^2$
$\therefore$ $\triangle ABC$ is right angled.
b vertex C **c** $\approx 26.6°$ **d** 10 units^2

17B MIDPOINTS

1 **a** M(2, 3) **b** $M\left(-1, \frac{1}{2}\right)$ **c** $M\left(-2\frac{1}{2}, 1\frac{1}{2}\right)$
d $M\left(\frac{a+7}{2}, 1\right)$

2 **a** Q(5, 12) **b** Q(−3, 4)

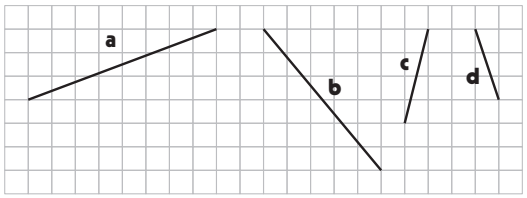
3 **a** A(−8, 5) **b** $2\sqrt{34}$ units

4 **a** $X\left(\frac{1}{2}, -1\frac{1}{2}\right)$ **b** D(−1, −7)

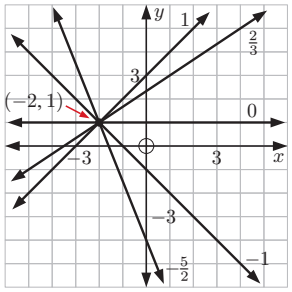
17C GRADIENT

1 **a** 2 **b** $-\frac{3}{5}$ **c** undefined **d** −6

2



3



4 **a** $\frac{3}{5}$ **b** −1 **c** 2 **d** $\frac{1}{2}$ **e** 0 **f** $-\frac{4}{3}$

5 **a** gradient of [PQ] $= \frac{5}{3}$, gradient of [QR] $= -\frac{13}{3}$,
gradient of [PR] $= -\frac{1}{3}$
b $-\frac{4}{3}$

6 $a = -9$

17D PARALLEL AND PERPENDICULAR LINES

1 **a** $\frac{2}{7}$ **b** $-\frac{7}{2}$ **c** −3 **d** $\frac{1}{3}$

2 **a** $\frac{4}{3}$ **b** $-\frac{1}{5}$ **c** 6 **d** $-\frac{2}{9}$

3 **a** **i** $\frac{2}{5}$ **ii** $-\frac{5}{2}$ **b** right angled at Q

4 **a** $t = \frac{13}{2}$ **b** $t = 7$

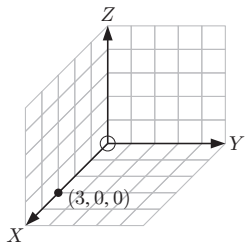
17E USING COORDINATE GEOMETRY

1 **a** **i** M(3, 7) **ii** N(6, 3)
b **i** gradient of [MN] $= -\frac{4}{3}$, gradient of [AC] $= -\frac{4}{3}$
Gradients are equal so [MN] $\parallel$ [AC].
ii MN $= 5$ units, AC $= 10$ units
$\therefore$ MN $= \frac{1}{2}$ AC

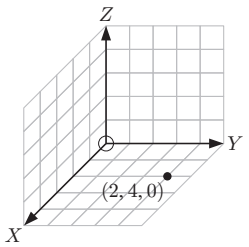
2 **a** OA $= 5$ units, AB $= 5$ units, BC $= 15$ units, OC $= 15$ units
b a kite
c gradient of [OB] $= \frac{1}{3}$, gradient of [AC] $= -3$
Gradients are negative reciprocals so [OB] $\perp$ [AC].

17F 3-DIMENSIONAL COORDINATE GEOMETRY

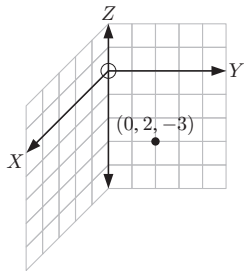
1 a



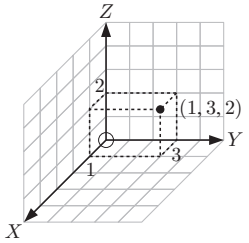
b



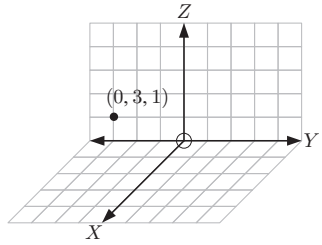
c



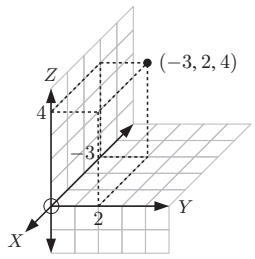
d



e



f



2 a **i** $2\sqrt{22}$ units **ii** $(2, 2, -1)$

b **i** $\sqrt{178}$ units **ii** $\left(0, \frac{1}{2}, 1\frac{1}{2}\right)$

3 a PQ $= \sqrt{30}$ units, QR $= \sqrt{41}$ units, QR $= \sqrt{11}$ units

b Yes, it is right angled at P.

REVIEW OF CHAPTER 17

1 a $\sqrt{34}$ units **b** $\sqrt{53}$ units **c** $2\sqrt{29}$ units

2 a M$(-1, 6)$ **b** M$\left(-1, -\frac{1}{2}\right)$ **c** M$\left(-1\frac{1}{2}, 3\frac{1}{2}\right)$

3 a B$(-1, 6)$ **b** D$(7, -4)$

4 a 3 **b** $-\frac{1}{3}$ **c** $\frac{5}{2}$

5 a $\frac{2}{3}$ **b** $t = 4$

6 a PQ $= \sqrt{34}$ units, QR $= \sqrt{136}$ units, PR $= \sqrt{170}$ units

$\text{PQ}^2 + \text{QR}^2 = 34 + 136 = 170 = \text{PR}^2$

$\therefore$ $\triangle$PQR is right angled at Q.

b gradient of [PQ] $= \frac{5}{3}$, gradient of [QR] $= -\frac{3}{5}$

Gradients are negative reciprocals so [PQ] $\perp$ [QR].

$\therefore$ $\triangle$PQR is right angled at Q.

7 a 11 units **b** $\left(1, 1\frac{1}{2}, 1\right)$

8 a B$(8, 10)$ **b** $\sqrt{85}$ units

c CP $= \sqrt{85}$ units which is the radius of the circle.

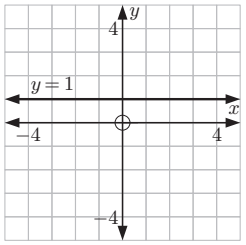
$\therefore$ P$(-7, 5)$ also lies on the circle.

d gradient of [AP] $= -3$, gradient of [PB] $= \frac{1}{3}$

Gradients are negative reciprocals so [AP] $\perp$ [PB].

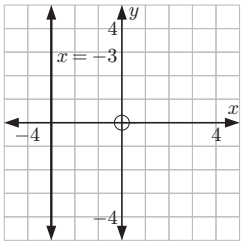
18A VERTICAL AND HORIZONTAL LINES

1 a



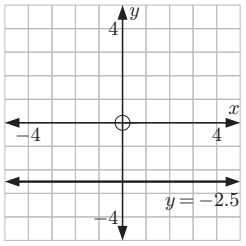
gradient is 0

b



gradient is undefined

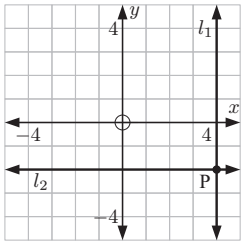
c



gradient is 0

2 a $x = 2$ **b** $y = -3$

3 a



b P$(4, -2)$

c $-\frac{1}{2}$

18B POINTS ON A LINE

1 a no **b** yes

2 a $c = -10$ **b** $c = -6$ **c** $c = 2$ **d** $c = 8$

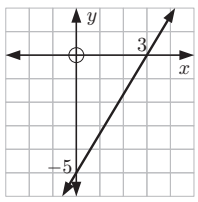
18C AXES INTERCEPTS

1 a x-intercept is -2, y-intercept is 3, gradient is $\frac{3}{2}$

b x-intercept is 4, y-intercept is 5, gradient is $-\frac{5}{4}$

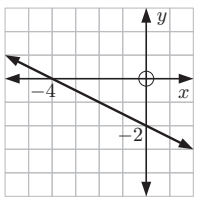
c x-intercept is 3, y-intercept is -1, gradient is $\frac{1}{3}$

