Unit 7 – Ratio and proportion

1 Use ratio language

➜ pages 6–8

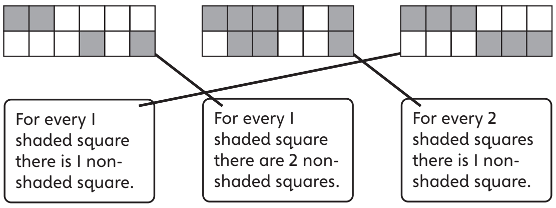
1. For every **1** apple there are **2** pears.
For every **2** pears there is **1** apple.

2. Children should draw 3 apples under each banana.

3. a) For every **3** rulers, there are **2** pencils.
For every **2** pencils there are **3** rulers.

4. a) Children should draw 1 or more groups of 3 triangles and 1 circle.
b) Children should draw 1 or more groups of 2 squares and 5 circles.

5. a)



b) Children should shade 10 squares and leave 2 unshaded.

6. a) Various towers are possible, such as a tower with 1 white and 3 red cubes or 2 white and 6 red cubes. The number of red cubes must be 3 times the number of white cubes.
b) The statement is correct. 3 red + 1 white = 4 cubes in each group. $\frac{3}{4}$ are red and $\frac{1}{4}$ are white.

Reflect

For every 4 apples there are 2 bananas. Or for every 2 apples there is 1 banana.

For every 2 bananas there are 4 apples. Or for every 1 banana there are 2 apples.

2 Introduce the ratio symbol

➜ pages 9–11

1. For every **4** chicks there is **1** hen.
Or, the ratio of chicks to hens is 4 : 1.

2. a) The ratio of jars to tins is 1 : 2.
b) The ratio of jars to tins is 2 : 5.

3. a) 1 : 3 b) 1 : 3 c) 1 : 4

4. a) Children draw 2 or more groups of 3 triangles and 1 circle.
b) Children draw 2 or more groups of 3 triangles and 2 circles.
c) Children draw 2 or more groups of 1 triangle and 3 circles.
d) Children draw 2 or more groups of 1 triangle and 4 circles.

5. a) No, the pencil is shorter than the straw. The ratio is 1 : 2, so the straw is double the length of the pencil.
b) Yes. The straw is twice as long as the pencil. The ratio is 1 : 2, so if the pencil is 10 cm long, the straw is 20 cm long.

6. $1\frac{1}{2}$ l – 250 ml = 1,250 ml
250 ml orange juice : 1,250 ml lemonade = 1 : 5
The ratio of orange juice to lemonade is **1 : 5**.

Reflect

2 : 1 is not the same as 1 : 2.
2 : 1 means the first quantity is double the second quantity.
1 : 2 means the first quantity is half of the second quantity.

3 Use ratio

➜ pages 12–14

1. a) Children should draw 4 circles under each group of squares.
b) Lee draws **12** circles in total.

2. There are **12** strawberry sweets in the jar.

Strawberry	Lime
2	3
4	6
6	9
8	12
10	15
12	18

3. 12 ÷ 2 = 5
5 × 6 = 30
There are **30** striped buttons.

4. 7 ÷ 1 = 7
7 × 4 = 28
There are **28** box fish.

5. 1 square would need 2·5 rectangles, which is not possible in this pattern. Each pattern must have a number of squares that is a multiple of 2.

6. 36 ÷ 9 = 4
4 × 5 = 20
There are 20 sheep and 36 cows.
There are **16** more cows than sheep.

7. 80p ÷ 10 = 8p
8 × 3 = 24
24 × 5p = 120p
80p + 120p = £2
Josh has £2 in total.

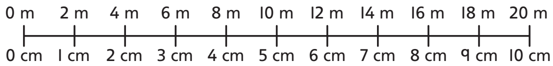
Reflect

There are always more small balloons because 4 > 3.

4 Scale drawing

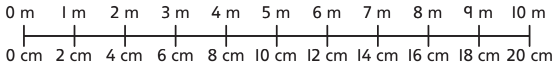
➜ pages 15–17

1. a)



b) The length of the canteen is **10** m in real life.
c) The actual perimeter of the board room is **24** m.
d) Children draw a rectangle 1 cm by 2·5 cm.

2. a) Every **2** cm on the plan represents **1** m in real life.
b)



c) 5 cm × 4 cm = 2.5 m × 2 m in real life.

3. 12 × 25,000 = 300,000 cm = 3 km
The actual distance between the two houses is **3 km**.

4. 11 × 5 = 55 km
The actual length of their route is **55 km**.

5. The missing scale is 1 : **50**. Children should notice that the question states that the shapes have perimeters of equal lengths and calculate the missing scale based on this.

Reflect

1 : 200 could be the same as 1 cm : 2 m as 200 cm = 2 m.

1 : 200 would be different to 1 cm : 2 m if the unit of measure is not cm.

5 Scale factors

➜ pages 18–20

1. a) 9 cm × **2**
Mo's line is **2** times longer than Zac's.
So, the scale factor enlargement is **2**.
b) 9 cm × **5** = **45** cm
Olivia's line is **5** times longer than Zac's.
So, the scale factor enlargement is **5**.

2. Children should draw a right-angled isosceles triangle with sides 8 squares long.
Children should draw the L shape with two long sides of 8 squares and 4 short sides of 4 squares.

3.

Rectangle	Original length	Scale factor of enlargement	New length
A	6 cm	4	24 cm
B	12 cm	5	60 cm
C	18 cm	$\frac{1}{2}$	9 cm
D	18 cm	$1\frac{1}{2}$	27 cm
E	5 cm	100	5 m

4. Reena is incorrect. She has enlarged the shape by scale factor 2 because all the lengths have been doubled (× 2) not trebled (× 3).

5. a) $20 \div 8 = 2\frac{1}{2}$. The scale factor is $\mathbf{2\frac{1}{2}}$.
b) $3 \div 12 = \frac{1}{4}$. The scale factor is $\mathbf{\frac{1}{4}}$.

Reflect

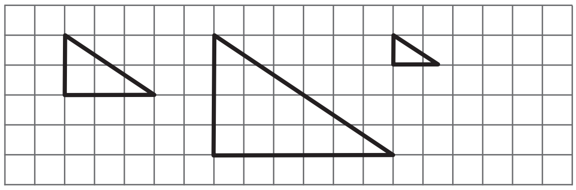
Children's shapes will vary. The enlarged shape's dimensions should all be 3 times the dimensions of the original shape.

6 Similar shapes

➜ pages 21–23

1. a) Yes, the shapes are similar. The scale factor is 2 because the dimensions have been doubled (× 2).
b) No, these shapes are not similar. Some sides have doubled in length but some sides have stayed the same.

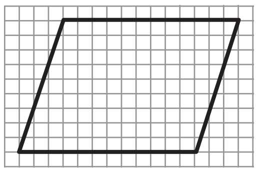
2. Children should draw two triangles where one triangle's sides are all a multiple of the other triangle's sides and their angles are the same size.



3. a) The scale factor is **3**.
The length of $a = 3 \times 5 =$ **15** cm.
b) The scale factor is **5**.
The length of $b = 40 \div 5 =$ **8** cm.

4. $x = 10 \div 2 =$ **5** cm
$y = 10 \times 2\frac{1}{2} =$ **25** cm

5. a) The ratio of $a : b$ = **1 : 2**.
b) Children should draw a parallelogram with top and bottom sides of 12 squares and left and right sides of 9 squares.



Reflect

All sides are in the ratio 1 : 4.

The sides of one shape are 4 times the length of the sides of the other shape.

7 Ratio problems

➜ pages 24–26

1. Bar model shows 5 in each section.
There are **5** slices of carrot cake and **25** slices of lemon cake.

2. 63 ÷ 7 = 9
9 × 2 = 18
9 × 5 = 45
There are **18** footballs and **45** tennis balls.

3. Children should shade in 18 squares and leave 30 unshaded.

4. a) 40 ÷ 5 = 8
8 × 3 = 24
There are **24** spotty socks.
b) 8 × 2 = 16
There are 16 plain socks so **8** pairs of plain socks can be made.

5. 72 ÷ 12 = 6
Zac: 6 × 7 = £42
Jamie: 5 × 6 = £30
42 – 30 = £12
Zac receives **£12** more than Jamie.

6. Bella's number is 420 (140 × 3).
Aki's number is 980 (140 × 7).
The sum of their numbers is **1,400**.

Reflect

Various explanations are possible to show that 60 shared in the ratio 2 : 3 is 24 and 36.

Children could construct a table or use multiplication and division.

60 ÷ (2 + 3) = 60 ÷ 5 = 12
12 × 2 = 24
12 × 3 = 36

8 Problem solving - ratio and proportion (1)

➜ pages 27–29

1. 60 ÷ 5 = 12p
7 × 12 = 84p
7 pencils cost **84p**.

2. 8 + 8 + 4 + 4 = 24 m
The perimeter of the patio is **24** m.

3. a) **300** g flour
6 eggs
900 ml milk
3 tbsp oil
b) 100 ÷ 4 = 25 g
25 × 10 = 250 g
Toshi needs **250** g of flour.
c) 300 ÷ 4 = 75 ml
75 × 9 = 675 ml
Toshi needs **675** ml of milk to make 9 pancakes.
d) 1 pancake = 25 g
370 ÷ 25 = 14 remainder 8
He has enough flour to make **14** pancakes.

