



for **AQA, Edexcel** and **OCR**  
**two-tier GCSE mathematics**

## **Answers for *Foundation 2* practice**

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# 1 Ordering, adding and subtracting fractions

## A Review: fractions (p 8)

- 1  $\frac{2}{5}$
- 2 (a)  $\frac{1}{3} = \frac{5}{15}$       (b)  $\frac{2}{7} = \frac{6}{21}$       (c)  $\frac{3}{5} = \frac{24}{40}$   
 (d)  $\frac{5}{6} = \frac{20}{24}$       (e)  $\frac{7}{8} = \frac{28}{32}$
- 3 Three fractions equivalent to  $\frac{8}{12}$
- 4  $\frac{8}{3} = 2\frac{2}{3}$ ,  $\frac{9}{5} = 1\frac{4}{5}$ ,  $\frac{7}{3} = 2\frac{1}{3}$ ,  $\frac{6}{5} = 1\frac{1}{5}$ ,  $\frac{16}{5} = 3\frac{1}{5}$
- 5 (a)  $1\frac{1}{4}$       (b)  $2\frac{2}{3}$       (c)  $2\frac{1}{2}$       (d)  $4\frac{1}{3}$       (e)  $1\frac{7}{10}$
- 6 (a)  $\frac{4}{5}$       (b)  $\frac{2}{3}$       (c)  $1\frac{1}{3}$       (d)  $\frac{1}{6}$

## B Comparing (one denominator a multiple of the other)

### C Adding and subtracting (one denominator a multiple of the other) (p 8)

- 1 (a)  $\frac{3}{5}$       (b)  $\frac{1}{3}$       (c)  $\frac{2}{5}$       (d)  $\frac{4}{9}$       (e)  $\frac{5}{8}$
- 2 (a)  $\frac{5}{8}$       (b)  $\frac{1}{2}$       (c)  $\frac{5}{8}$       (d)  $\frac{1}{9}$       (e)  $\frac{3}{5}$
- 3 (a) Morning      (b)  $\frac{1}{2}$
- 4 (a)  $1\frac{3}{8}$       (b)  $1\frac{1}{10}$       (c)  $1\frac{3}{4}$       (d)  $1\frac{7}{8}$       (e)  $1\frac{1}{4}$   
 (f)  $1\frac{2}{9}$       (g)  $1\frac{1}{2}$       (h)  $1\frac{1}{6}$       (i)  $1\frac{3}{4}$       (j)  $2\frac{1}{8}$
- 5 (a) After lunch      (b)  $1\frac{3}{10}$  litre      (c)  $\frac{7}{10}$  litre

## D Comparing (neither denominator a multiple of the other)

### E Adding and subtracting (neither denominator a multiple of the other) (p 9)

- 1 (a)  $\frac{3}{4} = \frac{6}{8} = \frac{9}{12} = \frac{12}{16} = \frac{15}{20}$       (b)  $\frac{2}{5} = \frac{4}{10} = \frac{6}{15} = \frac{8}{20} = \frac{10}{25}$   
 (c)  $\frac{3}{4}$       (d)  $1\frac{3}{20}$
- 2 (a) HOST      (b) ARTS      (c) COLA
- 3 (a)  $\frac{7}{10}$       (b)  $\frac{5}{12}$       (c)  $\frac{4}{15}$       (d)  $\frac{9}{20}$       (e)  $\frac{1}{15}$   
 (f)  $\frac{5}{28}$       (g)  $\frac{21}{40}$       (h)  $\frac{7}{12}$       (i)  $\frac{17}{30}$       (j)  $\frac{1}{24}$
- 4 (a)  $\frac{8}{15}$       (b)  $\frac{7}{15}$
- 5  $1\frac{7}{24}$  inch
- 6 (a)  $3\frac{3}{10}$       (b)  $1\frac{1}{3}$       (c)  $2\frac{9}{20}$       (d)  $1\frac{1}{6}$       (e)  $4\frac{7}{12}$
- 7  $\frac{5}{8}$  is closest to  $\frac{3}{4}$ :  $\frac{5}{8} = \frac{15}{24}$ ,  $\frac{7}{12} = \frac{14}{24}$  and  $\frac{3}{4} = \frac{18}{24}$

# 2 Angles with triangles and parallel lines

## A Giving reasons: angles on a line, round a point, in a triangle

### B Giving reasons: vertically opposite angles (p 10)

There are valid alternatives to some of the explanations given here.

- 1  $a = 135^\circ$  (angles round point add up to  $360^\circ$ )  
 $b = 85^\circ$  (angles on straight line add up to  $180^\circ$ )  
 $c = 65^\circ$  (angles of triangle add up to  $180^\circ$ )  
 $d = 105^\circ$  (vertically opposite angles are equal)
- 2 (a) Equilateral  
 (b) Isosceles  
 (c) (i)  $60^\circ$       (ii)  $60^\circ$       (iii)  $66^\circ$       (iv)  $54^\circ$
- 3 (a)  $\angle DBC = 80^\circ$  (=  $\angle ABE$ , vertically opposite)  
 $\angle BCD = 57^\circ$  (=  $180^\circ - 43^\circ - 80^\circ$ , angles of triangle BCD add up to  $180^\circ$ )  
 (b)  $\angle FGJ = 98^\circ$  (vertically opposite to  $\angle IGH$ )  
 $\angle FGK = 34^\circ$  (=  $98^\circ - 64^\circ$ )  
 (c) Acute angle LMN =  $45^\circ$  (=  $360^\circ - 315^\circ$ , angles round point add up to  $360^\circ$ )  
 $\angle LNM = 65^\circ$  (=  $180^\circ - 45^\circ - 70^\circ$ , angles of triangle add up to  $180^\circ$ )  
 $\angle LNO = 115^\circ$  (=  $180^\circ - 65^\circ$ , angles on straight line ONM add up to  $180^\circ$ )
- 4 (a)  $\angle BAC + \angle ACB = 90^\circ$  (=  $180^\circ - 90^\circ$ , angles of triangle add up to  $180^\circ$ )  
 But  $\angle BAC = \angle ACB$  (angles opposite equal sides in isosceles triangle)  
 So  $\angle ACB = 45^\circ$   
 $\angle ACD = 135^\circ$  (=  $180^\circ - 45^\circ$ , angles on straight line add up to  $180^\circ$ )  
 (b)  $\angle GEF = 75^\circ$  (=  $\angle GFE$ , angles opposite equal sides in isosceles triangle)  
 $\angle EGF = 30^\circ$  (=  $180^\circ - 75^\circ - 75^\circ$ , angles of triangle add up to  $180^\circ$ )  
 $\angle HGI = 30^\circ$  (=  $\angle EGF$ , vertically opposite angles)  
 (c)  $\angle JLK = 46^\circ$  (=  $180^\circ - 134^\circ$ , angles on straight line add up to  $180^\circ$ )  
 $\angle LJK + \angle LKJ = 134^\circ$  (=  $180^\circ - 46^\circ$ , angles of triangle add up to  $180^\circ$ )  
 But  $\angle LJK = \angle LKJ$  (angles opposite equal sides in isosceles triangle)  
 So  $\angle LJK = \frac{1}{2} \times 134^\circ = 67^\circ$

### C Angles from parallel lines crossing (p 11)

- 1 (a)  $a$  and  $b$ ,  $g$  and  $h$   
(b)  $a$  and  $c$ ,  $b$  and  $d$ ,  $e$  and  $f$ ,  $f$  and  $h$   
(c)  $b$  and  $c$ ,  $f$  and  $g$   
(d)  $e$  and  $d$
- 2 (a)  $70^\circ$  (corresponding angles are equal)  
(b)  $102^\circ$  (alternate angles are equal)  
(c)  $57^\circ$  (corresponding angles and vertically opposite angles)
- 3 (a)  $48^\circ$  ( $= \angle ABD$ , alternate angles)  
(b)  $132^\circ$  ( $= 180^\circ - \angle BDE$ , angles on straight line add up to  $180^\circ$ )  
(c)  $45^\circ$  ( $= 180^\circ - 135^\circ$ , angles on straight line add up to  $180^\circ$ )  
(d)  $93^\circ$  (sum of  $\angle BDE$  and  $\angle EDG$ )  
(e)  $45^\circ$  ( $= \angle EDG$ , alternate angles)
- 4 (a)  $\angle EBC = 38^\circ$  ( $= 180^\circ - 142^\circ$  angles on straight line add up to  $180^\circ$ )  
 $x = 38^\circ$  ( $= \angle EBC$ , alternate angles)  
(b)  $\angle IGH = 88^\circ$  ( $= \angle KIJ$ , corresponding angles)  
 $y = 92^\circ$  ( $= 180^\circ - 88^\circ$ , angles on straight line add up to  $180^\circ$ )  
(c)  $\angle OLQ = 119^\circ$  ( $= 360^\circ - 67^\circ - 80^\circ - 94^\circ$ , angles round point add up to  $360^\circ$ )  
 $\angle PQR = 119^\circ$  ( $= \angle OLQ$ , corresponding angles)  
 $z = 61^\circ$  ( $= 180^\circ - 119^\circ$ , angles on straight line add up to  $180^\circ$ )
- 5  $p = q + r$

### D Mixed questions (p 12)

- 1  $135^\circ$
- 2 (a)  $\angle BCH = 74^\circ$  ( $= \angle ABG$ , corresponding angles)  
 $\angle ECD = 74^\circ$  ( $= \angle BCH$ , vertically opposite angles)  
 $p = 35^\circ$  ( $= \angle ECD - \angle FCD$ )  
(b)  $\angle IKJ = 48^\circ$  ( $= 180^\circ - 132^\circ$ , angles on straight line add up to  $180^\circ$ )  
 $\angle IJK = 60^\circ$  ( $= \angle JLM$ , corresponding angles)  
 $q = 116^\circ$  ( $= 180^\circ - 48^\circ - 60^\circ$ , angles of triangle add up to  $180^\circ$ )  
(c)  $\angle QRP = 152^\circ$  ( $= \angle NQO$ , corresponding angles)  
 $\angle QRS = 28^\circ$  ( $= 180^\circ - 152^\circ$ , angles on straight line add up to  $180^\circ$ )  
Acute  $\angle QSR = 28^\circ$  ( $= \angle QRS$ , angles opposite equal sides of isosceles triangle)  
 $r = 332^\circ$  (angles round point S add up to  $360^\circ$ )

## 3 Multiplying and dividing fractions

### A Review: calculating with fractions (p 13)

- 1 (a) 4 (b) 2 (c) 16 (d) 15 (e) 35  
2 (a)  $4\frac{1}{2}$  (b)  $2\frac{1}{10}$  (c)  $6\frac{2}{5}$  (d)  $8\frac{1}{3}$  (e)  $8\frac{3}{4}$   
3 £16  
4 (a)  $\frac{1}{2}$  hour (b)  $1\frac{1}{4}$  hours (c)  $3\frac{1}{2}$  hours  
5  $\frac{1}{8}$  kg  
6  $\frac{1}{5}$

### B Fraction of a fraction

### C Multiplying fractions together (p 13)

- 1 (a)  $\frac{1}{6}$  (b)  $\frac{1}{20}$  (c)  $\frac{1}{12}$  (d)  $\frac{1}{50}$  (e)  $\frac{1}{36}$   
2 (a)  $\frac{1}{8}$  (b)  $\frac{1}{30}$  (c)  $\frac{4}{15}$  (d)  $\frac{3}{70}$  (e)  $\frac{3}{40}$   
(f)  $\frac{10}{21}$  (g)  $\frac{9}{40}$  (h)  $\frac{15}{32}$  (i)  $\frac{21}{40}$  (j)  $\frac{8}{45}$   
3  $\frac{1}{3}$  of  $\frac{1}{6}$  is greater:  $\frac{1}{4}$  of  $\frac{1}{5} = \frac{1}{20}$ ,  $\frac{1}{3}$  of  $\frac{1}{6} = \frac{1}{18}$  and  $\frac{1}{18}$  is greater than  $\frac{1}{20}$ .  
4 (a)  $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$  (b)  $\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$   
(c)  $\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$  (d)  $\frac{5}{7} \times \frac{2}{3} = \frac{10}{21}$   
5 (a)  $\frac{2}{5}$  (b)  $\frac{1}{2}$  (c)  $\frac{4}{9}$  (d)  $\frac{3}{25}$  (e)  $\frac{2}{3}$   
6 (a) Two multiplications with answer  $\frac{1}{12}$   
(b) Two multiplications with answer  $\frac{8}{35}$   
7  $\frac{3}{4} \times \frac{4}{9} = \frac{1}{3}$

### D Reciprocals (p 14)

- 1 (a)  $\frac{1}{9}$  (b) 9 (c)  $\frac{4}{3}$  (d)  $\frac{1}{10}$  (e)  $\frac{7}{2}$   
2 (a) (i)  $\frac{5}{4}$  (ii)  $\frac{4}{5}$   
(b) (i)  $\frac{5}{2}$  (ii)  $\frac{2}{5}$   
(c) (i)  $\frac{7}{4}$  (ii)  $\frac{4}{7}$   
(d) (i)  $\frac{11}{8}$  (ii)  $\frac{8}{11}$   
(e) (i)  $\frac{17}{5}$  (ii)  $\frac{5}{17}$   
3 1

### E Dividing a whole number by a fraction

### F Dividing a fraction by a fraction (p 14)

- 1 (a) 14 (b) 28 (c) 30 (d) 72 (e) 25  
2 (a) 15 (b) 18 (c) 25 (d)  $3\frac{3}{7}$  (e)  $6\frac{2}{3}$   
3 (a)  $\frac{4}{9}$  (b)  $\frac{9}{10}$  (c)  $1\frac{1}{5}$  (d)  $2\frac{1}{2}$  (e)  $1\frac{1}{6}$   
4 6 days

5  $4 \div \frac{3}{4} = 5\frac{1}{3}$ , so she does have enough for 5 days.

