

# ANSWERS

## Exercise 1a

- (1) (i) 30 (ii) 26 (iii) 10 (iv) 68 (v) 72 (vi) 64 (vii)  $5\frac{4}{7}$  (viii) 240  
(ix) 198 (x) 41.8  
(2) (i)  $(7 + 4) \times 3$  (ii)  $6 + (3 \times 5)$  (iii)  $(3 + 5) \times (5 - 3)$  (iv)  $6 + (8 \div 2)$   
(v)  $(12 - 2) \div 5$  (vi)  $4 \times 12 \times (3 + 2)$  (vii)  $12 - (3 \times 2) + 4$   
(viii)  $16 + 7 \times (3 + 2)$  (ix)  $(6 \div 8) \times 12$  (x)  $((7 + 8) \div (5 \times 5)) \times 10$   
(3) (i) 27 (ii) 330 (iii) 11 (iv) 24 (v) 144 (vi) 52 (vii) 28 (viii) 8  
(ix) 192 (x) 32

## Exercise 1b

- (1) 10, 60 (2) 2, 240 (3) 5, 200 (4) 12, 72 (5) 10, 300  
(6) 4, 84 (7) 20, 240 (8) 2, 800 (9) 20, 600 (10) 14, 56  
(11) 9, 540 (12) 12, 120 (13) 3, 36 (14) 6, 72 (15) 2, 950

## Exercise 1c

- (1) 10, 60 (2) 6, 240 (3) 2, 1600 (4) 22, 132 (5) 5, 1000  
(6) 9, 252 (7) 5, 600 (8) 6, 120 (9) 40, 240 (10) 4, 280  
(11) 12, 144 (12) 12, 420 (13) 10, 1050 (14) 4, 3400 (15) 5, 1560

## Exercise 1d

- (1)  $\frac{4}{10}, \frac{6}{15}, \frac{8}{20}, \frac{10}{25}, \frac{12}{30}$  (3)  $\frac{4}{14}, \frac{6}{21}, \frac{8}{28}, \frac{10}{35}, \frac{12}{42}$  etc.

## Exercise 1e

- (1) (i)  $\frac{2}{3}$  (ii)  $\frac{3}{8}$  (iii)  $\frac{2}{5}$  (iv)  $\frac{1}{4}$  (v)  $\frac{1}{5}$  (vi)  $\frac{3}{8}$   
(2) (i)  $\frac{2}{3}$  (ii)  $\frac{3}{5}$  (iii)  $\frac{4}{5}$  (iv)  $\frac{2}{9}$  (v)  $\frac{3}{8}$  (vi)  $\frac{1}{4}$  (vii)  $\frac{1}{7}$  (viii)  $\frac{1}{5}$  (ix)  $\frac{2}{3}$   
(x)  $\frac{4}{9}$  (xi)  $\frac{6}{7}$  (xii)  $\frac{7}{8}$  (xiii)  $\frac{5}{6}$  (xiv)  $\frac{1}{3}$  (xv)  $\frac{2}{7}$  (xvi)  $\frac{1}{5}$  (xvii)  $\frac{1}{9}$  (xviii)  $\frac{1}{8}$   
(xix)  $\frac{5}{11}$  (xx)  $\frac{3}{10}$   
(3) (i)  $\frac{5}{6}$  (ii)  $\frac{11}{15}$  (iii)  $1\frac{1}{12}$  (iv)  $\frac{1}{15}$  (v)  $1\frac{1}{6}$  (vi)  $3\frac{3}{8}$  (vii)  $1\frac{1}{3}$  (viii) 2 (ix) 12  
(x)  $\frac{5}{24}$  (xi)  $1\frac{1}{10}$  (xii)  $\frac{8}{35}$  (xiii)  $\frac{8}{9}$  (xiv)  $\frac{5}{12}$  (xv)  $\frac{5}{6}$  (xvi)  $\frac{1}{8}$  (xvii)  $\frac{1}{9}$   
(xviii)  $1\frac{29}{35}$  (xix)  $4\frac{9}{10}$  (xx)  $10\frac{7}{20}$

## Exercise 1f

- (1) £1.70 (2) 4.5 litres (3)  $\frac{12}{13}$  (4) 28 litres (5)  $\frac{3}{4}$  (6)  $\frac{7}{10}$   
(7) (i)  $\frac{9}{25}$  (ii)  $\frac{2}{5}$  (iii)  $\frac{19}{25}$  (8) (i)  $\frac{3}{4}$  (ii)  $\frac{13}{16}$  (9) (i)  $\frac{1}{3}$  (ii)  $\frac{2}{5}$  (iii)  $\frac{2}{5}$   
(iv)  $\frac{3}{20}$  (10) £10.20

## Exercise 1g

- (1) (i) 60% (ii) 25% (iii) 75% (iv)  $12\frac{1}{2}\%$  (v) 12% (vi) 15%  
(vii) 62.5% (viii) 30% (ix) 250% (x) 46.5% (xi)  $66\frac{2}{3}\%$  (xii) 55.6%  
(xiii)  $6\frac{2}{3}\%$  (xiv) 9.1% (xv)  $333\frac{1}{3}\%$

- (2) (i)  $\frac{6}{25}$  (ii)  $\frac{3}{20}$  (iii)  $\frac{1}{3}$  (iv)  $\frac{3}{25}$  (v)  $\frac{3}{5}$  (vi)  $1\frac{1}{2}$  (vii)  $\frac{9}{20}$  (viii)  $\frac{27}{40}$   
 (ix)  $\frac{7}{25}$  (x)  $\frac{33}{100}$  (xi)  $1\frac{1}{5}$  (xii)  $\frac{2}{25}$  (xiii)  $\frac{1}{200}$  (xiv)  $\frac{9}{400}$

**Exercise 1h**

- (1)  $600 + 80 + 4$  (2)  $900 + 6$  (3)  $40 + \frac{2}{10}$  (4)  $3 + \frac{6}{10} + \frac{8}{100}$   
 (5)  $10\,000 + 100 + 9$  (6)  $20 + 8 + \frac{9}{100} + \frac{4}{1000}$  (7)  $60 + 3 + \frac{7}{10} + \frac{5}{1000}$   
 (8)  $1 + \frac{1}{1000}$  (9)  $6\,000\,000 + 400 + 2$  (10)  $6 + \frac{1}{100} + \frac{1}{10000}$   
 (11) eight hundred (12) eighty  
 (13) eight (14) eight hundredths  
 (15) eight tenths  
 (16) eight thousand  
 (17) eight hundred  
 (18) eight (19) eight thousandths  
 (20) eight hundredths

**Exercise 1i**

- (1) 6.87 (2) 3.10 (3) 28.18 (4) 63.10 (5) 20.09 (6) 31.98 (7) 5.09  
 (8) 0.01 (9) 0.00 (10) 6.90 (11) 81.6 (12) 2500 (13) 9000 (14) 10.1  
 (15) 0.0483 (16) 63.8 (17) 185\,000 (18) 88.9 (19) 90\,900 (20) 12.0  
 (21) 6890 (22) 64.3 (23) 0.00489 (24) 0.124 (25) 668

**Exercise 1j**

- (1) 0.4 (2) 0.625 (3) 0.25 (4) 0.375 (5) 0.7 (6) 0.3125 (7) 0.12  
 (8) 0.45 (9) 0.4375 (10) 0.55 (11) 0.027 (12) 0.128

**Exercise 1k**

- (1) rational (2) rational (3) irrational (4) rational (5) rational  
 (6) irrational (7) rational (8) rational (9) rational (10) rational

**Exercise 1l**

- (1)  $-8, -4, -2.5, 3, 6, 10$  (2)  $14^\circ\text{C}$  (3)  $-10^\circ\text{C}$  (3) £12.20 in credit  
 (5)  $19^\circ\text{C}$  (6) £31.83 (7) 36 feet  
 (8) (i) 1 (ii)  $-11$  (iii)  $-3$  (iv) 13 (v) 8 (vi) 1 (vii)  $-5$   
 (viii)  $-1\frac{1}{2}$  (ix)  $17\frac{1}{2}$  (x)  $2\frac{1}{4}$  (xi)  $2\frac{1}{4}$  (xii) 6 (xiii)  $-8$  (xiv)  $-33$   
 (xv) 16 (xvi)  $-13$  (xvii)  $-13\frac{1}{2}$  (xviii)  $-8.6$  (xix)  $-4.8$  (xx)  $-4.4$   
 (xxi)  $-12$  (xxii)  $-1$  (xxiii)  $-3$  (xxiv)  $8\frac{3}{4}$

**Exercise 1m**

- (1) 64 (2) 512 (3) 36 (4) 256 (5) 8192 (6) 25 (7) 128 (8) 35  
 (9) 16 (10) 5000 (11) 54 (12) 1 (13) 671 (14) 36 (15) 4

**Exercise 1n**

- (1)  $6.3 \times 10^2$  (2)  $2.8 \times 10^3$  (3)  $4.875 \times 10^3$  (4)  $6.8 \times 10^4$  (5)  $1.26 \times 10^5$   
 (6)  $9.6 \times 10^6$  (7)  $1.259 \times 10^2$  (8)  $1.2 \times 10^{-1}$  (9)  $3 \times 10^{-3}$   
 (10)  $4.65 \times 10^{-4}$  (11)  $1.11 \times 10^{-1}$  (12)  $8.5 \times 10^7$  (13)  $6.4 \times 10^{-6}$   
 392 (14)  $8.4 \times 10^2$  (15)  $7.84 \times 10^{-8}$  (16)  $9.98 \times 10^8$  (17) 6200 (18) 380

