Unit 7: Decimals

Lesson 1: Multiplying by 10, 100 and 1,000

→ pages 6–8

1. a) 1·3 × 10 = 13; 1 counter in tens column and 3 counters in ones column.
b) 3·03 × 10 = 30·3; 3 counters in tens column and 3 counters in tenths column.

2. a) 1,008; 1st box ticked.
b) 8,103, 2nd box ticked.
c) 0·012 × 1,000 = 12

3. a) 1·1 × 10 = 11
1·2 × 10 = 12
1·02 × 10 = 10·2
102 = 1·02 × 100
b) 9,990 = 99·9 × 100
99,990 = 999·9 × 100
0·999 × 100 = 99·9
9·999 × 1,000 = 9,999
c) 2·5 × 10 = 25
2·5 × 20 = 50
2·5 × 200 = 500
2·5 × 2,000 = 5,000

4. a) The total cost of the order will be £600.
b) The total mass of all the bricks is 1,000 kg.

5. 5·02 × 100 = 502
Explanations will vary; for example, children could show 5·02 with counters on a place value grid and move counters two columns to the left to represent multiplying by 100 to give 502.

6. a) 0·025 × 100 = 10 × 0·25
1,000 × 1·01 = 101 × 10
0·09 × 1,000 = 10 × 9
3·5 × 40 = 400 × 0·35
2·5 × 200 = 5 × 100
5,000 × 0·03 = 50 × 3
b) Answers will vary but triangle should be 10 × star in each case; for example:

	Solution 1	Solution 2	Solution 3	Solution 4	Solution 5	Solution 6	Solution 7
▲	10	100	20	30	40	50	200
★	1	10	2	3	4	5	20

Reflect

Answers will vary but check children recognise that multiplying by 10, 100 and 1,000 involves exchanging on a place value grid and that the digits move to the left on the grid: once for ×10, twice for ×100 and three times for ×1,000.

Lesson 2: Dividing by multiples of 10, 100 and 1,000

→ pages 9–11

1. a) 1·7 b) 0·15

2. The tap loses 1·25 litres of water each day.

3. 2·05; tick bottom left-hand image.

4. 0·4 ÷ 10 = 0·04

5. 30·6 ÷ 100 = 0·306 3·6 ÷ 10 = 0·36 36 ÷ 1,000 = 0·036

6. a) 1·2, 0·8, 0·6, 0·4
b) 0·04, 0·06, 0·08, 0·03
c) 1·2, 0·8, 0·6, 0·2

7. Completed divisions to say:
206 ÷ 1,000 = 0·206
26 ÷ 1,000 = 0·026
260 ÷ 100 = 2·6
20·6 ÷ 10 = 2·06
2·6 ÷ 100 = 0·026
2·06 ÷ 10 = 0·206

Reflect

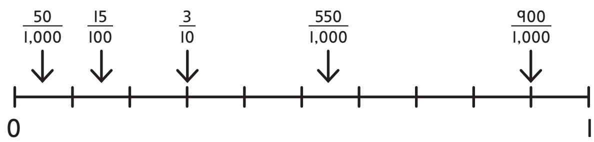
Answers will vary; for example: Danny has a rope that is 5·7 m in length and wants to cut 10 equal pieces. How long should each piece be? (5·7 ÷ 10 = 0·57)

Lesson 3: Decimals as fractions

→ pages 12–14

1. a) 0·007 is equivalent to $\frac{7}{1,000}$
b) 0·131 is equivalent to $\frac{131}{1,000}$
c) 0·997 is equivalent to $\frac{997}{1,000}$
d) 0·51 is equivalent to $\frac{51}{100}$

2. $\frac{900}{1,000}$ = 0·9 $\frac{15}{100}$ = 0·15 $\frac{3}{10}$ = 0·3 $\frac{550}{1,000}$ = 0·55 $\frac{50}{1,000}$ = 0·05



3. 0·3 ➜ $\frac{300}{1,000}$
0·03 ➜ $\frac{30}{1,000}$
0·33 ➜ $\frac{33}{100}$
0·303 ➜ $\frac{303}{1,000}$
3·3 ➜ $\frac{33}{10}$
0·003 ➜ $\frac{3}{1,000}$

4. a) 0·04 = $\frac{4}{100}$ = $\frac{1}{25}$ c) 0·04 = $\frac{4}{1,000}$ = $\frac{1}{250}$
b) 0·05 = $\frac{5}{100}$ = $\frac{1}{20}$ d) 0·005 = $\frac{5}{1,000}$ = $\frac{1}{200}$

5. a) Circled: 1 $\frac{823}{1,000}$ b) Circled: $\frac{17}{20}$

6. a) Two possible answers:
$0{\cdot}1 + 0{\cdot}02 = \frac{3}{25}$ (= 0·12)
$0{\cdot}105 + 0{\cdot}015 = \frac{3}{25}$ (= 0·12)
b) Two pairs:
$2 - 1{\cdot}98 = \frac{5}{250}$ (= 0·02)
$1{\cdot}02 - 1 = \frac{5}{250}$ (= 0·02)

Reflect

Explanations will vary; for example:

0·555 is a decimal involving tenths, hundredths and thousandths; there are 5 tenths, 5 hundredths and 5 thousandths which are equivalent to 555 thousandths or $\frac{555}{1,000}$. Both 555 and 1,000 are divisible by 5 (they end in a 0 or a 5), so $\frac{555}{1,000}$ can be simplified to $\frac{111}{200}$ (111 × 5 = 555 and 200 × 5 = 1,000).

Lesson 4: Fractions as decimals (I)

➜ pages 15–17

1. a)

O	•	Tth	Hth	Thth
0	•	0	3	

b)

O	•	Tth	Hth	Thth
0	•	3	4	

c)

O	•	Tth	Hth	Thth
0	•	0	0	3

d)

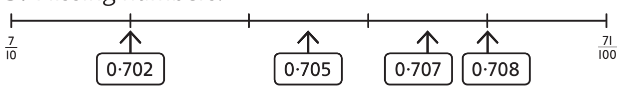
O	•	Tth	Hth	Thth
0	•	3	4	5

2. a) Circled: 7·7 b) Circled: 3·7

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

4. a) $\frac{1}{50} = \frac{2}{100} = 0{\cdot}02$ d) $\frac{3}{50} = \frac{6}{100} = 0{\cdot}06$
b) $\frac{3}{200} = \frac{15}{1,000} = 0{\cdot}515$ e) $\frac{99}{500} = \frac{198}{1,000} = 0{\cdot}198$
c) $\frac{99}{250} = \frac{396}{1,000} = 0{\cdot}396$

5. Missing numbers:



6. Answers will vary; for example:

Between 0 and I	Between I and I0	Greater than I0
$\frac{2}{4} = 0{\cdot}5$	$\frac{500}{250} = 2$	$\frac{500}{25} = 20$
$\frac{2}{5} = 0{\cdot}4$	$\frac{500}{200} = 2{\cdot}5$	$\frac{250}{5} = 50$
$\frac{2}{25} = 0{\cdot}08$	$\frac{25}{5} = 5$	$\frac{50}{4} = 12{\cdot}5$
$\frac{5}{50} = 0{\cdot}1$	$\frac{200}{25} = 8$	$\frac{200}{4} = 50$

Reflect

Answers will vary; check that children recognise that in both cases they need to use equivalent fractions to either simplify a fraction or convert it to a fraction in tenths, hundredths, or thousandths. When writing fractions as tenths, hundredths or thousandths, the digits in the numerator are the same as the digits in the decimal.

The difference is that when converting from decimals to fractions they need to simplify the fractions using division and common factors, whereas when converting from fractions to decimals they need to use multiplication so that they can write the fractions with 10, 100 or 1,000 as a denominator (as appropriate).