2 a



gradient is $\frac{5}{3}$

b



gradient is $-\frac{1}{2}$

3 a 4 **b** 6 **c** 3 **d** -2

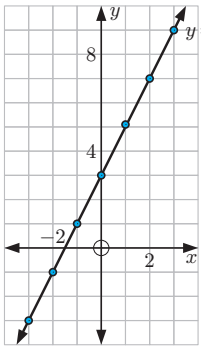
4 a 3 **b** 4 **c** 7 **d** -3

18D GRAPHING FROM A TABLE OF VALUES

1 a i

x	-3	-2	-1	0	1	2	3
y	-3	-1	1	3	5	7	9

ii

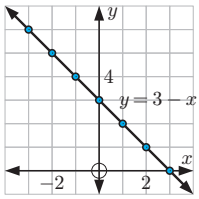


iii gradient is 2, x-intercept is $-\frac{3}{2}$, y-intercept is 3

b i

x	-3	-2	-1	0	1	2	3
y	6	5	4	3	2	1	0

ii

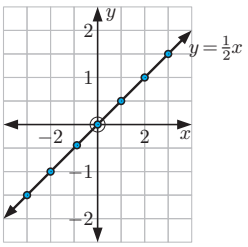


iii gradient is -1, x-intercept is 3, y-intercept is 3

c i

x	-3	-2	-1	0	1	2	3
y	$-1\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	$1\frac{1}{2}$

ii

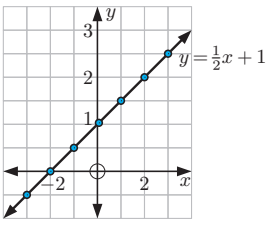


iii gradient is $\frac{1}{2}$, x-intercept is 0, y-intercept is 0

d i

x	-3	-2	-1	0	1	2	3
y	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$

ii



iii gradient is $\frac{1}{2}$, x-intercept is -2, y-intercept is 1

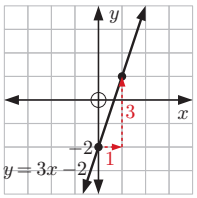
18E GRADIENT-INTERCEPT FORM

1 a gradient is 2, y-intercept is 5

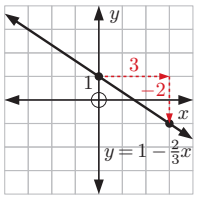
b gradient is $-\frac{3}{4}$, y-intercept is 1

c gradient is $-\frac{1}{4}$, y-intercept is $\frac{1}{6}$

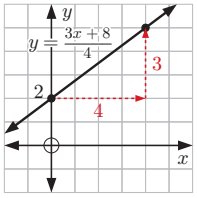
2 a



b

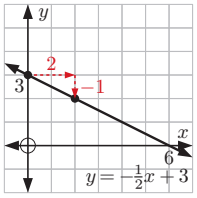


c



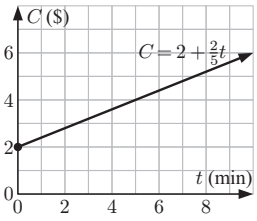
3 a i $-\frac{1}{2}$ **ii** 3 **iii** 6

b



c no

4 a



b $\frac{2}{5}$; the cost of hiring a bicycle is 40 cents per minute.

c 2; the base cost of hiring a bicycle is $2.

18F GENERAL FORM

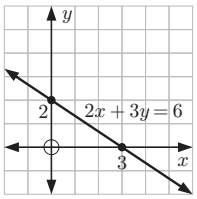
1 a $3x + y = 2$ **b** $x + 4y = 5$ **c** $2x - 5y = -15$

2 a i $y = -\frac{1}{2}x + 2$ **ii** $-\frac{1}{2}$

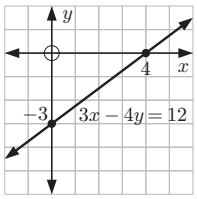
b i $y = \frac{3}{4}x - \frac{3}{2}$ **ii** $\frac{3}{4}$

c i $y = \frac{7}{3}x + 3$ **ii** $\frac{7}{3}$

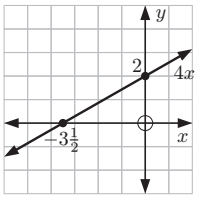
3 a



b



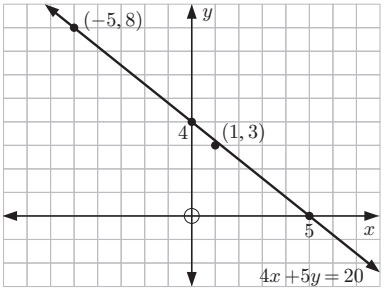
c



4 a x-intercept is 5, y-intercept is 4

b i no **ii** yes

c



d D

18G FINDING THE EQUATION OF A LINE

1 **a** $y = 4x + 3$ **b** $y = -3x$ **c** $y = -\frac{2}{3}x + 1$

2 **a** The plane's height decreases by 150 m per minute.

$\therefore$ the gradient must be -150.

b 3000; the plane is initially 3000 m above the ground.

c $H = -150t + 3000$

d 20; the plane takes 20 minutes to land.

3 **a** $y = 6x - 7$ **b** $y = -\frac{1}{2}x - 10$ **c** $y = \frac{3}{4}x + \frac{1}{4}$

4 **a** $2x - y = -9$ **b** $2x + 3y = -6$ **c** $3x + y = 10$

5 **a** $y = \frac{1}{2}x - 1$ **b** $y = 7x + 2$ **c** $y = -\frac{1}{6}x + 4$

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

7 **a** $y = x - 3$ **b** $y = 2x - 1$

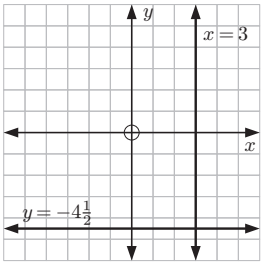
8 **a** $y = x - 1$ **b** $y = -\frac{3}{5}x + \frac{8}{5}$

9 **a** $6x + 5y = 13$ **b** $x - 4y = -24$

10 **a** $E = -\frac{1}{2}t + 3$ **b** $V = \frac{5}{3}S + 5$ **c** $h = -\frac{3}{4}d - \frac{1}{4}$

REVIEW OF CHAPTER 18

1

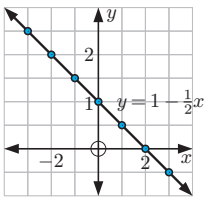


2 no

3 **a**

x	-3	-2	-1	0	1	2	3
y	$2\frac{1}{2}$	2	$1\frac{1}{2}$	1	$\frac{1}{2}$	0	$-\frac{1}{2}$

b



c gradient is $-\frac{1}{2}$, x-intercept is 2, y-intercept is 1

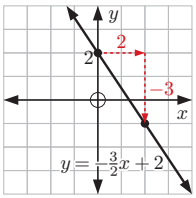
4 **a** gradient is $\frac{4}{5}$, y-intercept is -10

b gradient is -2, y-intercept is 3

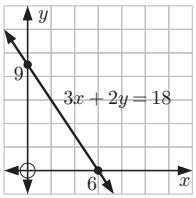
c gradient is $-\frac{4}{3}$, y-intercept is $\frac{2}{3}$

5 **a** $2x - 3y = 3$ **b** $y = -\frac{4}{5}x + 2$

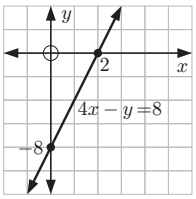
6 **a**



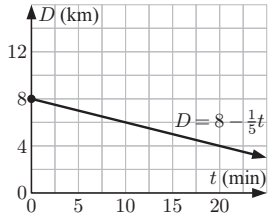
b



c



7 **a**



b 8; the park is 8 kilometres from Daniel's house.

c $-\frac{1}{5}$; Daniel is running toward his home at $\frac{1}{5}$ kilometres per minute.

d 40; it takes Daniel 40 minutes to arrive home.

8 **a** $y = -\frac{2}{3}x + \frac{14}{3}$ **b** $y = \frac{7}{6}x - \frac{8}{3}$

9 **a** $2x - 3y = 6$ **b** $x + 4y = -2$

10 **a** $y = -\frac{3}{4}x + 1$ **b** $y = \frac{3}{5}x + \frac{16}{5}$

19A SOLUTION BY TRIAL AND ERROR

1 **a** yes **b** no

2 **a** $x = 2, \quad y = -1$ **b** $x = 3, \quad y = 7$

19B GRAPHICAL SOLUTION

1 **a** $x = -4, \quad y = -2$ **b** $x = 1, \quad y = 3$

c $x = 1, \quad y = -6$ **d** $x = 3, \quad y = -2$

2 **a** The lines are parallel.

$\therefore$ there are no solutions.

b The lines are coincident.

$\therefore$ there are infinitely many solutions.