4. 3 fish cost £2·80 × 3 = £8·40
6 bags of chips cost £3·60 × 2 or £1·20 × 6 = £7·20
Total cost = £8·40 + £7·20 = £15·60

5. 4 spheres = 850 – 490 = 360 g
1 sphere = 360 ÷ 4 = 90 g
3 spheres = 3 × 90 = 270 g
2 cubes = 490 – 270 = 220 g
1 cube = 110 g
The mass of 5 cubes = 5 × 110 = **550 g**

Reflect

Various methods are possible.

Children could explain working out the cost of 1 bar and using that to work out the mass of 9 bars.

120 ÷ 6 = 20 g
20 g × 9 = **180 g**

Children could explain working out the mass of 3 bars and adding that onto the mass of the 6 bars.

120 ÷ 2 = 60 g
60 g + 120 g = **180 g**

9 Problem solving - ratio and proportion (2)

➜ pages 30–32

1. 16 ÷ 4 = 4
4 × 3 = 12
There are **12** lilies.

2. a) There are **4** times more mint than strawberry sweets.
The ratio 4 : 1 means that for every 1 strawberry sweet there are 4 mint sweets.
b) 32 ÷ 4 = 8
8 × 1 = 8
There are **8** strawberry sweets.

3. 16 ÷ 2 = 8
3 × 8 = 24
16 + 24 = 40
There are **40** squares of chocolate in the whole bar.

4. Ratio flour : sugar = 4 : 1
525 ÷ 5 = 105 g.
The sugar weighs **105** g.

5. 5 yellow
Blue: 5 × 2 = 10
Red: 5 × 4 = 20
5 + 10 + 20 = 35
There are **35** bricks altogether.

6. There are **20** blue marbles. Explanations will vary.

7. They catch **39** fish altogether.
The ratio 3 : 1 = 18 : 6
6 + 15 = 21 (3 more than 18)
18 + 21 = 39

Reflect

Children should explain if they find bar models helpful and how they help them.

My journal

→ page 33

a) Andy is incorrect. A scale factor of 2 means each side should be doubled (× 2). One side has increased by a scale factor of 1·5 and the other side has not changed.

b) The ratio is 1 : 2. The second side is twice the length of the first side for all of the sides.

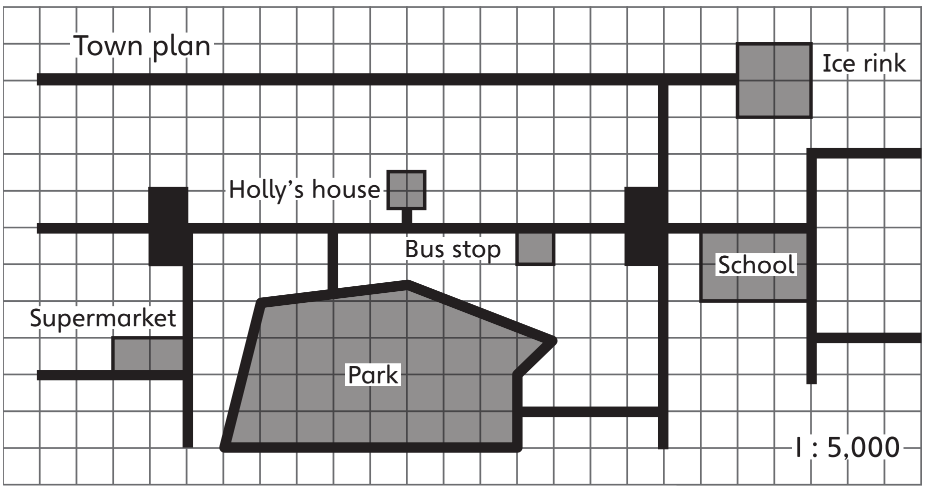
Power puzzle

→ page 34

a) 1 cm = 5,000 cm = **50 m** in real life

b) 4 squares = 4 × 50 m = 200 m
The shortest distance is **200 m.**

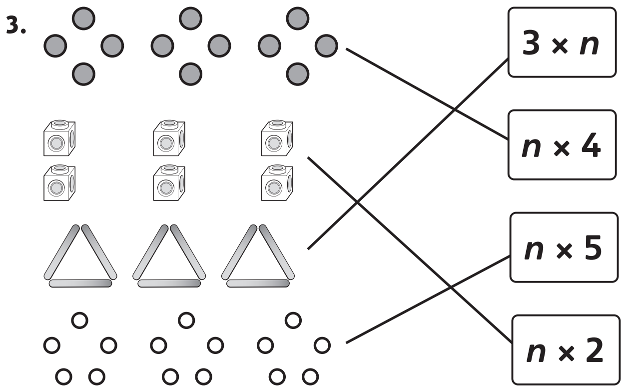
c) 350 m ÷ 50 m = 7
Children should draw the swimming pool 7 squares from Holly's house.



Unit 8 – Algebra

1 Find a rule – one step

→ pages 35–37

1. a) Outputs: 4, 8, 12, 20, 32, 4*p*
   b) Outputs: 6, **12**, **30**, **66**, **108**, **6*q***
2. a) Number of stars: 3, **6**, **9**, **15**, **30**, **300**, **4,500**
   b) For *n* fairy cakes you need 3 × *n* stars.
3. 

4. a)

Minutes Zac has been painting	45	50	90	120	*m*	*y* + 30
Minutes Kate has been painting	15	20	60	90	*m* – 30	*y*

   b) If Zac has been painting for *m* minutes, Kate has been painting for ***m* – 30 minutes**.
   c) If Kate has been painting for y minutes, Zac has been painting for ***y* + 30 minutes**.
5. a) The number of legs on *b* spiders is 8*b*.
   The number of wheels on *v* tricycles is 3*v*.
   The number of days in *m* week is 7*m*.
   The number of weeks in *k* years is 52*k*.
   b) The number of **days in *d* years** is 365 × *d*
6. Left-hand table:
   Missing values: 19·5, *n* + 4
   The rule is + 4.
   Right-hand table:
   Missing values: 2·5, *y* ÷ 2·5
   The rule is × 2·5.

Reflect

Both expressions involve the letter *a* and the number 5.

a × 5 means *a* multiplied by 5. 5 + *a* means 5 added to *a*.

2 Find a rule – two steps

→ pages 38–40

1. Outputs: 5, **7**, **9**, **11**, **13**, **2*n* + 3**
2. a) Total savings: 28, **31**, **34**, **37**, **40**, **55**
   b) After *y* weeks, Olivia has saved 25 + **3** × ***y*** pounds.
3. a) Number of sticks used: 3, 5, 7, 9, 11, 21, 201
   b) To make *n* triangles, **2 × *n* + 1** sticks are used.
4. For *g* houses you need 5 × *g* + 5 sticks.
5. You would need 2 × 100 + 2 = 202 circles with 100 squares.

Reflect

Children's answers will vary. They should write a short number story. For example: Max has £100. He spends £3 a day on lunch. How much will he have left after *y* days?

3 Form expressions

→ pages 41–43

1. a) If Richard has *p* guinea pigs, Luis has ***p* + 2** guinea pigs.
   b)

p + 2	*p* + 2	*p* + 2

3*p* + 6

   c) Ambika has 3 × 3 + 6 = 15 guinea pigs.
   d)

	Number of guinea pigs				
Richard	1	2	5	10	20
Luis	3	4	7	12	22
Ambika	9	12	21	36	66

2. a) Outputs: 5, 10, 15, 25, 50
   If the input is *a*, the output is 5*a*.
   b) Outputs: 7, 12, 17, 27, 52
   If the input is *b*, the output is 5*b* + 2.
   c) Outputs: 15, 20, 25, 35, 60
   If the input is *c*, the output is (*c* + 2) × 5.
   d) Outputs: 10, 20, 30, 50, 100
   If the input is *d*, the output is 2*d* × 5 or 10*d*.
3. Max is correct.
   The outputs for both are: –9, –8, –5, 90, 990, *a* – 10
   a – 10 = *a* + 5 – 15 because 5 – 15 = – 10
4. a) and b) Various responses are possible. For example: × 2, × 5; × 5, + 50; + 40, × 2. Children's answers will depend on the functions they choose.

Reflect

No, this method does not work when the function involves an addition or subtraction. This method would only work if the function is a single step multiplication or division or a combination of multiplication and division.

When *m* = 10, 3*m* + 2 = 30 + 2 = 32

When *m* = 100, 3*m* + 2 = 300 + 2 = 302, not 32 × 10 (320)

4 Substitution (I)

→ pages 44–46

1. a) The total value = ***5n*** pence.

b)

Number of 5p coins	Reena's total value
4	20p
5	25p
10	50p
30	£1·50
50	£2·50

2. a) 20*n*

b)

Time in minutes	Cost
n	20*n* pence
10	£2
30	£6
60	£12
120	£24

3.

	t + 30	30 – *t*	30*t*
t = 5	35	25	150
t = 10	40	20	300
t = 30	0	0	900
t = 0	30	30	0

4. Aki's method does not work.
10*y* means 10 × *y*. The order of operations states that multiplication is completed before addition.
10 × 7 + 5 = 75, whereas (7 + 5) × 10 = 120.