Lesson 5: Fractions as decimals (2)

➜ pages 18–20

1. 0·80 0·30 0·28

2. A = $\frac{1}{20} = 0{\cdot}05$ C = $\frac{9}{20} = 0{\cdot}45$
B = $\frac{3}{10} = 0{\cdot}3$ D = $\frac{6}{10} = 0{\cdot}6$

E = $\frac{4}{10} = 0{\cdot}4$ G = $\frac{28}{10} = 2{\cdot}8$
F = $\frac{12}{10} = 1{\cdot}2$ H = $\frac{36}{10} = 3{\cdot}6$

3. $\frac{3}{12} = \frac{1}{4}$ $\frac{7}{50} = \frac{17}{100}$ $\frac{81}{250} = \frac{324}{1,000}$
1 ÷ 4 17 ÷ 100 324 ÷ 1,000
0·25 0·17 0·324

4. Children complete the three division calculations to work out:
$\frac{5}{8} = 0{\cdot}625$ $\frac{5}{12} = 0{\cdot}4166 \ldots = 0{\cdot}417$ (to 3 dp) $\frac{12}{5} = 2{\cdot}4$

5. a) $\frac{1}{6} = 0{\cdot}166$ (to 3 dp) c) $\frac{54}{1,000} = 0{\cdot}027$
b) $\frac{16}{80} = 0{\cdot}2$ d) $\frac{14}{24} = 0{\cdot}583$ (to 3 dp)

6. a) $\frac{1}{9} = 1 \div 9$ $\frac{2}{9} = 2 \div 9$

0 · I I I …
9 | I · ¹0 ¹0 ¹0

0 · 2 2 2 …
9 | 2 · ²0 ²0 ²0

$\frac{3}{9} = 3 \div 9$ $\frac{4}{9} = 4 \div 9$

0 · 3 3 3 …
9 | 3 · ³0 ³0 ³0

0 · 4 4 4 …
9 | 4 · ⁴0 ⁴0 ⁴0

b) Rounded to three decimal places:
$\frac{5}{9} = 0{\cdot}556$ $\frac{9}{9} = 0{\cdot}999 \ldots = 1$
$\frac{6}{9} = 0{\cdot}667$ $\frac{10}{9} = 1{\cdot}111$
$\frac{7}{9} = 0{\cdot}778$ $\frac{11}{9} = 1{\cdot}222$
$\frac{8}{9} = 0{\cdot}889$ $\frac{19}{9} = 1{\cdot}111$

Reflect

Methods may vary; for example:

0 · 6 2 5
8 | 5 · ⁵0 ²0 ⁴0

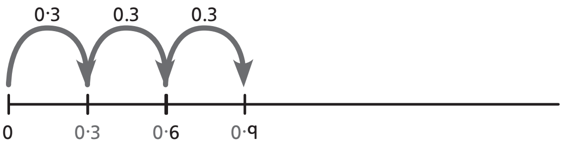
So, $\frac{5}{8} = 0{\cdot}625$
$\frac{55}{100} = 0{\cdot}55$ (using decimal place value)
Comparing the tenths, 6 is more than 5, so $\frac{5}{8} > 0{\cdot}55$.

Lesson 6: Multiplying decimals (1)

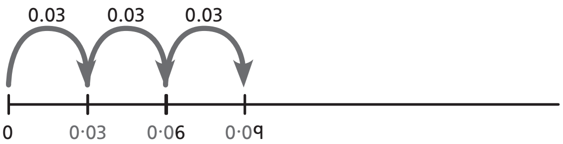
→ pages 21–23

1. 4 × 0·2 = 0·8
3 × 0·02 = 0·06

2. a) 3 × 0·3 = 0·9, 2 more jumps of 0·3 on the number line to show 0·6 and 0·9:



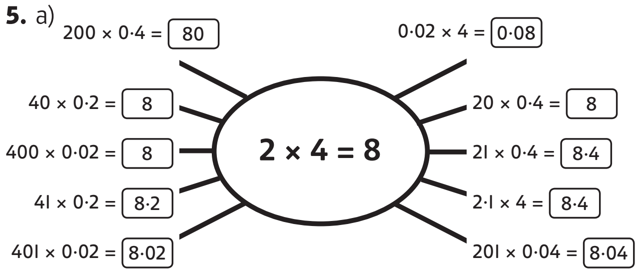
b) 3 × 0·03 = 0·09, 3 jumps of 0·03 on the number line to show 0·03, 0·06 and 0·09:



3. Bella needs 0·1 litres more water to make 1 litre.

4. a) $21 \times \frac{2}{10} = \frac{42}{10} = 4{\cdot}2$ 201 × 0·03 = 6·03
310 × 0·02 = 6·2 $31 \times \frac{3}{100} = 0{\cdot}93$
b) 0·93 4·2 6·03 6·2

5. a)



b) Answers will vary; for example:
20 × 40 = 800; 0·2 × 400 = 80

Reflect

Answers will vary; check that children recognise the importance of using core multiplication facts and adjusting for decimals by dividing by 10, 100, 1,000, etc., or adjusting for multiples of 10 by multiplying.

Lesson 7: Multiplying decimals (2)

→ pages 24–26

1. a) 3 × 0·5 = 1·5
0·3 × 5 = 1·5
b) 4 × 0·06 = 0·24
6 × 0·04 = 0·24
c) 5 × 0·03 = 0·15
3 × 0·05 = 0·15
d) 6 × 0·04 = 0·24
4 × 0·06 = 0·24

2. a) 4 × 3 = 12
0·4 × 3 = 1·2
0·04 × 3 = 0·12
4 × 0·3 = 1·2
4 × 0·03 = 0·12
b) 14 × 3 = 42
1·4 × 3 = 4·2
14 × 0·3 = 4·2
0·14 × 3 = 0·42
0·03 × 14 = 0·42
c) 7 × 8 = 56
7 × 0·08 = 0·56
0·7 × 8 = 5·6
0·07 × 80 = 5·6
700 × 0·8 = 560

3. 140 × 0·07 = 9·8 is closest to 10.

4. Isla is not correct. The answers to the calculations are correct.
Diagrams will vary; for example: children could show an array, counters on a place value grid, jumps along a number line, etc.

5. a) Answers will vary; for example:
2·3 × 45 = 103·5
2·4 × 35 = 84
2·5 × 43 = 107·5
3·4 × 25 = 85
b) Smallest product: 2·4 × 35 = 84
Largest product: 5·2 × 43 = 223·6
Difference: 139·6

Reflect

Answers will vary. Children should use their knowledge of factors of 36 and their understanding of place value in decimals to identify calculations; for example:

0·12 × 3 = 0·36; 0·09 × 4 = 0·36; 0·6 × 0·6 = 0·36

Lesson 8: Dividing decimals (1)

→ pages 27–29

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

2. a) 36 ÷ 4 = 9
3·6 ÷ 4 = 0·9
0·36 ÷ 4 = 0·09
16 ÷ 4 = 4
1·6 ÷ 4 = 0·4
0·16 ÷ 4 = 0·04
48 ÷ 4 = 12
4·8 ÷ 4 = 1·2
0·48 ÷ 4 = 0·12
28 ÷ 4 = 7
2·8 ÷ 4 = 0·7
0·28 ÷ 4 = 0·07
b) 3·6 ÷ 6 = 0·6
0·72 ÷ 6 = 0·12
4·8 ÷ 6 = 0·8
0·18 ÷ 6 = 0·03

3. a) 0·2 ÷ 4 = 0·05
b) 0·3 ÷ 6 = 0·05
c) 0·4 ÷ 8 = 0·05
d) 0·5 ÷ 10 = 0·05
In each calculation, the second number (divisor) is equal to the first number (dividend) multiplied by 10 and doubled. This means that the answer to each calculation will be $\frac{1}{20}$ or 0·05.

4. 7 × 8 = 56
0·7 × 8 = 5·6
5·6 ÷ 7 = 0·8
5·6 ÷ 8 = 0·7

5. 1 pen costs £0·20.