- 6 (a)  $3 \div \frac{1}{4} = 12$       (b)  $6 \div \frac{1}{3} = 18$   
 (c)  $4 \div \frac{2}{3} = 6$       (d)  $3 \div \frac{3}{4} = 4$

## 4 Accuracy

### A Review: rounding (p 15)

- 1 (a) 16 km      (b) 4 km  
 2 (a) 5 hours      (b) 16 hours  
 3 (a) 4      (b) 25      (c) 16      (d) 21      (e) 9  
 4 (a) 4.4      (b) 0.7      (c) 23.7      (d) 15.4      (e) 7.1  
 5 (a) 6      (b) 20      (c) 100      (d) 0.6      (e) 2

### B Deciding on sensible accuracy (p 15)

- 1 (a) B (16 500) and C (16 000) are the most likely.  
 (b) C (195 000) and D (£200 000) are the most likely.  
 2 C (7 km)  
 3 B ( $4\frac{1}{2}$  hours) and C (4 hours 20 minutes) are the most likely.

### C Giving answers to a sensible degree of accuracy (p 16)

- 1 0.21 m  
 2 3.3 litres  
 3  $51.1 \text{ cm}^3$   
 4 1.91 m

### D Lower and upper limits of rounded measurements

(p 16)

- 1 56.5 seconds  
 2 266.5 ml  
 3 5.5 m, 6.5 m  
 4 9.5 km  
 5 B (14.92 kg), D (15.471 kg) and E (14.648 kg)  
 6 The bed might not fit. The length of the room and the bed could each be anywhere between 204.5 cm and 205.5 cm, so the length of the bed could be greater than the length of the room.

## 5 Probability

### A Review: equally likely outcomes (p 17)

1 (a) A grid such as this

+	1	2	3	4	5	6	7
1	2	3	4	5	6	7	8
2	3	4	5	6	7	8	9
3	4	5	6	7	8	9	10
4	5	6	7	8	9	10	11
5	6	7	8	9	10	11	12
6	7	8	9	10	11	12	13
7	8	9	10	11	12	13	14

(b) 8

(c) (i)  $\frac{28}{49} = \frac{4}{7}$       (ii)  $\frac{16}{49}$

- 2 (a) 1, 2    1, 5    1, 10    2, 5    2, 10    5, 10  
 (b) (i)  $\frac{1}{2}$       (ii)  $\frac{1}{3}$

### B Probabilities adding to 1 (p 17)

- 1 0.82  
 2 (a) 0.1      (b) 4  
 3  $\frac{13}{20}$   
 4 They add up to less than 1.

### C Using probability to estimate frequency (p 18)

- 1 45  
 2 40  
 3 (a) 4  
 (b) She should expect to lose £5.60.

### D Relative frequency (p 18)

1 (a)

Score	1	2	3	4
Rel. freq. after 40 throws	0.25	0.3	0.225	0.225

- (b) Each score comes up roughly  $\frac{1}{4}$  of the throws, so it might be a fair dice.  
 (c) From the data, the expected numbers would be  
 (i) 30      (ii) 300  
 2 (a) 0.4 or  $\frac{2}{5}$       (b) 150

## 6 Using a calculator

### A Order of operations

#### B Division (p 19)

- 1 (a) 173 (b) 21 (c) 1089 (d) 151  
 (e) 20 (f) 56 (g) 2.5 (h) 15
- 2 (a) 24.58 (b) 9.92 (c) 0.61 (d) 4.78  
 (e) 5.18 (f) 13.95

#### C Negative numbers (p 19)

- 1 (a) -4.6 (b) 15.54 (c) -2.4 (d) -5
- 2 55.6 degrees

#### D Brackets

#### E Squares and square roots (p 19)

- 1 (a) 6.5 (b) 29.3 (c) -19.1 (d) 8.1  
 (e) 8.5 (f) 1.4
- 2 (a) 39.06 (b) 50.30 (c) 5.52 (d) 6.49
- 3 (a) 8.2 (b) 45.36 (c) 1.4 (d) 13.04
- 4 (a) 1.73 (b) 3.34 (c) 1.32 (d) 6.88

#### F Reciprocals (p 20)

- 1 (a) 0.0625 (b) 0.025 (c) 50 (d) 80  
 (e) 0.3125
- 2 (a) 0.63 (b) 3.91 (c) 0.16 (d) 5.76

#### G Checking by a rough estimate (p 20)

- 1 (a) (i)  $\frac{5 \times 6}{3}$  (ii) 10  
 (b) 11.36
- 2 (a) (i) 4 (ii) 4.43  
 (b) (i) 20 (ii) 18.10  
 (c) (i) 4 (ii) 4.10

#### H Unitary method (p 20)

- 1 (a) £8.75 (b) £105
- 2 (a) £1.46 (b) £3.65
- 3 162.5 g
- 4 £214.20
- 5 (a) 12 litres (b) 735 km

## Mixed practice 1 (p 21)

- 1 3042
- 2 (a) 36 cm (b) 54 cm<sup>2</sup>
- 3 4:05 p.m.
- 4 -7, -4, -2, 0, 3
- 5 1, 2, 4, 8, 16
- 6 48°C
- 7  $\frac{1}{4}$
- 8 £360
- 9  $\frac{2}{3}$
- 10 3600 m
- 11  $a = 55^\circ, b = 125^\circ, c = 75^\circ, d = 30^\circ, e = 115^\circ, f = 115^\circ$
- 12 (a)  $\frac{1}{4}$  (b)  $3\frac{3}{4}$  (c)  $\frac{4}{9}$  (d)  $\frac{3}{8}$
- 13 28800
- 14  $\frac{2}{3} = \frac{16}{24}$  and  $\frac{5}{8} = \frac{15}{24}$  so  $\frac{2}{3}$  is larger.
- 15 (a) 68 cm (b) 1.5 kg (c) Positive correlation
- 16 0.3 (or 0.30)
- 17 6
- 18 2700
- 19 Cylinder
- 20 (a)  $\frac{1}{7}$  (b)  $\frac{5}{3}$
- 21 3
- 22 (a)  $\frac{7}{10}$  (b)  $\frac{1}{12}$  (c)  $\frac{13}{15}$  (d)  $\frac{7}{12}$
- 23 858
- 24 0.35
- 25 (a) True (b) False (c) True (d) True
- 26  $5\frac{1}{6}$
- 27 £1.95
- 28 (a) 46 (b) 0.6 (c) 5.94
- 29 (a)
- |                |               |   |    |    |    |    |    |
|----------------|---------------|---|----|----|----|----|----|
| Second spinner | 8             | 9 | 10 | 11 | 12 | 13 | 14 |
|                | 6             | 7 | 8  | 9  | 10 | 11 | 12 |
|                | 4             | 5 | 6  | 7  | 8  | 9  | 10 |
|                | 2             | 3 | 4  | 5  | 6  | 7  | 8  |
|                | 1             | 2 | 3  | 4  | 5  | 6  |    |
|                | First spinner |   |    |    |    |    |    |
- (b) (i)  $\frac{3}{24}$  or  $\frac{1}{8}$  (ii)  $\frac{9}{24}$  or  $\frac{3}{8}$  (iii)  $\frac{6}{24}$  or  $\frac{1}{4}$
- 30 (a)  $\frac{13}{20}$  (b)  $\frac{7}{20}$
- 31 19 grams (to the nearest gram)

32 (a) 3 (b) 10 (c)  $10\frac{2}{3}$  (d)  $\frac{1}{18}$  (e)  $\frac{1}{4}$

33  $\angle FBC = 115^\circ$  ( $\angle FBC$  and  $\angle EFB$  are alternate)  
 So  $\angle PBC = 180^\circ - 115^\circ = 65^\circ$  ( $\angle FBC$  and  $\angle PBC$  are angles on a straight line)  
 $\angle PCB = 40^\circ$  ( $\angle PCB$  and  $\angle DCG$  are vertically opposite)  
 So  $\angle BPC = 180^\circ - (65^\circ + 40^\circ) = 75^\circ$  (angles in a triangle add up to  $180^\circ$ )

34 (a)  $\frac{7}{3}$  (b)  $\frac{3}{7}$

35 30

36 (a) Reflex (b) 206

37 1

38  $\frac{1}{12}$

39 (a)

Symbol	Circle	Rhombus	Star	Heart	Square
Frequency	38	23	42	54	43
Relative frequency	0.19	<b>0.115</b>	<b>0.21</b>	<b>0.27</b>	<b>0.215</b>

(b) There is evidence to suggest that the spinner is biased. For example, the relative frequency for the heart is more than twice the relative frequency for the rhombus.

40 23 and 29

41 (a) Estimates are P: 3, Q: 9, R: 4

(b) P: 2.91, Q: 8.96, R: 3.89

42 6.5 g and 5.5 g

43 10

44 (a) 1.70 (b) 0.85 (c) 0.76 (d) 6.10

(e) 9.61 (f) 3.69

45 (a) 8 (b) 12 (c) 5 (d)  $\frac{7}{8}$

## 7 Circumference of a circle

### A Finding the circumference of a circle

#### B Using $\pi$ (p 25)

1 It will not be enough.

The top needs slightly more than  $3 \times 40 \text{ cm} = 120 \text{ cm}$ .  
 The bottom needs slightly more than  $3 \times 60 \text{ cm} = 180 \text{ cm}$ .  
 So altogether she needs more than 300 cm.

2 That will be enough.

The circumference is slightly more than  $3 \times 15 \text{ m} = 45 \text{ m}$ .  
 Two kerbstones will be needed for every metre.  
 So just over 90 kerbstones will be needed.

3 (a) 10.1 cm (b) 6.6 cm (c) 11.9 cm

(d) 6.0 cm (e) 7.5 cm (f) 8.8 cm

4 107 cm (to the nearest cm)

5 1052 m (to the nearest metre) or 1053 m if 3.142 is used

6 396 m (to the nearest metre)

### C Finding a diameter from a circumference (p 26)

1

Type of tree	Circumference	Diameter	Radius
Oak	120 cm	<b>38 cm</b>	<b>19 cm</b>
Silver birch	63 cm	<b>20 cm</b>	<b>10 cm</b>
Horse chestnut	151 cm	<b>48 cm</b>	<b>24 cm</b>
Yew	214 cm	<b>68 cm</b>	<b>34 cm</b>
Beech	75 cm	<b>24 cm</b>	<b>12 cm</b>

2 (a) 17.7 cm (b) 12.2 cm

3 59 cm (to the nearest cm)

4 (a) 68.8 cm or 68.7 cm if 3.142 is used

(b) 17.2 cm

5 15.9 cm

6 12 756 km (to the nearest km) or 12 755 km if 3.142 is used

### D Checking that a circumference answer makes sense

(p 27)

1 D 18 cm

2 A 48 cm

3 C 5 cm

### E Finding the perimeter of a shape that involves part of a circle (p 27)

1 25.0 cm

2 41.1 cm

3 33.6 cm

## 8 Working with expressions and formulas

### A Review: calculating

### B Review: simplifying (p 28)

- 1 (a)  $-7$  (b)  $3$  (c)  $-6$  (d)  $-3$   
 (e)  $-14$  (f)  $12$  (g)  $-5$  (h)  $5$
- 2 (a)  $31$  (b)  $18$  (c)  $18$  (d)  $3$   
 (e)  $10$  (f)  $8$  (g)  $3$  (h)  $4$
- 3 (a)  $22$  (b)  $54$  (c)  $10$  (d)  $19$
- 4 (a)  $80$  (b)  $900$  (c)  $14$
- 5 A and D ( $a + a = 2a$ )  
 B and G ( $2 \times a \times b = 2ab$ )  
 C and F ( $a \times b = ab$ )  
 E and H ( $a \times b \times 7 = 7ab$ )

- 6 (a)  $3g$  (b)  $5h$  (c)  $9j$  (d)  $2k$   
 (e)  $6a$  (f)  $5b$  (g)  $8n$  (h)  $8m$
- 7 (a)  $4m + 7n$  (b)  $7a + 8b$  (c)  $2h + k$

### C Substituting into expressions (p 28)

- 1 (a)  $5$  (b)  $19$  (c)  $20$  (d)  $6$  (e)  $5$
- 2 (a)  $5$  (b)  $-10$  (c)  $0$  (d)  $6$  (e)  $7\frac{1}{2}$
- 3 (a)  $7\frac{1}{2}$  (b)  $3$  (c)  $4$  (d)  $10$  (e)  $17$
- 4 (a)  $24$  (b)  $16$  (c)  $-16$  (d)  $-2$  (e)  $14$
- 5 (a)  $21.8$  (b)  $1.5$  (c)  $0.8$  (d)  $12$  (e)  $2.5$   
 (f)  $39$  (g)  $3.5$  (h)  $1.46$  (i)  $48$  (j)  $5.76$
- 6  $1\frac{1}{12}$  or  $\frac{13}{12}$

### D Substituting into formulas

### E Forming and solving an equation from a formula

(p 29)

- 1  $7$
- 2  $18$
- 3  $30.2$
- 4 (a)  $45$  degrees  
 (b) (i)  $0.8$  km (ii)  $4$  degrees  
 (c)  $2.4$
- 5  $60$
- 6 (a)  $25$  (b)  $2x + 7 = 9; x = 1$
- 7  $\pounds 80$

- 8 (a)  $670$  (b)  $2.75$  kg (c)  $25$

9  $x = 7$

10  $q = 5\frac{1}{2}$  or  $5.5$

11  $h = \frac{1}{2}$  or  $0.5$

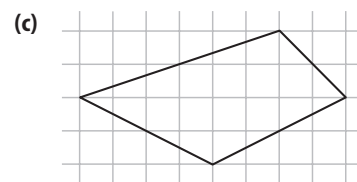
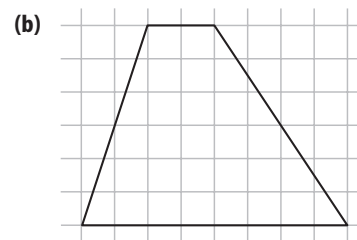
### F Forming and using formulas (p 30)

- 1 (a)  $\pounds 65$   
 (b)  $P = 30m + 2000$   
 (c)  $3950$   
 (d)  $30m + 2000 = 9200; m = 240$   
 (e)  $40$  miles
- 2 (a)  $\pounds 50$  (b)  $C = 9n + 5$  (c)  $185$   
 (d)  $15$  (e)  $25$

## 9 Enlargement

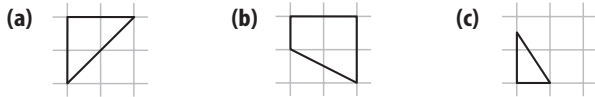
### A Enlargement, angle and perimeter (p 31)

- 1 Each of these should be drawn on cm squared paper.