5. Children should choose values for *y* that are even numbers so that 5*y* = a multiple of 10.
100 – multiple of 10 = multiple of 10.

6. When *y* = 1, 10*y* – *y* = 10 – 1 = 9.
Various answers are possible, depending on the value children choose for *y*.
The answer to 10*y* – *y* will always be 9*y*.

Reflect

2*y* means 2 × *y*. When you multiply a number by 2, the answer is always an even number.

When you add two even numbers together (4 + 2*y*) the answer is always even.

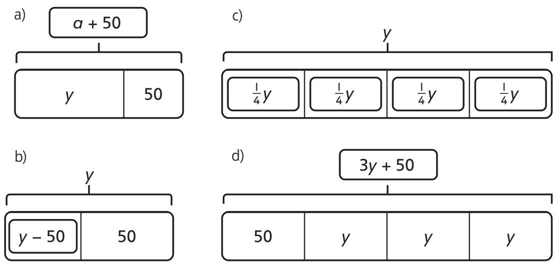
5 Substitution (2)

→ pages 47–49

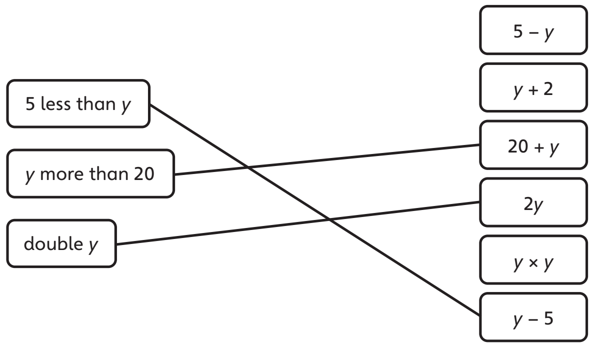
1. a) 100 – 5*y*
b) 100 – 12 × 5 = **40 cm** left

2. a) The total height is **15** + **10***n*.
b) When *n* = 8, the total height is
15 + 10 × 8 = 15 + 80 = **95 cm**

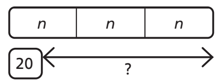
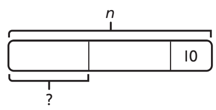
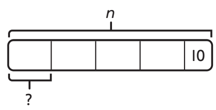
3.



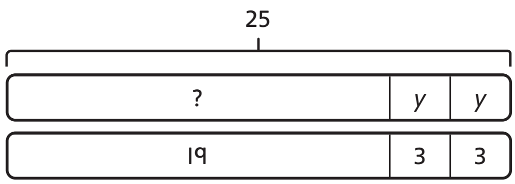
4.



5.

	Write an expression for each '?'	Substitute *n* = 110 into each expression. Calculate the value of '?'
	3*n* – 20	310
	(*n* – 10)	50
	(*n* – 10)	25

Reflect



When *y* = 3, the value of 25 – 2*y* = **19**.

6 Formulae

→ pages 50–52

1. a) Formula: **3a**.
Perimeter = 3 × 4 = **12 cm**
b) Formula: **4a**.
Perimeter = 4 × 4 = **16 cm**
c) Formula: **2a + 2b**.
Perimeter = 2 × 4 + 2 × 5 = **18 cm**
d) Formula: **4a + 4b**.
Perimeter = 4 × 4 + 4 × 5 = **36 cm**

2. Tower A: 100 feet = 12×100 = **1,200** inches
Tower B: 200 feet = 12×200 = **2,400** inches
Tower C: 150 feet = 12×150 = **1,800** inches

3. The rocket has travelled **9,600** km.

4. Max is not correct. The sides that are joined together are not part of the perimeter.
The new perimeter is $6a$.

5. a) $99 + 2 = 100 + 1$
$99 + 3 = 100 + 2$
$99 + 4 = 100 + \mathbf{3}$
$99 + 5 = 100 + \mathbf{4}$
$99 + a = 100 + \mathbf{(a - 1)}$
The answer is the same when the number added to 100 is one less than the number added to 99. This is always true, even with negative numbers and zero.

b) $99 \times 1 = 100 \times 1 - 1$
$99 \times 1 = 100 \times 2 - 2$
$99 \times 1 = 100 \times 3 - 3$
$99 \times 4 = 100 \times \mathbf{4 - 4}$
$99 \times b = 100 \times \mathbf{b - b}$
To multiply a number by 99, multiply it by 100 and then subtract the number being multiplied. This is always true, even with negative numbers and zero.

Reflect

Perimeter = $2x + y$

Perimeter when $x = 10$ and $y = 8$ = $2 \times 10 + 8 = 20 + 8 = 28$

7 Form and solve equations

➜ pages 53–55

1. a) When $a = 100$, $a + 150 = 250$
When $a = 200$, $a + 150 = 350$
Children's other answers will depend on values chosen for a.

b) When $b = 10$, $150 - b = 140$
When $b = 20$, $150 - b = 130$
When $b = 50$, $150 - b = 100$
Children's other answers will depend on values chosen for a.

c) $28 + c = 100$
$c = 100 - 28$
$c = 72$

2. a) $a = 12$ b) $a = 18$ c) $a = 5$ d) $a = 45$

3. a) $v = 310$
b) $y = 30$
c) $z = 3{,}000$

4. He is incorrect. The inverse or related fact for this subtraction is another subtraction: $f = 36 - 16 = 20$. Children may draw a bar model or a similar diagram to illustrate that 36 is the whole and f and 16 are the parts.

5. a) Equation: $10a = 2$
Solution: $a = 0{\cdot}2$
b) Equation: $15b = 150$
Solution: $b = 10$
c) Equation: $c \div 10 = 2$
Solution: $c = 20$
d) Equation: $d - 90{\cdot}9 = 909{\cdot}09$
Solution: 999·99

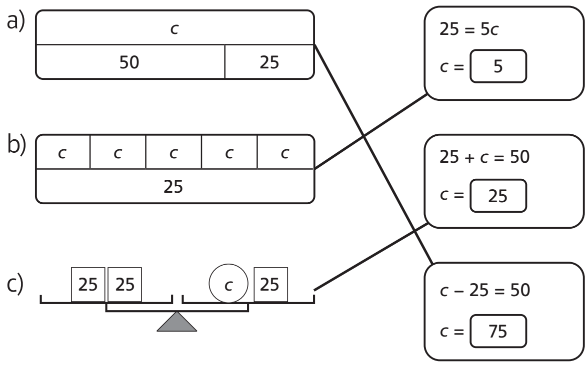
Reflect

Children could use several methods to show that $\mathbf{y = 125}$:
- a related subtraction: $y = 200 - 75$
- a bar or part-whole model
- a function machine.

8 Solve one-step equations

➜ pages 56–58

1. a) Subtract **25** from both scales
b = **15**
b) $3c$ = **150**
Divide each side by **3**
$c = 50$
c) $100 - 45 = 55$
$a = 55$
d) $5d = 150$
$150 \div 5 = 30$
$d = 30$

2.


3. a) f = **3**
b) g = **2·5**
c) h = **363**
d) i = **250**
e) j = **36**
f) k = **1**

4. There are many possible answers. For example:

$240 \div y = 80$	$y = 3$
$100 - y = 24$	$y = 76$
$y \div 80 = 10$	$y = 800$
$y - 100 = 24$	$y = 124$

Reflect

Children could use several diagrams to represent the equation $100 - y = 90$ and $y = 10$:
- bar and part-whole models with 100 as the whole
- scales with 100 on one side and y and 90 on the other side
- function machines showing $y + 90 = 100$ or $100 - 90 = y$

9 Solve two-step equations

→ pages 59–61

1. $5c + 15 = 50$
$5c = 35$
$c = 7$

2. a) $3a + 2 = 17$
$3a = 17 - 2 = 15$
$a = 5$

b) $4b + 80 = 100$
$4b = 100 - 80 = 20$
$b = 5$

3. Olivia is not correct.
$3y = 75$ so $y = 75 \div 3 = 25$

4. $6n + 3 = 51$
$6n = 48$
$n = 8$
There are 8 stickers in a pack.

5. a) $4a - 30 = 50$
$4a = 80$
$a = 20$

b) $2c - 50 = 80$
$2c = 130$
$c = 65$

6. a) $y \div 5 - 5 = 6$
$y \div 5 = 11$
$y = 55$

b) $(z + 20) \times 10 = 1{,}000$
$z + 20 = 100$
$z = 80$

Reflect

Children should draw a bar model with 25 as the whole and 5*y* and 5 as the parts.

5*y* could be shown as 5 parts each marked *y*, with a sixth part marked 5.

$5y + 5 = 25$
$5y = 20$
$y = 4$

10 Find pairs of values

→ pages 62–64

1. a) The scales are balanced so each side must have an equal mass. If one side equals 4 kg, the other side must also equal 4.

b) Various solutions are possible, such as

$a = 1$	$b = 3$
$a = 2$	$b = 2$
$a = 3$	$b = 1$
$a = 1{\cdot}5$	$b = 2{\cdot}5$
$a = 0{\cdot}5$	$b = 3{\cdot}5$
$a = 2{\cdot}8$	$b = 1{\cdot}2$

2.