- (19) 20 400 (20) 0.016 (21) 0.0036 (22) 0.00064 (23) 9090 (24) 0.106  
 (25) 633 (26) 0.0206 (27) 30 100 (28) 0.00111 (29) 0.0000141  
 (30) 6 860 000 (31) 0.00019 (32)  $8.4 \times 10^4$  (33)  $8.71 \times 10^5$   
 (34)  $2.389 \times 10^5$  (35)  $7.2 \times 10^5$  (36)  $3.36 \times 10^{11}$  (37)  $3.2 \times 10^{13}$   
 (38)  $5.2 \times 10^{-2}$  (39)  $3.02 \times 10^{-3}$  (40)  $6.538 \times 10^{-2}$  (41)  $7.6 \times 10^{-2}$   
 (42)  $3.43 \times 10^3$  (43)  $1.58 \times 10^3$  (44)  $2.83 \times 10^4$  (45)  $8 \times 10^2$  (46) 1.87  
 (47)  $9 \times 10^4$  (48)  $5.76 \times 10^6$  (49)  $1.44 \times 10^{-4}$  (50)  $2.24 \times 10^4$   
 (51)  $1.23 \times 10^{-7}$  (52)  $9.43 \times 10^{12}$  km (53)  $3.84 \times 10^4$  km

### Miscellaneous exercise 1

1. (i) 63, 84 (ii) 71 (iii) 121, 169  
 2. £8.40 3. (i)  $\frac{9}{32}$  (ii)  $\frac{2}{3}$  (iii)  $15\frac{5}{8}\%$   
 4. 270 5. 138.9% 6. (i) shade 21 squares (ii) shade 10 sectors  
 (iii) shade 7 triangles  
 7. (i) 369, 123 (ii) 0.9% 8.  $1.05 \times 10^{-1}$  mm  
 9. (i)  $2^{24}$  (ii)  $2^{18}$  10. (i) 250 000 (ii) 53 010 (iii) 205 000  
 (iv) 25 020 000,  $2.5 \times 10^5$ ,  $5.3 \times 10^4$ ,  $2.05 \times 10^5$ ,  $2.5 \times 10^7$   
 11. (a) 22 (b) 60% 12.  $-7^\circ\text{C}$  13. (a) 180 (b) 80 (c) 65% (d) £960  
 (e) £1500 (f) 64%

### Exercise 2a

- (1) (i) 16 (ii) 10 (iii) 21 (iv)  $1\frac{3}{4}$  (2) (i) 18 (ii)  $10\frac{1}{2}$  (iii) 0 (iv) 2  
 (3) (i) 48p (ii) 72p (iii) 57p (iv) 17 (4) (i) 6 (ii) 8 (iii) 2 (iv)  $2\frac{1}{2}$   
 (v)  $1\frac{3}{4}$  (vi) 0 (5) (i) 0 (ii)  $-27$  (iii) 96 (iv)  $-27$  (v) 26.4  
 (6) (i)  $-24$  (ii) 192 (iii) 24

### Exercise 2b

- (1)  $10x$  (3)  $4t$  (4)  $5t^2$  (5)  $5pq$  (6)  $15m$  (7)  $4n$  (8)  $3t^2 + 5t$   
 (9)  $12xy$  (10)  $2q^2$

### Exercise 2c

- (1)  $4x + 4y$  (2)  $2p - 4q$  (3)  $3t + 6x$  (4)  $4qx + 4qy$   
 (5)  $15t - 6q$  (6)  $5a + 7b$  (7)  $6x - 30y$  (8)  $3z + 6t$  (9)  $6x + 6y$   
 (10)  $10a + 5b$  (11)  $6 - 6b$  (12)  $9x + 14$  (13)  $10t - 5$  (14)  $6tx + 6ty$   
 (15)  $5q + 7p$  (16)  $18x + 6y$  (17)  $xa + xb$  (18)  $10x + 28$  (19)  $6x + 21$   
 (20)  $6x + 18$

### Exercise 2d

- (1) 8 (2) 35 (3) 2 (4) 11 (5)  $-9$  (6) 15 (7) 5 (8) 3 (9) 4  
 (10) 7 (11)  $-1$  (12) 3 (13)  $-10$  (14) 7 (15) 1 (16) 2 (17)  $-1$   
 (18) 0 (19)  $\frac{1}{2}$  (20) 24

### Exercise 2e

- (1) £4y (2) £52E (3)  $N + 1$ ,  $N + 2$  (4)  $7s$  (5) £2t + 3s  
 (6) (i) £52e + E (ii)  $\frac{£52e + E}{52}$  (7)  $£\frac{1}{3}P$  (8) £80c + 23s, £15, 120 (9) £225

- (10)  $\pounds x + 2.5y$ ,  $\pounds 227.50$  (11)  $180 - \frac{360}{n}$  (12)  $6x + 4 \text{ cm}$  (13)  $20x + 10y$   
 (14)  $3600x + 60y + t$  (15)  $4x + 6y + 15$

**Exercise 2f**

- (1) (i)  $x + 4$  (ii)  $2x + 4 = 38$  (iii) 17, 21 (2) (i)  $2x$  (ii)  $3x = 54$   
 (iii) 18, 36 (3) (i)  $x + 1$  (ii) 23, 24 (4) 3 (5) 11, 22, 27

**Exercise 2g**

- (1) 5 (2) 8 (3) (i)  $\frac{1}{3}$  (ii) 4 (4) 2 (5) 11 (6)  $4\frac{1}{2}$  (7) 15  
 (8) (i)  $3\frac{1}{2}$  (ii) 12 (9) (i) 5 (ii)  $1\frac{1}{4}$  (10) (i) 25 (ii)  $\frac{1}{3}$

**Exercise 2h**

- (1) (i) 30 (ii) 11 (iii) 13 (iv) 2 (v) no (2) 14

**Exercise 2i**

- (1) 61,  $3n + 1$  (2) 96,  $5n - 4$  (3) 81,  $4n + 1$  (4) 135,  $7n - 5$   
 (5)  $2^{-19}$ ,  $2^{-(n-1)}$  (6) 210,  $\frac{n(n+1)}{2}$  (7) 6765 (8) 12 (9) 400,  $n^2$   
 (10) 71 (prime) (11) (i) 16 should be 9 (ii) 30, 16, 36; 45, 25, 45  
 (iii) square numbers (12) (i) 72, 88, 104 (ii) 10 (iii)  $S = 16n + 8$

**Miscellaneous exercise 2**

1. (a) 68 (b)  $-10$  (c)  $F = 2(15 + c)$  (d) 70  
 2. (a) (i)  $x + 13$  (ii)  $x + 13 = 2(x - 7)$  (iii) 27  
 3. (ii) 35 (iii) 590 (iv)  $\frac{n(3n-1)}{2}$  (v) 4, 7, 10, 13  
 4. 2 5. (i)  $3.36 \times 10^5$  (ii)  $2.19 \times 10^2$   
 6. (i)  $310 \text{ cm}^2$  (ii)  $3.95 \times 10^6 \text{ km}^2$  (iii)  $620 \text{ cm}^2$  (iv) 1.61 cm  
 7. (a) (i) 37.68 mm (ii) 226.08 mm (b) 6 s  
 8. (a)  $\pounds 450 + 10x$  (b)  $\pounds 450 + Nx$  (c)  $\pounds 870$   
 9.  $x = 2$  10. (b) (i)  $P = 6H$  (ii)  $A = H(H + 1)$  (c) 13 (d) 19  
 11. (b) 0, 3, 9, 18 (c) 0, 1, 3, 6 (d) 10, 15 (e) 63 (f) row 6 column 9  
 12. (a) (i)  $7x$  (ii)  $x + 7p$  (iii)  $6x + 42p$  (b)  $x = 15, 22p$   
 13. (a) (i)  $\pounds 3E$  (ii)  $\pounds 3E - 5$  (b)  $E = 8.5, \pounds 8.50, \pounds 25.50, \pounds 20.50$   
 14. 3  
 15. (a) (i) 4 (ii) 12 (c) (i) squares (ii) multiples of 4 (iii) squares  
 (d) (i) 121 (ii) 48  
 16. (a) (i) 217.5 (ii) 1.9 (b) (i) 80 (ii) 2010 (c)  $R$  becomes negative

**Exercise 3a**

- (1) (i) 840 (ii) 600 000 (iii) 0.84 (iv) 28 000 (v) 64  
 (2) (i) 8.684 (ii) 10 (iii) 0.085 (iv) 600  
 (3) (i) 4600 (ii) 0.84 (iii)  $5 \times 10^5$  (iv) 620 000  
 (4) (i) 600 (ii) 5800 (iii)  $8 \times 10^5$  (iv) 6000  
 (5) (i)  $2 \times 10^4$  (ii) 0.84 (iii)  $4 \times 10^9$  (iv)  $8 \times 10^7$

- (6) (i) 6 (ii) 360 (iii) 380 (iv) 2.8  
(7) (i) 16.7 (ii) 9.7 (iii) 0.12 (iv) 0.0056  
(8) (i) 0.6 (ii) 2000 (iii) 84 (iv) 4.3

**Exercise 3b**

- Exact values (1) 8.53 (2) 7.28 (3) 4.97 (4) 45.5 (5) 96.6 (6) 2025  
(7) 21.1 (8) 7.14 (9) 31.1 (10) 0.44 (11) 54.1 (12) 0.23

**Exercise 3c**

- (1) 84 557 (2) 6 cm (3)  $-6^{\circ}\text{C}$  (4) 33 m.p.h. (5) 102 km/h (6) 79 911  
(7)  $26^{\circ}\text{C}$  (8)  $92^{\circ}\text{C}$