- 2 (a)  $20.4$  cm  
 (b) (i)  $61.2$  cm (ii)  $40^\circ$

3 Each of these should be drawn on cm squared paper.



4 11 cm

5 (a) B, D and E

(b) B: scale factor 2, D: scale factor  $1\frac{1}{2}$ , E: scale factor  $\frac{1}{2}$

### B Similar shapes (p 32)

1 A and D, B and F, C and E

2 (a) True (b) False

### C Enlargement and area (p 32)

1 (a) Length 10 cm, width 4 cm (b)  $40\text{ cm}^2$  (c) 4

2 (a) Base 12 cm, height 6 cm (b) 9

3  $81\text{ cm}^2$

4  $48\text{ cm}^2$

5  $2\text{ cm}^2$

### D Enlargement and volume (p 33)

1 (a) 2

(b) (i)  $1\text{ cm}^3$  (ii)  $8\text{ cm}^3$  (iii) 8

(c) 8

2 (a) 4 (b) 64

## 10 Percentage increase and decrease

### A Review: percentage of a quantity (p 34)

1 (a) 30 m (b) £3.60 (c) 21 kg (d) £25.50

2 (a) £6 (b) £0.21 (c) £48 (d) £4

3 (a) £21.36 (b) £33.29 (c) £9.74 (d) £0.59

4 36% of £520

5 (a) 490 (b) 756 (c) 252

### B Percentage increase

### C Percentage decrease (p 34)

1 (a) £8 (b) £88

2 (a) £15 (b) £285

3 (a) £60 (b) £96 (c) £18

(d) £7.20 (e) £38.40

4 (a) £170 (b) £51 (c) £119

(d) £28.90 (e) £6.80

5 6000

6 £7200

7 £180 000

8 (a) £100 (b) £2100

9 £154.50

10 £336

### D Increase and decrease with fractions (p 35)

1 (a) 50 (b) 150

2 8 hours

3 100

4 £510

### E Increasing using a multiplier

### F Decreasing using a multiplier (p 35)

1 (a) 1.16 (b) 1.23 (c) 1.4

(d) 1.85 (e) 1.03

2 (a) £46.40 (b) £66.12 (c) £19.14

(d) £42.63 (e) £223.88

3 (a) 0.85 (b) 0.74 (c) 0.6

(d) 0.2 (e) 0.96

4 (a) £25.50 (b) £22.95 (c) £36.21

(d) £15.64 (e) £4.93

5 413

- 6 399  
 7 £520  
 8 £795  
 9 2461  
 10 1310

**G Finding an increase as a percentage**

**H Finding a decrease as a percentage** (p 36)

- 1 (a) 1.08 (b) 8%  
 2 (a) 0.85 (b) 15%  
 3 4%  
 4 45%  
 5 (a) 25% decrease (b) 18% increase  
 (c) 9% increase (d) 14% decrease  
 (e) 12% increase (f) 53% decrease  
 6 8.7%

**I Percentages in the real world** (p 37)

- 1 (a) £43.71 (b) £76.26 (c) £514.06  
 (d) £152.74  
 2 (a) £10.32 (b) Yes  
 3 (a) £57 (b) £405 (c) £419  
 4 £493.50  
 5 £158.25  
 6 £36.67

## 11 Solving linear equations

**A Review: simple linear equations**

**B Review: problem solving** (p 38)

- 1 (a)  $x = 3$  (b)  $x = 10$  (c)  $x = 6$   
 (d)  $x = 4$  (e)  $x = 3$  (f)  $x = 6$   
 (g)  $x = 1.5$  (h)  $x = -2$   
 2 (a)  $3x + 5 = x + 11$ ;  $x = 3$   
 (b)  $5x + 12 = 3x + 20$ ;  $x = 4$   
 3 (a)  $n = 3$  (b)  $n = 2$  (c)  $n = 5$   
 (d)  $n = 4$  (e)  $n = 4$  (f)  $n = 2$   
 (g)  $n = 3.5$  (h)  $n = -2$  (i)  $n = 7$   
 4 (a)  $360^\circ$   
 (b) (i)  $10p = 360$ ;  $p = 36$   
 (ii)  $4p + 100 = 360$ ;  $p = 65$   
 (iii)  $3p + 210 = 360$ ;  $p = 50$   
 5 (a)  $6x + 12$  (b)  $6x + 12 = 30$ ;  $x = 3$   
 6 (a)  $(x + 3)$  cm  
 (b)  $4x + 3 = 31$ ;  $x = 7$  so a red rod is 7 cm long

**C Equations that involve a fraction**

**D Brackets in equations**

**E Equations with  $x$  subtracted** (p 39)

- 1 (a)  $n = 15$  (b)  $n = 8$  (c)  $n = 25$   
 (d)  $n = 4$  (e)  $n = 12$  (f)  $n = 14$   
 (g)  $n = 21$  (h)  $n = -10$   
 2 (a)  $x = 4$  (b)  $x = 2$  (c)  $x = 5$   
 (d)  $x = 9$  (e)  $x = 7$  (f)  $x = 5$   
 (g)  $x = 2$  (h)  $x = 2$  (i)  $x = -1$   
 3 (a)  $x = 7$  (b)  $x = 13$  (c)  $x = 7$   
 (d)  $x = 9$  (e)  $x = 2$  (f)  $x = 8$   
 (g)  $x = 6$  (h)  $x = 5.5$   
 4 (a)  $x = 10$  (b)  $x = 8$  (c)  $x = 4$   
 (d)  $x = 2.5$  (e)  $x = 5$  (f)  $x = 7$   
 5 (a)  $x = 2$  (b)  $x = 16$  (c)  $x = 4$   
 (d)  $x = 3$  (e)  $x = 4$  (f)  $x = -3$   
 6 (a)  $n = 2$  (b)  $p = 7$  (c)  $x = 2$   
 (d)  $n = 1$  (e)  $p = 3$  (f)  $x = 2.5$   
 7 (a)  $x = 2$  (b)  $x = 1$  (c)  $x = 4$   
 8 (a)  $x = 10$  (b)  $y = 12$  (c)  $z = 14$   
 (d)  $n = 5$  (e)  $p = 10$  (f)  $q = 3$   
 (g)  $g = -3$  (h)  $h = 4$  (i)  $k = 3$

## 12 Compound measures

### A Review: speed, distance and time (p 40)

- 3 m.p.h.
- 30 m
- 30 minutes
- 4 hours
- 69 km
- 1.4 m/s

### B Hours and minutes on a calculator (p 43)

- (a) 2.5 hours (b) 0.25 hours  
(c) 3.75 hours
- (a) 4 hours 30 minutes (b) 2 hours 15 minutes  
(c) 45 minutes
- (a) 72 m.p.h. (b) 520 m.p.h.
- (a) 144 km (b) 6 miles
- (a) 1 hour 30 minutes (b) 2 hours 15 minutes
- 225 km
- 56 m.p.h.
- 1 hour 15 minutes
- 87.5 km
- (a) 1 hour 45 minutes (b) 9:35 a.m.

### C Rates (p 41)

- 360 pages
- $3\frac{1}{2}$  hours
- 55 words per minute (to the nearest word)
- 1250 times
- 21.3 ml per minute (to 1 d.p.)
- 480 strokes
- 38 seconds (to the nearest second)

### D Compound measures (p 42)

- 253 people per  $\text{km}^2$  (to the nearest whole number)

City	Population density (people/ $\text{km}^2$ )
London	4562
Birmingham	3646
Leeds	1296
Manchester	3386

- 8 gallons (to the nearest gallon)

- (a) 56 miles per gallon (b) 336 miles
- (a)  $8\text{ cm}^3$  (b) 21.6 g
- (a) (i)  $7.9\text{ g/cm}^3$  (to 1 d.p.) (ii) Steel  
(b) (i)  $8.5\text{ g/cm}^3$  (ii) Brass  
(c) (i)  $11.3\text{ g/cm}^3$  (to 1 d.p.) (ii) Lead

## 13 Angles of a polygon

### A Angles of a regular polygon (p 43)

- $a = 90^\circ, b = 120^\circ, c = 72^\circ$
- (a) 8 (b) An octagon (c) Isosceles  
(d)  $67\frac{1}{2}^\circ$  (e)  $67\frac{1}{2}^\circ$  (f)  $135^\circ$
- $120^\circ$
- (a)  $108^\circ$  (b)  $144^\circ$  (c)  $150^\circ$
- (a)  $120^\circ$  (b) A regular hexagon
- (a)  $150^\circ$  (b) A regular dodecagon

### B Interior angles of a quadrilateral

### C Interior angles of any polygon (p 44)

- $a = 119^\circ, b = 92^\circ, c = 110^\circ, d = 77^\circ, e = 65^\circ$
- $a = 100^\circ, b = 50^\circ, c = 120^\circ, d = 60^\circ, e = 60^\circ, f = 102^\circ, g = 102^\circ, h = 55^\circ, i = 95^\circ$
- There are four triangles.  
The sum of the angles of each triangle is  $180^\circ$ .  
The angles of the triangles make up the interior angles of the hexagon.  
So the interior angles of the hexagon add up to  $4 \times 180^\circ$ .
- number of sides  $\rightarrow$   $- 2$   $\rightarrow$   $\times 180^\circ$   $\rightarrow$  sum of interior angles
- (a)  $540^\circ$  (b)  $900^\circ$  (c)  $1620^\circ$
- (a)  $107^\circ$  (b)  $160^\circ$  (c)  $145^\circ$

### D Exterior angles of any polygon (p 45)

- $a = 132^\circ, b = 71^\circ, c = 74^\circ$
- 12
- (a) 18 (b) 36 (c) 15 (d) 5

### E Mixed questions (p 45)

- (a) A rhombus (b)  $144^\circ, 36^\circ, 144^\circ, 36^\circ$
- (a)  $150^\circ$  (b)  $30^\circ$   
(c) 12 (a dodecagon)

## 14 Fractions and decimals

### A Changing between decimals and fractions

#### B Recurring decimals (p 46)

- 1 (a)  $\frac{4}{5}$  (b)  $\frac{13}{20}$  (c)  $\frac{17}{50}$  (d)  $\frac{13}{25}$  (e)  $\frac{1}{20}$   
 (f)  $\frac{29}{40}$  (g)  $\frac{41}{250}$  (h)  $\frac{1}{40}$  (i)  $\frac{1}{200}$  (j)  $\frac{1}{125}$
- 2 (a) 0.4 (b) 0.375 (c) 1.8 (d) 2.125
- 3  $\frac{3}{5}, \frac{5}{8}, \frac{7}{10}, \frac{19}{20}$
- 4 (a) 0.3333333... (b) 0.1666666...  
 (c) 0.5555555... (d) 0.7777777...

#### C Multiplying decimals (p 46)

- 1 (a) 0.12 (b) 0.14 (c) 0.48  
 (d) 0.27 (e) 0.09
- 2 B, D and F
- 3 (a) 67.31 (b) 67.31 (c) 6.731  
 (d) 0.6731 (e) 0.06731
- 4 (a) 2.4 (b) 2.052
- 5 (a) 4.75 (b) 17.01 (c) 29.76  
 (d) 21.84 (e) 14.88 (f) 8.148  
 (g) 67.62 (h) 3.243 (i) 21.624  
 (j) 3.332

#### D Dividing by a single-digit decimal (p 47)

- 1 (a) 40 (b) 50 (c) 8 (d) 400 (e) 7  
 (f) 70 (g) 300 (h) 900 (i) 5 (j) 70
- 2 O 3, G 20, O 25, A 14, N 4, N 2, N 200, S 300  
 → NONAGONS
- 3 (a) 34.1 (b) 0.9 (c) 0.2 (d) 0.4 (e) 3.8

#### E Dividing by a two-digit decimal (p 47)

- 1 (a) 28 (b) 28 (c) 280 (d) 2800 (e) 280
- 2 (a) 23 (b) 12 (c) 280 (d) 26 (e) 112
- 3 (a) 23 (b) 14 (c) 230 (d) 230 (e) 1400
- 4 25

#### F Using a calculator to solve problems with decimals

(p 47)

- 1 (a) \$149.35  
 (b) £90.24  
 (c) New York by \$2.15 or £1.04 (to 2 d.p.)