6. Amelia's sunflower is 0·7 m tall; Bella's is 2·1 m tall; Lee's is 2·6 m tall.

Reflect

Answers will vary; for example: 8 oranges cost £3·20, how much does one orange cost? (£0·40)

Lesson 9: Dividing decimals (2)

➜ pages 30–32

1.

```
    1 · 0 6          1 · 4 4          1 · 1 5
4 ) 4 · 2 ²4     6 ) 8 · ²6 ²4    8 ) 9 · ¹2 ⁴0
4·24 ÷ 4 = 1·06  8·64 ÷ 6 = 1·44  9·2 ÷ 8 = 1·15
```

2. a)

No decimal places	One decimal place	Two decimal places
E	B, C	A, D, F

b) A 25 ÷ 4 = 6·25
B 2·6 ÷ 2 = 1·3
C 100·5 ÷ 5 = 20·1
D 8·72 ÷ 4 = 2·18
E 1,080 ÷ 4 = 270
F 1·38 ÷ 3 = 0·46

3. a) 10·5 ÷ 3 = 3·5   10·5 ÷ 6 = 1·75   10·5 ÷ 30 = 0·35
b) Explanations may vary; for example:
The core fact is 10·5 ÷ 3 = 3·5.
10·5 ÷ 6 is connected to this since:
10·5 ÷ 6 = 10·5 ÷ 3 ÷ 2 = 3·5 ÷ 2 = 1·75
10·5 ÷ 30 is connected to this since:
10·5 ÷ 30 = 10·5 ÷ 3 ÷ 10 = 3·5 ÷ 10 = 0·35

4. a) The digit in the second decimal place is incorrect; she has carried over 3 but written it in the hundredths column. The 3 tenths should be exchanged for 30 hundredths. The correct answer is 0·733.
b) Dividing a number by 10 is most efficiently done using place value. 7·33 is made up of 7 ones, 3 tenths and 3 hundredths. When a number is divided by 10 each digit moves one position to the right (because this makes its value 10 times smaller) so the answer will have 7 tenths, 3 hundredths and 3 thousandths. 7·33 ÷ 10 = 0·733

5. 27·5 ÷ 10 = 2·75
$\frac{7·7}{11}$ = 0·7

6. 6 large blocks = 6 × 14·2 kg = 85·2 kg,
so 1 small block = 85·2 kg ÷ 8 = 10·65 kg.
The mass of 1 small block is 10·65 kg.