19C SOLUTION BY EQUATING VALUES OF y

1 **a** $x = 1, \quad y = 7$ **b** $x = -4, \quad y = -5$

c $x = -2, \quad y = 3$

2 $(4, 11)$

19D SOLUTION BY SUBSTITUTION

1 **a** $x = -4, \quad y = -2$ **b** $x = 6, \quad y = 3$

c $x = 5, \quad y = -2$ **d** $x = -2, \quad y = 7$

e $x = \frac{4}{5}, \quad y = \frac{11}{5}$ **f** $x = \frac{49}{18}, \quad y = \frac{1}{18}$

2 $\left(\frac{9}{10}, -\frac{17}{5}\right)$

19E SOLUTION BY ELIMINATION

1 **a** $x = 1, \quad y = -1$ **b** $x = 0, \quad y = -\frac{3}{2}$
c $x = -3, \quad y = \frac{1}{5}$ **d** $x = \frac{29}{12}, \quad y = -\frac{10}{3}$

2 **a** $6x - 18y = -15$ **b** $6x - 2y = 8$

3 **a** $x = -2, \quad y = -\frac{11}{4}$ **b** $x = -2, \quad y = 2$
c $x = -\frac{5}{4}, \quad y = -\frac{11}{12}$ **d** $x = 6, \quad y = 4$
e $x = 5, \quad y = -1$ **f** $x = 26, \quad y = \frac{61}{2}$

4 We obtain $0 = 0$, which is always true.
$\therefore$ there are infinitely many solutions.

19F PROBLEM SOLVING WITH SIMULTANEOUS EQUATIONS

1 The numbers are 36 and 39.

2 11 bicycles and 3 tricycles

3 Sausage rolls cost \$2.50 and custard tarts cost \$1.50 .

4 seven 20 cent coins and eleven 50 cent coins.

5 **a** $x = 9, \quad y = 3$ **b** 48 cm

6 Matt is 15 years old and Cara is 3 years old.

REVIEW OF CHAPTER 19

1 $x = -2, \quad y = -3$

2 **a** $x = 6, \quad y = -7$ **b** $x = 2, \quad y = 3$

3 **a** $x = -3, \quad y = -19$ **b** $x = -\frac{1}{11}, \quad y = \frac{26}{11}$

4 **a** $x = -7, \quad y = -\frac{13}{2}$ **b** $x = -2, \quad y = -5$

5 Bags of flour cost \$1.80 and bags of sugar cost \$1.50 .

6 **a** $x = 2, \quad y = -2$ **b** 54 m^2

20A QUADRATIC EQUATIONS

1 **a** quadratic equation **b** not a quadratic equation
c quadratic equation

2 **a** 5 and -1 **b** 0 and -8

20B EQUATIONS OF THE FORM $x^2 = k$

1 **a** $x = \pm 5$ **b** no real solutions **c** $x = \pm\sqrt{6}$

2 **a** $x = 1$ or -7 **b** $x = 2 \pm \sqrt{10}$ **c** no real solutions
d $x = -5 \pm \sqrt{11}$ **e** $x = -\frac{3}{2}$ **f** $x = \frac{2}{3}$ or 0

20C THE NULL FACTOR LAW

1 **a** $p = 0$ or $q = 0$ **b** $a = 0$ or $b = 1$ **c** $z = 0$

2 **a** $x = 0$ or 3 **b** $x = 0$ or -11 **c** $x = 0$ or -4
d $x = -6$ **e** $x = 0$ or $-\frac{1}{3}$ **f** $x = 0$ or $\frac{1}{2}$

3 **a** $x = 4$ or -1 **b** $x = -6$ or 5 **c** $x = 0$ or -1
d $x = -5$ or $-\frac{1}{4}$ **e** $x = \frac{3}{2}$ or 8 **f** $x = 9$ or $\frac{5}{3}$

20D SOLVING BY FACTORISATION

1 **a** $x = 0$ or -2 **b** $x = 0$ or 12 **c** $x = 0$ or -5
d $x = 0$ or 9 **e** $x = 0$ or 2 **f** $x = 0$ or -3

2 **a** $x = 0$ or 7 **b** $x = 0$ or $\frac{1}{2}$ **c** $x = 0$ or $-\frac{5}{3}$
d $x = 0$ or 8 **e** $x = 0$ or $\frac{1}{2}$ **f** $x = 6$ or -1

3 **a** $x = \pm 3$ **b** $x = \pm 1$ **c** $x = \pm 5$

4 **a** $x = \pm\frac{6}{5}$ **b** $x = \pm\frac{1}{4}$ **c** $x = \frac{3}{2}$ **d** $x = \frac{1}{3}$ or 5

5 **a** $x = -1$ or -5 **b** $x = 9$ or -2 **c** $x = -8$
d $x = 1$ or -17 **e** $x = 5$ or 4 **f** $x = 22$ or 2

6 **a** $x = 3$ or 1 **b** $x = 7$ or -3 **c** $x = 1$ or -5
d $x = 11$ or -10 **e** $x = 10$ or -8 **f** $x = 9$

7 **a** $x = 5$ or 3 **b** $x = -2$ or -6 **c** $x = 5$ or -10

8 **a** $x = -1$ or -2 **b** $x = -6$ **c** $x = 4$ or -2

20E PROBLEM SOLVING

1 The number is 4 or -5. **2** The numbers are 3 and 5.

3 The height is 9 cm.

4 **a** $x(x - 3)$ m^2 **b** The dimensions are 5 m by 2 m.

5 $x = 5$ **6** The inner radius is 5 m.

7 The middle number is 10 or -10.

REVIEW OF CHAPTER 20

1 **a** quadratic equation **b** not a quadratic equation
c quadratic equation

2 **a** $x = \pm 2$ **b** $x = 3 \pm \sqrt{13}$ **c** $x = 1$ or -2

3 **a** $p = 0$ or $q = -1$ **b** $x = 0$ or $y = 0$

4 **a** $x = 0$ or -6 **b** $x = 0$ or 11 **c** $x = 7$ or 2

5 **a** $x = \pm 7$ **b** $x = \pm\frac{3}{5}$

6 **a** $x = 3$ or -8 **b** $x = 10$ **c** $x = 7$ or 4

7 **a** $x = 15$ or -2 **b** $x = -2$ or -7 **c** $x = 6$ or -4

8 The number is 7 or -8.

9 $x = 16$; the perimeter is 144 mm.

10 The numbers are 8 and 15 or -8 and -15.

21A QUADRATIC FUNCTIONS

1 **a** quadratic function; $a = -5, \quad b = 0, \quad c = 1$
b not a quadratic function as it has $\frac{1}{x^2}$ in it
c not a quadratic function as it has no x^2 term
d quadratic function; $a = \frac{1}{4}, \quad b = 0, \quad c = \frac{1}{2}$

2 **a** $y = 9$ **b** $y = -41$ **c** $y = \frac{9}{2}$

3 **a** $k = 27$ **b** $k = -5$

4 **a** yes **b** no **c** yes

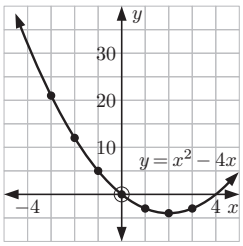
5 **a** $x = 3$ **b** $x = -3$ or 9 **c** $x = -2$ or 8

6 $k = 4$ or -2

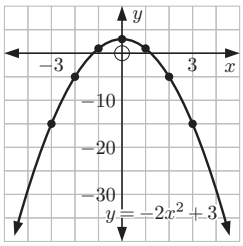
7 **a** **i** 40 m **ii** 13.75 m
b **i** 1 second and 5 seconds **ii** 3 seconds
c 6 seconds