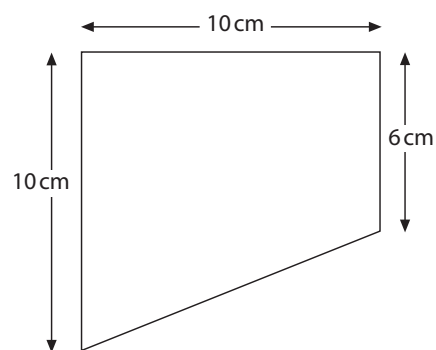
- 2 (a) £13.08 (b) 1.4 kg
- 3 98.9p (to 1 d.p.) or 99p (to the nearest penny)

#### G Mixed questions (p 48)

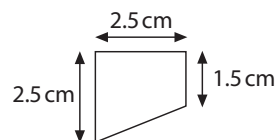
- 1 (a) 1.053 (b) 10 530 (c) 3.9 (d) 27
- 2 (a) 6.3 kg (b) 56.7 kg
- 3 (a) 3.42 litres (b) 2.92 litres
- 4 0.45 m
- 5 (a) (i) £18.90 (ii) £6.50 (iii) £6.30  
 (b) £13.46
- 6 (a) £24  
 (b) It is bigger because 4 is more than 3.8 and £6 is more than £5.85.  
 (c) £22.23

## Mixed practice 2 (p 49)

- 1 90 cm
- 2 (a) 21 (b) -45 (c) -12 (d) -3 (e) -20
- 3  $\frac{9}{20}$
- 4 (a) Trapezium  
 (b) 5.4 cm  
 (c) (i) 18.4 cm (ii) 20 cm<sup>2</sup>  
 (d) (i) A drawing with these dimensions



- (ii) 36.8 cm
- (e) (i) A drawing with these dimensions



- (ii) 5 cm<sup>2</sup>
- 5 0.09, 0.099, 0.1, 0.19, 0.2
- 6 (a)  $1\frac{1}{2}$  (b) 3 (c) 1 (d)  $\frac{1}{8}$  (e) 0

7 Colin is right. Multiplication is done before addition in any calculation without brackets so

$$10 + 2 \times 4 = 10 + 8 = 18.$$

8 0.12

9 (a)  $4x + 4$  (b)  $4x + 4 = 64, x = 15$

(c)  $255 \text{ m}^2$

10 (a) 220 miles (b) 4.5 km per hour

11 (a) 2.4 cm (b) 7.5 cm

12 (a)  $2a$  (b)  $13a + b$  (c)  $15a$

13 (a) £8.88 (b) £5.40 (c) £93.96 (d) £2.36

14 (a) 3 (b) 2 (c)  $\frac{1}{2}$  (d)  $1\frac{1}{2}$

15 73% (to the nearest 1%)

16 (a) 14 (b) £20

17 7.22

18  $p = 108^\circ, q = 72^\circ, r = 36^\circ$

19 (a)  $x = 4$  (b)  $y = 3$  (c)  $z = -3$

(d)  $e = 7$  (e)  $f = 1.5$  (f)  $g = 6$

20 (a) 1 (b) 39.3 cm

21 (a) £27.44 (b) £1800

22 (a)  $6x + 90$  (b)  $6x + 90 = 360, x = 45$

23 (a) 8:15 p.m. (b) 9.52 miles per litre (to 2 d.p.)

24 14%

25 35 cm

26 (a) 1862 miles (b) 6 hours and 30 minutes

27 (a) 2.7 (b) 39.9

(c) 2.9 (d) 16.96 (to 2 d.p.)

28  $15^\circ$

29 80 000

30 £166.85

31 27

32 (a)  $n = 25$  (b)  $n = 12$  (c)  $n = 3$

33 7.1%

34 (a) 210 euros (b)  $E = 45d + 75$  (c) 8

35 (a) 9 (b) 410 (c) 11.8

(d) 5.2

36 (a) 12 (b) 5 (c) -2

(d) -1 (e) 13

37 5

38 (a) £4.52 (b) Euros

## 15 Transformations

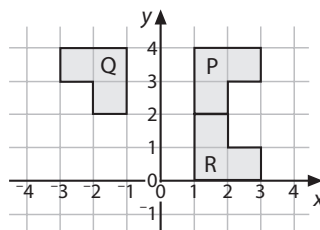
### A Reflection (p 53)

1 (a) G (b) F (c) A (d) H

2 (a) Reflection in the  $x$ -axis

(b) Reflection in the line  $y = -x$

3

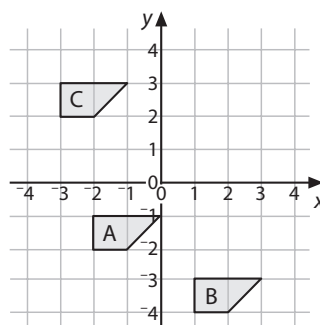


(a) Q as on diagram above

(b) R as on diagram above

### B Translation (p 53)

1



(a) B as on diagram above

(b) C as on diagram above

(c) (i) 4 units to the left and 6 units up

(ii) 4 units to the right and 6 units down

(iii) 3 units to the left and 2 units up

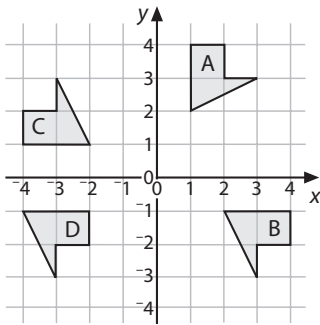
(iv) 1 unit to the right and 4 units down

2 (a) (i) M (ii) L

(b) (i)  $\begin{bmatrix} 3 \\ 1 \end{bmatrix}$  (ii)  $\begin{bmatrix} -3 \\ -2 \end{bmatrix}$

### C Rotation (p 54)

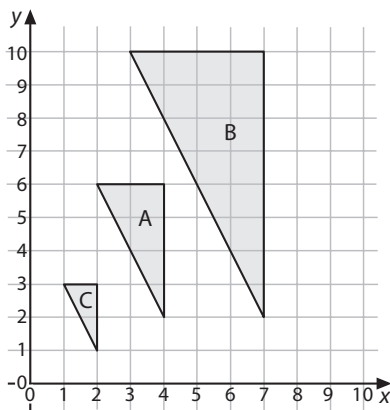
1



- Rotation  $90^\circ$  clockwise about  $(0, 0)$
- C as on diagram above
- Rotation  $180^\circ$  about  $(0, 0)$
- D as on diagram above

### D Enlargement (p 54)

1



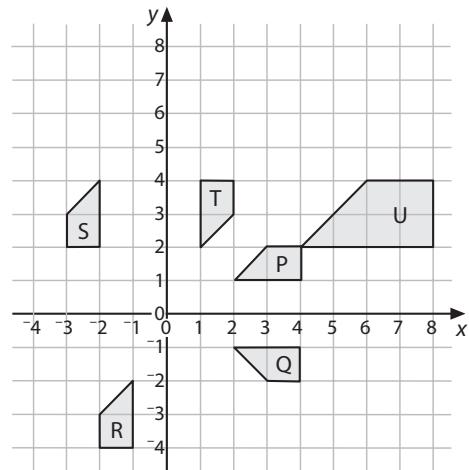
- B as on diagram above
  - C as on diagram above
- 2 Shape Q is an enlargement of shape P with scale factor 3 and centre of enlargement  $(9, 1)$ .

### E Reflection, translation, rotation and enlargement

(p 55)

- 1
- Rotation  $90^\circ$  anticlockwise about  $(0, 0)$
  - Reflection in the line  $x = -4$
  - Reflection in the  $x$ -axis
  - Rotation  $90^\circ$  clockwise about  $(0, 0)$
  - Translation by  $\begin{bmatrix} 3 \\ 2 \end{bmatrix}$
  - Translation by  $\begin{bmatrix} -2 \\ 5 \end{bmatrix}$
  - Reflection in the line  $x = 4$

2



- Q as on diagram above
- R as on diagram above
- S as on diagram above
- T as on diagram above
- U as on diagram above
- Q, R, S and T
- Reflection in the line  $y = x$

## 16 Indices

### A Index notation

### B Calculating powers (p 56)

- 1 (a)  $2^5$  (b)  $3^{11}$  (c)  $5^6$  (d)  $10^9$   
 2 (a) 25 (b) 32 (c) 27 (d) 81 (e) 1  
 3 (a) 2 (b) 4 (c) 2 (d) 4  
 4 (a) 225 (b) 729 (c) 1024 (d) 625 (e) 16384

5	1	1	2	5		3	4
	9		7		4	2	8
	5		9	6	6		2
6	3	0	7		7	2	5
	1		8	3	4	4	8
9	2	1	6			0	0
	5			10	1	0	2

- 6 (a) 3.25 (b) 8.1664 (c) 5.125  
 (d) 50.43 (e) 2.304 (f) 1157.625  
 (g) 0.512 (h) 50  
 7 15000  
 8 (a)  $3 \times 5^2$  (b)  $3^2 \times 11$  (c)  $2^2 \times 5^2$   
 (d)  $2^3 \times 3^2$  (e)  $2 \times 3^2 \times 5$

### C Substituting into expressions containing powers (p 57)

- 1 (a) 8 (b) 9 (c) 10 (d) 20 (e) 13  
 (f) 25 (g) 18 (h) 20 (i) 1 (j) 15  
 2 (a) 381 (b) 40 (c) 2 (d) 36 (e) 162  
 3 (a) 30 (b) 20 (c) 65 (d) 70 (e) 41  
 4 (a) 10 (b) 5 (c) 25 (d) -27 (e) 1  
 (f) 128 (g) 61 (h) 81 (i) 32 (j) -108

### D Multiplying powers

### E Dividing powers (p 57)

- 1 (a) 5 (b) 9 (c) 14 (d) 9  
 2 (a)  $3^7$  (b)  $5^9$  (c)  $2^{12}$  (d)  $11^5$  (e)  $7^6$   
 3 (a) 3 (b) 3 (c) 7 (d) 1  
 4 (a)  $3^5$  (b)  $3^4$  (c)  $3^2$  (d)  $3^4$  (e)  $3^1$   
 (f)  $3^3$  (g)  $3^6$  (h)  $3^9$  (i)  $3^3$  (j)  $3^7$

### F Simplifying expressions containing powers (p 57)

- 1 (a)  $a^2$  (b)  $b^3$  (c)  $x^4$  (d)  $2y^2$  (e)  $2n^2$   
 (f)  $k^5$  (g)  $m^{10}$  (h)  $h^4$  (i)  $d^3$  (j)  $p^8$   
 (k)  $10n^2$  (l)  $6b^5$

## 17 Ratio

### A Review: ratio (p 58)

- 1 (a) 4:1 (b) 1:4  
 2 (a) 5:1 (b) 1:3 (c) 4:3 (d) 8:3  
 3 (a) 1.5 litre (b) 400 ml  
 4 (a) 25 (b) 8 (c) 21

### B Dividing in a given ratio (p 58)

- 1 (a) £8, £12 (b) £18, £9 (c) 15 kg, 45 kg  
 (d) 150 kg, 250 kg (e) £3.60, £0.90 (f) £7.20, £4.80  
 2 10  
 3 (a) 80 (b) 240  
 4 (a) 500 g  
 (b) 150 g  
 (c) 750 g wheat seeds, 1250 g sunflower seeds

### C Ratios in the form $a:b:c$ (p 59)

- 1 4:3:2  
 2 (a) 1:4:3 (b) 3:2:1 (c) 5:3:2 (d) 6:4:3  
 3 (a) 4:2:1 (b) 1.75 litres or 1750 ml  
 4 Chris £200, Geoff £150, Kristin £50  
 5 (a) 1200 g lime, 800 g potash  
 (b) 2 kg ammonia, 6 kg lime  
 (c) 500 g ammonia, 1500 g lime  
 (d) 250 g ammonia, 750 g lime, 500 g potash

### D Converting between ratios, fractions and percentages (p 59)

- 1 (a)  $\frac{3}{4}$  (b)  $\frac{1}{4}$   
 2 (a)  $\frac{2}{5}$  (b)  $\frac{3}{5}$   
 3 (a)  $\frac{1}{5}$  (b) 80%  
 4 (a) 12 (b) 2:1  
 5 (a) 40% (b) 3:2

## 18 Area of a circle and related shapes

These answers assume a calculator value of  $\pi$  is used.