**Exercise 3d**

- (1) 9 h 38 min (2) 7.05 p.m. (3) 10 (4) 1.20 p.m. (5) 575 (6) 40  
(7) 8784 (8)  $-9^{\circ}\text{C}$

**Exercise 3e**

- (1) (i) £121 (ii) £38 (2) (i) 2 h 55 min (ii) 20.49 (iii) 2h 38 min  
(iv) 10.06 (v) 6

**Exercise 3g**

- (1) (i) £134.75 (ii) 43 (2) (i) 12 (ii) £39.16 (3) 8 hours (4)  $13\frac{3}{4}$  min  
(5) £4.44 (6) £3.60 (7)  $1\frac{1}{4}$  min (8) 28 h  $7\frac{1}{2}$  min, £112.50

**Exercise 3h**

- (1) 450 g (2) 2000 g (will you use them all?) (3) 650 g (4) 1 litre  
(5) 25 fl oz if it keeps in tin (6) 3 kg if you can eat them all quickly enough

**Exercise 3i**

- (1) £4.20 (2) £6.14 (3) 97 or 98p

**Exercise 3j**

- (1) 7:1 (2) 6:1 (3) 2:3 (4) 2:5 (5) 5:2 (6) 2:3 (7) 2:3  
(8) 10:7:6 (9) 3:4:5 (10) 1:3

**Exercise 3k**

- (1) £15, £18, £12 (2) 3, 8.4, 2.6 (3) £2.40, £2.95, £3.40  
(4) £212.50, £522.50, £1015 (5) £6500, £6125, £4875, probably not

**Exercise 3l**

- (1) 56p (2) £10.08 (3) 1.68 m (4)  $5\text{ cm}^2$  (5) £90 000 (6) £5.47  
(7) £8.64 (8) 5.06 cm (9) 12.5% (10) 12.5% (11) 22.5% (12) 5%  
(13) 9.68% (14) 8.80% (15) 4% (16) 0.103 (17) £1250 (18) 100 300  
(19) 0.04%

**Miscellaneous exercise 3**

1. 31    2. £3, £2.60, £1.60    3. 3.4, 4.6, 5    4. about 2 weeks    5. 1284 cm  
6. 3562    7. (i) 57    (ii) 1.8 m    8. (i) 35p    (ii) about 4 weeks  
9. points 27, 14, 8, 7    10. 99p    11. (a) 48    (b) 37.5    12. (i)  $26\frac{2}{3}$  min  
(ii)  $42\frac{2}{3}$  min    13. (a) £102.50    (b) £147.50    (c) 2160    (d) £80  
14. 630 s    15.  $1.5 \times 10^5$     16. 0.022%    17. (i) 7.45    (ii) 0.18  
(iii) Greater London    (iv) 3.3    18. (i) 12.57    (ii) 6 (direct)    (iii) 1932  
19. 431.8, 7849.065, 16.83, 157.48    20. (a) 9.00 a.m.    (b)  $2\frac{1}{2}$  h    (c) 3.45 p.m.

**Exercise 4a**

- (1) £5.12    (2) £10 320    (3) £1.05    (4) £43.20    (5) 5p    (6) £32.10  
(7) 2 or 3p    (8) £133.76    (9) £7150    (10) £1.90    (11) £139.52  
(12) 6.25%    (13) 64p    (14) £125    (15) £96 320    (16) £5.25

**Exercise 4b**

- (1) £153    (2) £34.13    (3) 2 years 8 months    (4) 4.2%    (5) £3530, £5040  
(6) £2720.98    (7) £3561.92    (8) £1106.92    (9) £84 477    (10) £2.08  
(11) £140 600

**Exercise 4c**

- (1) £189.42    (2) £8398    (3) £9250    (4) £118.80    (5) 2400    (6) £144

**Exercise 4d**

- (1) £3625, £906.25    (2) £5225, £1306.25    (3) £7290, £1822.50  
(4) £9300, £2325    (5) £32 250, £10 005    (6) £108 750, £40 605

**Exercise 4e**

- (1) 46 000    (2) 4077.9    (3) £26.98    (4) £273.60    (5) 101 116  
(6) (i) 114 023    (ii) 1411.5    (iii) 1268.3    (iv) 11 323

**Exercise 4f**

- (1) £65.18, £546.48    (2) £139.94, £558.56    (3) £41.23, £164.51  
(4) £25.75, £360.88    (5) £59.65, £65.51    (6) £72.97, £291.23  
(7) £17.49, £69.74    (8) £157.82, £3269.20    (9) £8.50    (10) £13

**Exercise 4g**

- (1) £135, £15    (2) £24.60, £6.10    (3) £548.80, £50.80  
(4) £944, £94    (5) £383, £84    (6) £280, £0    (7) £540, £60  
(8) £169.60, £34.60

**Exercise 4h**

- (1) 28.3%    (2) 23.1%    (3) 21.6%    (4) 36.5%    (5) 8.2%    (6) 112.9%

**Exercise 4i**

- (1) (a) £517.50    (b) £124 200    (2) £787.20    (3) £84 000, £837.90

**Exercise 4j**

- 396    (1) £15.12    (2) £144.22

**Exercise 4k**

- (1) (i) £97.20 (ii) £182.25 (iii) £4.03 (iv) £154.95  
 (2) (i) £756 (ii) £172 (iii) £100

**Exercise 4l**

- (1) £81.60

**Miscellaneous exercise 4**

1. (i) £1.72 (ii) 30% 2. £11.91 3. (a) £31.20 (b) £46.80 4. £520.22  
 5. (i) £12 (ii) £10 (iii) £7.50 (iv) £17.58 6. (a) 52.1% (b) £675  
 7. (a) (i) £1.88 (ii) 87.02DR (b) (i) £428 (ii) £1.07 (d) 23%  
 8. (a) (i) 5060 (ii) 7p (b) (i) 27.7 (ii) 10p (c) £64.43 9. (i) £372  
 (ii) (a) £428.67 (b) £402.58 10. (a) £208 (b) £72.80 (c) £352  
 (d) £680 (e) £578 11. (b) 24.5% 12. (i) £3 (ii) £4.20 (iii) £1.20  
 (iv) £24 13. (a) £1665 (b) £647.50 (c) £2660.04  
 (d) £239.96 more than from the bank  
 14. (a) £931.76 (b) £1335.26 (c) £1450 (d) £337.02 (e) £2267.02  
 15. (a) (i) £100 (ii) £540 (iii) £640 (iv) £537 (b) £630  
 16. (i) 2660 (ii) 9.5; £596.80, 3.8, £141.80  
 17. (i) £3370 (ii) £3360 (iii) £3120

**Exercise 5a**

- (1)  $135^\circ$  (2)  $570^\circ$  (3)  $2160^\circ$  (4) 18 m, 144 (5)  $x = 20$   
 (6)  $a = 20, b = 120, c = 40$  (7)  $137^\circ$  (8)  $36^\circ$  (9)  $x = 55$   
 (10)  $x = 60$ , largest angle =  $180^\circ$  (11)  $135^\circ$  (12)  $315^\circ, 270^\circ, 585^\circ$  (13) no, yes  
 (14) no (15)  $a = 61, b = 61, c = 105, d = 68, e = 68, f = 68$  (16)  $x = 100$   
 (17)  $314^\circ, 242^\circ, 150^\circ$

**Exercise 5b**

- (1) (iii) 10, 10, 10 (2)  $x = 52$  (3)  $x = 74$  (5)  $\triangle PTS$  is isosceles  
 (6) (i)  $220^\circ$  (ii)  $310^\circ$  (7) (i)  $110^\circ$  (ii)  $290^\circ$  (iii)  $170^\circ$   
 (8) (i)  $54^\circ$  (ii)  $63^\circ$  (9)  $a = 45, b = 87, c = 45, d = 48, e = 132$   
 (10)  $a = 50, b = 40, c = 110$

**Exercise 5c**

- (1)  $108^\circ, 135^\circ, 144^\circ$  (2) 6 (4) 8 (5) 2, 5, 9, 14, 54 (6) 15 (7)  $30^\circ, 75^\circ$   
 (8)  $x = 132$  (9)  $x = 60$  (10)  $x = 120$

**Exercise 5d**

- (1)  $a = 50, b = 80, c = 26$  (2) trapezium (3) H, O (4)  $60^\circ, 90^\circ, 90^\circ$   
 (5) equilateral triangle, square, hexagon (6) jigsaws (9) kite

**Exercise 5e**

- (2) any two of AFE, DEF, FBD and EDC; similar triangles; any of the above  
 and triangle ABC (3) BFC and DCG (4) ADE and BEF (5) 24.25 m  
 (6) 6 (7)  $BX = 6$  cm (8)  $BF = 6$  cm,  $GD = 8$  cm,  $DH = 4$  cm  
 (9) (i) 2.4 m (ii)  $5/4$  (iii) 3 m (iv) no (13.8 m total length)  
 (10) (a) (i) CDA (ii) RQA or PDQ (b) (i) parallelogram (ii) trapezium

**Exercise 5f**

- (1) (i)  $25^\circ$  (ii)  $65^\circ$  (2)  $x = 62$  (3) (i)  $50^\circ$  (ii)  $80^\circ$  (iii)  $75^\circ$   
 (4) (i)  $62^\circ$  (ii)  $34^\circ$ , isosceles triangle (5)  $a = 90$ ,  $b = 30$ ,  $c = 90$ ,  $d = 60$   
 (6) (i), (ii) (7) (i)  $75^\circ$  (ii)  $37.5^\circ$  (8) (i)  $122^\circ$  (ii)  $29^\circ$  (iii)  $16^\circ$   
 (9) CDE and CBE, ODE and OBE, CDO and CBO (10) (i) DEA and DFC,  
 BED and BFD, BAD and BCD (ii)  $70^\circ$ ,  $90^\circ$ ,  $55^\circ$