21B GRAPHS OF QUADRATIC FUNCTIONS

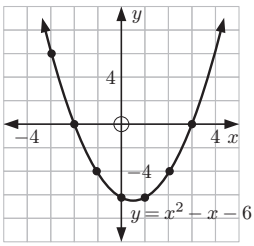
1 a



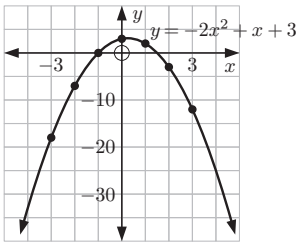
b



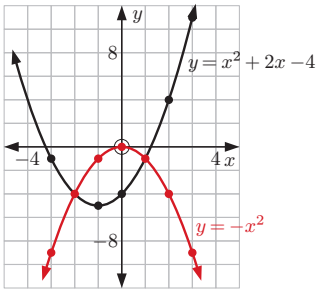
c



d



2 a

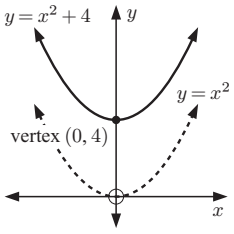


b $x = -2$ or 1

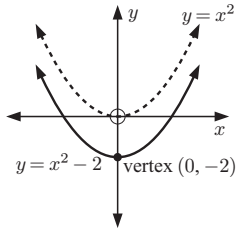
c $x = -2$ or 1

21C USING TRANSFORMATIONS TO GRAPH QUADRATICS

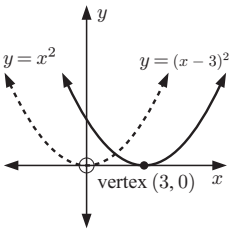
1 a



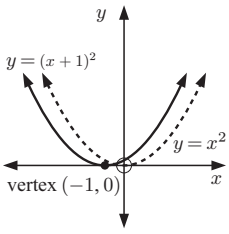
b



c

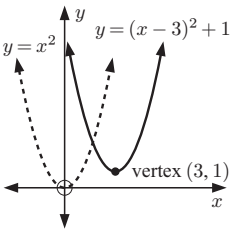


d

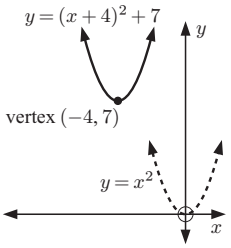


2 a $(-3, 0)$ **b** $(0, 2)$ **c** $(0, -8)$ **d** $(2, 0)$

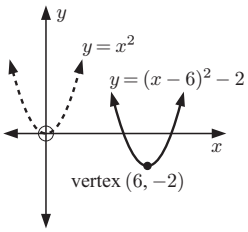
3 a



b

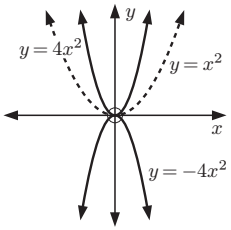


c

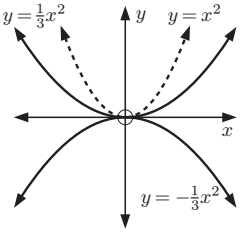


4 a $(7, -1)$ **b** $(-5, -5)$ **c** $(-2, 2)$

5 a



b



6 a E **b** D **c** F **d** B **e** A **f** C

21D AXES INTERCEPTS

1 a -12 **b** -3 **c** 8 **d** 25 **e** -5 **f** 15

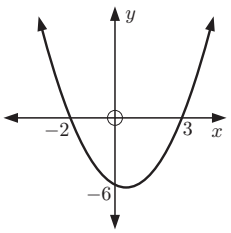
2 a 1 and -2 **b** -1 and -5 **c** 9

3 a -15 **b** -22 **c** 32

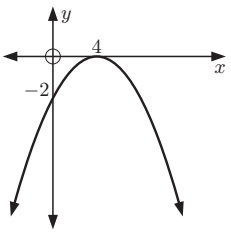
4 a -6 and 6 **b** 2 and 15 **c** -11 **d** -1 and 14
e -1 and -5 **f** 2 and 3

21E USING AXES INTERCEPTS TO GRAPH QUADRATICS

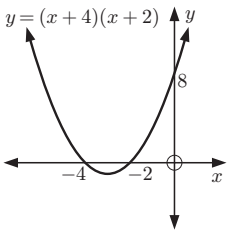
1 a



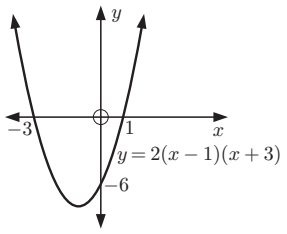
b



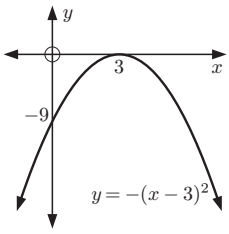
2 a



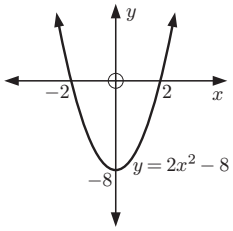
b



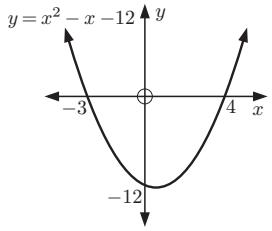
c



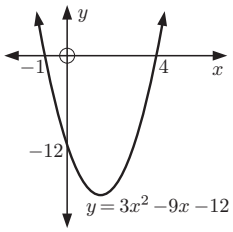
d



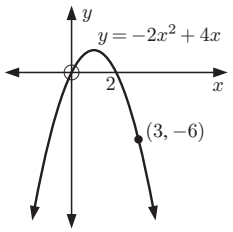
e



f

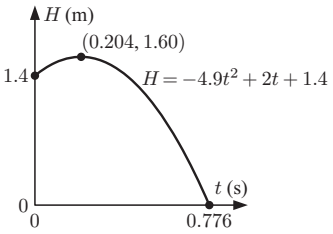


3



21F PROJECTILE MOTION

1 a

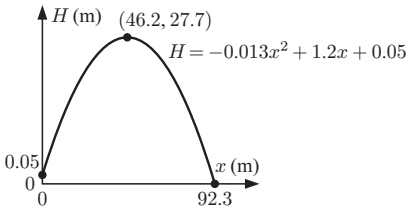


b **i** ≈ 1.60 m

ii ≈ 0.204 s

iii ≈ 0.776 s

2 a



b ≈ 27.7 m

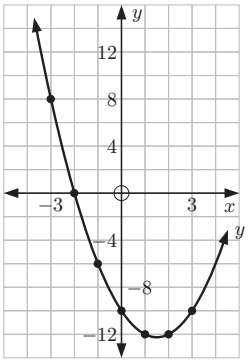
c no

REVIEW OF CHAPTER 21

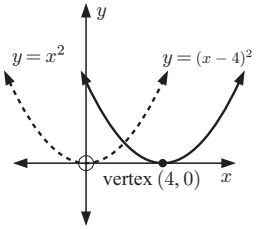
1 a $y = 5$ **b** $y = 21$ **c** $y = 0$

2 a $k = 51$ **b** $k = -7$ or 4

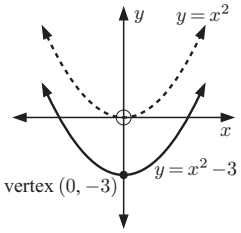
3



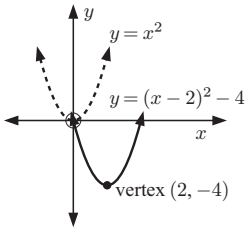
4 a



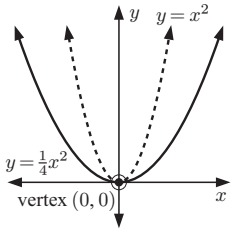
b



c



d

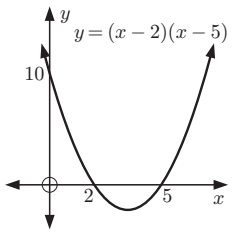


5 a $(5, 6)$ **b** $(-3, -1)$ **c** $(-6, 8)$

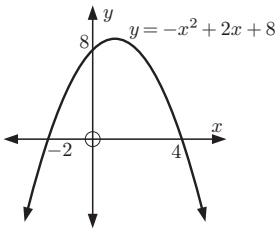
6 a 12 **b** 25 **c** -14

7 a -1 and 8 **b** -11 and 1 **c** 5

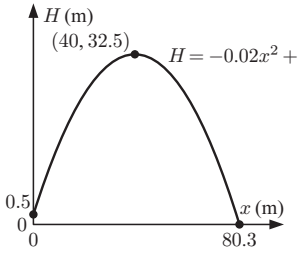
8 a



b



9 a



b 32.5 m **c** **i** yes **ii** ≈ 5.31 m

22A CONGRUENCE

1 a yes **b** no **2** **A** and **D**

3 a 35 cm **b** 120° **c** 195 cm

22B CONGRUENT TRIANGLES

1 **a** yes {SAS} **b** yes {AAcorS}

c No, not enough information.

2 **a** **A** and **C** {SSS} **b** **B** and **C** {SAS}

3 **a** **i** $\triangle ABC \cong \triangle YXZ$ {RHS}

ii $BC = XZ$, $\widehat{ABC} = \widehat{YXZ}$, $\widehat{BAC} = \widehat{XYZ}$

b **i** not congruent (triangles are equiangular but there is not enough information about the side lengths to conclude they are congruent)

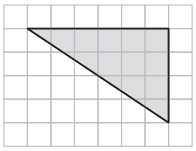
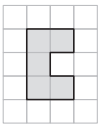
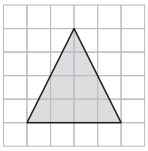
4 24 cm

5 **Hint:** Show that $\triangle MAD \cong \triangle NCD$.

22C ENLARGEMENTS AND REDUCTIONS

1 **a** reduction, scale factor $\frac{1}{2}$ **b** enlargement, scale factor 3

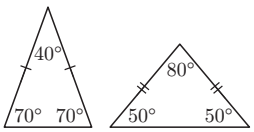
c enlargement, scale factor $\frac{4}{3}$

2 **a**  **b**  **c** 

22D SIMILARITY

1 **a** similar **b** not similar

2 false



3 **a** $x \approx 18.67$ **b** $x = 115$

4 **a** 12 cm **b** $\frac{1}{90}$

5 **a** $x = 4$ **b** $x = 46$

22E SIMILAR TRIANGLES

1 **a** $\triangle$s ABE and ACD are equiangular as:

- $\widehat{ABE} = \widehat{ACD}$ {equal corresponding angles}
- the angle at A is common to both triangles.