### A Area of a circle (p 60)

- 1 (a) About  $14 \text{ cm}^2$ ,  $13.9 \text{ cm}^2$  (b) About  $4 \text{ cm}^2$ ,  $3.8 \text{ cm}^2$   
 (c) About  $7 \text{ cm}^2$ ,  $7.1 \text{ cm}^2$  (d) About  $9 \text{ cm}^2$ ,  $9.6 \text{ cm}^2$   
 2 (a)  $145 \text{ cm}^2$  (b)  $66 \text{ cm}^2$  (c)  $216 \text{ cm}^2$  (d)  $380 \text{ cm}^2$   
 3 (a)  $13 \text{ cm}^2$  (b)  $41 \text{ cm}^2$  (c)  $121 \text{ cm}^2$  (d)  $145 \text{ cm}^2$

### B Area of a shape that involves part of a circle (p 60)

- 1 (a)  $13.6 \text{ cm}^2$   
 (b) The shape covers more than 12 squares, so the answer is sensible.  
 2  $80 \text{ m}^2$  (to the nearest square metre)  
 3  $123 \text{ cm}^2$   
 4  $135 \text{ m}^2$  (to the nearest square metre)  
 5 (a)  $4.7 \text{ cm}^2$  (b)  $5.4 \text{ cm}^2$

### C Mixed questions on circumference and area (p 61)

- 1 (a) (i)  $32.7 \text{ cm}$  (to 1 d.p.)  
 (ii)  $85 \text{ cm}^2$  (to the nearest  $\text{cm}^2$ )  
 (b) (i)  $49.6 \text{ cm}$  (to 1 d.p.)  
 (ii)  $196 \text{ cm}^2$  (to the nearest  $\text{cm}^2$ )  
 (c) (i)  $31.1 \text{ cm}$  (to 1 d.p.)  
 (ii)  $77 \text{ cm}^2$  (to the nearest  $\text{cm}^2$ )  
 (d) (i)  $45.2 \text{ cm}$  (to 1 d.p.)  
 (ii)  $163 \text{ cm}^2$  (to the nearest  $\text{cm}^2$ )  
 2 (a)  $8.9 \text{ m}$  (b)  $250 \text{ m}^2$   
 3 (a) (i)  $25.7 \text{ cm}$  (ii)  $39.3 \text{ cm}^2$   
 (b) (i)  $26.3 \text{ cm}$  (ii)  $36.6 \text{ cm}^2$   
 (c) (i)  $33.4 \text{ cm}$  (ii)  $36.9 \text{ cm}^2$

### D Exact values involving $\pi$ (p 62)

- 1 (a) Circumference =  $\pi d$   
 $= \pi \times 18$   
 $= 18\pi$   
 (b) Radius =  $18 \div 2 = 9$   
 Area =  $\pi r^2$   
 $= \pi \times 9^2$   
 $= 81\pi$   
 2 A and X, B and W, C and Y, D and V, E and Z  
 3 (a)  $12\pi$  (b)  $16\pi$  (c)  $25\pi$

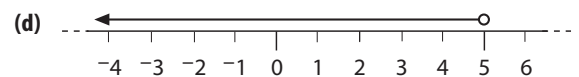
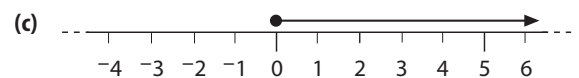
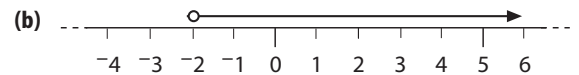
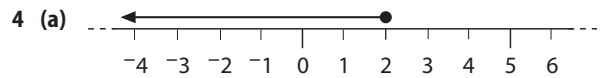
## 19 Inequalities

### A Basic notation (p 63)

- 1 (a) True (b) False (c) True (d) True  
 (e) False (f) True (g) False (h) True  
 2 (a) True (b) False (c) True (d) False  
 3 (a) True (b) False (c) True (d) True  
 4 (a) True (b) False (c) False (d) False  
 5 (a)  $<$  (b)  $>$  (c)  $<$  (d)  $<$

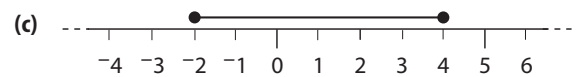
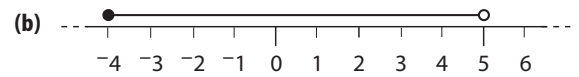
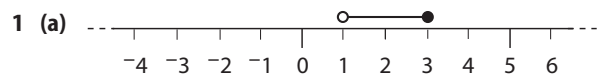
### B Extending the notation and using a number line (p 63)

- 1 (a)  $\sqrt{7}$ ,  $-8$ ,  $-2$ ,  $3$ ,  $0.7$  (b)  $\sqrt{50}$ ,  $\frac{22}{3}$   
 2 A and S ( $x \leq 3$ ), B and P ( $x > 3$ ), C and R ( $x < 3$ ),  
 D and Q ( $x \geq 3$ )  
 3 (a)  $x \geq 1$  (b)  $x \leq -1$  (c)  $x < 4$  (d)  $x > -3$



- 5 Five integers from the set  $2, 1, 0, -1, -2, -3, -4, \dots$

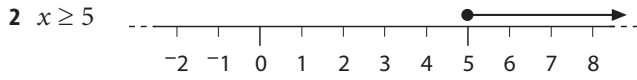
### C Combined inequalities (p 64)



- 2 (a)  $0 < x \leq 4$  (b)  $-2 < x < 1$   
 3 Any five numbers between 3 and 7.  
 The set can include 7 but not 3.  
 4 (a)  $0, 1, 2, 3, 4, 5$  (b)  $2, 3, 4, 5$   
 (c)  $0, 1, 2$  (d)  $-3, -2, -1, 0, 1, 2, 3, 4$

### D Solving simple inequalities (p 64)

- 1 (a)  $n \leq 8$  (b)  $m > 8$  (c)  $p \geq 14$  (d)  $x < 11$   
 (e)  $g \leq 6$  (f)  $y > 7$  (g)  $w < 4\frac{1}{2}$  (h)  $k > 3\frac{1}{2}$



- 3 (a)  $w \geq 5$  (b)  $x \leq 4$   
 (c)  $y > 4$  (d)  $z \leq 9$   
 (e)  $a < 2$  (f)  $b > 7$   
 (g)  $c \leq 5\frac{1}{2}$  (h)  $d \leq 2$   
 (i)  $p < -4$  (j)  $q \geq -6$   
 (k)  $r > -2$  (l)  $s \leq 2\frac{1}{4}$  or 2.25  
 (m)  $e > -3$  (n)  $f \leq -1\frac{1}{2}$  or -1.5  
 (o)  $g \leq -3$  (p)  $h \geq \frac{4}{5}$  or 0.8

## 20 Interpreting data

### A Ungrouped data: median, mean and range (p 65)

- 1 (a) 26 s (b) 26.2 s (c) 9 s  
 2 (a) 15 (b) 7  
 (c) The year 7 students remembered slightly more objects, on average. The numbers remembered are more spread out for the year 9 students.

### B Frequency tables: mode, median, range and mean

(p 65)

- 1 (a) £15 (b) 21 (c) £10 (d) £250 (e) £11.90  
 2 (a) 0 (b) 5 (c) 1 (d) 1.5

### C Grouped data: modal interval and median (p 66)

- 1 (a) 60–64 cm (b) 15 (c) 60–64 cm  
 2 20–29

### D Grouped data: estimating the mean (p 66)

- 1 (a) 2 (b) 25 (c) 9.8  
 2 (a) 4.5 (b) 36 (c) 21  
 3 42.25

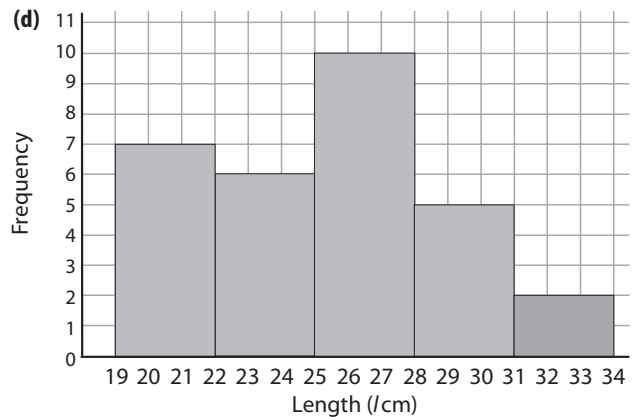
### E Continuous data, frequency polygon (p 67)

1 (a)

Length ( <i>l</i> /cm)	Frequency
$19.0 \leq l < 22.0$	7
$22.0 \leq l < 25.0$	6
$25.0 \leq l < 28.0$	10
$28.0 \leq l < 31.0$	5
$31.0 \leq l < 34.0$	2
Total	30

- (b)  $25.0 \leq l < 28.0$

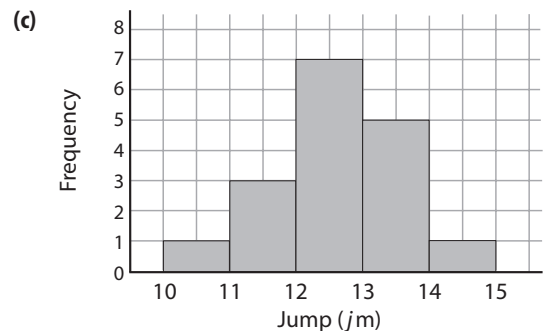
- (c) 13



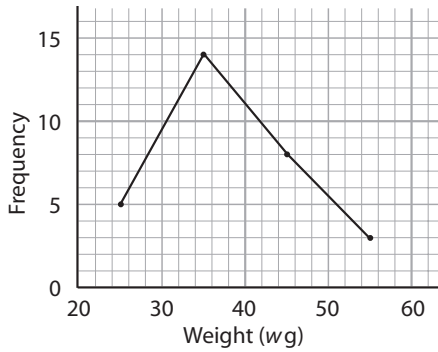
2 (a)

Jump ( <i>j</i> /m)	Frequency
$10.0 \leq j < 11.0$	1
$11.0 \leq j < 12.0$	3
$12.0 \leq j < 13.0$	7
$13.0 \leq j < 14.0$	5
$14.0 \leq j < 15.0$	1
Total	17

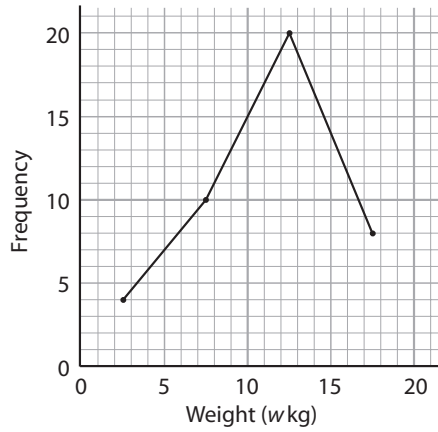
- (b)  $12.0 \leq j < 13.0$



- 3 (a) 25  
 (b) 38 g  
 (c)

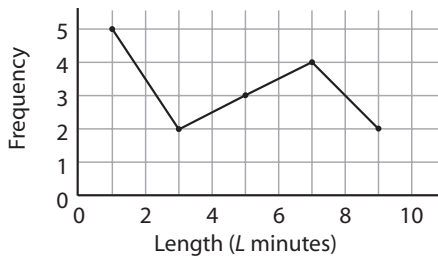


- 4 (a)  $10 \leq w < 15$   
 (b) 2.5  
 (c) 11.3 kg (to 1 d.p.)  
 (d)



**F Mixed questions** (p 68)

- 1 (a) 3.8 km (b) 11.8 km (c) 6.8 km  
 2 (a)  $0 < L \leq 2$   
 (b) 16  
 (c)  $4 < L \leq 6$   
 (d) 6  
 (e) 72 minutes  
 (f) 4.5 minutes  
 (g)



- 3 (a)

Weight (wg)	Frequency
$720 \leq w < 740$	2
$740 \leq w < 760$	3
$760 \leq w < 780$	5
$780 \leq w < 800$	7
$800 \leq w < 820$	6

- (b) 780 g (to the nearest gram)

- (c)

Weight (wg)	Frequency
$720 \leq w < 740$	5
$740 \leq w < 760$	8
$760 \leq w < 780$	6
$780 \leq w < 800$	3
$800 \leq w < 820$	1

- (d) 759 g (to the nearest gram)

- (e) The males weigh about 20 g more on average than the females.

## 21 Map scale

**A Using a scale given as a ratio** (p 69)

- 1 (a) 2 m (b) 15 m (c) 10 m (d) 2.4 m (e) 2 cm  
 2 (a) 0.5 km (b) 2 km (c) 12 cm  
 3 (a) B and R, C and P, D and Q  
 (b) 100 m or 0.1 km  
 4 (a) 3.5 m (b) 8.4 cm

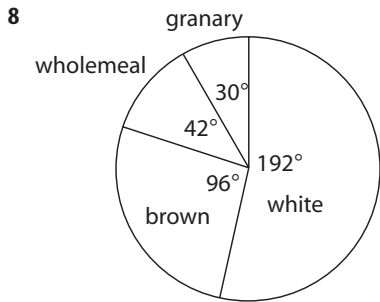
# Mixed practice 3 (p 70)

- 1 £200  
 2 It is a leading question and could be improved by removing 'which are more healthy than meat'.  
 3 (a) 3000 (b) 7000 (c) 34 000 (d) 849 000  
 4 (a) 3 (b) 3.1 (c) 4  
 5 5:8

6 (a)

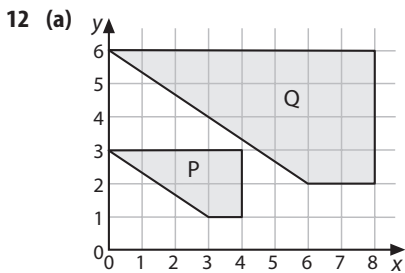
	Girls	Boys	Total
Hot lunch	12	25	<b>37</b>
Cold lunch	28	<b>32</b>	<b>60</b>
No lunch	<b>10</b>	13	<b>23</b>
Total	50	<b>70</b>	120

- (b) 50%  
 (c)  $\frac{1}{5}$   
 7 (a) 3 (b)  $\frac{1}{2}$

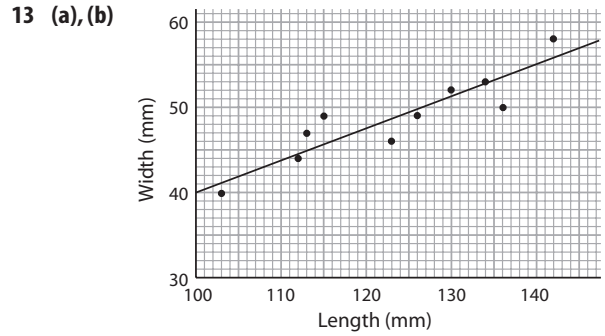


(The angles are shown for checking only. They would not usually be marked on a pie chart.)