**Exercise 5g**

- (1)  $25/9$  (2) 4 cm (3) (i) 1 m (ii) 1.25 m (iii)  $1.25 \text{ m}^2$   
 (4) 25 ml,  $32 \text{ m}^2$  (5) 80 g (6) 3 cm (7) (ii)  
 (8) 5 cm, 5 cm, 4 cm, 6 cm, AWB and DYC (10) (i), (iii) (11) (i), (iii)  
 (12) (iii)

**Miscellaneous exercise 5**

1.  $210^\circ$ ,  $300^\circ$  2.  $x = 72$  3.  $72^\circ$ ,  $72^\circ$ ,  $36^\circ$  4. (iv) 5.  $90^\circ$ ,  $36^\circ$ , 7 sides  
 6.  $60^\circ$ ,  $80^\circ$ ,  $100^\circ$ ,  $120^\circ$ , trapezium (or could be a cyclic quadrilateral)  
 7.  $70^\circ$ ,  $80^\circ$ , trapezium 8.  $C = (9, 7)$ ,  $D = (2, 8)$   
 10.  $a = 67.5^\circ$ ,  $b = 112.5^\circ$ ,  $c = 90^\circ$ ,  $d = 135^\circ$   
 11.  $a = 5 \text{ cm}$ ,  $b = 90^\circ$ ,  $c = 90^\circ$ ,  $d = 5 \text{ cm}$  12. (i)  $27^\circ$  (ii)  $36^\circ$  13.  $100 \text{ cm}^2$   
 14. (a)  $12 \text{ in}^2$  (b) 9 in by 12 in (c) 42 in (d)  $108 \text{ in}^2$  (e) 9  
 15.  $34^\circ$ ,  $68^\circ$ ,  $22^\circ$  16.  $150^\circ$

**Exercise 6a**

- (1)  $A = 30 \text{ cm}^2$ ,  $B = 41 \text{ cm}^2$ ,  $C = 42 \text{ cm}^2$  (2) (i)  $0.25 \text{ cm}^2$  (ii) 30–31  
 (iii)  $7.5 \text{ cm}^2$  approx.

**Exercise 6c**

- (1)  $9.94 \text{ cm}^2$  (2)  $8.37 \text{ cm}^2$  (3)  $5.58 \text{ cm}^2$  (4)  $14.62 \text{ cm}^2$  (5)  $7.36 \text{ cm}^2$   
 (6)  $8.5 \text{ cm}^2$  (7)  $12.79 \text{ cm}^2$  (8)  $28.43 \text{ cm}^2$

**Exercise 6d**

- (1) 25.1 cm (2) 3.18 cm (3) 5.64 cm (4) 31.4 m  
 (5) (i) 320 cm (ii) 1.44 km/h (6) 21.5% (7) 0.285 mm  
 (8) (i) 204.2 cm (ii) 245

**Exercise 6e**

- (1)  $402 \text{ cm}^3$  (2)  $268 \text{ cm}^3$  (3)  $50 \text{ m}^3$  (4)  $1131 \text{ cm}^2$  (5) 1.19 cm  
 (6)  $942.5 \text{ cm}^2$  (7) 238 (8)  $12 \text{ cm}^3$  (9)  $194.56 \text{ cm}^2$  (10)  $1200 \text{ cm}^3$

**Exercise 6f**

- (1) 110.7 (2) 19.32 (3) 4 (4) 78.9 (5) 2.5 (6) 80 (7) 22.08  
 (8) 0.00129 (9)  $1.26 \times 10^5$

**Miscellaneous exercise 6**

1. (a)  $50.3 \text{ m}^2$  (b)  $249.7 \text{ m}^2$  2. 31 m 3.  $\frac{3}{8}$   
 4. (a)  $\frac{1}{4}$  (b)  $\frac{1}{8}$  (c)  $\frac{1}{16}$  (d)  $\frac{3}{16}$  (e)  $\frac{3}{8}$  5.  $301.4 \text{ cm}^2$  6. 180  
 7. (a)  $300 \text{ mm}^2$  (b)  $266 \text{ mm}^2$  (c) 11.3%  
 8. (a)  $108 \text{ cm}^2$  (b) 48 cm (c)  $48 \text{ cm}^3$  9. (a)  $39.3 \text{ cm}^3$  (b)  $51.1 \text{ cm}^2$



10. (a)  $198 \text{ cm}^3$  (b)  $1357 \text{ mm}^3$  (c) 145 11.  $12\frac{5}{6} \text{ ft}^3$   
 12. (a) (i)  $42 \text{ cm}$  (ii)  $28 \text{ cm}$  (iii)  $1176 \text{ cm}^2$  (b) (i)  $153.9 \text{ cm}^2$   
 (ii)  $923.4 \text{ cm}^2$  (c)  $78.5\%$  13. (a)  $1.508 \times 10^5$  (b)  $1.508 \times 10^6$   
 14. (i) (a)  $54\pi \text{ m}^3$  (b)  $170 \text{ m}^3$  (ii) (a)  $0.0072\pi \text{ m}^3$  (b)  $0.023 \text{ m}^3$   
 (iii) 2 h 3 min 15. (i)  $10 \text{ cm}$  (ii)  $4200 \text{ cm}^3$  (iii)  $2368 \text{ cm}^2$   
 16. (a) 0.012 (b) 0.00407 (c) 32 (d) 5.76  
 17. (a) (i)  $6.16 \text{ cm}^2$  (ii)  $1.44 \text{ cm}^3$  (b)  $852 \text{ cm}^2$   
 18. (a) (i)  $8.2 \text{ cm}$  (ii)  $17.8 \text{ cm}$  (b)  $9.8 \text{ cm}$  (c)  $45.5 \text{ cm}$  (d) 6  
 (e) (i) 1:1.9 (ii)  $2.6 \text{ cm}$  19.  $81 \text{ m}^2$

### Exercise 7a

- (1) (i), (iii), (vi) (2) 6 m (3) 13 cm (4) 1.1 m (5) 6.32 km, A and C  
 (6) (i)  $14 \text{ cm}^2$  (ii)  $AB = 6.32 \text{ cm}$ ,  $BC = 4.47 \text{ cm}$ ,  $CA = 8.25 \text{ cm}$   
 (7) 13 m, 56 m (8) 6.5 km (9) 20 cm (10) 18 cm (11) 2.49 cm  
 (12) 70 m, 510 m

### Exercise 7b

- (1)  $x = 30.3$ ,  $y = 71.6$ ,  $z = 77.3$  (2) (i) 4.3, 6.6 (ii) 8.7, 14.8 (iii) 1.7, 4.6  
 (3) 9.01 cm, 8.75 cm (4) (i) 2.89 cm (ii) 10 cm (5)  $108.9^\circ$  (6) 12 m  
 (7) 51.4 m (8)  $x = 11.3$  (9) radius = 4.41 cm

### Exercise 7c

- (1)  $x = 38.7$ ,  $y = 54.3$ ,  $z = 91.2$  (2)  $AB = 6.4$ ,  $AC = 7.7$ ,  $DE = 13.2$ ,  $EF = 21.2$ ,  
 $GH = 4.9$ ,  $HI = 11.0$  (3)  $64.6^\circ$ ,  $70.5^\circ$  (4) 11.8 m  
 (5)  $\sin \angle ADB = 0.5$ ,  $\angle BAC$ , 10.4 cm,  $BC = 3 \text{ cm}$  (6) 2.2 m  
 (7)  $BD = 7.52 \text{ m}$ ,  $AB = 2.74 \text{ m}$  (8) 3.88 km N, 14.49 km E; 6 km N,  
 10.39 km E; 9.88 km N, 24.88 km E;  $068.3^\circ$   
 (9) (a) 1.414 cm (b) 1.732 cm (c)  $35.3^\circ$  (10) (a) 36.9 m (b)  $45^\circ$   
 (c) 26.1 m (d)  $681 \text{ m}^2$

### Miscellaneous exercise 7

1. 8 m, 13 m 2. yes 3. 28.3 m 4. (i) 9 m (ii)  $34.8^\circ$  (iii) 14.6 m  
 5. (a) 150 m (b) 446 m (c)  $19.7^\circ$   
 6. (a) 36 m (b) 27 m (c) 14 m (d)  $480 \text{ m}^2$  7. 5 cm  
 8. (a) 15 cm (b)  $90^\circ$  (c) 3.2 cm 9. (a) 5.2 km (b) 3 km (c) 3.10 p.m.  
 10. (a) (i)  $1\frac{1}{4}$  hrs (ii) 23.10 hrs (b) (i)  $301^\circ$  (ii) 233 km (iii) 103 km  
 11. (a) 0.8 m (b)  $13.2^\circ$  (c) 2.81 m  
 12. (i) 3.12 cm (ii)  $15.0 \text{ cm}^2$  (iii)  $105 \text{ cm}^3$  13. 11 cm 14.  $2.06 \text{ m}^2$

### Exercise 8a

- (1) (2, 1), (3, 1) (2)  $A = (10, 8)$ ,  $B = (20, 3)$ ,  $C = (20, 8)$ ,  $D = (22, 8)$   
 (3)  $C = (1, 11)$ ,  $D = (4, 11)$  or  $C = (1, 3)$ ,  $D = (4, 3)$  (4) rectangle; 2.2, 4.5;  $9.9 \text{ u}^2$   
 (5)  $C$ ,  $(-4, 5)$ ,  $(-1.5, 2.5)$ ,  $(-3.5, 1.5)$ ; 4.47 (6)  $C = (10, 5)$ ,  $AB = 5.8$ ,  
 area =  $34 \text{ u}^2$  (7) 180, 240 (9) (a) (i) 1051 (ii) 1254 (iii) 1250  
 (b) (i) 137 515 (ii) 129 534 (iii) 129 544  
 (c) (i) Doglane Farm (ii) caravan (site of) (iii) figure 308  
 (height measurement) (iv) road junction (v) Izaak Walton Hotel

**Exercise 8b**

- (1) (a) (i) 4.5 (ii) 27 (b) 13.5 gallons (2) (a) 50 kg (b) 9 yrs  
 (c) 11 yrs (d) 46 kg (e) 6 kg (3) (a) £4.50 (b) 100 (d) 175  
 (4) (i) cyclist = 24 km/h, car = 80 km/h (ii) 18.7 km (iii) 35 min  
 (5) (i) 20 m/s (ii)  $1 \text{ m/s}^2$  (iii) 400 m (6) between 6.30 a.m. and 11.30 a.m.  
 (7) (b) (i) 615 g (ii)  $285 \text{ cm}^3$  (c) 415 g (8) (b) (i)  $-1.25 \text{ m/s}^2$  (ii) 68 m  
 (9) (a) 38 m (b) accelerates to maximum speed after 3 seconds  
 (10) 11.25 a.m.