Reflect

Answers could vary; for example:

```
     3 0 · 7 5
4 ) 1 ¹2 3 · ³0 ²0
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Children might start from the division 123 ÷ 4 = 30 r 3 and then divide the remainder by 4.

3 ÷ 4 = $\frac{3}{4}$ = 0·75 so 123 ÷ 4 = 30 + 0·75 = 30·75

End of unit check

➜ pages 33–34

My journal

3: 3 × 0·8 = 2·4 ÷ 20 = 0·12
6: 6 × 0·8 = 4·8 ÷ 20 = 0·24
20: 20 × 0·8 = 1·6 ÷ 20 = 0·8
100: 100 × 0·8 = 80 ÷ 20 = 4

The output is always multiplied by $\frac{0·8}{20} = \frac{8}{200} = \frac{1}{25}$ which is the same as dividing by 25; for example:

3 ÷ 25 = $\frac{3}{25}$ = 0·12

Power play

Answers will vary.

Unit 8: Percentages

Lesson I: Percentage of (I)

→ pages 35–37

1. a) 40 c) 15 e) 48
b) 20 d) 150 f) 4·8

2. a) 20 yellow squares, 10 red squares and 4 blue squares.
b) 10 yellow triangles, 5 red triangles and 2 blue triangles.

3. a) £6 c) £2·50
b) £7·50 d) £11·25

4. a) 2 kg = 2,000 g
Pineapple: 25% of 2 kg = 500 g
Bananas: 10% of 2 kg = 200 g
Apples: 2,000 – 500 – 200 = 1,300 g
1,300 – 200 = 1,100 g
Emma bought 1,100 more grams of apples than bananas.
b) Aki: $1\frac{1}{2}$ kg = 1,500 g
25% of 1,500 g = 375 g
Bella: $3\frac{1}{2}$ kg = 3,500 g
10% of 3,500 g = 350 g
375 > 350
Aki bought more potatoes.

5.

50% of 50 = 25	25% of 50 = 12·5	10% of 30 = 3
50% of 5 = 2·5	25% of 500 = 125	10% of 300 = 30
50% of 0·5 = 0·25	25% of 1,000 = 250	10% of 3 = 0·3

6. Saturday: 50% of £40 = £20
£40 – £20 = £20
Sunday: 10% of £20 = £2
£20 – £2 = £18
Monday: 25% of £18 = £4·50
£18 – £4·50 = £13·50
£13·50 – £5·75 = £7·75
Richard has £7·75 left.

Reflect

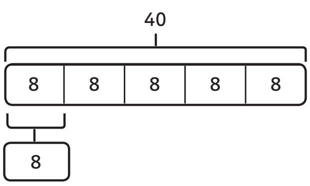
Answers will vary; for example:

A bar model (whole labelled as 100%) divided into 10 equal parts (labelled 10%).
To find 10% of a number divide by 10.

Lesson 2: Percentage of (2)

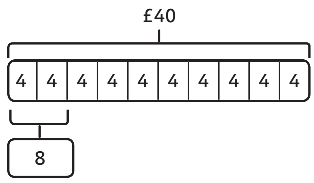
→ pages 38–40

1. a)



40 ÷ 5 = 8
20% of £40 is £8.

b)



10% of £40 = £4
20% of £40 = £4 + £4
= £8

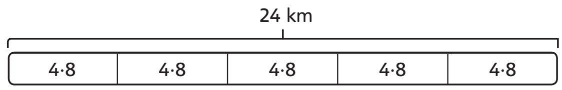
2. 20% of 15 = 3
3 circles should be shaded.

3. Zac is correct that to find 10% he divides by 10. However, to find 20% he needs to divide by 5, since 20% × 5 = 100%. This can also be shown with a bar model.

4.

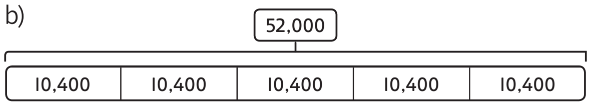
Starting number	10% of the number	20% of the number
400	40	80
410	41	82
41	4·1	8·2
401	40·1	80·2
14	1·4	2·8
20·5	2·05	4·1

5. a)



20% of 24 km = 4·8 km
Ambika has cycled 4,800 m.

b)



20% of 52,000 = 10,400
10,400 fans support the away team.

6. a) 20% of 400 g = 80 g
25% of 400 g = 100 g
100 – 80 = 20 g
There are 20 g more sugar than cocoa in the bar.
b) 4 squares is 25% of the bar.
25% of 80 g = 20 g
Andy has eaten 20 g of cocoa.

Reflect

Lexi is correct. If she knows 10%, she can multiply by 10 to get 100% which is the whole amount. She can also divide 10% by 10 to find 1% and using combinations of multiples of 10% and 1% can find any other amount.

Lesson 3: Percentage of (3)

→ pages 41–43

1. a) 7 c) 17
b) 6 d) 0·61

2. Calculations completed and matched:
1% of 300 = 3 ➜ 300 ÷ 100 = 3
10% of 3,000 = 300 ➜ $\frac{1}{10}$ of 3,000 = 300
1% of 30 = 0·3 ➜ 30 ÷ 100 = 0·3
10% of 300 = 30 ➜ place value grid showing $\frac{1}{10}$ of 300 is 30

3. a) 1% of 1,200 = 12
There are 12 Green Goblins.
b) 12 × 3 = 36
3% of 1,200 = 36
There are 36 Sapphire Specials.

4. a) 10% is £150.
1% is £15.
2% is £30.
3% is £45.
b) 10% is 15 m.
1% is 1·5 m.
2% is 3 m.
3% is 4·5 m.
c) 10% is 1·5 kg.
1% is 150 g.
3% is 450 g.
6% is 900 g.

5. 2% of 600 = 12
10% of 56 = 5·6
3% of 250 = 7·5
25% of 18 = 4·5
1% or 500 = 5·5
7% of 100 = 7
Least 4·5 5·5 5·6 7 7·5 12 Greatest

6. a) Yes; 1% of 200 is 2 and 3% is 6. 1% of 300 is 3 and 2% is 6.
b) Examples will vary; for example:
5% of 200 is 10 and 2% of 500 is 10
20% of 1,000 = 200; 10% of 2,000 = 200
Children should notice that the answers are always equal.

Reflect

Children should explain that to work out 3% of any number, first find 1% by dividing by 100 and then find 3% by multiplying 1% by 3. Diagrams may vary; for example: hundredths grid with 3 squares shaded.

Lesson 4: Percentage of (4)

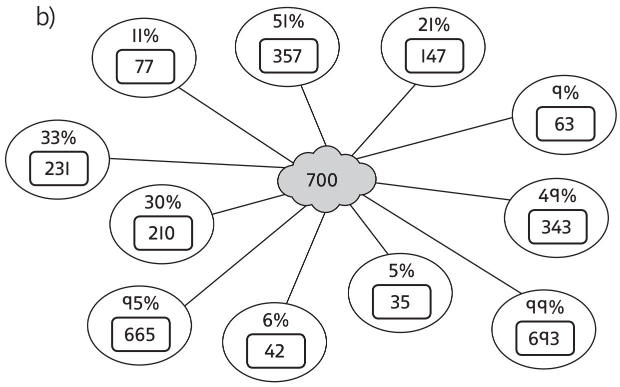
➜ pages 44–46

1. a) 30% of £400 = £120
Each section of bar model is 40.
400 ÷ 10 = 40
40 × 3 = 120
b) 60% of 400 g = 240 g
400 on top of bar model; each section is 40.
c) 90% of 500 m = 450 m
Each section of bar model is 50.
d) 75% of £60 = £45
Whole is £60
Bar model split into 4 equal sections of £15.

2. There are 24 red tulips.
There are 12 yellow tulips.
There are 204 pink tulips.

3. a) 50% of 700 = 350
10% of 700 = 70
1% of 700 = 7

b)



4. 11% of 32,500 = 3,575 29% of 32,500 = 9,425
32,500 – 3,575 – 9,425 = 19,500
19,500 people finished the marathon.

5. Area of pitch: 100 m × 70 m = 7,000 m^2
Monday: 30% of 7,000 m^2 = 2,100 m^2
Tuesday: 7,000 – 2,100 m^2 = 4,900 m^2
50% of 4,900 m^2 = 2,450 m^2
Wednesday: 1,250 m^2
Thursday: 7,000 – 2,100 – 2,450 – 1,250 = 1,200 m^2
1,200 square metres of the pitch still needed mowing on Thursday.

Reflect

Methods will vary; for example:

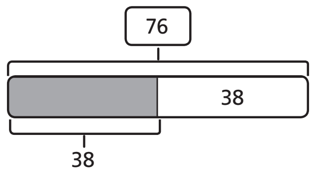
10% of 300 = 30, 5% of 300 = 15.
So 80% of 300 = 8 × 30 = 240, then add 5% to give 85% of 300 = 240 + 15 = 255.

10% of 300 = 30, 5% of 300 = 15. So 15% of 300 = 45.
85% = 100% - 15%, so 85% of 300 = 300 – 45 = 255.

Lesson 5: Finding missing values

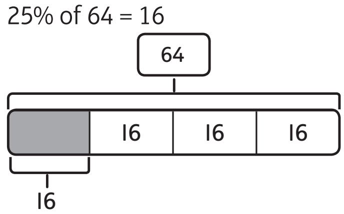
➜ pages 47–49

1. a) 50% of 76 = 38



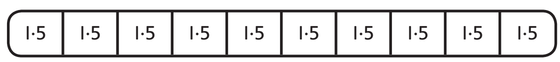
38 × 2 = 76

b) 25% of 64 = 16



16 × 4 = 64

c) 10% of 15 = 1·5



1.5 × 10 = 15

2. 40% of 60 = 24 ➜ left-hand bar model with 24 in empty box
40% of 150 = 60 ➜ right-hand bar model with 150 as whole

3. a) 70% = 63, so 100% = 90
30% of 90 = 27
There are 27 orange sweets.
b) The string was 320 cm long before Amelia cut it.

4. a) 420 b) 600

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
c) 60% of 150 = 90
60% of 75 = 45
60% of 7·5 = 4·5

6. 45 cm = 15% of length, so 15 cm = 5% of length, so total length = 15 cm × 20 = 300 cm.
So, perimeter is
20 cm + 300 cm + 20 cm + 300 cm = 640 cm
The perimeter of the whole rectangle is 640 cm.

Reflect

Diagrams will vary; for example:

Two bar models, one with 45 as the whole and split into 5 equal sections of 9, other model with 225 as the whole and split into 5 equal sections of 45.

Lesson 6: Converting fractions to percentages

➜ pages 50–52

1. a) $\frac{3}{20} = \frac{15}{100}$ = 15% c) $\frac{13}{50} = \frac{26}{100}$ = 26%
b) $\frac{4}{25} = \frac{16}{100}$ = 16% d) $\frac{4}{40}$ = 10%

2. $\frac{19}{20} = \frac{95}{100}$ = ➜ 95%
$\frac{19}{25} = \frac{76}{100}$ (numerator and denominator multiplied by 4) ➜ 76%
$\frac{19}{50} = \frac{38}{100}$ = ➜ 38%

3. Luis: $\frac{14}{20} = \frac{7}{10}$ = 70%
Kate: $\frac{28}{40} = \frac{7}{10}$ = 70%
Both scored 70%.

4.

Week	Number of eggs laid	Number of eggs that hatched	Percentage of eggs hatched
Week 1	10	6	$\frac{6}{10}$ = 60%
Week 2	20	6	$\frac{6}{20}$ = 30%
Week 3	8	6	$\frac{6}{8}$ = 75%