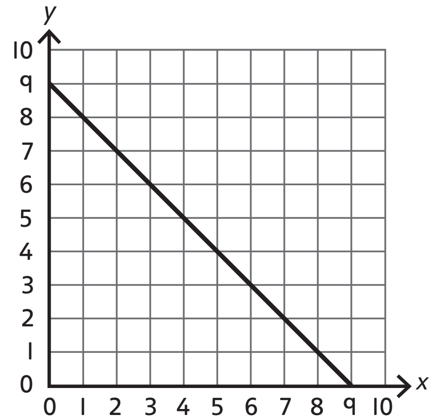
$j = 1$	$k = 5$
$j = 2$	$k = 4$
$j = 3$	$k = 3$
$j = 4$	$k = 2$
$j = 5$	$k = 1$

3. a) *e* and *f* represent the length of adjacent sides. The area of a rectangle is width × length = $e \times f$.

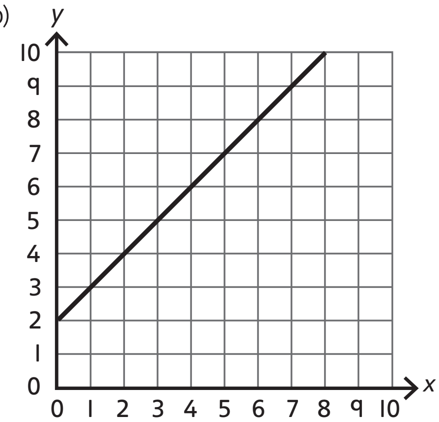
b) There are many possible solutions. For example:

$e = 1$	$f = 100$
$e = 2$	$f = 50$
$e = 4$	$f = 25$
$e = 5$	$f = 20$
$e = 10$	$f = 10$

4. a)



b)



5. a) $1 + 3 + 5 + 11 = 20$
$1 + 3 + 7 + 9 = 20$

b) $1 + 4 - 3$
$1 + 6 - 5$
$1 + 8 - 7$
$3 + 4 - 5$
$3 + 6 - 7$
$3 + 8 - 9$
$5 + 4 - 7$
$5 + 6 - 9$
$7 + 4 - 9$

Reflect

Various responses are possible but children should describe a systematic approach, such as starting with 0 or 1.

11 Solve problems with two unknowns

→ pages 65–67

1. $10 \times 2p + 1 \times 5p$
   $5 \times 2p + 3 \times 5p$

2.

$a = 1$ cm	$b = 11$ cm	area = 11 cm^2
$a = 2$ cm	$b = 10$ cm	area = 20 cm^2
$a = 3$ cm	$b = 9$ cm	area = 27 cm^2
$a = 9$ cm	$b = 3$ cm	area = 27 cm^2
$a = 10$ cm	$b = 2$ cm	area = 20 cm^2
$a = 11$ cm	$b = 1$ cm	area = 11 cm^2

   When a or b is more than 3 the area is over 30 cm^2.

3. $4b + 8r = 32$

$b = 6, r = 1$	$6 \times 4 + 8 \times 1 = 24 + 8 = 32$
$b = 4, r = 2$	$4 \times 4 + 8 \times 2 = 16 + 16 = 32$
$b = 2, r = 3$	$2 \times 4 + 8 \times 3 = 8 + 24 = 32$

4. a) There are many possible solutions. For example:

$a = 5$	$b = 0$
$a = 6$	$b = 2$
$a = 7$	$b = 4$
$a = 8$	$b = 6$
$a = 9$	$b = 8$

   As a increases by 1, b increases by 2 and is always even.

   b) There are many possible solutions. The equation can be rearranged to $d - c = 200$. Then, any pair of numbers with a difference of 200 can be used, with d being the larger number.

$d = 218$	$c = 18$
$d = 300$	$c = 100$
$d = 605$	$c = 405$
$d = 546$	$c = 346$
$d = 721$	$c = 521$

5.

Bella	Danny
2 + 7 = 9	1 + 9 = 10
2 + 17 = 19	4 + 16 = 20
2 + 19 = 21	4 + 16 = 20
5 + 7 = 12	4 + 9 = 13
5 + 11 = 16	1 + 16 = 17
5 + 19 = 24	9 + 16 = 25
7 + 11 = 18	1 + 16 = 17
7 + 17 = 24	9 + 16 = 25

Reflect

Children's answers will vary. There are many equations with more than 3 solutions. For example, $3x - y = 4$, $p + q = 12$, $a \times b = 24$.

My journal

→ pages 68–69

a) $3a + 5 = 20$
$3a = 15$
$a = 5$
Children's stories will vary. For example: Max buys 3 books costing £a each. He pays with a £20 note and receives £5 change. How much did each book cost?

b) $5b = 17 + 8 = 25$
$b = 5$
Children's stories will vary. For example: There are 17 sweets in one bag and 8 sweets in another bag. b children share them equally. How many sweets does each child get?

Power puzzle

→ page 70

There are 88 rectangles in this grid:
The whole is a 4 by 4 square
Four 3 by 3 squares in different positions
Nine 2 by 2 squares
Sixteen 1 by 1 squares
Twenty-four 2 × 1 rectangles
Sixteen 3 × 1 rectangles
Eight 4 × 1 rectangles
Six 4 × 2 rectangles
Four 4 × 3 rectangles.

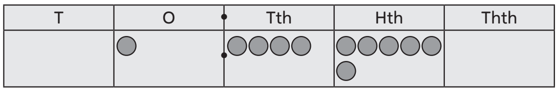
Unit 9 – Decimals

1 Place value to 3 decimal places

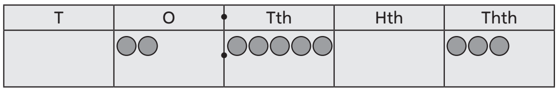
→ pages 71–73

1. a) 2·3
b) 2·36
c) 0·317
d) 20·3

2. a)



b)



3. a) 3 tenths
b) 5 tenths
c) 2 thousandths
d) 5 ones
e) 4 hundreds
f) 4 hundredths

4. a) 0·06
b) 0·9, 0·005
c) 0·01, 0·009
d) 2, 0·6, 0·04

5. a) 2·45 = 2 + 0·4 + **0·05**
b) 7·125 = 7 + **0·1** + **0·02 + 0·005**
c) 0·518 = 0·5 + **0·01 + 0·008**
d) 86·09 = 80 + **6** + **0·09**
e) 0·067 = **0·06** + **0·007**
f) **0·589** = 0·5 + 0·08 + 0·009
g) **6·037** = 6 + 0·03 + 0·007

6. a) 3·296
b) 3·206
c) 3·197

Reflect

Answers will vary depending on what children have learnt.

2 Round decimals

→ pages 74–76

1. a) 2·6 rounded to the nearest whole number is **3**.
b) 15·2 rounded to the nearest whole number is **15**.
c) 7·85 rounded to the nearest whole number is **8**.
d) 5·43 rounded to the nearest whole number is **5**.
5·5 rounded to the nearest whole number is **6**.
5·741 rounded to the nearest whole number is **6**.

2. a) 1·63 rounded to the nearest tenth is **1·6**.
b) 4·875 rounded to the nearest tenth is **4·9**.

3.

Number	Rounded to the nearest whole number	Rounded to one decimal place
3·72	4	3·7
4·18	4	4·2
39·16	39	39·2
0·871	1	0·9
3·025	3	3·0

4. a) 1·712 rounded to 2 decimal places is **1·71**.
b) 1·715 rounded to 2 decimal places is **1·72**.

5. Emma looked at the thousandths digit first, when she should have looked at the tenths digit.
4 < 5 so the whole number rounds down.
12·47 rounded to the nearest whole number is 12.

6. a) Any two of:
6·545, 6·546, 6·547, 6·548, 6·549, 6·551, 6·552, 6·553, 6·554
b) 6·545
c) 6·554

Reflect

Richard is correct. Children should discuss looking at the tenths digit to work out if you need to round up or down to the nearest whole number.

3 Add and subtract decimals

→ pages 77–79

1. a) 1·8 + 5·4 = **7·2**
b) 16·75 + 1·83 = **18·58**
c) 0·194 + 0·907 = **1·101**
d) 13·8 + 26·4 = **40·2**
e) 4·76 + 3·2 = **7·96**
f) 126·9 + 38·45 = **165·35**

2. Toshi has placed the digits in the wrong columns.
3·6 is 3 ones and 6 tenths, not 6 hundredths.
The correct answer is 2·23.

3. a) 36·9 – 12·5 = **24·4**
b) 6·84 – 1·68 = **5·16**
c) 0·729 – 0·052 = **0·677**
d) 6·18 – 1·7 = **4·48**
e) 42·73 – 23·05 = **19·68**
f) 13·5 – 2·49 = **11·01**

4. a) 4·7 – 1·3 = **3·4**
b) 4·7 – 1·35 = **3·35**
c) 4·7 – 1·359 = **3·341**

5. a) 6·3 + **4·88** = 11·18
b) 9·5 – **6·42** = 3·08

Reflect

Every digit must be in its correct place value column, otherwise the addition or subtraction will not be correct.