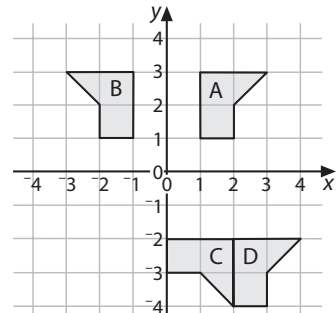
- 9 (a) 48 (b) 48 (c) 48.5  
 10 (a) 10 grams (b) 24 grams  
 11 (a) False (b) True (c) True (d) True



- (b) An enlargement with scale factor  $\frac{1}{2}$ , centre (0, 0)

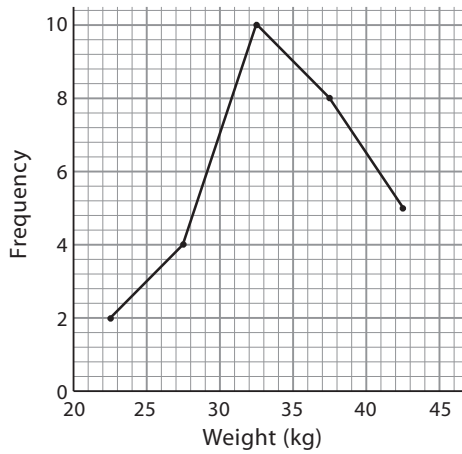


- (c) 47–48 mm  
 14 (a) A circle with diameter 8 cm  
 (b) 25.1 cm  
 (c)  $50.3 \text{ cm}^2$   
 15 (a)  $x \leq 2$  (b)  $-3 \leq x < 4$   
 16  $3^4$   
 17 (a) 25  
 (b) 10  
 (c) (i) 57 (ii) 47  
 18  $\frac{2}{5}$   
 19 (a) 169 (b) 517 (c) 144 (d) 18.359  
 20 (a), (b), (c)



- (d) A rotation of  $90^\circ$  anticlockwise about (2, -2)  
 21 (a)  $15x^2$  (b)  $12pq$   
 22  $7.1 \text{ g/cm}^3$   
 23 (a) 18 (b) 16 (c) 3 (d) 6  
 24   
 25 (a) 3 (b) 9 (c) 6  
 26 8  
 27 (a)  $x \leq 6$  (b)  $x > 4.5$  (c)  $x < 4$  (d)  $x \geq -3$   
 28 (a) 4 (b)  $9.8 \text{ m}^2$  (c) 15.7 m  
 29 (a)  $2^5$  (b)  $2^7$  (c)  $2^7$  (d)  $2^3$   
 30 9 litres of red wine, 6 litres of lemonade, 3 litres of orange juice  
 31  $k = 1.5$

- 32 (a) 6  
 (b)  $30 \leq w < 35$   
 (c) 34.2 kg  
 (d)



- 33 (a)  $2n^2$  (b)  $n^4$  (c)  $6n^3$  (d)  $n^3$   
 34 (a) 38.6 cm (to the nearest 0.1 cm)  
 (b)  $88.4 \text{ cm}^2$  (to the nearest  $0.1 \text{ cm}^2$ )  
 35 (a) 3, 4, 5, 6, 7 (b) 1, 2, 3, 4, 5, 6  
 (c) -2, -1, 0, 1, 2, 3 (d) -2, -1, 0, 1, 2, 3  
 36 21.25 km

## 22 Changing the subject

### A Review: using formulas

### B Changing the subject of a formula such as $y = 5x - 7$ (p 74)

- 1 (a) 53 (b) 503 (c)  $b = 20$   
 (d) 24 (e)  $b = \frac{g-3}{5}$   
 2 (a)  $b = \frac{g-1}{4}$  (b) 15  
 3 (a)  $x = \frac{y-7}{3}$  (b)  $g = \frac{f-11}{4}$  (c)  $k = \frac{j}{5}$   
 (d)  $q = \frac{p-15}{7}$  (e)  $x = \frac{y-5}{6}$  (f)  $d = c - 9$   
 (g)  $m = \frac{h-25}{9}$  (h)  $v = \frac{u-3}{5}$   
 4 (a)  $x = \frac{y+1}{2}$  (b)  $g = \frac{f+10}{7}$  (c)  $k = j + 5$   
 (d)  $q = \frac{p+6}{5}$  (e)  $x = \frac{y+4}{9}$  (f)  $d = c + 8$   
 (g)  $m = \frac{h+3}{4}$  (h)  $v = \frac{u+2}{9}$   
 5 (a)  $x = \frac{y-9}{5}$  (b)  $g = \frac{f+9}{4}$  (c)  $q = \frac{p-12}{3}$   
 (d)  $s = \frac{t+7}{3}$  (e)  $x = \frac{y}{4}$  (f)  $v = \frac{u+12}{7}$   
 (g)  $u = \frac{v-2}{8}$  (h)  $g = \frac{h+3}{10}$

### C Changing the subject of a formula such as $y = x + 2z$ (p 74)

- 1 (a)  $g = \frac{h-j}{2}$  (b)  $p = \frac{q-r}{5}$  (c)  $n = \frac{m-p}{3}$   
 (d)  $x = Y - z$  (e)  $c = \frac{a-b}{4}$  (f)  $h = \frac{f-g}{2}$   
 (g)  $s = \frac{T-r}{6}$  (h)  $n = P - m$

## 23 Coordinates in three dimensions

### A Identifying points (p 75)

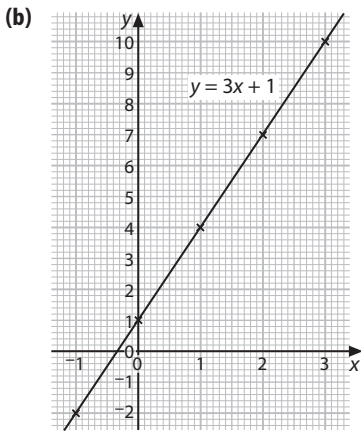
- 1 A (0, 0, 2), B (3, 0, 2), C (3, 1, 0)
- 2 (a) C  
 (b) A (1, 0, 1), B (3, 0, 0), D (3, 3, 0), E (2, 3, 2), F (2, 1, 1)
- 3 A (1, 0, 1), B (1, 3, 0), C (1, 2, 3), D (0, 1, 3)
- 4 (3, 0, 0), (3, 3, 0), (3, 0, 3), (0, 3, 3), (3, 3, 3)

## 24 Drawing and using quadratic graphs

### A Review: linear graphs (p 76)

A1 (a)

x	-1	0	1	2	3
y	-2	1	4	7	10



- (c)  $x = 2.7$  (to 1 d.p.)  
 (d)  $x = -0.3$  (to 1 d.p.)

### B Simple quadratic graphs

### C More complex quadratic graphs (p 76)

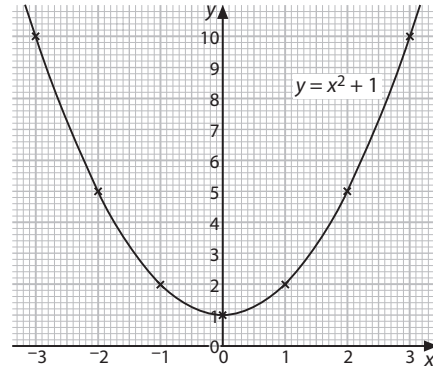
1 (a) 10

(b) 5

(c)

x	-3	-2	-1	0	1	2	3
y	10	5	2	1	2	5	10

(d)



(e)  $x = -2.2$  and  $x = 2.2$  (both values to 1 d.p.)

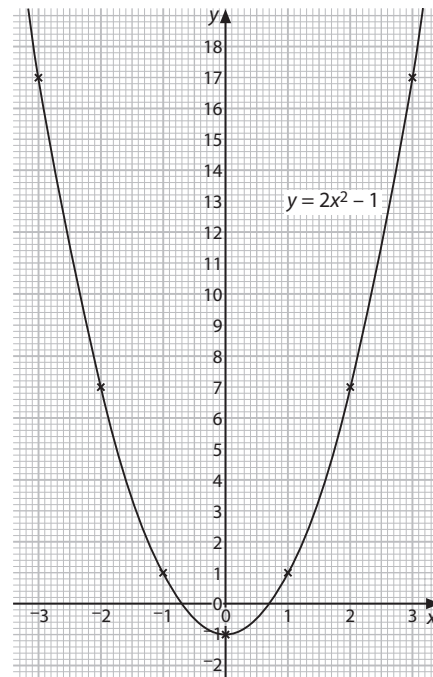
2 (a) When  $x = 3$ ,  $2x^2 - 1$

$$\begin{aligned}
 &= 2 \times 3^2 - 1 \\
 &= 2 \times 3 \times 3 - 1 \\
 &= 18 - 1 \\
 &= 17
 \end{aligned}$$

(b)

x	-3	-2	-1	0	1	2	3
y	17	7	1	-1	1	7	17

(c)



(d)  $x = -2$  and  $x = 2$

(e)  $x = -0.7$  and  $x = 0.7$  (both values to 1 d.p.)

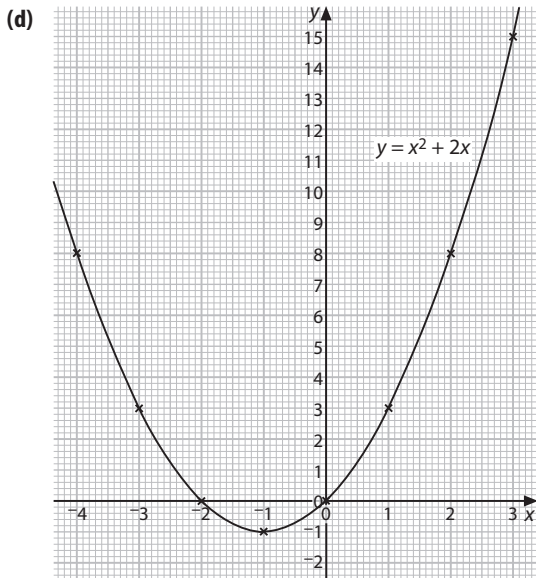
(f)  $x = -2.1$  and  $x = 2.1$  (both values to 1 d.p.)

3 (a) 3

(b) When  $x = -4$ ,  $x^2 + 2x = (-4)^2 + 2 \times -4$   
 $= 16 + -8$   
 $= 8$

(c)

x	-4	-3	-2	-1	0	1	2	3
y	8	3	0	-1	0	3	8	15



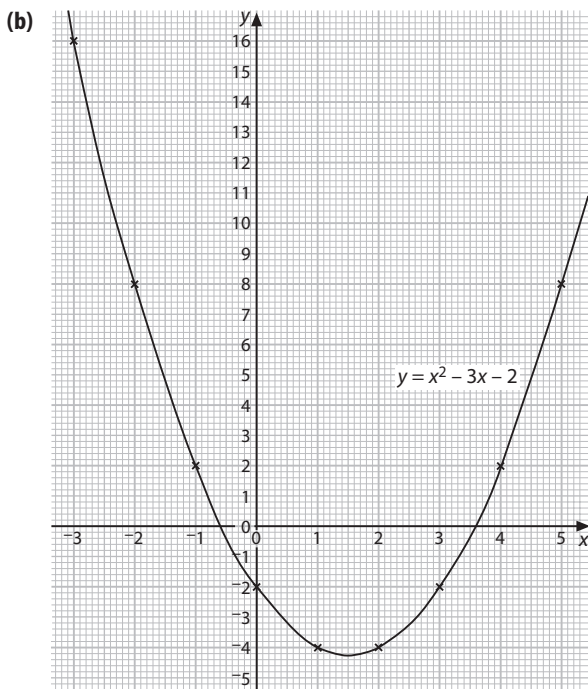
(e)  $x = -2$  and  $x = 0$

(f)  $x = -3.8$  and  $x = 1.8$  (both values to 1 d.p.)

**D Using a calculator** (p 77)

1 (a)

x	-3	-2	-1	0	1	2	3	4	5
y	16	8	2	-2	-4	-4	-2	2	8



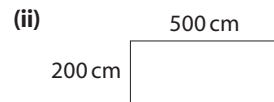
(c)  $x = -0.6$  and  $x = 3.6$  (both values to 1 d.p.)

(d)  $x = -2.1$  and  $x = 5.1$  (both values to 1 d.p.)