Week 4	12	6	$\frac{6}{12}$ = 50%

5. a) $\frac{12}{20}$ = 60% b) $\frac{8}{16}$ = 50%

6. blue = $\frac{42}{200}$ = 21%
grey = $\frac{60}{200}$ = 30%
black = $\frac{40}{200}$ = 20%
white = $\frac{44}{200}$ = 22%
yellow = $\frac{14}{200}$ = 7%

Reflect

Methods may vary; for example:

Multiply numerator and denominator by 4 since 4 × 25 = 100 to make the fraction have a denominator of 100 and then write the numerator as the percentage, i.e. $\frac{3}{25} = \frac{12}{100}$ = 12%.

Lesson 7: Equivalent fractions, decimals and percentages (1)

➜ pages 53–55

1. Equivalent decimals, fractions and percentages completed:

0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9	1
$\frac{0}{10}$	$\frac{1}{10}$	$\frac{2}{10}$	$\frac{3}{10}$	$\frac{4}{10}$	$\frac{5}{10}$	$\frac{6}{10}$	$\frac{7}{10}$	$\frac{8}{10}$	$\frac{9}{10}$	$\frac{10}{10}$
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

2. a) 0·39 = $\frac{39}{100}$ = 39%
b) 0·25 = $\frac{1}{4}$ (= $\frac{25}{100}$) = 25%
c) 0·4 = $\frac{2}{5}$ (= $\frac{40}{100}$) = 40%
d) 1·00 = $\frac{100}{100}$ = 100%

3. Amounts matched:
$\frac{17}{100}$ ➜ 0·17
$\frac{7}{100}$ ➜ 0·07
70% ➜ 0·7
71% ➜ 0·71

4.

Percentage	Decimal	Fraction
66%	0·66	$\frac{66}{100} = \frac{33}{50}$
60%	0·6	$\frac{60}{100} = \frac{6}{10} = \frac{3}{5}$
9%	0·09	$\frac{9}{100}$
0%	0	0
90%	0·9	$\frac{9}{10}$

5. To convert a decimal to a percentage you write the digit in the tenths and hundredths columns as the percentage, so for decimals written to 2 decimal places (2 dp) Jamie is correct, but for decimals with more than 2 dp, you insert a decimal point after the second digit and then write the digits in the thousandths column after the decimal point, i.e. 0·125 as a percentage is 12·5%.

6. 0·5 × 54 = 50% of 54 = 27
0·1 × 54 = 10% of 54 = 5·4

540 × 0·2 = 20% of 540 = 108
0·75 × 54 = 75% of 54 = 40·5
540 × 0·25 = 25% of 540 = 135
5,400 × 0·99 = 99% of 5·400 = 5,346

Reflect

Estimates will vary; for example:

$\frac{2}{3}$ = 0·666 (recurring) = 66·6 (recurring)%

$\frac{7}{10}$ = 0·7 = 70%

Lesson 8: Equivalent fractions, decimals and percentages (2)

→ pages 56–58

1. a) $\frac{4}{5} < 85\%$ b) $0{\cdot}404 > \frac{100}{250}$ c) $99\% < \frac{199}{200}$

2. $\frac{88}{1{,}000} = 0{\cdot}088$

3. $\frac{3}{10} < 0{\cdot}55 < 57\% < 61\% < 0{\cdot}62 < \frac{17}{25} < \frac{41}{50}$

4. $1{\cdot}8 = 1\frac{8}{10} = 1\frac{16}{20}$, so 1·8 is not more than $1\frac{17}{20}$.

5. a) 65% b) 0·36 c) $\frac{1}{5{,}000}$ (= $\frac{1}{200}$)

6. a) Diagrams will vary.
Lexi has eaten $\frac{8}{9}$ of an apple altogether.
$\frac{8}{9}$ = 0·888 = 88·89% (rounded to 2 dp)
Ebo has eaten 87% of an apple.
88·89 > 87.
Lexi has eaten the most apple.
b) Answers will vary; for example:
Jamie eats $\frac{2}{9}$ of 2 oranges, Max has eaten 51% of an orange. Who has eaten the most orange?

Reflect

Answers will vary but children should recognise that it is easier to order numbers if they are in the same form. For example:

To order fractions, decimals and percentages they could all be converted to equivalent percentages and then put in order from smallest to greatest.

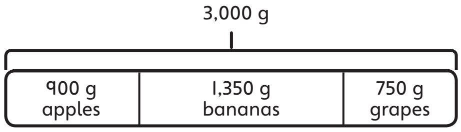
Lesson 9: Mixed problem solving

→ pages 59–61

1. a) $\frac{80}{200} = \frac{2}{5}$ b) $\frac{160}{400} = \frac{2}{5}$ c) $\frac{80}{200} = \frac{2}{5}$ d) $\frac{80}{400} = \frac{1}{5}$
e) Answers will vary, but designs should have 3 white tiles for every tile with 40% shaded.

2. a) This is $\frac{1}{2}$ of the whole shape.
b) Designs will vary but have an area of 5 squares.

3.



The grapes weigh 750 g.

4. Richard has 60%, which is 40% + £25.
100% = 40% + 40% + £25
100% = 80% + £25
100% – 80% = £25
20% = £25
60% = £25 × 3 = £75
Richard has £75.

5. The first percentage represents 45 out of 100 and the second score is 50 out of 100.
$\frac{45}{100} + \frac{50}{100} = \frac{95}{200} = 47{\cdot}5\%$

6. 50% of the left-hand shape is shaded. 50% of the rectangles are shaded and 50% of the circles are shaded, so in total 50% are shaded.
25% of the right-hand shape is shaded. The shape is made up of three sections which each contain 4 of the same shape. 1 out of 4 equal shapes in each section is shaded, so $\frac{1}{4}$ of each section is shaded. So $\frac{1}{4}$, or 25%, of the whole shape is shaded.

Reflect

Answers will vary but the problem should involve 20% in some way; for example:

Bella has £40 and spends $\frac{4}{5}$. How much has she left?

End of unit check

→ pages 62–63

My journal

1. a) Answers will vary; look for the shape being divided into other shapes. Children may shade 25% of each shape or 25% of the shape as a whole. .
b) Answers will vary, but the equivalent of one full section (representing 20%) and $\frac{3}{4}$ of another section (representing 15%) should be shaded.

Power play

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	127·5	195	18·75	0·75
100%	900	170	260	25	1
99%	891	168·3	257·4	24·75	0·99

Unit 9: Algebra

Lesson 1: Finding a rule (1)

➜ pages 64–66

1. a)

Number of cakes	1	2	3	5	10	100	1,500
Number of stars	1 × 3 = 3	2 × 3 = 6	3 × 3 = 9	5 × 3 = 15	10 × 3 = 30	100 × 3 = 300	1,500 × 3 = 4,500

b) For *n* fairy cakes, you need *n* × 3 stars.

2.

Number of cakes	5	6	12	20	101	*b*
Number of stars	25	30	60	100	505	*b* × 5

Children should draw a picture of fairy cake with 5 stars on it.

3. Patterns matched to rules:
Top pattern ➜ *n* × 4
2nd pattern ➜ double *n*
3rd pattern ➜ 3 × *n*
Bottom pattern ➜ *n* × 5

4.

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

If Zac has been painting for *x* minutes, Kate has been painting for *x* – 30 minutes.
If Kate has been painting for *y* minutes, Zac has been painting for *y* + 30 minutes.

5. a) *b* × 8
x × 3
m × 7
k × 52

b) The number of days in *d* years is 365 × *d*.

6.

1	3	12	15·5	*x*
5	7	16	19·5	*x* + 4

Either:
Rule to get from upper number to lower number is add 4.
Rule to get from lower number to upper number is subtract 4.

1	2	4	8	2 × *y* ÷ 5
2·5	5	10	20	*y*

Either:
Rule to get from upper number to lower number is halve and multiply by 5.
Rule to get from lower number to upper number is double and divide by 5.

Reflect

Same: both rules involve the digit 5.

Different: the first rule involves multiplying *a* by 5 and the second rule involves adding 5 to *a*.

Lesson 2: Finding a rule (2)

➜ pages 67–69

1. a)

Week	1	2	3	5	10	11
Total savings	28	31	34	40	55	58

b) After *y* weeks, Olivia has saved 25 + 3 × *y* pounds.

2. Number line showing jumps of £4 backwards from £50.

Week	1	2	3	5	10	*n*
Money left	46	42	38	30	10	50 – 4*n*

After *n* weeks, he has 50 – 4 × *n* pounds left.

3.

Number of triangles	1	2	3	4	5	10	100
Number of sticks used	3	5	7	9	11	21	201

To make 1 triangle, 3 sticks are used.
To make 2 triangles, 5 sticks are used.
To make 3 triangles, 7 sticks are used.
To make *n* triangle, 1 + 2 × *n* sticks are used.

4. For *g* houses, you need 5 + 5 × *g* sticks.
(Accept or equivalent expression; for example: (*g* + 1) × 5)

5. a) For *n* squares, you need 2*n* + 2 circles.