4 Multiply by 10, 100 and 1,000

→ pages 80–82

1. a) 1·75 × 10 = **17·5**
b) 3·8 × 10 = **38**
c) 2·095 × 10 = **20·95**
d) 26·3 × 10 = **263**

2. a) 3·48 × 100 = **348**
b) 0·19 × 100 = **19**
c) 0·711 × 100 = **71·1**
d) 0·045 × 100 = **4·5**

3. a) 1·9 × 1,000 = **1,900**
b) 1·95 × 1,000 = **1,950**
c) 0·711 × 1,000 = **711**
d) 0·038 × 1,000 = **38**

4. a) Bella has treated the decimal number like a whole number and placed two zeros at the end. This method does not work with decimals as placing two zeros does not change the value of the number: 1·600 is the same number as 1·6.
b) 1·6 × 100 = **160**

5.

Number	× 10	× 100	× 1,000
1·2	12	120	1,200
3·8	38	380	3,800
4·59	45·9	459	4,590
13·7	137	1,370	13,700

6. a) 1·5 × **10** = 15
b) 6·03 × **100** = 603
c) 6·8 × **1,000** = 6,800
d) **0·258** × 100 = 25·8
e) 1·76 × **10** = 17·6
f) **0·03** × 100 = 3
g) 1·7 × 10 × 10 = 1·7 × **100**
h) 3·85 × 10 × 10 × 10 = 3·85 × **1,000**

7. The triangle is worth 10 times the star.

	Solution 1	Solution 2	Solution 3	Solution 4	Solution 5	Solution 6	Solution 7
▲	10	100	1,000	20	200	2,000	30
★	1	10	100	2	20	200	3

Reflect

Children should discuss moving the decimal point and changing the value of the digits.

5 Divide by 10, 100 and 1,000

→ pages 83–85

1. a) 26·3 ÷ 10 = **2·63**
b) 4·5 ÷ 10 = **0·45**
c) 28 ÷ 10 = **2·8**
d) 176 ÷ 10 = **17·6**

2. a) 139 ÷ 100 = 1·39
b) 26·4 ÷ 100 = 0·264
c) 1·8 ÷ 100 = 0·018
d) 3 ÷ 100 = 0·03

3. a) 2,700 ÷ 1,000 = 2·7
b) 169 ÷ 1,000 = 0·169

4.

Number	÷ 10	÷ 100	÷ 1,000
13	1·3	0·13	0·013
140	14	1·4	0·14
2,018	201·8	20·18	2·018

5. a) 21·9 ÷ 10 = **2·19**
b) 184 ÷ 100 = **1·84**
c) 175 ÷ 10 = **17·5**
d) 7,600 ÷ 1,000 = **7·6**
e) 0·59 ÷ 10 = **0·059**

6. a) 18 ÷ **10** = 1·8
b) 2 ÷ **100** = 0·02
c) 39 ÷ **1,000** = 0·039
d) **1·9** ÷ 10 = 0·19

7. Different combinations can be shown:
26 ÷ 10 = 2·6 or 26 ÷ 1,000 = 0·026
260 ÷ 100 = 2·6
20·6 ÷ 10 = 2·06 or 20·6 ÷ 100 = 0·206
2·6 ÷ 100 = 0·026
2·06 ÷ 10 = 0·206

Reflect

The statement is true. Children should write an example that shows that dividing a number by 10 then by 10 again gives the same answer as dividing by 100.

For example: 87 ÷ 10 = 8·7 ÷ 10 = **0·87**
87 ÷ 100 = **0·87**

6 Multiply decimals by integers

→ pages 86–88

1. a) 2 × 0·4 = **0·8**
b) 3 × 0·02 = **0·06**
c) 0·3 × 5 = **1·5**

2. a) 0·4 × 2 = **0·8**
0·4 × 3 = **1·2**
0·4 × 4 = **1·6**
0·4 × 5 = **2·0 or 2**
7 × 0·4 = **2·8**
b) 7 × 3 = **21**
0·7 × 3 = **2·1**
0·07 × 3 = **0·21**
0·007 × 3 = **0·021**
c) Children should notice that the answers to a) are related to the 4 times table and that the answers to b) are related to the fact 7 × 3 = 21.

3. 0·7 × 6 = **4·2**
0·6 × 7 = **4·2**
0·06 × 7 = **0·42**
0·07 × 6 = **0·42**

4. 0·08 × 3 = 0·024 is not correct.
0·08 × 3 = 0·24
Explanations may vary but should discuss the fact 8 × 3 = 24:
- 0·08 is 100 times smaller than 8 so the answer is 100 times smaller than 24
- 0·08 × 3 = 24 ÷ 100 = 0·24
- 8 hundredths × 3 = 24 hundredths = 2 tenths and 4 hundredths = 0·24.

5. a) 0·7 × 2 = **1·4**
b) 6 × 0·8 = **4·8**
c) 0·03 × 3 = **0·09**
d) 0·002 × 4 = **0·008**
e) **0·5** × 7 = 3·5
f) 0·02 × **3** = 0·06
g) 0·02 × **8** = 0·16
h) 6 × **0·4** = 2·4
i) 6 × **0·04** = 0·24
j) 6 × **0·004** = 0·024

6. a) 17 × 8 = **136**   219 × 3 = **657**
   b) 17 × 0·8 = **13·6**   17 × 0·08 = **1·36**
   219 × 0·3 = **65·7**   219 × 0·03 = **6·57**

7. 3 × 0·8 = 2·4
   4 × **0·6** = 2·4
   The missing dimension is 0·6 m.

Reflect

Children should discuss using 4 × 7 = 28 to work out 0·4 × 7 = 2·8.

7 Divide decimals by integers

→ pages 89–91

1. a) 14 ÷ 2 = **7**
   b) 1·4 ÷ 2 = **0·7**
   c) 0·14 ÷ 2 = **0·07**
   Children should notice that the answers all contain the digit 7 but with a different place value.

2. a) 0·6 ÷ 3 = **0·2**
   b) 1·2 ÷ 6 = **0·2**
   c) **0·08** ÷ 4 = **0·02**

3. a) 36 ÷ 4 = **9**   48 ÷ 4 =**12**
   16 ÷ 4 = **4**   3·6 ÷ 4 = **0·9**
   4·8 ÷ 4 = **1·2**   1·6 ÷ 4 = **0·4**
   0·36 ÷ 4 = **0·09**   0·48 ÷ 4 = **0·12**
   0·16 ÷ 4 = **0·04**
   b) 3·6 ÷ 6 = **0·6**   4·8 ÷ 6 = **0·8**
   0·72 ÷ 6 = **0·12**   0·18 ÷ 6 = **0·03**

4. a) 2·4 ÷ **2** = 1·2
   b) 3·6 ÷ **6** = 0·6
   c) 0·36 ÷ **3** = 0·12
   d) 0·45 ÷ **5** = 0·09
   e) 0·45 ÷ **9** = 0·05
   f) **2·8** ÷ 4 = 0·7
   g) **0·49** ÷ 7 = 0·07
   h) **0·24** ÷ 2 = 0·12
   i) **1·2** ÷ 3 = 0·4
   j) **0·025** ÷ 5 = 0·005

5. 4·2 ÷ 6 = 0·7
   0·7 kg is the mass of one box.
   5 × 0·7 = 3·5
   The mass of 5 boxes is **3·5 kg**.

6. a) 8·64 ÷ 6 = **1·44**   b) 9·2 ÷ 8 = **1·15**

7. 0·2 ÷ 5 = **0·04**
   Oliver could convert 0·2 to 20 hundredths.
   20 hundredths ÷ 5 = 4 hundredths = 0·04.

Reflect

0·24 ÷ 6 = 0·4 is ten times too large.
0·24 ÷ 6 = **0·04**

8 Fractions to decimals

→ pages 92–94

1. $\frac{1}{4}$ = 0·25
   $\frac{1}{2}$ = 0·5
   $\frac{3}{4}$ = 0·75
   $\frac{4}{4}$ = 1

2. a) 0·2
   b) $\frac{1}{10}$ = **0·1** $\frac{3}{10}$ = **0·3**
   $\frac{7}{10}$ = **0·7** $\frac{9}{10}$ = **0·9**

3. a) $\frac{2}{5}$ = **0·4**   c) $\frac{14}{20}$ = **0·7**   e) $\frac{11}{20}$ = **0·55**
   b) $\frac{8}{20}$ = **0·4**   d) $\frac{4}{5}$ = **0·8**   f) $\frac{17}{20}$ = **0·85**

4.

Fraction	$\frac{7}{100}$	$\frac{12}{100}$	$\frac{38}{100}$	$\frac{79}{100}$	$\frac{2}{100}$
Decimal	0·07	0·12	0·38	0·79	0·02

5. a) $\frac{1}{50}$ = $\frac{\mathbf{2}}{100}$ = **0·02**   c) $\frac{3}{50}$ = $\frac{\mathbf{6}}{100}$ = **0·06**
   b) $\frac{3}{200}$ = $\frac{\mathbf{15}}{1{,}000}$ = **0·015**   d) $\frac{99}{500}$ = $\frac{\mathbf{198}}{\mathbf{1{,}000}}$ = **0·198**

6. Various responses are possible. Children could explain that $\frac{1}{4}$ and $\frac{3}{12}$ are both equivalent to 0·25.