## 25 Units of area and volume

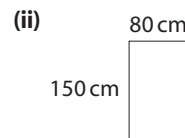
### A Units of area (p 78)

1 (a) (i)  $10 \text{ m}^2$



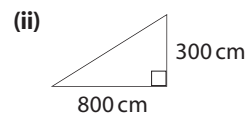
(iii)  $100\,000 \text{ cm}^2$

(b) (i)  $1.2 \text{ m}^2$



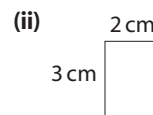
(iii)  $12\,000 \text{ cm}^2$

(c) (i)  $12 \text{ m}^2$



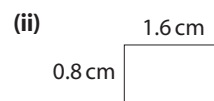
(iii)  $120\,000 \text{ cm}^2$

2 (a) (i)  $600 \text{ mm}^2$



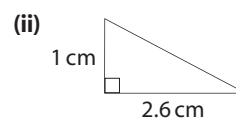
(iii)  $6 \text{ cm}^2$

(b) (i)  $128 \text{ mm}^2$



(iii)  $1.28 \text{ cm}^2$

(c) (i)  $130 \text{ mm}^2$



(iii)  $1.3 \text{ cm}^2$

## B Converting units of area (p 78)

- 1 (a) (i)  $1 \text{ m}^2$  (ii)  $10\,000 \text{ cm}^2$   
(b)  $1 \text{ m}^2 = 10\,000 \text{ cm}^2$
- (c) (i)  $50\,000 \text{ cm}^2$  (ii)  $180\,000 \text{ cm}^2$   
(iii)  $37\,000 \text{ cm}^2$  (iv)  $4000 \text{ cm}^2$   
(v)  $9500 \text{ cm}^2$
- 2 (a) (i)  $1 \text{ cm}^2$  (ii)  $100 \text{ mm}^2$   
(b)  $1 \text{ cm}^2 = 100 \text{ mm}^2$
- (c) (i)  $900 \text{ mm}^2$  (ii)  $4200 \text{ mm}^2$   
(iii)  $730 \text{ mm}^2$  (iv)  $10 \text{ mm}^2$   
(v)  $6 \text{ mm}^2$
- 3 (a)  $4 \text{ m}^2$  (b)  $20 \text{ m}^2$  (c)  $1.8 \text{ m}^2$  (d)  $0.6 \text{ m}^2$
- 4 (a)  $3 \text{ cm}^2$  (b)  $75 \text{ cm}^2$  (c)  $4.2 \text{ cm}^2$  (d)  $0.8 \text{ cm}^2$
- 5 (a) (i)  $18\,000 \text{ cm}^2$  (ii)  $1.8 \text{ m}^2$   
(b) (i)  $60\,000 \text{ cm}^2$  (ii)  $6 \text{ m}^2$   
(c) (i)  $8000 \text{ cm}^2$  (ii)  $0.8 \text{ m}^2$

## C Converting units of volume (p 79)

- 1 (a) (i)  $1 \text{ m}^3$  (ii)  $1\,000\,000 \text{ cm}^3$   
(b)  $1 \text{ m}^3 = 1\,000\,000 \text{ cm}^3$
- (c) (i)  $3\,000\,000 \text{ cm}^3$  (ii)  $16\,000\,000 \text{ cm}^3$   
(iii)  $800\,000 \text{ cm}^3$  (iv)  $10\,000 \text{ cm}^3$
- 2 (a)  $2 \text{ m}^3$  (b)  $12 \text{ m}^3$  (c)  $80 \text{ m}^3$  (d)  $0.4 \text{ m}^3$
- 3 (a)  $2000 \text{ ml}$  (b)  $2000 \text{ cm}^3$
- 4 (a)  $40\,000 \text{ cm}^3$  (b)  $40 \text{ litres}$
- 5  $12 \text{ litres}$

## 26 Trial and improvement

### A Searching for an exact solution to an equation

### B Searching for an approximate solution to an equation (p 80)

- 1 (a) (i) 68 (ii) 130 (iii) 222  
(b) Trials leading to  $x = 11$
- 2 (a) Trials leading to  $x = 15$   
(b) Trials leading to  $x = 4.5$   
(c) Trials leading to  $x = 25$   
(d) Trials leading to  $x = 8$
- 3 Trials leading to  $x = 2.4$
- 4 Trials leading to  $x = 6.9$
- 5 Trials leading to  $x = 7.7$
- 6 Trials leading to  $x = 5.2$
- 7 (a) When  $x = 1$ ,  $x^3 + 10x = 11$   
When  $x = 2$ ,  $x^3 + 10x = 28$   
20 is between 11 and 28 so a solution to  $x^3 + 10x = 20$  is between 1 and 2.  
(b) Trials leading to  $x = 1.6$
- 8 Trials leading to  $x = 5.2$

## 27 Pythagoras's theorem

### A Squares on right-angled triangles

#### B Using Pythagoras to find the hypotenuse (p 81)

- 1 (a)  $19\text{ cm}^2$  (b)  $17\text{ cm}^2$  (c)  $23\text{ cm}^2$   
2 (a) 13 cm (b) 17 cm (c) 25 cm  
3 (a) 18.9 cm (b) 14.4 cm (c) 13.0 cm (d) 16.6 cm  
4 36.3 cm  
5 (a) Sketch (b) 29 km  
6 It is not a right-angled triangle.  
The squares on the sides have areas  $16\text{ cm}^2$ ,  $49\text{ cm}^2$  and  $64\text{ cm}^2$ .  
But  $16 + 49 = 65$ , not 64.

#### C Distance between two points on a coordinate grid

(p 82)

- 1 (a), (b) Diagram with triangle added (c) 7.6 units  
2 (a) 9.4 units (b) 6.3 units (c) 9.5 units

#### D Using Pythagoras to find one of the shorter sides of the triangle (p 82)

- 1 (a)  $16\text{ cm}^2$  (b)  $13\text{ cm}^2$  (c)  $18\text{ cm}^2$   
2 (a) 33 cm (b) 9.0 cm (c) 6.0 cm  
3 (a) 16.6 cm (b) 16.5 cm (c) 28.2 cm  
4 27 m (to the nearest metre)  
5 1.7 m (to the nearest 0.1 m)  
6 Answers are given here to the nearest 0.1 cm.  
(a) 20.8 cm (b) 17.0 cm (c) 22.4 cm  
(d) 18.4 cm (e) 7.5 cm  
7 (a) 50 m (b) 30 m

## 28 Gradients and straight-line graphs

### A Gradient of a line (p 84)

- 1 (a) P: 4, Q: 2, R: 5, S: 1, T: 2, U:  $\frac{1}{2}$  or 0.5  
(b) R  
(c) Q and T  
2  $y = 3x$

### B Working with the equation of a straight-line graph

#### C Finding the equation of a straight-line graph (p 84)

- 1 2  
2 (a) 8 (b) -1  
3 C ( $y = 3x + 2$ )  
4 (a) 3 (b) 10  
5 (a) 4 (b) -5  
6 A and P ( $y = x + 2$ )  
B and R ( $y = x + 1$ )  
C and T ( $y = 2x + 3$ )  
D and Q ( $y = x + 3$ )  
E and S ( $y = 2x - 1$ )  
7 (a)  $y = x - 1$  (b)  $y = 2x + 1$  (c)  $y = 3x - 2$   
8 (a)  $y = x + 5$  (b)  $y = 10x + 20$  (c)  $y = 4x - 2$   
(d)  $y = 2x + 4$

#### D Negative gradient (p 86)

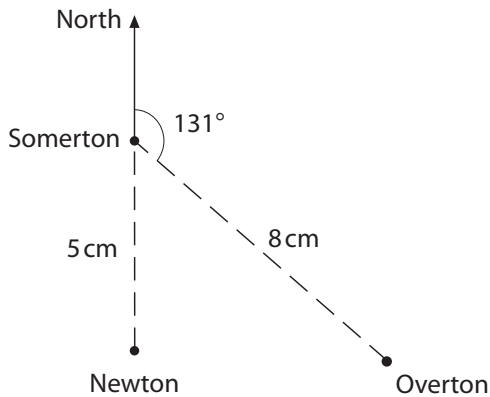
- 1 (a)  $y = -x + 2$  or  $y = 2 - x$   
(b)  $y = -2x + 3$  or  $y = 3 - 2x$   
2 (a) -3 (b) 7

## Mixed practice 4 (p 87)

- 1 (a) 5 (b) 1.36 (c) 7.3 (d) 2.93  
 2 Parallelogram  
 3 23  
 4 66  
 5 2 cm  
 6

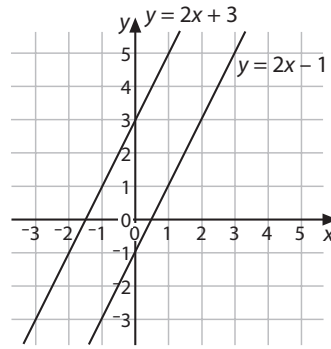
	Metric	Imperial
The length of a pencil	<b>centimetres</b>	inches
The distance from London to Paris	kilometres	<b>miles</b>
The capacity of a car's petrol tank	litres	<b>gallons</b>

- 7 (a) 30 cm (b)  $40 \text{ cm}^2$   
 8 45 litres  
 9 0.15  
 10  $\frac{1}{14}$   
 11 (a)  $Q = P + 5$  (b)  $x = \frac{y}{3}$   
 (c)  $h = \frac{g-6}{5}$  (d)  $j = \frac{h+k}{4}$   
 12 5 000 000  
 13 (a) 28.3 cm (b) 19.2 cm (c) 32.8 cm  
 14 Fay £24, John £32, Harriet £64  
 15 (a) 63  
 (b) Using this rule gives the 3rd term as  $17 - 3 = 14$  which is not correct as the 3rd term is 13.  
 16 (a), (b) A full-size copy of this drawing

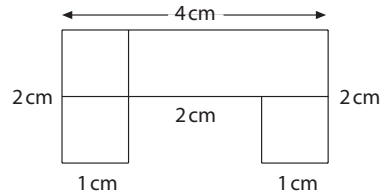


- (c) (i) About 12 km (ii)  $092^\circ$

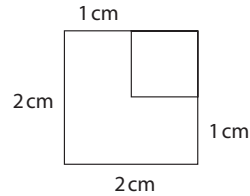
17



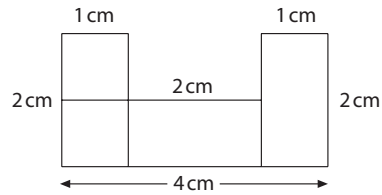
- (a) (i) The line that is labelled  $y = 2x - 1$  in the diagram  
 (ii) 2  
 (iii)  $y = 2x - 1$   
 (b) (i) The line that is labelled  $y = 2x + 3$  in the diagram  
 (ii)  $y = 2x + 3$   
 18  $20000 \text{ cm}^2$   
 19 (a) A full-size copy of this



- (b) A full-size copy of this



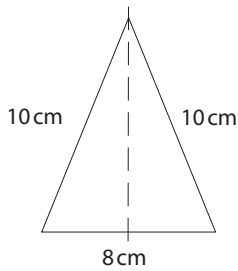
- (c) A full-size copy of this



- 20 (a) £11.50 (b)  $n = \frac{C-150}{50}$  (c) 37

21 (a) Isosceles

(b) A full-size drawing of the triangle below constructed with ruler and compasses



(c)  $47^\circ$

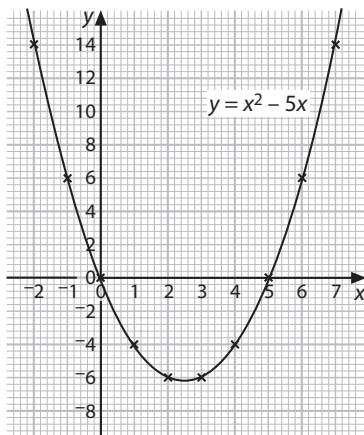
(d) The line of symmetry shown in the diagram

(e) (i) About 9.2 cm (ii) 9.17 cm

22 (a)

$x$	-2	-1	0	1	2	3	4	5	6	7
$y$	14	6	0	-4	-6	-6	-4	0	6	14

(b)



(c)  $x = -1.4$  and  $x = 6.4$  (both values correct to 1 d.p.)

(d)  $x = 2.5$

23 (a) 1

(b)  $\frac{3}{2}$  is the reciprocal of  $\frac{2}{3}$  and  $\frac{2}{3}$  is the reciprocal of  $\frac{3}{2}$ .

24 Trials leading to  $x = 2.7$  (to 1 d.p.)

25 (a) 225 (b) 11

26 £2.24

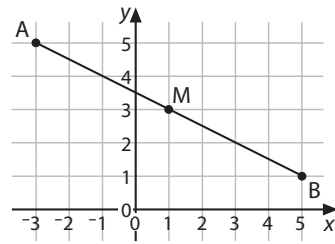
27 (a) 40.8 cm (b)  $36\pi \text{ cm}^2$

28  $4x + 2y$

29 A (1, 2, 0), B (1, 3, 2), C (2, 4, 1)

30 64

31 (a)



Point M has coordinates (1, 3).