**Exercise 8c**

- (1)  $A = (7, 23)$ ; (4, 14) (2)  $a = -1, b = 5$  (3) (a)  $A = (12, 0)$  (b) (0, 5)  
 (c) 13 units (4) (a)  $x = 5, y = 2$  (b)  $x = -1, y = 3$  (c)  $x = -2, y = -5$   
 (5) (a) 6 (b)  $x = 3, y = 15$  (c) the point A (d)  $y = 3x + 2$   
 (6) (a) 13 (b) 5.3 (c) 24 (7) (i) 2 (ii) -4  
 (8) (a) 4, -2, 0, 4 (c) -2.25 (d) 1 (9) (a) 7, 1, 1, 7, 17 (c) 1, 3  
 (e) (2.85, 5.85); (-0.35, 2.65) (10) (a) 5, 2.67, 2, 2, 2.33, 2.86, 3.5  
 (c) 1.94 (d)  $x = 1.38, x = 3.62$

**Miscellaneous exercise 8**

1. -1 2. (a) (8, 0) (b) 17 (c)  $61.9^\circ$  (d)  $14.9^\circ$  (e) 3.75  
 3. (i) 16 km/h (ii) 30 min (iii) 75 min (iv) 19.2 km/h  
 4. (i) 50 s (ii) 40 m/s (iii)  $2 \text{ m/s}^2$  (iv) 1400 m  
 5. (b)  $60 \rightarrow 60.8^\circ\text{F}$  (c) 10.15 a.m.  $\rightarrow$  7.15 p.m. (d) 12.50 a.m.  $\rightarrow$  6.40 a.m.  
 6. (a) 90, 180, 210 (c) 220 km (d)  $C = 60 + 0.6x$  7. (i) (2, 6)  
 (ii) isosceles (iii) (2, -6) (iv)  $y = -3x$  8.  $2, y = 2x + 1$   
 9. (a) 9.09, 7.07, 5.31 (c) 6.37 10. (a) 4, 0, 2.25 (b) 2 (c) 2.73, -0.73  
 11. (a) 0.875, 5.625, 9 (b) (i) -8.75 (ii)  $x = 1, x = 3.562$   
 12. (b) 3.5, acceleration of the car after 4 seconds  
 13. (c) decreases (d) infinity (e) (i) 6.8 (ii) 1.7 (iii) -36

**Exercise 9a**

- (1) (ii) 0 (iii)  $1/90$  (iv)  $1/5$  (v)  $1/13$  (vi)  $3/4$  (vii)  $5/36$  (viii)  $5/26$   
 (ix)  $4/5$  (x)  $8/11$  (xi) 1 (xii) 0 (xiii)  $3/20$  (xiv)  $1/26$  (xv) 0  
 (xvi)  $1/1000000$  (xvii)  $3/4$  (xviii)  $1/12$  (xvix)  $2/3$  (xx)  $4/25$   
 (2) (i)  $6/36 = 1/6$  (ii)  $9/36 = 1/4$  (iii)  $6/36 = 1/6$  (iv)  $11/36$   
 (v)  $24/36 = 2/3$  (3) (i)  $15/100 = 3/20$  (ii)  $51/100$  (iii)  $93/100$

**Exercise 9b**

- (1) (a)  $1/6$  (b)  $1/3$  (c)  $2/5$  (2) there are 2 odd numbers which are also  
 less than 4 (3)  $1/2, 1/6$  (4) (a) 6 pairs (b)  $1/2$  (c)  $5/6$   
 (5)  $1/3, 1/9, 5/9$  (6) (i)  $1/5$  (ii)  $1/20$  (iii)  $7/20$  (7) (a)  $4/9$  (b)  $5/9$   
 (8) (a)  $1/2$  (b)  $1/4$  (c)  $1/4$  (d)  $1/16$  (e)  $5/8$  (9) (a) (i)  $1/4$  (ii)  $9/16$   
 (b)  $49/256$  ( $7/16 \times 7/16$ ) (10) (b)  $2/3$  (c) (i)  $1/6$  (ii)  $1/3$

**Exercise 9c**

- 400 (1) (i)  $1/3$  (ii)  $1/10$  (iii)  $2/5$  (iv)  $4/9$  (v)  $2/15$  (vi)  $3/4$  (vii)  $3/5$

- (viii) 5/9 (ix) 6/10 (x) 10/11 (2) (i) 3 to 1 against (ii) 4 to 1 on  
 (iii) 2 to 1 on (iv) 6 to 1 against (v) 9 to 1 against (vi) 5 to 1 on  
 (vii) 5 to 2 against (viii) 8 to 3 against (3) 11 to 1 against  
 (4) 1 to 2 against (5) 1 to 3 against (6) 11 to 1 against  
 (7) 1/30, 29 to 1 against, 11/30 (8) 39 to 1 against (9) 2 to 1 against  
 (10) 5 to 1 against

**Miscellaneous exercise 9**

1.  $1/2$  2. 20 3.  $7/12, 5/12$  4.  $1/8$  5. (a)  $1/5$  (b)  $5/14$  6.  $1/2, 2/9$   
 7.  $A \rightarrow D \rightarrow C, A \rightarrow B \rightarrow C, A \rightarrow D \rightarrow E \rightarrow B \rightarrow C, A \rightarrow B \rightarrow E \rightarrow D \rightarrow C, 1/2$   
 8. (a)  $3/10$  (b)  $3/20$  (c)  $1/2$  (d)  $3/10$  9. (a) 0.72 (b) 0.18  
 (c) 0.26 (d) 0.98 10. (a) (i)  $1/2$  (ii)  $1/5$  (b) (i)  $1/20$  (ii)  $1/10$   
 11. (a)

	First time test		Repeat test		Totals
	Male	Female	Male	Female	
Passed	81	62	60	45	248
Failed	59	48	30	25	162

- (b) (i) 98, 66 (ii) the claim is justified (c) 0.42 12. (b) (i)  $4/15$  (ii)  $2/5$

**Exercise 10a**

- (1) purchaser may not be the reader; not a random sample; observations of physical facts could be very subjective  
 (2)

	Drivers	Non-drivers
Male	12	14
Female	16	18

- (3) (a) (i) in general would drink more (ii) may drink more expensive drinks  
 (4) (a) (i) absentees on that day will not form part of the population sampled  
 (ii) because of the amount of time required, it would be impractical to interview 150 students in this way

**Exercise 10b**

- (2) (a) 60 (b) 130 (c) 160  
 (3) (a) 46 (b) 538 (c) 60  
 (d) 0– 99 4 (e) 12 (f) 20%  
 100–199 12  
 200–299 14  
 300–399 18  
 400–499 9  
 500–599 3  
 (4) (i) discrete (ii) continuous (iii) discrete (iv) continuous (v) discrete

- (vi) discrete (vii) continuous (5) (b) 15 (c) 55  
 (6) (a) 34 000 (b) (i) 1983 (ii) 25 000 (8) (a) 110 (b) July  
 (c) December 82 (d) September (9) (a) 8 (b)  $\frac{1}{8}$   
 (10) (i) 250 (ii) 22% (iii) 10 (11) angles:  $108^\circ$ ,  $97^\circ$ ,  $90^\circ$ ,  $22^\circ$ ,  $43^\circ$   
 (15) no vertical scale (16) (i) joining of plotted points incorrectly  
 (ii) no heading (iii) vertical scale does not start at zero

**Miscellaneous exercise 10**

2. a leading question 3. stratified sampling 5. (a) 281 (b) £1352.50  
 (c) £4.81 (d) closed ticket office (e) Thursday  
 6. (a) 635 (b) Monday, Wednesday (c) Tuesday 7. (a) continuous  
 (b) discrete (c) discrete (d) continuous 9.  $110^\circ$ ,  $90^\circ$ ,  $20^\circ$ ,  $40^\circ$ ,  $100^\circ$   
 10. (a) £8.80 (b) £23.55 (c) £11.10 11. (a) 43 seconds  
 12. more than half of the 200 cars (152) exceeded 80 km/h therefore a  
 majority broke the law 13. (b) (i) 32 (ii) 84 (iii) 32  
 14. no quantities and bars are not of uniform width; vertical scale does not  
 start from the origin; no units on the vertical scale; no interpretation of the  
 word 'goodness' 15. I: no vertical scale II: represents information most  
 fairly III: vertical scale does not start from the origin  
 16. 1: bars not of uniform width, no vertical scale 2: acceptable  
 3: vertical scale does not start from the origin and is non-uniform