7. a) $\frac{4}{5}$ = **0·8** $\frac{7}{10}$ = **0·7** $\frac{77}{100}$ = **0·77**
   b) Smallest to greatest: $\frac{7}{10}$, $\frac{77}{100}$, $\frac{4}{5}$

8. Max is correct. 0·28 is equivalent to $\frac{28}{100}$ or $\frac{7}{25}$. 7 of the 25 squares in the grid are shaded so 0·28 or 28% of the grid is shaded.

Reflect

Children practise giving the equivalents of fractions and decimals relating to fifths, tenths and quarters.

9 Fractions as division

→ pages 95–97

1. $\frac{1}{8}$ = 0·125
   $\frac{1}{5}$ = 0·2
   $\frac{1}{10}$ = 0·1

2. a) Aisha has put the digits the wrong way around. 5 should be divided by 6, not 6 by 5.
   b) $\frac{5}{6}$ = 0·833 to 3 decimal places
   c) Recurring means that a digit or set of digits keeps repeating without ever finishing. $\frac{5}{6}$ is recurring because the answer keeps repeating 3 unless you round it.

3. a) Children should carry out the division correctly to show 0·75 in the answer line.
   b) $\frac{5}{8}$ = 0·625 $\frac{12}{5}$ = 2·4

4. a) $\frac{7}{8}$ = **0·875**

b) $\frac{5}{12}$ = **0·417** to 3 decimal places

c) $\frac{2}{7}$ = **0·286** to 3 decimal places

d) $\frac{14}{15}$ = **0·933** to 3 decimal places

5. a) $\frac{1}{9}$ = **0·111** $\frac{2}{9}$ = **0·222**

$\frac{3}{9}$ = 3 ÷ 9 = **0·333** $\frac{4}{9}$ = 4 ÷ 9 = **0·444**

b) $\frac{5}{9}$ = **0·556**

$\frac{6}{9}$ = **0·667**

$\frac{7}{9}$ = **0·778**

$\frac{8}{9}$ = **0·889**

$\frac{9}{9}$ = **1·000**

$\frac{10}{9}$ = **1·111**

$\frac{11}{9}$ = **1·222**

$\frac{19}{9}$ = **2·111**

Reflect

Answers will vary depending on what children have learnt.

My journal

→ page 98

3 × 0·8 ÷ 20 = **2·4 ÷ 20 = 0·12**
6 × 0·8 ÷ 20 = **4·8** ÷ 20 = 0·24
20 × 0·8 ÷ 20 = **16 ÷ 20 = 0·8**
100 × 0·8 ÷ 20 = **80** ÷ 20 = 4

Power play

→ page 99

A wide variety of answers are possible. For example, 1·3 × 5 = 6·5; 4·2 × 6 = 25·2. Children may need help checking their answers as they progress through the game.

Unit 10 – Percentages

1 Understand percentages

→ pages 100–102

1. a) 17%
b) 60%
c) 3%
d) 93%

2. Children should shade:
a) 4 columns or rows to show 40%.
b) 1 column or row plus 5 squares in the adjacent row or column to show 15%.

3. a) 47% is already shaded.
b) Children should shade 15 squares in one colour.
c) Children should shade 21 squares in another colour.
d) 100% – (47% + 15% + 21%) = 17% is not shaded.

4. a) 50% of the numbers are even.
b) 20% of the numbers are multiples of 5.
c) 19% of the numbers contain the digit 1.
d) 10% of the numbers are squares numbers.

5. $\frac{36}{100}$ = 36%

6. a) $\frac{11}{50} = \frac{22}{100}$ = **22%** is shaded.
b) Children should shade 10 squares.
c) 5% of 50 = 2·5 so children cannot show this in whole squares, but they could shade $2\frac{1}{2}$ squares.

Reflect

Per cent means out of 100, so percentages are always shown out of 100. Fractions of other amounts can also be expressed as percentages but using equivalent fractions out of 100.

2 Fractions to percentages

→ pages 103–105

1. a) $\frac{1}{2}$ = **50%**
b) $\frac{3}{4}$ = **75%**
c) $\frac{1}{10}$ = **10%**
d) $\frac{9}{10}$ = **90%**

2. a) $\frac{2}{10}$ = **20%**
$\frac{7}{10}$ = **70%**
$\frac{8}{10}$ = **80%**
b) $\frac{1}{5}$ = **20%**
$\frac{2}{5}$ = **40%**
$\frac{3}{5}$ = **60%**
$\frac{4}{5}$ = **80%**

3. a) $\frac{11}{50} = \frac{\mathbf{22}}{100}$ = **22%**
b) $\frac{17}{50} = \frac{\mathbf{34}}{100}$ = **34%**
c) $\frac{12}{25} = \frac{\mathbf{48}}{100}$ = **48%**
d) $\frac{9}{25} = \frac{\mathbf{36}}{100}$ = **36%**
e) $\frac{11}{20} = \frac{\mathbf{55}}{100}$ = **55%**
f) $\frac{84}{200} = \frac{\mathbf{42}}{100}$ = **42%**

4. a) $\frac{9}{25} = \frac{36}{100}$ = **36%**
b) $\frac{12}{40} = \frac{3}{10}$ = **30%**

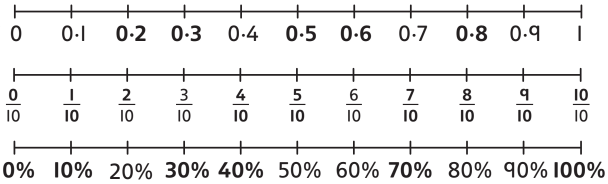
5. $\frac{24}{40} = \frac{6}{10}$ = 60%

Reflect

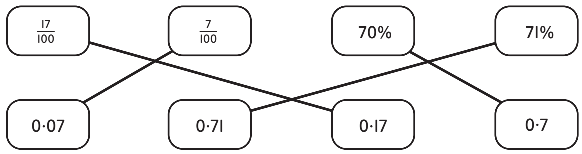
Children should explain converting a fraction to an equivalent fraction in hundredths or tenths in order to convert it to a percentage.

3 Equivalent fractions, decimals and percentages

→ pages 106–108

1.


2. a) 0·39 = $\frac{39}{100}$ = 39%
b) 0·25 = $\frac{25}{100}$ = 25%
c) 0·4 = $\frac{40}{100}$ = 40%
d) 1·0 = $\frac{100}{100}$ = 100%

3.


4. a) $\frac{11}{25}$ = 44% = 0·44
$\frac{39}{50}$ = 78% = 0·78
b) 35% = $\frac{35}{100}$ = 0·35
96% = $\frac{96}{100}$ = 96%

5.

Percentage	Decimal	Fraction
66%	0·66	$\frac{66}{100}$
60%	0·6	$\frac{60}{100} = \frac{6}{10}$
9%	0·09	$\frac{9}{100}$
90%	0·9	$\frac{90}{100} = \frac{9}{10}$

6. Jamie has not multiplied each decimal by 100.
0·43 is 43% because 0·43 × 100 = 43.
0·4 × 100 = 40, so 0·4 = 40%.
0·125 × 100 = 12·5, so 0·125 = 12·5%.

Reflect

A good estimate is between 60% and 70%, shown with equivalent fractions and decimals:

60% = 0·6 = $\frac{6}{10} = \frac{3}{5}$

65% = 0·65 = $\frac{65}{100} = \frac{13}{20}$

70% = 0·7 = $\frac{70}{100} = \frac{7}{10}$

4 Order fractions, decimals and percentages

→ pages 109–111

1. Children should circle:

a) 75% ($\frac{73}{100}$ = 73% < 75%)

b) 75% ($\frac{7}{10}$ = 70% < 75%)

c) 0·79 (0·79 = 79% > 75%)

d) 78% $\left(\frac{3}{4}\right.$ = 75% < 78%$\left.\right)$

2. a) $\frac{27}{50} = \frac{54}{100}$ = 54%

b) $\frac{27}{50}$ > 48% because 54% > 48%.

3. Children should circle:

a) 18% (0·22 = 22% > 18%)

b) $\frac{3}{20}$ (3/20 = 15% < 18%)

c) 18% (0·3 = 30% > 18%)

d) $\frac{13}{100}$ ($\frac{13}{100}$ = 13% < 18%)

4. a) $\frac{9}{20}$ = 48% $\frac{5}{25}$ = 20% 0·68 = 68%

b) Smallest to largest: $\frac{5}{25}$, $\frac{9}{20}$, 0·68

5. a) $\frac{4}{5}$ **<** 85% c) 99% **>** $\frac{180}{200}$

b) $\frac{3}{10}$ **<** 45% d) 0·44 **>** $\frac{18}{50}$

6. 0·8 = 80%, so 1·8 = 180%

$\frac{17}{20}$ = 85%, so $1\frac{17}{20}$ = 185%

180% < 185%, so 1·8 < $1\frac{17}{20}$.

1·8 is not more than $1\frac{17}{20}$.