$\therefore$ the triangles are similar.

b $\triangle$s FGH and JIH are equiangular as:

- $\widehat{GFH} = \widehat{IJH}$ {given}
- $\widehat{GHF} = \widehat{IHJ}$ {vertically opposite angles}

$\therefore$ the triangles are similar.

c $\frac{MN}{MK} = \frac{3}{6} = \frac{1}{2}$, $\frac{NK}{KL} = \frac{4}{8} = \frac{1}{2}$, $\frac{MK}{ML} = \frac{6}{12} = \frac{1}{2}$

$\therefore$ corresponding side lengths are in the same ratio.

$\therefore$ $\triangle$s MNK and MKL are similar.

2 **a** $\triangle$s ABC and EDC are equiangular as:

- $\widehat{ABC} = \widehat{EDC}$ {equal alternate angles}
- $\widehat{ACB} = \widehat{ECD}$ {vertically opposite angles}

$\therefore$ the triangles are similar.

$x = 4.5$

b $\triangle$s PQT and PRS are equiangular as:

- $\widehat{PTQ} = \widehat{PSR}$ {given}
- the angle at P is common to both triangles.

$\therefore$ the triangles are similar.

$x = \frac{48}{7} \approx 6.86$

c $\triangle$s XYZ and XUV are equiangular as:

- $\widehat{XYZ} = \widehat{XUV}$ {equal corresponding angles}
- the angle at X is common to both triangles.

$\therefore$ the triangles are similar.

$x = 3$

3 **a** $x = 3$ **b** $x = 5$

22F PROBLEM SOLVING

1 6 m **2** 4.42 m

3 **a** 400 m **b** 440 m farther

4 ≈ 14.4 cm **5** PZ = 133.125 cm

22G AREAS OF SIMILAR FIGURES

1 **a** $x = 7.5$ **b** $x = 3.75$

2 **a** $k = 4.5$ **b** 36 cm **c** 20.25 times larger

3 **a** $\triangle$s ABC and DEC are equiangular as:

- $\widehat{BAC} = \widehat{EDC}$ {given}
- $\widehat{BCA} = \widehat{ECD}$ {vertically opposite angles}

$\therefore$ the triangles are similar.

b scale factor $= \frac{3}{5}$ **c** 12 cm

22H VOLUMES OF SIMILAR SOLIDS

1 **a** $V \approx 3240$ **b** $x = 3.6$ **2** 1944 cm^3

3 **a** scale factor ≈ 0.630 **b** ≈ 1210 cm^2

REVIEW OF CHAPTER 22

1 **a** Not enough information to conclude the triangles are congruent.

b yes {AAcorS}

2 **a** **Hint:** Use AAcorS.

b **Hint:** Use congruence of triangles PXB and QXC to show that PX = QX and AP = AQ.

3 enlargement, scale factor $\frac{3}{2}$ **4** not similar

5 **a** $\triangle$s ABD and ECD are equiangular as:

- $\widehat{ABD} = \widehat{ECD}$ {equal corresponding angles}
- the angle at D is common to both triangles.

$\therefore$ the triangles are similar.

$x = 10$

b $\triangle$s PQR and TSR are equiangular as:

- $\widehat{PQR} = \widehat{TSR}$ {given}
- $\widehat{PRQ} = \widehat{TRS}$ {vertically opposite angles}

$\therefore$ the triangles are similar.

$x = 8$

6 72 m **7** **a** $x = 61.25$ **b** $x \approx 6.67$

8 14 cm^2

23A SCALE DIAGRAMS IN GEOMETRY

1 ≈ 8.4 m

23B LABELLING RIGHT ANGLED TRIANGLES

1 **a** **i** [AC] **ii** [AB] **iii** [BC]

b **i** [PQ] **ii** [QR] **iii** [PR]

c **i** [XY] **ii** [YZ] **iii** [XZ]

23C THE TRIGONOMETRIC RATIOS

1 **a** **i** $\frac{20}{29}$ **ii** $\frac{21}{29}$ **iii** $\frac{20}{21}$

b **i** $\frac{5}{6}$ **ii** $\frac{\sqrt{11}}{6}$ **iii** $\frac{5}{\sqrt{11}}$

2 **a** AB $= 30$ mm, BC $= 20$ mm, AC $= 36$ mm

b **i** ≈ 0.556 **ii** ≈ 0.833 **iii** ≈ 0.667

c **i** ≈ 0.559 **ii** ≈ 0.829 **iii** ≈ 0.675

3 **a** **i** ≈ 0.616 **ii** ≈ 0.616 **iii** ≈ 0.899 **iv** ≈ 0.899

b $\tan\theta \times \cos\theta = \sin\theta$

c $\tan\theta \times \cos\theta = \frac{b}{a} \times \frac{a}{c} = \frac{b}{c} = \sin\theta$

23D FINDING SIDE LENGTHS

1 **a** $\tan 72^\circ = \frac{y}{x}$ **b** $\cos 30^\circ = \frac{b}{c}$ **c** $\sin 55^\circ = \frac{r}{q}$

2 **a** $x \approx 122.41$ **b** $x \approx 43.66$ **c** $x \approx 39.59$

d $x \approx 22.73$ **e** $x \approx 4.98$ **f** $x \approx 53.73$

3 $\theta = 65^\circ$, $a \approx 1.87$, $b \approx 4.41$

23E FINDING ANGLES

1 **a** $\theta \approx 64.2^\circ$ **b** $\theta \approx 66.8^\circ$ **c** $\theta \approx 34.7^\circ$

d $\theta \approx 48.0^\circ$ **e** $\theta \approx 36.9^\circ$ **f** $\theta \approx 22.4^\circ$

2 $x \approx 4.6$, $\alpha \approx 44.6^\circ$, $\beta \approx 45.4^\circ$

3 The triangle does not exist. The hypotenuse must be longer than the other sides.

23F PROBLEM SOLVING

1 ≈ 52.6 cm **2** ≈ 72.6 cm

3 $\alpha \approx 63.4^\circ$, $\beta \approx 116.6^\circ$

4 $\widehat{BAC} \approx 27.8^\circ$, $\widehat{BCA} \approx 51.1^\circ$, $\widehat{ABC} \approx 101.1^\circ$

5 ≈ 28.3 cm

6 $a \approx 43.2^\circ$, $b \approx 18.8^\circ$, $c \approx 13.1^\circ$, $d \approx 14.9^\circ$

REVIEW OF CHAPTER 23

1 **a** q **b** r **c** p **d** p **e** r

2 **a** $\frac{7}{\sqrt{65}}$ **b** $\frac{4}{\sqrt{65}}$ **c** $\frac{7}{4}$

3 $\sin 71^\circ = \frac{n}{m}$

4 **a** $x \approx 13.8$ **b** $x \approx 36.3$ **c** $x \approx 24.3$

5 **a** $\alpha \approx 41.8^\circ$ **b** $\alpha \approx 28.6^\circ$ **c** $\alpha \approx 53.2^\circ$

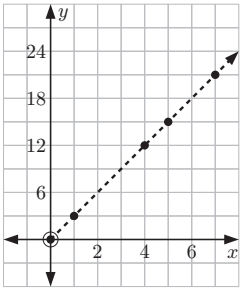
6 $\theta = 35^\circ$, $a \approx 6.10$, $b \approx 3.50$

7 $\approx 56.3^\circ$ **8** ≈ 28.7 km

24A DIRECT PROPORTION

1 **C**

2 **a**

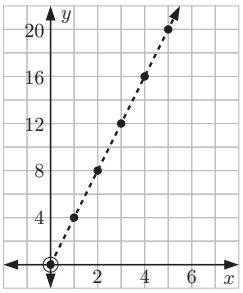


b directly proportional, $k = 3$

3 **a**

Time (h hours)	0	1	2	3	4	5
Charge (C)	0	4	8	12	16	20

b



c directly proportional, $k = 4$

4 **a** y is divided by 4 **b** x is multiplied by 5

c y is increased by 15%

5 **a** $y = 27.5$ **b** $x = 3.6$

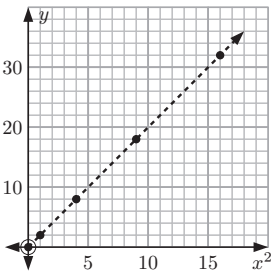
6 **a** 0.6 L **b** 525 g **7** **a** 36 kg m/s **b** 6 m/s

24B POWERS IN DIRECT PROPORTION

1 **a** $B \propto \sqrt{t}$, $k = 100$ **b** $S \propto r^2$, $k = 4\pi$

c $L \propto \sqrt[3]{v}$, $k = \frac{1}{8}$

2



$y = 2x^2$

3 **a** $Q = 6.25$ **b** $t = 14$

4 **a** 12 656.25 watts **b** ≈ 23.7 m/s

5 **a** ≈ 1.27 s **b** ≈ 351 cm

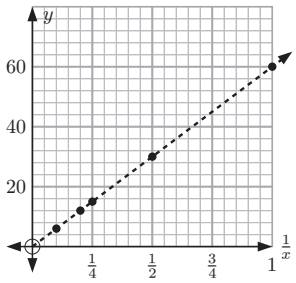
6 **a** 44% increase **b** $\approx 29.3\%$ decrease

24C INVERSE PROPORTION

1 **a, d**

x	1	2	4	5	10
$\frac{1}{x}$	1	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{10}$
y	60	30	15	12	6
xy	60	60	60	60	60

b



c The points on the graph of y against $\frac{1}{x}$ form a straight line through the origin.