n = 100, so 2*n* = 200
2*n* + 2 = 202 circles

b) Answers will vary; for example:
Two circles drawn in each square: For *n* squares, you need 2*n* circles.

Reflect

Answers will vary; for example:

Emma puts £100 in a bank account and takes £3 out every week to pay for a trip to the swimming pool. After *y* weeks how much money is left in the account?

Lesson 3: Using a rule (1)

➜ pages 70–72

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

b) Bar model with six sections labelled *x*, 2, *x*, 2, *x*, 2 (can be in any order).

c) Ambika has 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)

Input	1	2	3	5	10
Output	5	10	15	25	50

If the input is a, the output is $5 \times a$ (which can be written as $5a$).

b)

Input	1	2	3	5	10
Output	7	12	17	27	52

If the input is b, the output is $5b + 2$.

c) Outputs will vary as children choose own inputs, for example:

Input	1	2	3	5	10
Output	15	20	25	35	60

If the input is c, the output is $5(2 + c)$ or $10 + 5c$.

d) Outputs will vary as children choose own inputs; for example:

Input	1	2	3	5	10
Output	10	20	30	50	100

If the input is d, the output is $10d$.

3.

Input	1	2	5	100	1,000	a
Output for − 10	$^-9$	$^-8$	$^-5$	90	990	$a - 10$
Output for +5 − 15	$^-9$	$^-8$	$^-5$	90	990	$a + 5 = 15 = a - 10$

Yes, Max is correct since $a + 5 - 15 = a - 10$.

4. a) and b) There are many possible pairs of operations; for example:
+ 10 × 5; × 10 × 10; × 2 + 80
Children should complete the table according to their functions; for example:
+ 10 × 5 gives:

Input	10	20	30	40	x
Output	100	150	200	250	$5(x + 10)$ or $5x + 50$

Reflect

No, Emma is not correct.

When $x = 100$: $3x + 2 = 300 + 2 = 302$
When $x = 10$: $3x + 2 = 30 + 2 = 32$
$32 \times 10 = 320$ which is not 302, Emma's suggestion does not work.

Reasons will vary; for example: Using the rule on $x = 10$ gives $(3 \times 10) + 2$. When you then multiply this answer by 10, this gives $3 \times 100 + 20$. This is not the same as the required output of $3 \times 100 + 2$.

Lesson 4: Using a rule (2)

→ pages 73–75

1. a) The total value is $5n$ pence.

b)

Number of coins	Reena's total value
4	5p × 4 = 20p
5	5p × 5 = 25p
10	5p × 10 = 50p
30	5p × 30 = 150p
50	5p × 50 = 250p

2. a) Hiring of the court costs $20n$ pence (for n minutes).

b)

Time in minutes	Cost
n	20p × n = 20pn
10	20p × 10 = 200p (=£2)
30	20p × 30 = 600p (=£6)
60	20p × 60 = 1,200p (=£12)
120	20p × 120 = 2,400p (=£24)

3.

	$x + 30$	$30 - x$	$30x$
$x = 5$	35	25	150
$x = 10$	40	20	300
$x = 30$	60	0	900
$x = 0$	30	30	0

4. No, the order of the operations matters.
If Aki adds 5 then multiplies by 10 he would get $(7 + 5) \times 10 = 12 \times 10 = 120$.
The correct answer is $(7 \times 10) + 5 = 70 + 5 = 75$.

5. If y is an even number then $5y$ will be a multiple of 10 so $100 - 5y$ will be a multiple of 10.

6. When $y = 1$, $10y - y = 9$.
Other examples will vary, depending on the choice of y but $10y - y$ will always be equal to $9y$.
Diagrams could include bar models split into 10 sections marked y with one subtracted.

Reflect

Answers will vary; for example:

$y = 1$: $4 + 2y = 6$
$y = 5$: $4 + 2y = 14$

Doubling any whole number gives an even number, so $2y$ is always even. 4 is even and when you add two even numbers together the answer will also be even. So, the rule $4 + 2y$ always generates even numbers.

Lesson 5: Using a rule (3)

➜ pages 76–78

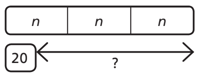
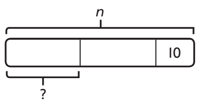
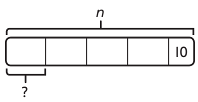
1. a) Length of ribbon left is 100 – 5*y*.
   b) There is 40 cm of ribbon left.

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

3. a) A: *a* + 50, C: $\frac{a}{4}$ or *a* ÷ 4
   B: *a* – 50 D: 50 + 3*a*
   b) A = 125 B = 25 C = 18·75 D = 275

4. Equivalent expressions matched:
   5 less than *y* ➜ *y* – 5
   y more than 20 ➜ 20 + *y*
   double *y* ➜ 2*y*

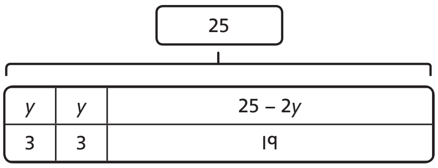
5.

	Write an expression for each ?.	Substitute *n* = 110 into each expression. Calculate the value of ?.
	3*n* – 20	310
	$\frac{n-10}{2}$ (or (*n* – 10) ÷ 2)	50
	$\frac{n-10}{4}$ (or (*n* – 10) ÷ 4)	25

Reflect

When *y* = 3, 25 – 2*y* = 25 – 6 = 19

Bar models may vary; for example:



Lesson 6: Formulae

➜ pages 79–81

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

2. Tower A = 1,200 inches
   Tower B = 2,400 inches
   Tower C = 1,800 inches

3. 200 × 48 = 9,600
   The rocket has travelled 9,600 miles.

4. Max is incorrect, since one side of each of the squares now lies inside the new shape. The perimeter of the new shape is 6*a*; for example:
   a = 2 cm, so perimeter of the new shape is
   6 × 2 = 12 cm.

5. Pattern A continued: 99 + 4 = 100 + 3
   99 + 5 = 100 + 4,
   99 + *a* = 100 + *a* – 1
   Described in words: Adding a number to 99 will always give the same answer as adding one less than the number to 100.
   Pattern B continued: 99 × 3 = 100 × 3 – 3,
   99 × 4 = 100 × 4 – 4
   99 × *b* = 100 × *b* – *b*
   Described in words: Multiplying a number by 99 will always give the same answer as multiplying it by 100 and then subtracting one lot of the number.

Reflect

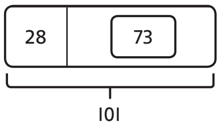
The formula for the perimeter is 2*x* + *y*.

Substituting *x* = 10 and *y* = 8 into this expression gives 20 + 8 = 28.

Lesson 7: Solving equations (1)

➜ pages 82–84

1. a) Right-hand column completed: 250 350
   Additional rows will vary depending on choice of *a*.
   Check right-hand column = *a* + 150.
   b) Right-hand column completed: 140 130 100
   Additional rows will vary depending on choice of *b*.
   Check right-hand column = 150 – *b*.
   c) *c* = 101 – 28 = 73

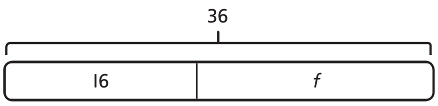


   c = 73

2. a) Equation: *m* + 50 = 500; *m* = 500 – 50 = 450.
   Mass of flour is 450 g.
   b) Equation: *s* – 25 = 250; *s* = 250 + 25 = 275.
   Bag originally contained 275 g of raisins.

3. a) *x* – 10 = 300
   x = 300 + 10 = 310
   b) 300 = 10*y*
   y = 300 ÷ 10 = 30
   c) *z* ÷ 10 = 300
   z = 300 × 10 = 3,000

4. No, Luis is not correct. Explanations may vary; for example: The equation can be represented by a part-whole bar model where the whole is 36, one part is *f* and the other part is 16. *f* can therefore be worked out by finding 36 – 16, which equals 20.



5. a) Equation: $10a = 2$
Solution: $a = 10 \div 2 = 0{\cdot}2$
b) Equation: $1{\cdot}5b = 150$
Solution $b = 150 \div 1{\cdot}5 = 100$
c) Equation: $c \div 10 = 2$
Solution: $c = 2 \times 10 = 20$
d) Equation: $d - 90{\cdot}9 = 909{\cdot}09$
Solution: $d = 909{\cdot}09 + 90{\cdot}9 = 999{\cdot}99$

Reflect

Solution: $y = 125$

Methods will vary; for example:
Method 1: writing the equation as a bar model and using the inverse of +75 to subtract 75, i.e. $200 - 75 = 125 = y$.
Method 2 could involve substituting in different values of y until finding that when $y = 125$, $y + 75 = 200$.

Lesson 8: Solving equations (2)

➜ pages 85–87

1. a) $x + 25 = 40$
Subtract 25 from each scale.
$x = 15$
b) $3c = 150$
÷ each side by 3