7. a) $\frac{4}{9}$ = 0·444 2 × $\frac{4}{9}$ = 0·889 = 88·9% of one apple
Lexi has eaten the most apple. Children are most likely to use two hundredths grids to shade and compare each amount. They may also use fraction strips.

b) Children had to assume that the apples are the same size.

Reflect

To order fractions, decimals and percentages, **change the fractions and decimals into percentages or change the fractions and percentages into decimals.**

5 Simple percentage of an amount

→ pages 112–114

1. a) 4 d) 350
b) £48 e) 9 kg
c) 75 m f) £98

2. 10 × 10% = 100% so you can divide by 10 to find 10%. 5 × 20% = 100%, so you need to divide by 5 to find 20%.

3.

Starting number	10% of the number	20% of the number
400	40	80
410	41	82
41	4·1	8·2
401	40·1	80·2
14	1·4	2·8
20·5	2·05	4·1

4. 10,400 fans support the away team.

5. a) Cocoa: 20% of 400 g = 80 g
Sugar: 25% of 400 g = 100 g
100 g – 80 g = 20 g
There are **20 g** more sugar than cocoa.

b) $\frac{4}{16} = \frac{1}{4}$ = 25%
25% of the bar = 100 g
20% of 100 g = 20 g
Andy has eaten **20 g** of cocoa.

Reflect

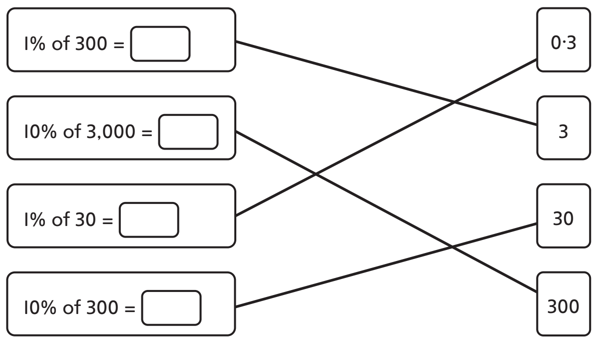
Lexi is correct. If she can use 10% to find 1%, 5% and multiples of 10%, then she can find any percentage.

6 Percentage of an amount – 1%

→ pages 115–117

1. a) 6 d) 17 g) 5·5 kg
b) 7 e) 32 h) 0·6
c) 9 f) £26 i) 70p

2.



3. There are **12** Green Goblins.
There are **36** Sapphire Specials.

4. a) 1% = £15 b) 1% = 1·5 m c) 1% = 150 g
2% = £30 2% = 3 m 3% = 450 g
3% = £45 3% = 4·5 m 6% = 900 g

5. a) 2% of 600 km = **12 km**
b) 10% of 56 cm = **5·6 cm (56 mm)**
c) 3% of £250 = **£7·50**
d) 25% of 18 = **4·5**

6. Reena is correct, 3% of 200 = 2% of 300 = 6
Where the amount is a multiple of 100, swapping the value of the hundreds digit with the percentage amount gives the same result. For example, 5% of 600 = 30 and 6% of 500 = 30.

Reflect

Children should explain finding 1% and multiplying by 3. They could draw a bar model or grid.

7 Percentages of an amount

→ pages 118–120

1. a) 30% of £400 = £120
   400 ÷ 10 = **40**
   40 × 3 = **120**
   b) 60% of 400 g = **240 g**
   c) 75% of £60 = **£45**
   d) 15% of £120 = **£18**
2. There are **24** red, **12** yellow and **204** pink tulips.
3. a) 50% of 700 = **350**
   10% of 700 = **70**
   1% of 700 = **7**
   b) Clockwise from top left:
   11% of 700 = **77**
   51% of 700 = **357**
   9% of 700 = **63**
   49% of 700 = **343**
   99% of 700 = **693**
   5% of 700 = **35**
   6% of 700 = **42**
   30% of 700 = **210**
   33% of 700 = **231**
4. 100% – (11% + 29%) = 60% finished the marathon.
   60% of 32,500 = 19,500
   19,500 people completed the race.
5. The whole area of the pitch = 70 × 100 = 7,000 m^2
   Monday: 30% of 7,000 = 2,100 m^2
   Tuesday: (100% – 30%) ÷ 2 = 35% of 7,000 = 2,450 m^2
   Wednesday: 1,250 m^2
   Thursday = 7,000 – (2,100 + 2,450 + 1,250) = **1,200 m^2** left to mow.

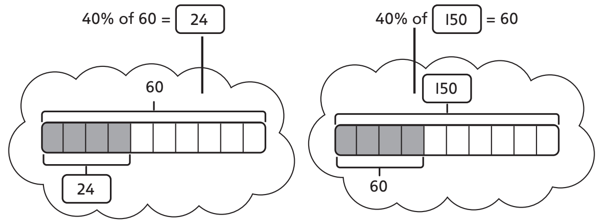
Reflect

Children may suggest a variety of methods to find 85% of 300. For example:

- 85 × 1% = 85 × 3 = **225**
- 50% + 30% + 5% = 150 + 90 + 15 = **225**.

8 Percentages (missing values)

→ pages 121–123

1. a) 50% of **76** = 38
   b) 25% of **64** = 16
   c) 10% of **15** = 1·5
2. 

3. a) There are 27 lemon sweets.
   b) The string was 320 cm before it was cut.
4. Aki started with the number 420.
5. a) 10% of **90** = 9
   20% of **45** = 9
   30% of **30** = 9
   b) 30% of **300** = 90
   30% of **600** = 180
   30% of **6,000** = 1,800
6. 15% of Width = 45 cm
   10% of Width = 30 cm
   100% of Width = 300 cm
   Perimeter = 2 × Width + 2 × Height = 300 + 300 + 20 + 20 = **640 cm**

Reflect

Children should draw bar models to show the difference between '20% of 45 = ?' and '20% of ? = 45'.

My journal

→ page 124

1. a) Children should shade 25% of the diagram. A common misconception can be demonstrated when children only shade in 1 of the 4 sections.
   b) 35% of the bar model should be shaded..

Power play

→ page 125

of	900	170	260	25	1
10%	90	17	26	2·5	0·1
1%	9	1·7	2·6	0·25	0·01
75%	675	127·25	195	18·75	0·75
100%	900	170	260	25	1
99%	891	168·3	257·4	24·75	0·99

Unit 11 – Measure – perimeter, area and volume

1 Shapes – same area

➜ pages 126–128

Discover

1. a) Area of rectangle A = **20** cm^2
   Area of rectangle B = **20** cm^2
   Rectangles A and B have the same area.
   Children should tick: **Yes**.
   b) Area of rectangle C = **48** cm^2
   Area of rectangle D = **48** cm^2
   Rectangles C and D have the same area.
   Children should tick: **Yes**.
2. a) Children should draw:
   Shape A: a 6 × 6 square
   Shape B: a 12 × 3 rectangle
   Shape C: any compound shape.
   b) Children should draw other shapes with an area of 36 cm^2 but different dimensions.
3. B: **3** cm
   C: **2** cm and **15** cm
4.

L cm	48	24	16	12	8
W cm	1	2	3	4	6

Reflect

Aki can work out the area of his room by multiplying:
4 m × 3 m or 3 m × 4 m = 12 m^2.

2 Area and perimeter

➜ pages 129–131

1. a)

Shape	Area (cm^2)	Perimeter (cm)
A	16	16
B	18	18
C	22	22

   b) For shapes A, B and C, the perimeter in cm is the same as the area in cm^2.
2. a) Children should draw a shape with an area of 4 squares.
   b) Children should draw a shape with a perimeter of 8 squares.
3.

Shape	Area (cm^2)	Perimeter (cm)
A	6	14
B	6	14
C	5	12
D	5	12

   The shapes with equal areas are: **A and B** and **C and D**.
4. All the shapes have the same area but different perimeters.
5. Andy is correct. When one of the corner squares or a square inside is removed, the perimeter stays the same. Removing any other square from the outside edges increases the perimeter.

Reflect

Children should provide a counter example to show two shapes with the same area which have different perimeters. For example, a 5 × 4 and a 2 × 10 rectangle have the same area but different perimeters.

3 Area and perimeter – missing lengths

➜ pages 132–134

1. a)

Shape	Area (cm^2)	Perimeter (cm)
A	18	16
B	14	16
C	16	16
C	7	16

   b) I notice that **all the shapes have the same perimeter but different areas**.
2. A: Width = **2** cm, Area = **14** cm^2
   B: Width = **6** cm, Area = **18** cm^2
   I notice that **both shapes have the same perimeter but different areas**.
3. Children should draw:
   A: 3 × 3 square
   B: 5 × 1 rectangle
   C: 4 × 2 rectangle.
4. A is a 7 × 8 rectangle with an area of 56 m^2.
   B is a 1 × 14 rectangle with an area of 14 m^2.
5. Squares **D or E** can be removed without changing the perimeter.
6. The greatest possible area is 4 × 5 = **20 m^2**.

Reflect

Children should provide a counter example to show two shapes which have the same perimeter but which have different areas. For example, a 6 × 3 and a 2 × 7 rectangle both have a perimeter of 18 but have different areas.