**Exercise 11a**

- (1) 4 (2)  $-5.76$  (3) 12.3125 (4) 1.13 (5)  $-0.64$  (6) 3.25 (7) 1.39  
 (8) 4.32 (9) 35.95 (10) 10.6 (11) 1.39 (12)  $-81$  (13) 0.04 (14) 5.28  
 (15)  $-2.88$

**Exercise 11b**

- (1) 6 (2) 12 (3) 9 (4) 4 (5) 30 (6)  $6\frac{3}{4}$  (7)  $\frac{1}{2}$  (8) 3 (9) 8 (10) 6  
 (11) 29 (12)  $-\frac{8}{11}$

**Exercise 11c**

- (1)  $\frac{ty}{4}$  (2)  $\frac{2yN}{t}$  (3)  $\frac{3}{p}-1$  (4)  $y\frac{(r-z)}{3}$  (5)  $\frac{y-t}{a-q}$  (6)  $\frac{by-a}{1-y}$   
 (7)  $\frac{4N-y}{2}$  (8)  $\frac{5z}{t^2}$  (9)  $\frac{2}{T-y}$  (10)  $\frac{b(q-c)}{a}$

**Exercise 11d**

- (1) 4, 11 (2) 2, 4 (3) 4, 5 (4) 3.4, 2.2 (5)  $-\frac{3}{7}$ ,  $1\frac{1}{7}$  (6) 1, 6 (7)  $\frac{2}{3}$ , 0  
 (8)  $-13$ ,  $-18$

**Exercise 11e**

- (1)  $8x^2$  (2)  $15t^2$  (3)  $12q^2$  (4)  $12tq$  (5)  $2t^3$  (6)  $4at$  (7)  $15p^2$   
 (8)  $4p^2$  (9)  $32x^3$  (10)  $12uv$  (11) 6 (12)  $3x$  (13)  $\frac{2t}{3}$  (14)  $2q$   
 (15)  $\frac{2t^2}{p}$  (16)  $9x$  (17)  $\frac{5}{p}$  (18)  $\frac{2}{9x}$  (19)  $\frac{1}{2}$  (20) 6

**Exercise 11f**

- (1)  $xp + xq + yp + yq$  (2)  $ac + ad + 2bc + 2bd$   
 (3)  $3x^2 + 11xy + 6y^2$  (4)  $2x^2 + 5x + 2$  (5)  $x^2 + 2x - 3$   
 (6)  $2x^2 + 7x + 3$  (7)  $x^2 + 8x + 15$  (8)  $2t^2 + 7t + 6$  (9)  $t^2 - 5t + 6$   
 (10)  $x^2 + x - 30$  (11)  $2x^2 - 5x + 2$  (12)  $6x^2 + 13x + 5$  (13)  $u^2 + 5uv + 6v^2$   
 (14)  $6u^2 + 5uv - 4v^2$  (15)  $3x^2 + 16x - 35$  (16)  $t^2 - 4$  (17)  $9x^2 - 25$   
 (18)  $49x^2 - 28x + 4$  (19)  $x^2 + 8x + 16$  (20)  $9x^2 - 6x + 1$

**Exercise 11g**

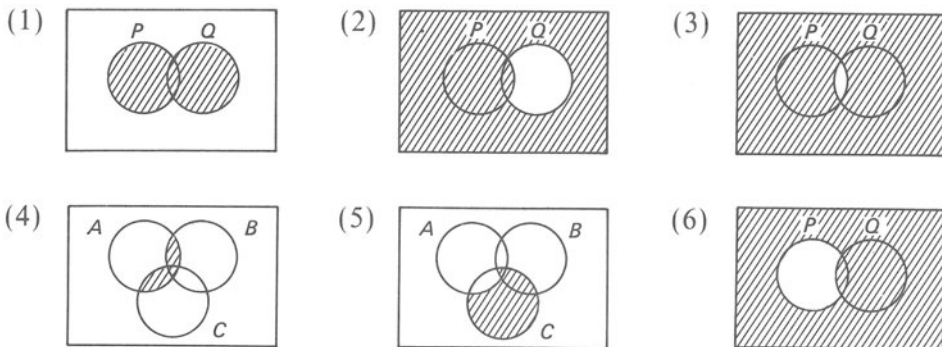
- (1)  $4(x + 4)$  (2)  $3(x - 3)$  (3)  $t(t + 1)$  (4)  $a(b + 2a)$  (5)  $2p(3q + 1)$   
 (6)  $ac(1 + 4ac)$  (7)  $3t(3t - 1)$  (8)  $b(6 + 5b)$  (9)  $p^2(2p + 1)$   
 (11)  $(x + 1)(x + 2)$  (12)  $(x + 6)(x + 4)$  (13)  $(x + 4)(x + 1)$   
 (14)  $(x + 6)(x + 8)$  (15)  $(x + 6)(x + 3)$  (16)  $x(x + 3)$  (17)  $(x - 5)(x - 1)$   
 (18)  $(x - 4)(x - 2)$  (19)  $(x + 5)(x - 3)$  (20)  $(2x + 1)(x + 2)$   
 (21)  $(2x - 1)(x + 2)$  (22)  $(2x - 3)(x + 1)$  (23)  $(x + 3)^2$  (24)  $(2x + 1)^2$   
 (25)  $(x - 4)(x + 4)$  (26)  $(2x - 3)(2x + 3)$  (27)  $2(x - 5)(x + 5)$   
 (29)  $x(x - 1)(x + 1)$

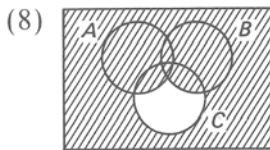
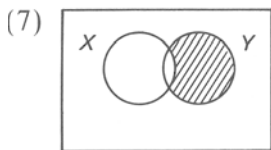
**Exercise 11h**

- (1)  $-1, 3$  (2)  $\frac{1}{2}, -1$  (3)  $1$  (4)  $1.85, -4.85$  (5)  $0.36, -8.36$   
 (6)  $1.82, 0.18$  (8)  $1$  (9)  $2, 8$  (10)  $3, \frac{1}{3}$  (11)  $0, 9$  (12)  $0.41, -2.41$   
 (13)  $2.36, -0.11$  (14)  $-1.64, -10.36$  (15)  $\pm 1.15$

**Exercise 11i**

- (1)  $\frac{7x}{12}$  (2)  $\frac{x}{6}$  (3)  $\frac{11x}{12}$  (4)  $\frac{9y}{10}$  (5)  $\frac{x+4}{4}$  (6)  $\frac{3}{2y}$  (7)  $\frac{2n+3m}{6mn}$  (8)  $\frac{1}{10q}$   
 (9)  $\frac{11}{12t}$  (10)  $\frac{x+2y}{y}$  (11)  $\frac{2a}{3b}$  (12)  $\frac{1}{2}$  (13)  $1$  (14)  $\frac{a}{d}$  (15)  $2x$  (16)  $1$   
 (17)  $\frac{4x}{y}$  (18)  $8$  (19)  $\frac{2a}{t}$  (20)  $\frac{3}{t}$  (21)  $1\frac{1}{2}$  (22)  $\frac{1}{2}$  (23)  $\frac{1}{x}$  (24)  $2x$   
 (25)  $q^3$

**Exercise 11j**



**Exercise 11k**

- (1) (i)  $-0.531$  (ii)  $7.531$  (iii)  $6.000$  (iv)  $-1.000$  (v)  $-0.887$  (vi)  $7.887$   
 (vii)  $0.437$  (viii)  $3.873$

(2) (a)  $2.236$  (b)  $5$  (c)  $2.2361$  (e)  $x_{n+1} = \frac{1}{2} \left( x_n + \frac{11}{x_n} \right)$

(3) (a)  $x - 2$  (b)  $\frac{1}{x}, \frac{x-2}{1}$  (d)  $2.33333333, 2.4285714, 2.4117647$  (e)  $2.4142$

(4)  $72$  (5) (ii)  $2.15 \text{ m/s}$  (iii)  $425 \text{ m}$

**Miscellaneous exercise 11**

1. (a)  $9x^2 - 4$  (b)  $9x^2 - 4$  2. (a)  $64 \text{ m}$  (b)  $1 - \frac{2h}{d}$  (c)  $\frac{1}{3}$

3.  $40, 100$  (a)  $44p$  (b)  $50, \frac{40}{(C-40)}$  4. (a) (i)  $\frac{48}{x}$  (ii)  $x + 4$  (iii)  $\frac{48}{x+4}$   
 (c)  $12$  (d)  $3 \text{ hours}$

5. (i)  $\text{£}x + 5$  (ii)  $\frac{300}{x+5}$  (iii)  $\frac{120}{x-1}$  (iv)  $\frac{300}{x+5} + \frac{120}{x-1}$  (v)  $25$

6. (a)  $\frac{12x+1}{(x+3)(2x-1)}$  (b)  $\frac{3}{4}$  7. (a)  $9 - x$  (b)  $9x - x^2$  (c)  $4, 5$  8. (c)  $4$

9. (i)  $160 \text{ hours}$  (ii)  $1060 \text{ km}$  10. (b)  $\frac{n(n+1)}{2}$  (c)  $1.5, 4.5$  11.  $2.7$

12.  $9.28, 3.72$  13. (c)  $189$  14. (b)  $1.5, 1.66, 1.7$  (c)  $1.7071$  15. (b)  $3$

(d)  $x_{n+1} = \sqrt{\frac{11}{x_n} - 7x_n}$  16. (d)  $3.66667, 3.36364$  (e)  $3.45$