$\therefore$ y is directly proportional to $\frac{1}{x}$.

$\therefore$ y is inversely proportional to x.

2 **a**

x	1	2	3	5	10
y	30	15	10	6	3
xy	30	30	30	30	30

x and y are inversely proportional, and $xy = 30$.

b

x	2	3	5	9	12
y	18	12	7	4	3
xy	36	36	35	36	36

x and y are not inversely proportional.

c

x	2	8	4	10	12
y	60	15	30	12	10
xy	120	120	120	120	120

x and y are inversely proportional, and $xy = 120$.

3 **a** x is multiplied by $\frac{1}{7}$ **b** y is multiplied by $\frac{2}{5}$

4 **a** $T = 12.5$ **b** $n = \frac{4}{3}$ **5** \$7.20

6 **a** 125 newtons **b** ≈ 13.9 m

24D POWERS IN INVERSE PROPORTION

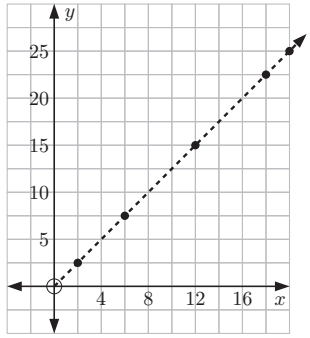
1 **a** $y = 1$ **b** $x = \frac{4}{5}$

2 **a** 10 seconds **b** 12.5 m/s^2

3 The force is decreased by $\approx 67.3\%$.

REVIEW OF CHAPTER 24

1 **a**



b The graph is a straight line through the origin so y is directly proportional to x.

c $y = 1.25x$

2 **a** $y = 8$ **b** $x = 37.5$ **3** 18 cakes

4 **B** and **D** **5** $a = 15$, $b = 30$ **6** 21 crates

7 **a** 28 800 units **b** ≈ 11.2 cm

8 **a** $y = 10$ **b** $x = \frac{16}{25}$

9 **a** $\approx 18.3\%$ increase **b** $\approx 36\%$ decrease

25A SAMPLE SPACE AND EVENTS

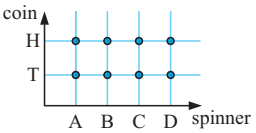
1 **a** {BBB, BBG, BGB, GBB, BGG, GBG, GGB, GGG}

b {4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48}

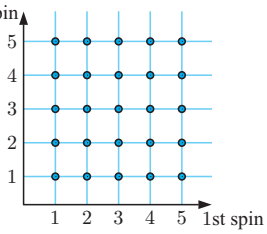
2 **a** $U = \{1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60\}$

b **i** $A = \{1, 3, 5, 15\}$ **ii** $B = \{2, 3, 5\}$

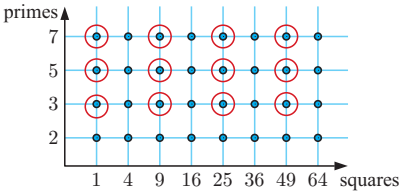
3 **a**



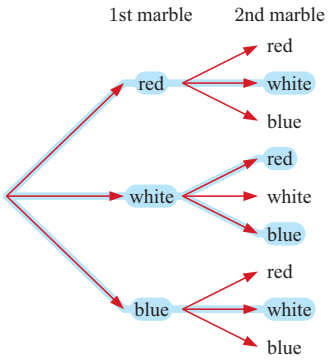
b



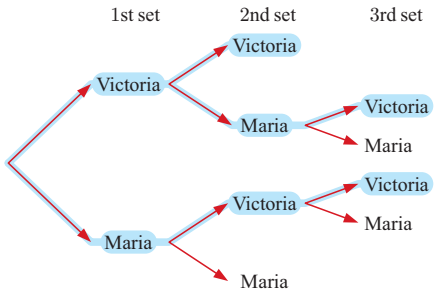
4



5



6



25B THEORETICAL PROBABILITY

1 **a** $\frac{1}{12}$ **b** $\frac{1}{4}$ **c** $\frac{1}{3}$

2 **a** E' is the event that the selected cookie is not oatmeal.

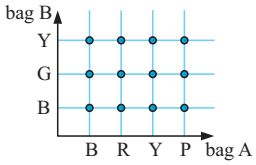
b $\mathrm{P}(E) = \frac{2}{5}$, $\mathrm{P}(E') = \frac{3}{5}$

3 **a** $\frac{11}{25}$ **b** $\frac{1}{5}$ **c** $\frac{14}{25}$

4 **a** $\frac{1}{52}$ **b** $\frac{5}{13}$ **c** $\frac{1}{13}$ **d** $\frac{1}{4}$

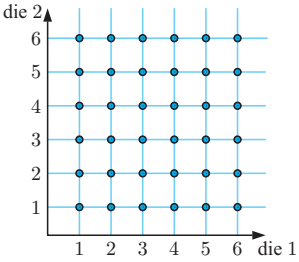
5 **a** $\frac{1}{7}$ **b** $\frac{1}{1461}$

6 **a**



b **i** $\frac{1}{6}$ **ii** $\frac{1}{2}$ **iii** $\frac{1}{6}$ **iv** $\frac{5}{6}$

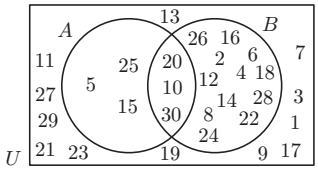
7 **a**



b **i** $\frac{1}{18}$ **ii** $\frac{5}{9}$ **iii** $\frac{5}{36}$ **iv** $\frac{3}{4}$

25C PROBABILITIES FROM VENN DIAGRAMS

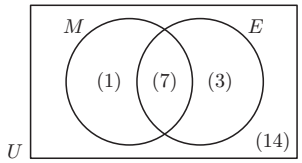
1 **a**



b **i** $\frac{1}{5}$ **ii** $\frac{1}{10}$ **iii** $\frac{2}{5}$

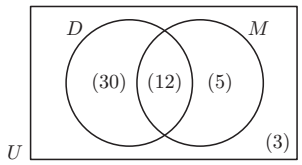
2 **a** 56 children **b** **i** $\frac{25}{56}$ **ii** $\frac{17}{28}$

3 **a**



b **i** $\frac{1}{25}$ **ii** $\frac{3}{25}$ **iii** $\frac{14}{25}$

4 **a**



b **i** $\frac{6}{25}$ **ii** $\frac{47}{50}$ **iii** $\frac{7}{10}$

25D INDEPENDENT EVENTS

1 $\frac{1}{12}$ **2** $\frac{1}{5}$ **3** **a** 26% **b** 21%

4 **a** 0.2048 **b** 0.476 **c** 0.130 56

25E DEPENDENT EVENTS

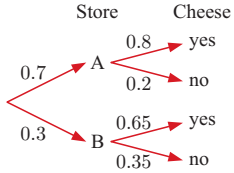
1 **a** $\frac{5}{26}$ **b** $\frac{7}{26}$ **c** $\frac{7}{26}$ **d** $\frac{7}{26}$

2 **a** **i** $\frac{3}{8}$ **ii** $\frac{1}{8}$ **b** $\frac{1}{2}$

3 **a** $\frac{230}{777}$ **b** $\frac{22}{777}$ **4** **a** $\frac{4}{33}$ **b** $\frac{243}{53\,900}$

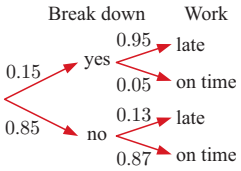
25F PROBABILITIES FROM TREE DIAGRAMS

1 **a**



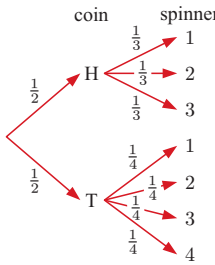
b 0.755

2 **a**



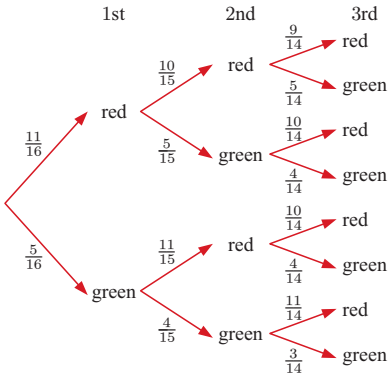
b 0.253

3 **a**



b **i** $\frac{7}{24}$ **ii** $\frac{5}{12}$

4 **a**



b $\frac{11}{56}$

25G EXPERIMENTAL PROBABILITY

1 ≈ 0.702 **2** **a** ≈ 0.56 **b** ≈ 0.25

3 **a** **i** ≈ 0.409 **ii** ≈ 0.402 **iii** ≈ 0.406

b The entire weekend as the sample size is largest.