$c = 50$
c) $a + 45 = 100$
$100 - 45 = 55$
$a = 55$
d) $5d = 150$
$150 \div 5 = 30$
$d = 30$

2. a) ➜ $c - 25 = 50$
$c = 75$
b) ➜ $25 = 5c$
$c = 5$
c) ➜ $25 + c = 50$
$c = 25$

3. a) $f = 3$
b) $g = 2{\cdot}5$
c) $h = 363$
d) $i = 250$
e) $j = 36$
f) $k = 1$

4. Answers will vary; for example:
$y + 8 = 10$
$y = 2$
$80 \div y = 8$
$y = 10$
$24 - y = 10$
$y = 14$
$80 \times y = 240$
$y = 3$

Reflect

Answers will vary; for example:

Bar model where the whole is 100, one part is x and the other part is 90.

Other diagrams could include balance scales with 100 on one side and 90 and x on the other.

Lesson 9: Solving equations (3)

➜ pages 88–90

1. a) $3a + 2 = 17$
$-2 \quad -2$
$3a = 15$
$\div 3 \quad \div 3$
$a = 5$
b) $4b + 80 = 100$
$b = 20$

2. $50 = 15 + 5c$
$35 = 5c$
$c = 7$

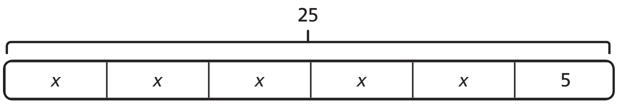
3. $3y + 5 = 80$
$3y = 75$
$y = 25$

4. $6n + 3 = 50 + 1$
$6n + 3 = 51$
$6n = 48$
$n = 8$

5. a) $a = 20$
b) $c = 65$
c) $b = 14$
d) $d = 15$

6. a) $(x \div 5) - 5 = 6$
$x \div 5 = 11$
$x = 55$
b) $(z + 20) \times 10 = 1{,}000$
$z + 20 = 100$
$z = 80$

Reflect



Lesson 10: Solving equations (4)

➜ pages 91–93

1. a)

Perimeter	j = ?	k = ?
12 cm	1 cm	5 cm
12 cm	2 cm	4 cm
12 cm	3 cm	3 cm
12 cm	4 cm	2 cm
12 cm	5 cm	1 cm

b) The greatest area, of 9 cm^2, occurs when $j = 3$ cm and $k = 3$ cm.

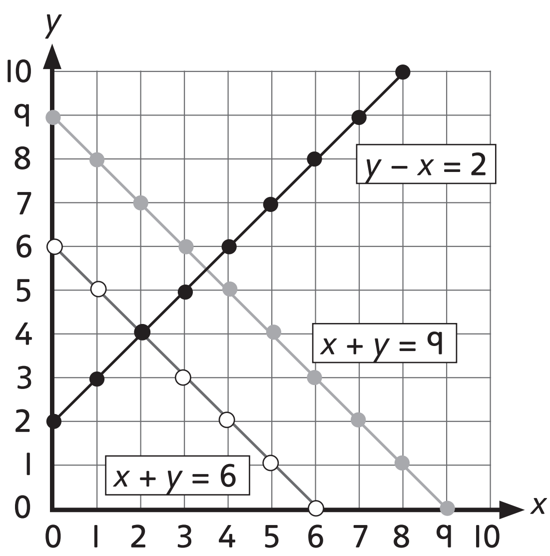
2. Equation: $a + b = 4$
Table completed showing pairs that total 4 kg.
Answers may vary; for example:

a = ?	*b* = ?
1 kg	3 kg
2 kg	2 kg
3 kg	1 kg
$3\frac{1}{2}$ kg	$\frac{1}{2}$ kg
0·6 kg	3·4 kg

3. Equation: $e \times f = 100$.
All possible solutions should be shown (may be in different order):

e = ?	*f* = ?
1 m	100 m
2 m	50 m
4 m	25 m
5 m	20 m
10 m	10 m
20 m	5 m
25 m	4 m
50 m	2 m
100 m	1 m

4.



5. a) The four numbers must be 1, 3, 5 and 11 or 1, 3, 7 and 9 (but be added in any order giving 24 calculations for each set).
b) There are 14 possible calculations:

1 + 2 − 1	5 + 4 − 7
3 + 2 − 3	7 + 4 − 9
5 + 2 − 5	1 + 6 − 5
7 + 2 − 7	3 + 6 − 7
9 + 2 − 9	5 + 6 − 9
1 + 4 − 3	1 + 8 − 7
3 + 4 − 5	3 + 8 − 9

Reflect

Answers will vary; for example:

Drawing a table helps, particularly if you list possibilities methodically starting either at the lowest or highest, finishing when the numbers start to repeat.

Lesson 11: Solving equations (5)

➜ pages 94–96

1. Two possible solutions:
3 × 5p and 5 × 2p   1 × 5p and 10 × 2p
25p could also be made using 5 × 5p coins but this would not match the criteria since Alex also has 2p coins.

2. Assuming lengths are whole numbers, there are six possible solutions:
a = 1 cm, b = 11 cm (area = 11 cm^2)
a = 11 cm, b = 1 cm (area = 11 cm^2)
a = 2 cm, b = 10 cm (area = 20 cm^2)
a = 10 cm, b = 2 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)

3. Equation: $4b + 8r = 32$
There are 5 possible solutions:
$b = 8, r = 0$ $b = 6, r = 1$ $b = 4, r = 2$
$b = 2, r = 3$ $b = 0, r = 4$

4. a) $50a - 25b = 100$. Solutions given will vary; for example:
$a = 2, b = 0$: 100 − 0 = 100
$a = 3, b = 2$: 150 − 50 = 100
$a = 4, b = 4$: 200 − 100 = 100
$a = 5, b = 6$: 250 − 150 = 100
$a = 10, b = 16$: 500 − 400 = 100
Pattern: For every 1 a goes up, b goes up 2.
b) $50 + c = d - 150$. Solutions given will vary; for example:
$c = 50, d = 250$: 50 + 50 = 250 − 150
$c = 100, d = 300$: 50 + 100 = 300 − 150
$c = 150, d = 350$: 50 + 150 = 250 − 150
$c = 0, d = 200$: 50 + 0 = 200 − 150
$c = 800, d = 1{,}000$: 50 + 800 = 1,000 − 150
Pattern: c is always 200 smaller than d.

5. The only numbers less than 20 which are the sum of two square numbers are: 5, 10, 13 or 17. It is not possible to make a total of 11 by adding two prime numbers. Therefore, the combinations of possible choices with a difference of 1 are:

Bella	4 (2 + 2)	6 (3 + 3)	9 (2 + 7)	12 (5 + 7)	14 (3 + 11)	16 (5 + 11)	18 (7 + 11)
Danny	5 (1 + 4)	5 (1 + 4)	10 (1 + 9)	13 (4 + 9)	13 (4 + 9)	17 (1 + 16)	17 (1 + 16)

Reflect

Answers will vary; for example:

$6x + 2y = 28$

Solutions are $x = 1, y = 11; x = 2, y = 8; x = 3, y = 5; x = 4, y = 2$

End of unit check

→ pages 97–98

My journal

1 a) $3a + 5 = 20$
Answers will vary; for example:
Kate puts £5 in the bank, and saves a set amount each week. After 3 weeks she has £20. How much does she save each week?

b) $5b - 8 = 17$
Answers will vary; for example:
Kate saves a set amount each week. After 5 weeks she withdraws £8, leaving £17. How much does she save each week?

Power puzzle

There are 15 different types of rectangles:

2 × 1 rectangles, 1 × 2 rectangles, 3 × 1 rectangles,
1 × 3 rectangles, 4 × 1 rectangles, 1 × 4 rectangles,
2 × 2 squares, 3 × 3 squares, 4 × 4 squares,
2 × 3 rectangles, 3 × 2 rectangles, 2 × 4 rectangles,
4 × 2 rectangles, 4 × 3 rectangles, 3 × 4 rectangles.

Unit 10: Measure – imperial and metric measures

Lesson 1: Metric measures

➜ pages 100–102

1. Units circled:
a) km
b) g
c) mm
d) l
e) m

2.

	More than	Less than	About the same as
Yoghurt pot		✔	
Drinking glass		✔	
Cereal bowl			✔
Carton of milk	✔		
Watering can	✔		
Tin of soup			✔

3. a) Two from: m, cm, mm or km
b) Two from: mg (milligram), g, kg
c) Two from: ml, l, mm^3, cm^3, m^3

4. Circled:
a) 2 m
b) 25 kg
c) 21 mm
d) 200 ml
e) 800 g

5. Boxes ticked from top to bottom: True, False, False, True, False

6. a) Ticked: Less than a gram
b) Answers will vary; look for children recognising that medicines are generally taken in very small amounts and so are best described using a small unit of measure. Children may also use knowledge that a millimetre is smaller than a metre (or millilitre is smaller than a litre) to reason that a milligram must be smaller than a gram.

Reflect

No; the milk is given as 1,000 ml which is 1 litre, the flour is given as 0·25 kg which is 250 g, and the shoelaces are likely to be sold in pairs rather than length.

Lesson 2: Converting metric measures

➜ pages 103–105

1. a) 1,000 grams = 1 kg, so × by 1,000.
8·5 × 1,000 = 8,500
8·5 kg = 8,500 g
b) smaller unit ➜ larger unit, so ÷
1,000 m = 1 km, so ÷ by 1,000.
4,200 ÷ 1,000 = 4·2
4,200 m = 4·2 km

2. a) 2 l = 2,000 ml
3 l = 3,000 ml
3·5 l = 3,500 ml
3·54 l = 3,540 ml
35·4 l = 35,400 ml
b) 5,000 g = 5 kg
6,000 g = 6 kg
6,500 g = 6·5 kg
6,580 g = 6·58 kg
65,800 g = 65·8 kg

3. a) 500 cm
b) 7,500
c) 0·65
d) 34
e) 30
f) 12,050
g) 8,400
h) 1,005

4. a) Mistake: she has multiplied by 100 rather than 1,000.
Correct answer: 2·6 kg = 2,600 g.
b) Mistake: she has divided by 100 instead of multiplying by 100.
Correct answer: 4·9 m = 490 cm.

5. a) Possible pairs for A and B:
mm (A) and m (B); m (A) and km (B); mg (A) and g (B); g (A) and kg (B); ml (A) and l (B).
C is m; D is cm; E is cm; F is mm.
b) Yes, D and E are both cm as you multiply by 100 to convert from m to cm and multiply by 10 to convert from cm to mm.

Reflect

Ticked: Alex

Alex is correct because when converting within metric units you either divide or multiply by 10, 100 or 1,000. This changes the position of the digits in the place value grid and the value of these digits but the digits themselves do not change, although zeros may need to be added as place holders. So, the answer will only contain the digits 5, 7 and 0.