4 Area of a triangle – counting squares

→ pages 135–137

1. a) 8 cm^2 c) 8 cm^2
b) 4 cm^2

2. A: **8** cm^2 B: **7** cm^2 C: **3** cm^2 D: **3** cm^2

3. Area = **7·5 cm^2**

4. a) Various triangles are possible, such as height 5 cm and base 8 cm.
b) Children's answers will depend on part a). Children will need to measure, not count squares, as any diagonal lines will be more than 1 cm.

5. Jess is correct. The area of B is twice A (12 cm^2) because they have the same height but the base of B (8 cm) is double the base of A (4 cm).

6. Children should estimate approximately 20 cm^2.

Reflect

Answer will vary according to the methods children chose.

5 Area of a right-angled triangle

→ pages 138–140

1. a) Area = (**6** × **8**) ÷ 2 = **24** cm^2
b) (**5** × **8**) ÷ 2 = **20** cm^2
c) (**9** × **3**) ÷ 2 = **13·5** m^2
d) (**10** × **4·5**) ÷ 2 = **22·5** m^2

2. The area A is (4 × 5) ÷ 2 = 10 cm^2.
The area of B is (4 × 3) ÷ 2 = 6 cm^2.
For B, Danny has used the dimension of the diagonal instead of the base.

3. Children should circle triangle **A** (Area = 128 cm^2).

4. The area of the shaded triangle is (8 × 7) ÷ 2 = **28 cm^2**.

5. Area of the triangle is (8 × 5) ÷ 2 = 20 cm^2.
Area of the rectangle is 5 × 12 = 60 cm^2.
The area of the paper left is 60 – 20 = **40 cm^2**.

Reflect

The area of a triangle is half of the area of the rectangle surrounding it.

Find the area of the rectangle, then halve it to find the area of the triangle.

6 Area of any triangle

→ pages 141–143

1. a) (**5** × **6**) ÷ 2 = **15 m^2**
b) (**6** × **1·5**) ÷ 2 = **4·5 m^2**
c) (**17** × **4**) ÷ 2 = **34 km^2**

2. Children should draw triangles with a base of 4 cm and a height of 4 cm. The triangles have the same base, height and area but can still be different shapes.

3. a) Ben forgot to halve the base × height when he was working out the area.
The area of the triangle is (3 × 8) ÷ 2 = 12 cm^2.
b) Alex is not correct. Alex used the wrong dimension for the height, 10 cm instead of 8 cm.
The area of the triangle is (8 × 12) ÷ 2 = 48 cm^2.

4. a) Area = **35 cm^2**
b) Area = **6 cm^2**

5. a) Area of right-angled triangle = 800 cm^2
Area of small unshaded triangle = 440 cm^2
Area of shaded triangle = 800 – 440 = **360 cm^2**
b) Answers will depends on the square and triangles the children draw.

Reflect

Children should explain working out the base and height, multiplying them together and dividing by 2.

Area of triangle = base × height ÷ 2 = (5 × 2) ÷ 2 = 5 cm^2

7 Area of a parallelogram

→ pages 144–146

1. Area of A = **4** cm × **2** cm = **8** cm^2
Area of B = **3** cm × **2** cm = **6** cm^2
Area of C = **3** cm × **1** cm = **3** cm^2

2. A = **4** cm × **3** cm = **12** cm^2 C = **3** cm × **2** cm = **6** cm^2
B = **2** cm × **6** cm = **12** cm^2 D = **12** cm × **1** cm = **12** cm^2
Parallelogram **C** is the odd one out because **it has a different area to all the others**.

3. a) A = **10** × **12** cm = **120 cm^2**
B = **10** × **13** cm = **130 cm^2**
b) Area of parallelogram A **<** area of parallelogram B.

4. a = **10** m b = **25** m c = **20** m

5. The areas of these parallelograms are the same because the bases are all equal (4 cm) and the heights are all equal (4 cm).

6. Area of the path = (2 × 1) + (1 × 1) = **3 m²**.

Reflect

c) **30 cm²**
Base × vertical height = 5 cm × 6 cm = 30 cm².

8 Problem solving – area

→ pages 147–149

1. a) Area = **56** cm²
b) Area = **36** cm²
c) Area = **80** cm²

2. a = **6 cm** b = **3 cm** c = **6 cm**

3. a) Area = **6** cm² b) Area = **30** cm²

4. The length of the base of the parallelogram = **5** cm.

5. Area of big square = 20 × 20 = 400 cm²
Area of small square = 16 × 16 = 256 cm²
Area of 12 rectangles = 400 – 256 = 144 cm²
Area of 1 rectangle = 144 ÷ 12 = 12 cm²
Area = **12 cm²**

Reflect

Children's answers will vary depending on what they have learnt.

9 Problem solving – perimeter

→ pages 150–152

1. Race 1 = 1,000 m Race 2 = 960 m
Race **1** is longer.

2. Perimeter = **48** cm

3. Perimeter = **38** cm

4. Area A has the longer perimeter.

5. Shape A is longer as it comprises the 4 diagonal 10 cm lengths and 4 extra pieces which are 2 cm each. Shape B is only the 4 diagonal 10 cm lengths.
Shape A = 48 cm. Shape B = 40 cm

Reflect

When I cut a rectangular piece of paper into two equal parts, the perimeters of the new shapes **will be shorter than the perimeter of the rectangle**.

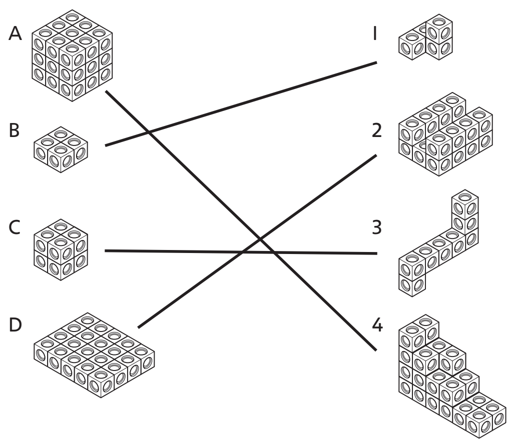
10 Volume – count cubes

→ pages 153–155

1. a) There are **6** 1 cm³ cubes in the solid.
Volume = **6** cm³
b) There are **8** 1 cm³ cubes in the solid.
Volume = **8** cm³
c) There are **8** 1 cm³ cubes in the solid.
Volume = **8** cm³

2. Children should circle all three shapes.

3.



4. Lee has not counted the hidden cube in the centre.
The volume is 7 cm³.

5. a) Volume = 5 × 2 × 3
= 5 × 6
= 30 cm³
b) Volume = 4 × 2 × 3
= 4 × 6
= 24 cm³

6. Ella is not correct. She cannot make a cube using 9 blocks. She could use 8 of them to make a 2 cm × 2 cm × 2 cm cube. She would need 27 to make the next size of cube, a 3 cm × 3 cm × 3 cm.

7. Filip is not correct. The volume of the cylinder depends on the width (diameter) of the circular face. It will be less than the volume of a cuboid with the same height and the same width.

Reflect

A 3 cm × 3 cm × 3 cm can be made from 27 smaller cubes because 3 × 3 × 3 = 27.

11 Volume of a cuboid

→ pages 156–158

1. a) Volume = 4 × 2 × 1 = **8** cm³
b) Volume = **3** × **3** × **4** = **36** cm³
c) Volume = **3** × **3** × **3** = **27** cm³
d) Volume = **5** × **4** × **3** = **60** cm³

2. Children should explain two of the following:
   8 × (7 × 5)
   (8 × 7) × 5
   (8 × 5) × 7
   Volume = 280 cm^3
3. The volume of the coloured glass = **440 cm^3**.
4. a) The width = **8** cm
   b) The length = **12** cm
5. h = **4** cm
6. Children's answers will vary. Possibilities include 10 × 4 × 2; 10 × 8 × 1; 20 × 4 × 1; 8 × 5 × 2.
7. **48** packets of tissues fit in the box.

Reflect

Children should explain: volume = width × length × height = 4 × 1 × 3 = 12 cm^3.

They should notice that the height has been given twice in the diagram, but that they only need to use it once.

My journal

→ pages 159–160

1 a) I know that the area of this parallelogram is **108 cm^2** because you multiply the base by the vertical height to find the area of a parallelogram.
  b) I know that the area of this triangle is **24·75 cm^2** because you multiply the base by the vertical height then divide by 2 to find the area of a triangle.

2. Children should draw a counter example to show that this statement is false. For example, a 2 × 4 and a 1 × 8 rectangle have the same area but different perimeters.
3. Children should justify why they think their shapes are the odd ones out.
   A: because I cannot find the area
   C: because one of the sides has a decimal/ because the perimeter is an odd number.

Power puzzle

→ page 161

1. Yes, Amy can fill the second tank. ⅓ of the larger tank is 64 cm^3 and the smaller tank also has a volume of 64 cm^3.
2. Volume of water before = 20 × 20 × 2·5 = 1,000 cm^3
   Volume of water after = 20 × 20 × 5 = 2,000 cm^3
   Difference in volume = volume of cube = 2,000 – 1,000 = 1,000 cm^3
   Volume of cube = width × length × height = 1,000 cm^3
   Dimensions of cube: **10** cm × **10** cm × **10** cm