4 **a** ≈ 0.815 **b** **i** ≈ 0.664 **ii** ≈ 0.0342

25H PROBABILITIES FROM TABLED DATA

1 **a** ≈ 0.05 **b** ≈ 0.15

2 **a** ≈ 0.136 **b** ≈ 0.024 **c** ≈ 0.824

3 **a** ≈ 0.289 **b** ≈ 0.446 **c** ≈ 0.217 **d** ≈ 0.711

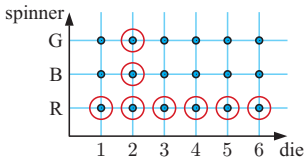
4 **a**

Tea \ *Coffee*	Like	Dislike	*Total*
Like	45	16	61
Dislike	13	23	36
Total	58	39	97

b **i** ≈ 0.598 **ii** ≈ 0.165 **iii** ≈ 0.763

REVIEW OF CHAPTER 25

1

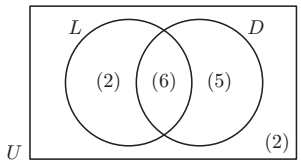


2 **a** $\frac{2}{15}$ **b** $\frac{7}{15}$ **c** $\frac{2}{5}$

3 **a** **i** $\frac{29}{50}$ **ii** $\frac{21}{50}$

b 1; it is certain that the tile will be a vowel or a consonant.

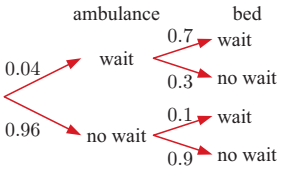
4 **a**



b $\frac{2}{15}$

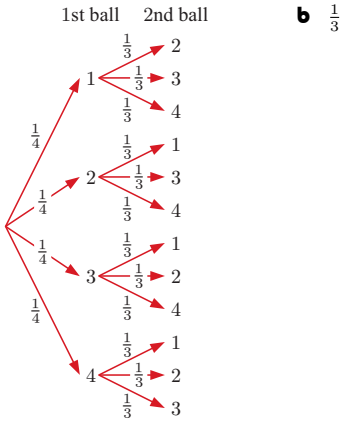
5 **a** 0.4225 **b** 0.2275

6 **a**



b 0.124

7 **a**



b $\frac{1}{3}$

8 ≈ 0.405

9 **a** ≈ 0.328 **b** ≈ 0.138 **c** ≈ 0.172 **d** ≈ 0.525

26A DATA COLLECTION

1 **a** census **b** sample

2 **a** **i** 220 members **ii** 50 members

b **i** Members who volunteer to complete the survey would be likely to have strong opinions, so this sample may not be representative of all the members.

ii Branch managers may have a higher income than the other members in the social club so may be less concerned about membership fees.

3 **a** Parents are more likely to have more people living in their household so may use more electricity than households with fewer people.

b The sample size is very small, and the street may not be representative of the whole city, for example it may contain very large houses with high electricity bills.

26B TYPES OF DATA

1 **a** discrete numerical **b** categorical

c continuous numerical **d** categorical

e discrete numerical **f** continuous numerical

2 **a** continuous; 10°C to 45°C

b discrete; 0, 1, 2, 3, 4, 5, 6, 7

c continuous; 60 km/h to 100 km/h

26C DISCRETE NUMERICAL DATA

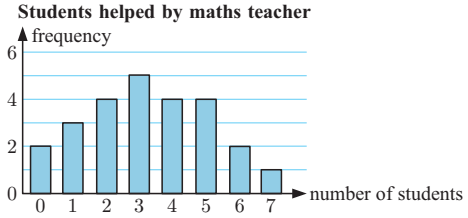
1 **a** **i** 20 tables **ii** 2 tables **b** 20%

c 6 drinks; the most common number of drinks ordered by the tables was 6.

2 **a**

Number of students	*Tally*	*Frequency*
0	||	2
1	|||	3
2	||||	4
3	𝍸	5
4	||||	4
5	||||	4
6	||	2
7	|	1
	Total	25

b



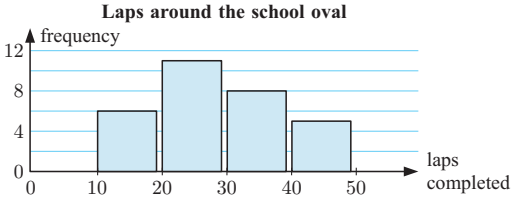
c 3 students; the most frequently occurring number of students who came to the maths teacher for help was 3 students.

d $\frac{4}{5}$

3 **a**

Test score	*Tally*	*Frequency*
10 to 19	𝍸 |	6
20 to 29	𝍸 𝍸 |	11
30 to 39	𝍸 |||	8
40 to 49	𝍸	5
	Total	30

b



c 20 to 29 laps **d** 13 days

4 **a** 30 innings **b** **i** 0 runs **ii** 67 runs

c 14 times **d** 10%

5 **a**

0	8
1	5 7
2	0 1 3 8 9
3	0 2 4 6 8 8 8 9
4	0 0 1 2 3 4 8 8 9 9
5	0 1 1 3 4 5 5 5 5 8 8
6	0 0 0

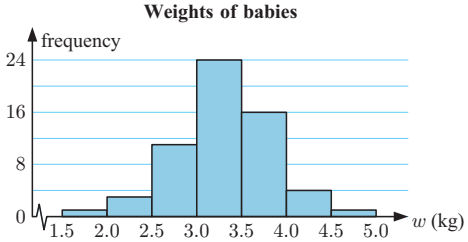
Scale: 3 | 4 means 34 marks

b 4 students **c** 32.5%

26D CONTINUOUS NUMERICAL DATA

1 **a** Weight can take any value within a certain interval.

b



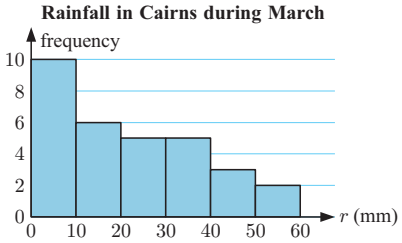
c $3.0 \leqslant w < 3.5$ kg; this class has the highest frequency.

d 25%

2 **a**

Rainfall (r mm)	*Frequency*
$0 \leqslant r < 10$	10
$10 \leqslant r < 20$	6
$20 \leqslant r < 30$	5
$30 \leqslant r < 40$	5
$40 \leqslant r < 50$	3
$50 \leqslant r < 60$	2
Total	31

b



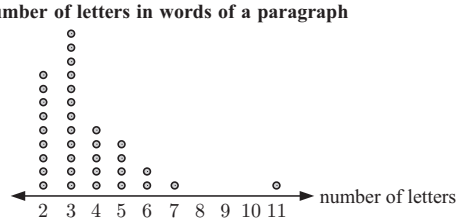
c $0 \leqslant r < 10$ mm **d** $\approx 48.4\%$

26E DESCRIBING THE DISTRIBUTION OF DATA

1 **a** bimodal **b** negatively skewed, "1" is an outlier

c symmetric

2 **a**



b 3 letters **c** positively skewed, "11" is an outlier

3 **a**

3	7 9
4	0 2 2 5 6 7 8
5	1 2 2 3 4 5 6 7 8 9
6	0 4 5 6 6 9
7	1 2 5

Scale: 5 | 1 means 51 pedestrians

b symmetric

c $\approx 67.9\%$

26F MEASURES OF CENTRE

1 mean = 10, median = 9, mode = 8, range = 17

2 **a** mean = 32.75 double faults, median = 31.5 double faults

b Each data value is different.

3 \$1 512 000 **4** $x = 10$

5 **a** 4 cousins **b** 5 cousins **c** 4.96 cousins

6 **a** positively skewed

b

Number of sushi rolls	*Frequency*
1	5
2	8
3	8
4	5
5	2
6	2
Total	30

c **i** 2 and 3 sushi rolls **ii** 3 sushi rolls

iii 2.9 sushi rolls

7 **a**

Length (l mm)	*Frequency*	*Interval midpoint*	*Product*
$40 \leqslant l < 45$	6	42.5	255
$45 \leqslant l < 50$	5	47.5	237.5
$50 \leqslant l < 55$	10	52.5	525
$55 \leqslant l < 60$	4	57.5	230

b ≈ 49.9 mm

8 **a** 30.89 tonnes

b

Weight (w tonnes)	*Frequency*
$10 \leqslant w < 20$	2
$20 \leqslant w < 30$	7
$30 \leqslant w < 40$	8
$40 \leqslant w < 50$	3
Total	20

c ≈ 31 tonnes; this is very close to the exact mean.