(b) 4.5 units

32 (a)  $25\,000 \text{ cm}^3$  (b)  $0.025 \text{ m}^3$

33 (a) 3 (b) -9

34 126 cm (or 1.26 m)

## 29 Statements about different types of number

### A Integers

### B Evens and odds

### C Multiples and primes (p 91)

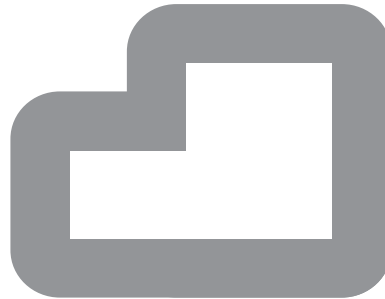
- 1 A and C are true.
- 2 A, B, D and E are always an integer.
- 3 (a) True (b) True (c) False (d) True
- 4 (a) Always even (b) Always even (c) Always odd (d) Sometimes even and sometimes odd (e) Always odd
- 5 (a) True (b) True (c) False (d) True
- 6 (a) An example showing that, where  $n$  is a whole number, the value of  $3n$  is sometimes not a multiple of 6. For example, when  $n = 3$ ,  $3n = 9$  which is not a multiple of 6. (b)  $n = 1$  gives  $5n = 5$  which is a prime. (c) An example showing that, where  $E$  is an even number, the value of  $\frac{1}{2}E - 1$  is sometimes odd. For example, when  $E = 4$ ,  $\frac{1}{2}E - 1 = 1$  which is odd. (d) An example showing that, where  $T$  is a multiple of 3, the value of  $T + 1$  is sometimes odd. For example, when  $T = 6$ ,  $T + 1 = 7$  which is odd. (e) An example (such as  $2 + 3 = 5$ ) showing that the sum of two prime numbers is sometimes prime. (f) An example showing that, where  $n$  is a whole number, the value of  $6n + 1$  is sometimes not prime. For example, when  $n = 4$ ,  $6n + 1 = 25$  which is not prime.

## 30 Loci and constructions

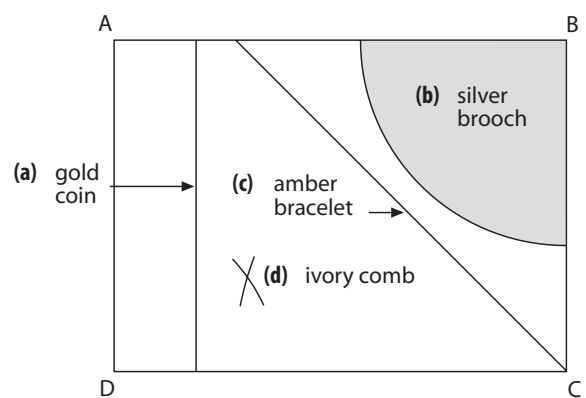
### A Points a given distance from a point or from a line

### B Points the same distance from two points or from two lines (p 92)

1



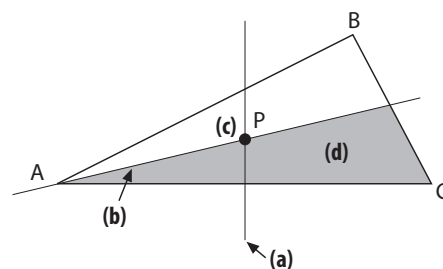
2



- 3 (a) L: Points closer to side PT than to side PQ and M: Points closer to point P than to point Q (b) Points closer to point S than to point R or Points closer to side TS than to side QR

### C Formal constructions with straight edge and compasses (p 93)

1





## 32 Standard form

### A Multiplying by powers of ten

#### B Index notation for powers of ten (p 96)

- 1 (a) 6 270 000 (b) 6850 (c) 3 500 000  
(d) 4 391 000
- 2 (a) 6.25 (b) 100 000 (c) 400
- 3 A and G, B and E, C and H, D and F
- 4 (a) 14 000 (b) 420 000 (c) 579 000 000  
(d) 6 020 000
- 5 (a) 3.8 (b) 5 (c) 6

#### C Writing numbers in standard form (p 96)

- 1 (a) 5000 (b) 800 000 (c) 42 000  
(d) 790 000 000 (e) 6 150 000
- 2 (a)  $4 \times 10^3$  (b)  $7 \times 10^6$  (c)  $5.6 \times 10^5$   
(d)  $9.62 \times 10^6$  (e)  $8.1 \times 10^9$

### D Interpreting your calculator display

#### E Keying-in numbers in standard form (p 96)

- 1 (a)  $1.2 \times 10^{11}$  (b)  $8 \times 10^{18}$  (c)  $2.1 \times 10^{11}$   
(d)  $2 \times 10^{12}$  (e)  $2.7 \times 10^{10}$  (f)  $9 \times 10^{14}$
- 2 (a) 430 000 (b) 40 000 (c) 60 000

## 33 Volume and surface area of prism and cylinder

### A Finding the volume of a prism by counting cubes (p 97)

- 1 (a)  $10 \text{ cm}^3$  (b)  $25 \text{ cm}^3$  (c)  $24 \text{ cm}^3$
- 2 On triangular dotted paper prisms drawn with a volume of  
(a)  $12 \text{ cm}^3$  (b)  $18 \text{ cm}^3$  (c)  $9 \text{ cm}^3$  (d)  $20 \text{ cm}^3$

### B Calculating to find the volume of a prism

#### C Using a formula to find the volume of a prism (p 97)

- 1 (a)  $42 \text{ cm}^3$  (b)  $155 \text{ cm}^3$
- 2 (a)  $15 \text{ cm}^2$  (b)  $60 \text{ cm}^3$
- 3 (a)  $40 \text{ cm}^3$  (b)  $42 \text{ cm}^3$  (c)  $80 \text{ cm}^3$
- 4 Sketch of triangular prism with a volume of  $12 \text{ cm}^3$

### D Surface area of a prism (p 98)

- 1 (a) 5 (b)  $72 \text{ cm}^2$
- 2 (a)  $140 \text{ cm}^2$  (b)  $612 \text{ cm}^2$

### E Volume and surface area of a cylinder (p 99)

- 1 (a)  $75.4 \text{ cm}^3$  (b)  $282.7 \text{ cm}^3$  (c)  $1847.3 \text{ cm}^3$   
All volumes given to the nearest  $0.1 \text{ cm}^3$
- 2 (a)  $244 \text{ cm}^3$  (b)  $227 \text{ cm}^2$
- 3 (a)  $565 \text{ cm}^3$  (to the nearest  $\text{cm}^3$ )  
(b)  $377 \text{ cm}^2$  (to the nearest  $\text{cm}^2$ )

### F Dimensions (p 99)

- 1 (a) A and C (b) B and E (c) D and F
- 2 (a) Area (b) Length (c) Length  
(d) Volume (e) Area

## 34 Expanding brackets

### A Review: multiplying out expressions such as $x(x - 5)$

### B Simplifying expressions that have like terms (p 100)

- 1 (a)  $3x + 15$  (b)  $5n - 10$   
 (c)  $6x + 6$  (d)  $x^2 + 2x$   
 (e)  $n^2 + 7n$  (f)  $n^2 - 4n$   
 (g)  $x^2 - x$  (h)  $n^2 + 5n$   
 (i)  $x^3 + 3x^2$  (j)  $n^3 - 11n$
- 2 (a)  $x^2 + 7x$  (b)  $x^2 + 7x + 1$   
 (c)  $x^2 + 9x - 5$  (d)  $x^2 + 5x$   
 (e)  $x^2 + 2x + 8$  (f)  $x^2 + 5x - 6$

### C Multiplying out expressions such as $(x + 1)(x + 3)$

(p 100)

- 1 (a)  $x^2 + 7x + 10$  (b)  $x^2 + 10x + 21$   
 (c)  $x^2 + 9x + 14$  (d)  $n^2 + 10n + 24$   
 (e)  $n^2 + 4n + 3$  (f)  $n^2 + 4n + 4$   
 (g)  $x^2 + 11x + 24$  (h)  $x^2 + 7x + 6$   
 (i)  $x^2 + 10x + 25$
- 2 (a)  $x^2 + 8x + 12$  (b)  $n^2 + 11n + 28$

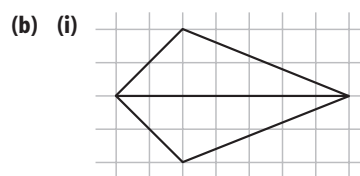
### E Multiplying out expressions such as $(x - 1)(x + 3)$

(p 100)

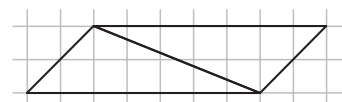
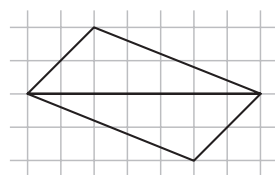
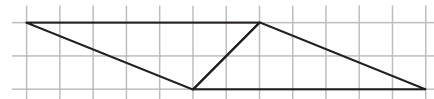
- 1 (a)  $x^2 + 4x - 12$  (b)  $x^2 + 4x - 21$   
 (c)  $x^2 + 2x - 24$  (d)  $n^2 + 2n - 35$   
 (e)  $n^2 + 2n - 3$  (f)  $n^2 + n - 12$   
 (g)  $x^2 - 2x - 15$  (h)  $x^2 - 3x - 28$   
 (i)  $x^2 - 2x - 3$
- 2 (a)  $x^2 - 7x + 12$  (b)  $x^2 - 8x + 12$   
 (c)  $x^2 - 6x + 5$

## Mixed practice 5 (p 101)

1 (a)  $7 \text{ cm}^2$



(ii) One of these parallelograms



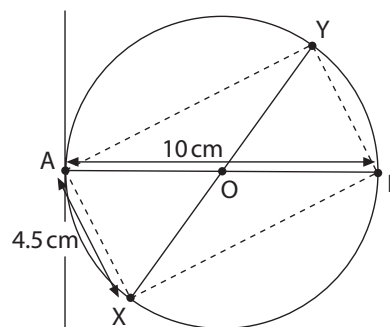
2 700 ml or 0.7 litre

3 (a) 1200 (b) 1800 (c) 0.08 (d) 500

4 (a)  $n - 5$  (b)  $5y$

5 17 676

6 A full-size copy of this drawing



- (a) AB as on diagram above  
 (b) O marked as above  
 (c) Circle drawn as above  
 (d) XY drawn as above (or with X in the upper semicircle)  
 (e) Rectangle  
 (f) Vertical line through A as above

7 (a) 15 (b) 15

8 (a) -12 (b) 32 (c) 2 (d) -4

- 9 (a)  $5(x + 2)$  (b)  $4(3x - 2)$   
 (c)  $x(x + 7)$  (d)  $x(2x - 5)$

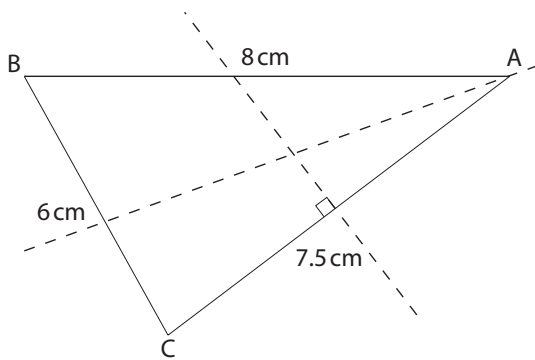
10 40

- 11 (a)  $\frac{9}{36}$  or  $\frac{1}{4}$  (b)  $\frac{24}{36}$  or  $\frac{2}{3}$  (c) 0

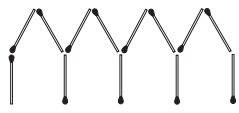
- 12 (a) Angles  $a$  and  $c$  are alternate angles.  
 (b)  $a = 50^\circ$  (vertically opposite angles)  
 $b = 130^\circ$  (angles on a straight line add up to  $180^\circ$ )  
 $c = 50^\circ$  (alternate angles or corresponding angles)  
 $d = 50^\circ$  (vertically opposite angles or corresponding angles)  
 $e = 40^\circ$  (angles on a straight line add up to  $180^\circ$ )

13 £8

- 14 (a) Scalene  
 (b) A full-size copy of the triangle ABC



- (c) The perpendicular bisector of AC as above  
 (d) The bisector of angle BAC as above

- 15 (a)   
 (b) (i) 16 (ii) 31  
 (c)  $3n + 1$

16 £1.53

17 £3.07

18  $x \geq 3$

19 27

- 20 (a) 2 (b)  $900 \text{ cm}^3$  (c)  $870 \text{ cm}^2$

21 2000 or 2 thousand

22  $3.9 \times 10^7$

- 23 (a)  $x = 2$  (b)  $x = 7$  (c)  $x = -2$

24 0.027, 3%, 0.3,  $\frac{33}{100}$ ,  $\frac{1}{3}$

25 A (0, 4, 0), B (0, 4, 5), C (3, 0, 5), D (3, 4, 5)

26 12% (to the nearest 1%)

- 27 (a) 20 000 (b) 8 100 000  
 (c) 3 200 000 000 (d) 10 600 000

- 28 (a)  $x^2 - 7x$  (b)  $x^2 + 8x + 12$   
 (c)  $6x^2 + 9x$  (d)  $x^2 + 3x - 10$

29 25

30  $13x + 5$

- 31 (a) A and E (b) BA  
 (c) 2 (d)  $100 \text{ cm}^3$

- 32 (a) False (b) True (c) True

33 566 Euros are worth  $566 \div 1.34 \approx \text{£}422.39$   
 78 300 Japanese yen are worth  $78\,300 \div 206 \approx \text{£}380.10$   
 So Delia pays less.

- 34 (a)  $3n + 5$  (b)  $7n - 2$

35 60 miles per hour is faster.  
 60 miles is approximately  $60 \times 8 \div 5 = 96$  kilometres  
 which is longer than 80 kilometres.  
 Alternatively, 80 kilometres is approximately  
 $80 \times 5 \div 8 = 50$  miles which is shorter than 60 miles.

36  $3 \times 10^8$

- 37 (a)  $0.8 \text{ m}^3$  (b)  $5.0 \text{ m}^2$

- 38 (a) Length (b) Volume (c) Area  
 (d) Area (e) Volume