17. (a)  $16.3$  (b)  $0.308\%$  18.  $840 \text{ m}$  19. (c) (i) *triangular* (ii)  $55$

(d)  $\frac{n(n+1)}{2}$  20. (b)  $1.3$  21.  $10 \text{ km}$

**Exercise 12a**

(1)  $\begin{pmatrix} 600 \\ -300 \end{pmatrix}$  (2)  $\begin{pmatrix} -700 \\ -400 \end{pmatrix}$  (3)  $\begin{pmatrix} -300 \\ -300 \end{pmatrix}$  (4)  $\begin{pmatrix} -500 \\ 400 \end{pmatrix}$  (5)  $\begin{pmatrix} 1800 \\ -100 \end{pmatrix}$

(6)  $\begin{pmatrix} -1800 \\ 100 \end{pmatrix}$  (7)  $\begin{pmatrix} 1100 \\ -500 \end{pmatrix}$

**Exercise 12b**

(1)  $\begin{pmatrix} 50 \\ 30 \end{pmatrix}$  (2)  $\begin{pmatrix} -10 \\ 30 \end{pmatrix}$  (3)  $\begin{pmatrix} -20 \\ -40 \end{pmatrix}$  (4)  $\begin{pmatrix} 30 \\ 50 \end{pmatrix}$  (5)  $\begin{pmatrix} -10 \\ 50 \end{pmatrix}$  (6)  $\begin{pmatrix} 10 \\ 90 \end{pmatrix}$

(7)  $\begin{pmatrix} 140 \\ 80 \end{pmatrix}$  (8)  $\begin{pmatrix} 70 \\ 70 \end{pmatrix}$  (9)  $\begin{pmatrix} 30 \\ 50 \end{pmatrix}$  (10)  $\begin{pmatrix} -50 \\ -30 \end{pmatrix}$

**Exercise 12c**

- (1) (i)  $11i + 5j$  (ii)  $-5i - 8j$  (iii)  $-2i - 6j$  (2) (a)  $b + c$  (b)  $a + b + c$   
 (c)  $a + b$  (3) (a)  $b - a$  (b)  $-b - a$  (c)  $2b$  (4) (a)  $\begin{pmatrix} -6 \\ -2 \end{pmatrix}$  (b)  $\begin{pmatrix} 7 \\ -2 \end{pmatrix}$   
 (c)  $\begin{pmatrix} 1 \\ -4 \end{pmatrix}$  (5)  $(5, -3), \begin{pmatrix} 2 \\ -4 \end{pmatrix}$  (6)  $(6, 4), (18, 8)$

**Exercise 12d**

- (1)  $\frac{1}{2} \begin{pmatrix} 3 & -2 \\ -5 & 4 \end{pmatrix}$  (2)  $\begin{pmatrix} 6 & 7 \\ 5 & 6 \end{pmatrix}$  (4)  $\frac{1}{36} \begin{pmatrix} 9 & -3 \\ 6 & 2 \end{pmatrix}$  (5)  $-1 \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$   
 (6)  $\frac{1}{78} \begin{pmatrix} 11 & 4 \\ -3 & 6 \end{pmatrix}$

**Miscellaneous exercise 12**

1. (a)  $4a$  (b)  $3a - 2b$  2. (a)  $a + c, \frac{2}{3}(a + c), \frac{1}{3}(2a - c)$  (b) (i)  $\frac{1}{2}(2a + c)$   
 (ii)  $a + \frac{c}{2}$  (iii)  $a + \frac{3}{2}c$  (iv) 1 3. (i)  $\frac{1}{2}b$  (ii)  $-a$  (iii)  $\frac{1}{2}b - a$  (iv)  $a + b$   
 4. (i)  $b - a$  (ii)  $\frac{1}{2}(b - a)$  (iii)  $\frac{1}{2}(b - 3a)$  5. (i)  $-y$  (ii)  $2y$  (iii)  $y - x$   
 6. (a) (i)  $x + y$  (ii)  $2(x + y)$  (iii)  $2x + y$  (iv)  $x + 2y$   
 (b) (i)  $\frac{3}{4}x + 2y$  (ii)  $\frac{3}{4}x + y$ , N is the mid point of FM 7. (a) (i)  $6i + 3j$   
 (ii)  $-2i + j$  (iii)  $4i + 4j$  (b) 5.66 km 8. (a) (i)  $\frac{1}{3}a - b$  (ii)  $\frac{1}{5}a - \frac{3}{5}b$   
 (b)  $\frac{3}{5}$  (c) (i)  $20 \text{ cm}^2$  (ii)  $12 \text{ cm}^2$  (iii)  $12 \text{ cm}^2$  9. (a) (i)  $\frac{3}{4}a$  (ii)  $b - a$   
 (iii)  $\frac{1}{4}(b - a)$  (iv)  $\frac{1}{4}(3a + b)$  (v)  $\frac{1}{4}b$  10. (c)  $90^\circ$  clockwise rotation about O  
 (d)  $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$  11. (d) (i) reflection in  $y = -x$  (ii)  $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$   
 12. (a) 4:1 (b)  $\frac{1}{4} \begin{pmatrix} 1 & -2 \\ 1 & 2 \end{pmatrix}, (3, -\frac{1}{2})$  (c)  $\begin{pmatrix} 0 & 4 \\ 2 & 10 \end{pmatrix}$  13. (b) (ii) enlargement  $\times 2$   
 (d) reflection in  $y = 2x$  14. (d) rotation  $90^\circ$  clockwise,  $R = PQ$  (e) 4  
 15. (c) enlargement  $\times 2$  (d)  $\begin{pmatrix} \frac{1}{2} & 0 \\ 0 & \frac{1}{2} \end{pmatrix}$  16. (a)  $\begin{pmatrix} -2 \\ 2 \end{pmatrix}$  (b)  $(5, 2)$   
 17.  $(2, -9)$  18. (a)  $\begin{pmatrix} 7 & 0 \\ 0 & 7 \end{pmatrix}$  (b)  $\frac{1}{7} \begin{pmatrix} 2 & 3 \\ 1 & -2 \end{pmatrix}$  19. (d) (i) 4 (ii) 25 (e) (i)  $2\frac{1}{2}$

**Exercise 13a**

- (1) (a) (i) 4 (ii) 5 (iii) 6 (b) (i) 19 (ii) 16.5 (iii) 15.5  
 (2) 18.6, 518.6 (3)  $-7/6, 218\frac{5}{6}$  (4) 26 kg (5) (i) 41 (ii) 64 (iii) 15  
 (6) 6 (7) 2, 2.5 (8) mode (9) (b) 39, 40 (c)  $11/52$   
 (d)  $11/52 \times 11/52 = 0.0447$  (10) (i) 0 (ii) 1 (iii) 1.8 (11) (i) 3, 2 (ii) 108  
 (iii) 2.16 (iv) 0.9 (12) £14.00, £16.00, £14.50, £16.00, £20.00  
 (a) £16.00, £15.25, £15.50 (b) mean (c) £850, median = £16.00, mean = £15.71  
 (13) (a) (i) 3, 2 (b) (i) £114 (ii) £3.80 (14) 101–150 miles, 150 miles  
 (15) (b) 28.5 seconds (16) 2.525 kg (18) (i) 72 (ii) 18 (19) 16.7

**Exercise 13b**

- (1) (a) 200 (b) 62 m.p.h. (c) 23 (2) 36.7 min, 42 days (3) 2.9  
 (4) £3.40 (5) 7.0, 2.3 (a) 10 (b) 3 or 6 (c) 3 (d) 6

- (6) (a) 58, 91, 100 (c) 28 (7) (a) 11, 23, 45, 72, 90, 99, 100  
 (c) (i) 3.1 kg (ii) 0.37 (8) (a) 84 (b) 54 (c) 8 (9) (a) 51 (b) 20 (c) 32  
 (10) (a) 16 (b)  $7\frac{2}{3}$  (c) 35.75 min (e) (i) 9 (ii) 49

### Exercise 13c

- (1) (a) 38.9, 38.4, 38, 37.3, 36.6, 35.9, 34.7, 33.1  
 (c) to smooth out daily fluctuations (2) 43.25, 43.50, 44.25  
 (3) (a) 673, 680, 707 (b) to smooth out termly fluctuations  
 (4) (i) -ve correlation (ii) +ve correlation (iii) little or no correlation  
 (5) (iii) 52 (6) (b) as age increases, price decreases (7) (a) (i) 43 seconds  
 (ii) 62 seconds (b) (ii) negative correlation - the more sunshine there is,  
 the less energy used

### Miscellaneous exercise 13

2. 27, 39 3. 5 4. 2.83 ( $2\frac{5}{6}$ ) 5. 183, 186.5, 183.5, 180.25, 178.25, 179.75,  
 183.25, 187.5, 188.5 6. mode = 6, median = 5, mean = 4.82  
 7. (a) (i) 25 (ii) 6 (iii) 5 (iv) 5.28 (b) mode = 7, median = 5,  
 mean = 5.36 8. (b) (i) 1 (ii) 0 (c) 0.48 (d) 0.384 9. (a) Tynemouth  
 (b) Keswick (c) 67 mm (d) 100 mm (e) 19/31 10. 3.2 kg  
 11. (a) 16.8 cm (c) 19.2 12. (b) (i) 842 (ii) 862 13. (a) (i) 6 (ii) 2.3  
 (b) (i) 31.6 14. (i) 4550 (ii) 54 (iii) 26 (iv) 20% (v) 41  
 15. (c) 4, 6, 9, 14, 16, 15 16. (a) 12 (b) 151 (c) 3/11 (e) positive  
 correlation - as the height of a plant increases, so does the number of tomatoes  
 17. (b) yes (c) 74.1 (d) 76