26G MEASURES OF SPREAD

1 **a** **i** 14 **ii** 8 **iii** $Q_1 = 6$, $Q_3 = 14$ **iv** 8

b **i** 22 **ii** 21.5 **iii** $Q_1 = 17$, $Q_3 = 26$ **iv** 9

2 **a** 46 g **b** 90 g **c** 44 g **d** 62 g

e 54 g **f** 75.5 g **g** 21.5 g

3 **a** range = 24, interquartile range = 10

b range = 64, interquartile range = 14.5

c the range

26H COMPARING NUMERICAL DATA

1 **a** Spain: mean ≈ 55.7, median = 46

Germany: mean ≈ 101, median = 113

b Spain: range = 129, interquartile range = 69

Germany: range = 153, interquartile range = 71

c Spain **d** Germany

2 **a** Mrs Black's group: 6 children, Mr White's group: 2 children

b Mrs Black's group: $96 \leqslant h < 100$ cm

Mr White's group: $104 \leqslant h < 108$ cm

c Mrs Black's group: positively skewed

Mr White's group: approximately symmetric

d Mr White's group

3 **a**

Salsa		*Jive*
9 8 7 6	1	8
9 8 8 6 5 4 3 3	2	1 2 3 4 6 7 9
8 4 1 1 0 0 0	3	0 1 2 2 3 5 8
0	4	1 1 2 3 4

Scale: 2 | 1 means 21 years

b Salsa: mean = 27 years, median = 28 years

Jive: mean = 31.6 years, median = 31.5 years

c the salsa class

4 **a** Puzzle A: $1 \leqslant t < 2$ min, Puzzle B: $5 \leqslant t < 6$ min,

Puzzle C: $10 \leqslant t < 11$ min

b **i** 20 students **ii** 16 students **iii** 2 students

c Puzzle A as it was generally completed faster than the other puzzles.

d Puzzle C

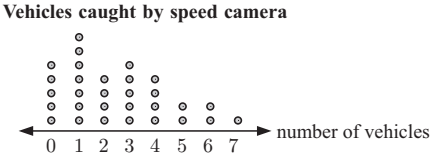
REVIEW OF CHAPTER 26

1 Medical students are likely to do more work than students in other disciplines, so the sample is not likely to represent the population.

2 **a** discrete numerical **b** continuous numerical

c categorical

3 **a**



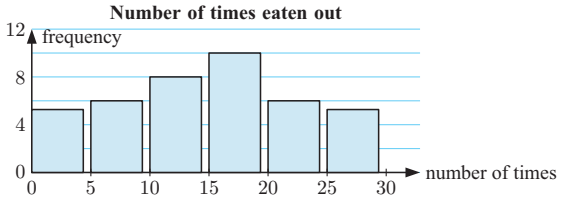
b 1 vehicle **c** positively skewed

4 **a** $60 \leqslant d < 65$ m **b** 28% **c** approximately symmetric

5 **a** ≈ 15.6 **b** 18 **c** 15 **d** $Q_1 = 10$, $Q_3 = 21$ **e** 11

6 $x = 1$

7 **a**



b 15 to 19 times **c** ≈ 14.6

8 **a** 0.2 **b** 4.7 **c** 4.5 **d** 2.8 **e** 1.85

f 3.85 **g** 2

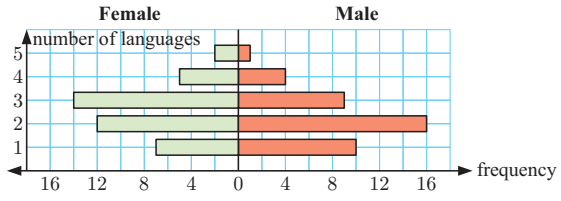
9 **a** Team A: 2 goals, Team B: 3 goals

b Team A: positively skewed, "8" is an outlier
Team B: symmetric

c Team A: 8 goals, Team B: 4 goals

d Team B **e** Team A

10 **a**



b Female: mean = 2.575 languages, median = 3 languages
Male: mean = 2.25 languages, median = 2 languages

c Females

27A NETWORKS

1 **a** **i** 5 vertices **ii** 6 edges **b** A, C, and E

c

Vertex	A	B	C	D	E
Degree	2	3	4	1	2

d Yes, it is possible to travel from every vertex to every other vertex.

2 **a** The nodes represent the players at the training session.

b The edges represent the practice matches that were played.

c 3; Vaibhav played 3 practice matches.

d Valdu

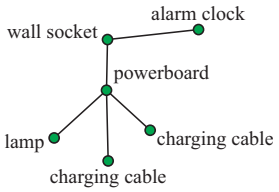
3 **a** 2; there are 2 ferry terminals which can be directly accessed from S.

b **i** 30 min **ii** 42 min **iii** 52 min

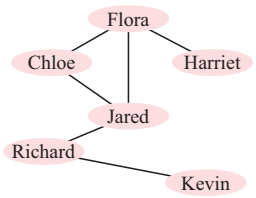
c via T

4 **a** connected **b** disconnected

5



6 **a**



b Richard and Chloe

c Flora

27B ROUTES ON NETWORKS

1 **a** yes **b** no **c** C → B → A → F → G

d B → A → F → H → G → F → B

2 P → T → S → R, weight = 19;

P → T → S → U → Q → R, weight = 26;

P → U → S → R, weight = 18;

P → U → Q → R, weight = 11

27C SHORTEST ROUTE PROBLEMS

1 **a** A → B → C → Z, cost = $12

b A → E → D → Z, cost = $22

2 **a** Q → P → V **b** R → U → V → P → T

27D EULERIAN NETWORKS

1 **Note:** Other answers are possible.

a A → B → C → E → D → B → E → A

b A → B → C → D → E → A → F → B → D → F → G → A

2 **Note:** Other answers are possible.

a A → B → C → A → D → C

b F → E → D → F → A → C → D → B → C

3 **Note:** Other answers are possible.

a semi-Eulerian; D → C → B → D → E → F → B → A → F

b not traversible

c Eulerian; A → B → C → D → C → E → D → B → E → A

4 **a** Exactly two vertices (A and C) have odd degree.

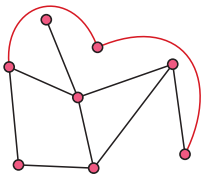
∴ the network is semi-Eulerian.

b No; a semi-Eulerian trail must start and end at the vertices of odd degree, and E has an even degree.

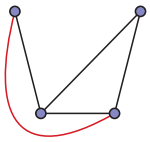
c E → A → H → G → F → C → D → H → E

27E PLANAR NETWORKS

1



2 **a** planar **b** non-planar



27F EULER'S FORMULA

1 **a** $v = 5, \quad f = 4, \quad e = 7$

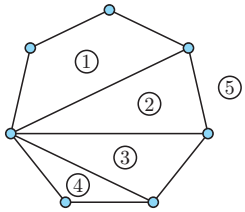
$v + f - e = 5 + 4 - 7 = 2$ ✓

b $v = 6, \quad f = 5, \quad e = 9$

$v + f - e = 6 + 5 - 9 = 2$ ✓

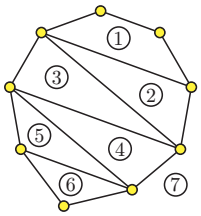
2 **a** 7 vertices

b **Note:** Other answers are possible.



3 **a** 14 edges

b **Note:** Other answers are possible.



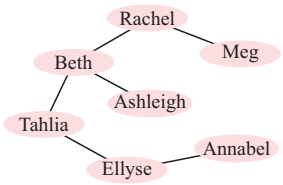
REVIEW OF CHAPTER 27

1 **a** **i** 6 vertices **ii** 8 edges **b** E and F

c

Vertex	A	B	C	D	E	F
Degree	2	2	2	3	3	4

2 **a**



b Beth

3 No; the route ends at a different vertex from the one it started at.

4 A → B → D → Z, travel time = 12 min

5 **Note:** Other answers are possible.

a Eulerian; A → B → E → A → D → C → A

b not traversible

6 **a** Exactly two vertices (B and C) have odd degree.

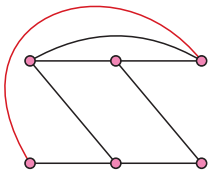
$\therefore$ the network is semi-Eulerian.

b **Note:** Other answers are possible.

B → D → E → A → C → F → A → B → C

c Not traversible as the network would have 4 vertices of odd degree.

7 planar



8 **a** 7 faces

b **Note:** Other answers are possible.