### Exercise 14a

- (1) (i)  $42^\circ$  (ii)  $138^\circ$  (2) opposite angles do not add up to  $180^\circ$   
 (3) (i)  $70^\circ$  (ii)  $110^\circ$  (4) (i)  $15^\circ$  (ii)  $\angle OAC$  (iii) isosceles triangle  
 (iv)  $75^\circ$  (v)  $60^\circ$  (5) (i)  $43^\circ$  (ii)  $100^\circ$  (6)  $\angle BAO$ ,  $\angle BCO$ ,  $28^\circ$   
 (7)  $\angle DAB$  (i)  $25^\circ$  (ii)  $67^\circ$  (8)  $30^\circ$  (9) (i)  $110^\circ$  (ii)  $140^\circ$  (iii) no  
 (10)  $\angle EBC = 75^\circ$ ,  $\angle ECB = 70^\circ$  (11) (i)  $124^\circ$  (ii)  $98^\circ$   
 (12) (a) BDE or FOD (b) ODC, OBA, OAB, FAE (c) (i)  $72^\circ$  (ii)  $18^\circ$   
 (iii)  $54^\circ$

### Exercise 14b

- (1) (i) -0.866 (ii) 0.342 (iii) -0.174 (iv) 0.5 (v) 0.985 (vi) -0.940  
 (vii) 0.940 (viii) -0.342 (2) (i) 0 (ii) -1 (3)  $48.6^\circ$ ,  $131.4^\circ$  (4)  $143.1^\circ$

### Exercise 14c

- (1) (i) 8.49 (ii) 7.08 (iii) 18.4 (iv) 8.58 (2) (i)  $34.2^\circ$  (ii)  $43.0^\circ$   
 (iii)  $37.6^\circ$  (3) (i) 33 (ii) 28.9 (iii) 10.4 (iv) 16.6 (4) (i)  $53.1^\circ$   
 (ii)  $101.0^\circ$  (iii)  $94.1^\circ$  (5) (i)  $19.8 \text{ cm}^2$  (ii)  $167 \text{ cm}^2$  (iii)  $68.3 \text{ cm}^2$   
 (6) 5/12,  $24.6^\circ$  (7) 440 m, 540 m, 410 m (8) (i)  $155^\circ$ ,  $11^\circ$  (ii) 127 m  
 (iii) 53.6 m (9) 42.3 m (10) (i) 6 km, 4 km (ii) 4.6 km  
 (11) (i)  $100^\circ$  (ii) 9.0 m (iii) 8.6 m (12)  $176 \text{ cm}^2$ ,  $3520 \text{ cm}^3$   
 (13) (a) 4850 m (b) 1070 m (14) (a) 2310 h (b) (i) 280 km (ii)  $322^\circ$   
 406 (iii) 74.2 km



**Exercise 14d**

(7) (b) 940 mm (8) (a) 1.37 m (b)  $50^\circ$

**Exercise 14e**

(1)  $670 \text{ m}^2$  (2)  $648 \text{ m}^2$  (3)  $409.5 \text{ m}^2$

**Exercise 14f**

(1)  $640 \text{ m}^2$  (2)  $634.7 \text{ m}^2$  (3)  $407.3 \text{ m}^2$

**Exercise 14g**

(1) 7, 13.5, 10, 11 (c) 33

(2) (b)  $1833 \text{ ft}^2$


(3)  $22.8 \text{ m}^2$

**Exercise 14h**

(1) straight line (2) straight line (3) ellipse

(4) line perpendicular to AB through the mid point

(5) sphere or circle (6) arc of a circle

(7)  (8) arc of a circle (9) almost a parabola

# INDEX

- algebra 23 ff, 277 ff
  - brackets 25–6
  - changing the subject 31, 280
  - expressions 28
  - factorisation 284–6
  - formula 23, 28
  - fractions 288–9
  - further linear equations 278–9
  - product of two brackets 282–3
  - quadratic equations 286–8
  - simple equations 26–8
  - simultaneous equations 210–12, 281–2
- angles
  - depression 176
  - elevation 176
  - types 105
- area 143–55
  - circle 151–2
  - parallelogram 147
  - Simpson's rule 384
  - surface 154–5
  - trapezium 149
  - trapezium rule 292–4
  - triangle 148
  - using sine formula 373–4
- arithmetic mean 327–9
- averages
  - arithmetic mean 327–9
  - mean of frequency distribution 330–2
  - mean of grouped frequency distribution 332–4
  - median 327–9
  - mode 328–9
  - moving 348–50
  - weighted 334–5
- balancing the books 91–2
  - bar charts 255–7
  - component 256–7
  - multiple 255–6
- bearings 105–6
- changing the subject of formulae 31, 280
- circle 127–9
  - tangent 129
- commission 75
- common difference 35
- contours 384–5
- co-ordinates 191–5
  - maps 192–3
- correlation 351
- cosine 180–2
  - obtuse angles 368–9
- cosine rule 371–3
- cumulative frequencies 339–44
- decimals 12–14
- density 160
- enlargement 123
  - extension to two and three dimensions 132–3
- equations
  - further linear 278–9
  - iterative 291–2
  - quadratic 212–14, 286–8
  - simple 26–8
  - simultaneous 210–12, 281–2
- estimation 53–4
- exchange rates 77–9
- expressions 28
- factorisation 284–6
- factors 4
  - prime 4
- formula 23, 28
  - changing the subject 31, 280
  - harder substitution 277–8
- fractions 5–9
  - equivalent 5
  - top heavy 7
- geometry 103 ff, 361 ff
  - angle 103
    - types 105
  - bearings 105–6
  - circle 127–9
  - congruency 122–3
  - degrees 103
  - further circle topics 361–4
  - parallel lines 106
  - polygons 115–20
  - similarity 122–3
  - triangles 111
- gradient 198–9
  - curve 214–15
- graphs
  - conversion 197
  - distance–time 199–200
  - drawing 201–2

- graphs – *continued*
  - gradient 198–9
  - gradient of a curve 214–15
  - interpretation 195
  - simultaneous equations 210–12
  - speed–time 200–1
  - straight line 209–12
- highest common factor (HCF) 4
- histograms 260–1
- income tax 76–7
- independent events 231–3
- indices 16–17
- insurance 89–91
- integers 3
- iterative equation 291–2
- interest
  - APR 85–6
  - borrowing money 80–7
  - compound 73–4
  - hire purchase 83–4
  - mortgage 86–7
  - simple 72
- line of best fit 351–2
- locus 387–8
- lowest common multiple (LCM) 4
- matrices
  - inverse 311
  - multiplication 310–11
  - transformations 312–18
- mean 327–9
- measures of spread 342–4
- median 327–9
- metric system 43 ff
  - changing units 44–5
  - other units 45
- misleading diagrams 261–3
- mode 328–9
- moving averages 348–50
- nets 134
- numbers
  - directed 14–15
  - integers 3
  - irrational 14
  - patterns 35
  - prime 3
  - rational 14
  - square 3
- numerical methods 289–94
  - iterative 291–2
  - trapezium rule 292–4
- odds 239
- offsets 382–3
- percentages 10–11, 60, 69–74
  - compound interest 73–4
  - profit and loss 70–1
  - simple interest 72
  - VAT 70
- pictograms 254
- pie charts 257–9
- piecework 75
- polygons 115–20
  - exterior angles 116
  - properties 119–20
  - symmetry 119–20
  - tessellations 120
- possibility spaces 226
- probability 225 ff
  - addition 230–1
  - complement 228
  - estimating 227
  - independent events 231–3
  - odds 239
  - possibility spaces 226
  - trees 233–6
- Pythagoras 169–71
- quadratic equations 286–8
- quadratic graphs 212–14
- range 342
- rate 55
  - best buy 56–7
- ratio 58–9
  - proportional parts 59
- reading scales 46–8
- sample survey 247–8
- sampling 246–7
  - quota 247
  - random 246
  - stratified 247
  - systematic 247
- scale drawings 379–80
- scatter diagrams 350–2
- significant figures 12
- Simpson's rule 384
- simultaneous equations 210–12, 281–2
- sine 180–2
  - obtuse angles 368–9
- sine rule 369–71
- standard deviation 342–3
- standard form 18
- statistics 245 ff, 327 ff
  - averages 327–35
  - cause and effect 350
  - cumulative frequencies 339–44
  - grouped frequency 252–4
  - measures of spread 342–4
  - misleading diagrams 261–3
  - moving averages 348–50
  - presentation of data 254–61
  - sampling 246–7

statistics – *continued*  
  tabulation 251–4  
stem and leaf diagrams 259–60  
surveying 381–5  
  contours 384–5  
  offsets 382–3  
  Simpson’s rule 384  
  triangulation 381–2  
  
tables 50–3  
tangent  
  angle 174–6  
  circle 127, 129  
  to a curve 214–15  
terms  
  like 25  
  unlike 25  
tessellations 120  
time 49–50  
transformations  
  using vectors and matrices 312–18  
trapezium rule 292–4  
trees  
  probability 233–6  
triangles 111  
  types 112

triangulation 381–2  
trigonometry 169 ff, 368 ff  
  area of a triangle 373–4  
  cosine 180–2  
  cosine rule 371–3  
  obtuse angles 368–9  
  Pythagoras 169–71  
  sine 180–2  
  sine rule 369–71  
  tangent 174–6  
  three-dimensional problems 182–3  
truncation 12  
  
unit vectors 309–10  
  
VAT 70  
vectors 305–10  
Venn diagrams 32–4, 289  
volume 155–9  
  cone 157  
  cuboid 155  
  cylinder 156  
  prism 158  
  sphere 157  
  
weighted averages 334–5