Lesson 3: Problem solving – metric measures

➜ pages 106–108

1. a) Isla has 2,100 m left to run.
b) Yes, because the bush is 250 cm tall and the fence is 205 cm tall so the bush is 45 cm taller.
c) 48 servings of 50 g can be taken from the bag.

2. Aki needs to convert the units to a common unit, either grams or kilograms. He has just added the amounts without converting one first.
Correct answer: 880 g + 1,500 g = 2,380 g (or 2·38 kg)

3. a) There are 300 ml of squash in each glass.
b) There are 60 ml of orange juice in each glass.

4. Max's bed is 138 cm long.

5. One banana weighs 150 g. One apple weighs 200 g.

Reflect

Answers will vary; for example:
Bella has a water bottle that has 0·5 l of water in it. She pours 300 ml into a glass. How much water does she have left?
Look for children fluently and accurately converting between units of metric measures so that they can solve problems.

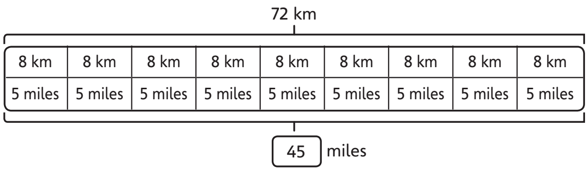
Lesson 4: Miles and km

➜ pages 109–111

1.

	Speed (mph)	Speed (km/h)
A	2·5	4
B	5	8
C	10	16
D	35	56
E	50	80

2. 45 miles is the same as 72 km.



72 ÷ 8 km = 9
9 × 5 miles = 45 miles

3.

Name of river	Length (miles)	Length (km)
River Mersey	70	112
River Tamar	50	80
River Severn	220	352
River Clyde	110	176

The longest river is the River Severn.

4. Circled: Both
100 miles is about 160 km.

5. Ticked: A
Explanations may vary; for example:
8 km is about 5 miles, so 80 km is about 50 miles, so Train B only travels about 50 miles every hour but Train A travels 60 miles every hour. Train A is faster.

Reflect

Answers will vary; for example:

If I know that 5 miles is about the same as 8 km,
I also know that 10 miles is about the same as 16 km;
800 km is about the same as 500 miles; 1 mile is about $\frac{8}{5}$ km = 1·6 km. To convert from miles to kilometres multiply by 1·6; to convert from kilometres to miles multiply by 0·625.

Lesson 5: Imperial measures

➜ pages 112–114

1. a) 5 cm is about 2 inches.
b) 11 cm is about 4·4 inches. (Accept reasonable estimates.)
c) 8 inches is about 20 cm.
d) $6\frac{1}{2}$ inches is about 16·3 cm. (Accept reasonable estimates.)
e) Explanations may vary; for example:
5 cm = 2 inches so multiply both sides of the equation by 10 to give 50 cm = 20 inches.

2.

Kilograms	1	2	3	5	10	50	100
Pounds	2·2	4·4	6·6	11	22	110	220

3. Ticked: b)

4. 560 × 3·5 = 1,960 ml so Mo has about 1·96 litres of milk (or roughly 2 litres).

5. Converting heights to cm:

Name	Height
Aki	145 cm
Lee	50 inches = 125 cm
Jamilla	5 feet = 60 inches = 150 cm
Ambika	1,390 mm = 139 cm
Max	148 cm

Lee Ambika Aki Max Jamilla

Reflect

Answers will vary; for example:

Working with metric is useful since conversion between units involves 10, 100 and 1,000 and these are easy to multiply and divide. However, working with imperial can involve smaller numbers like measuring height in feet, which are easier to work with.

End of unit check

➜ pages 115–116

My journal

1. a) The mistake is that she has multiplied/divided by 100, not 1,000.
The correct answer is 4,500 ml is the same as 4·5 l (or 450 millilitres is the same as 0·45 litres).
b) The mistake is that he has not converted the units to a common unit of measurement (grams); he cannot just take away 1, he needs to convert the kg to g first.
The correct answer is 750 g.

c) The mistake is that she has doubled ·6 to get ·12;
1·6 × 2 = 3·2.
The correct answer is 3·2 km.

Power puzzle

a)

	Number	Letter
56 km = ? m	56,000	P
470 g = ? kg	0·47	A
47 cm = ? mm	470	S
210 g = ? kg	0·21	T
390 mm = ? cm	39	I
2, 100 ml = ? l	2·1	E
0·47 l = ? ml	470	S

Answer = pasties

b)

	Number	Letter
47 cm = ? m	0·47	A
56 kg = ? g	56,000	P
560 m = ? cm	56,000	P
5·6 kg = ? g	5,600	L
0·21 cm = ? mm	2·1	E
56 l = ? ml	56,000	P
3,900 cm = ? m	39	I
2,100 g = ? kg	2·1	E

Answer = apple pie

Unit 11: Measure – perimeter, area and volume

Lesson 1: Shapes with the same area

→ pages 117–119

1. a) Area of rectangle A = 20 cm^2
Area of rectangle B = 20 cm^2
Ticked: Yes
b) Area of rectangle C = 48 cm^2
Area of rectangle D = 48 cm^2
Ticked: Yes

2. Answers will vary; check that the shapes on the grid are:
Shape A = 6 cm × 6 cm square
Shape B = 3 cm × 12 cm rectangle
Shape C = any compound shape with area of 36 cm^2
Children should name other shapes with the same area as shapes A, B and C.

3. Shape B: 3 cm
Shape C: Pair with product of 30; for example, 2 cm and 15 cm, or 1 cm and 30 cm.

4.

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

Reflect

He can use multiplication. There are 4 rows of 3 squares.

4 × 3 =12 squares

This represents 12 m^2.

Lesson 2: Area and perimeter (1)

→ pages 120–122

1. a)

Shape	Perimeter (cm)	Area (cm^2)
A	4 × 4 = 16	4 × 4 = 16
B	3 × 2 + 6 × 2 = 18	3 × 6 = 18
C	6 + 1 + 2 + 4 + 4 + 5 = 22	4 × 5 + 1 × 2 = 20 + 2 = 22

b) For each shape, the perimeter is equal to the area.

2. a) Any shape with area of 4 squares; for example: T-shape with area of 4 squares.
b) Any shape with perimeter of 8 squares; for example: a straight line of 3 squares.
c) Answers will vary; for example: 4 by 1 rectangle (area = 4 cm^2, perimeter of 10 cm).

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 shapes A and B and Shapes C and D.

4. Shape A area = 20 cm^2 perimeter = 24 cm
Shape B area = 20 cm^2 perimeter = 18 cm
Shape C area = 20 cm^2 perimeter = 42 cm
Same: the areas are all 20 cm^2.
Different: all have different perimeters.

5. Andy is correct. Removing one square means the perimeter will increase or stay the same. Children should draw different shapes and work out the perimeter each time.

Reflect

Explanations will vary; for example:

Consider a 2 × 2 square and a 1 × 4 rectangle. Both have an area of 4 square units but the square has perimeter of 8 units and the rectangle has an area of 10 units. So, shapes with the same area do not always have the same perimeter.

Lesson 3: Area and perimeter (2)

→ pages 123–125

1. a)

Shape	Perimeter (cm)	Area (cm^2)
A	16	8
B	16	14
C	16	16
D	16	7

b) I notice that the shapes have the same perimeter but different areas.

2. Shape A: Shape B
width = 2 cm length = 6 cm
area = 14 cm^2 area = 18 cm^2
I notice that the shapes have the same perimeters but different areas. Also, the perimeter and area for shape B are both 18.

3. Different shapes are possible but the most likely are:
Shape A = 3 cm × 3 cm square
Shape B = 5 cm × 1 cm rectangle
Shape C = 4 cm × 2 cm rectangle

4. Garden A is 7 m × 8 m and garden B is 14 m × 1 m.

5. Either D or E can be removed without changing the perimeter.

6. Greatest area = 20 cm^2 (5 cm × 4 cm rectangle)

Reflect

Disagree; children should refer to some of the examples from the lesson of shapes which have the same perimeter but different area.

Lesson 4: Area of a parallelogram

➜ pages 126–128

1. Area of A = 4 cm × 2 cm = 8 cm^2
   Area of B = 2 cm × 3 cm = 6 cm^2
   Area of C = 3 cm × 1 cm = 3 cm^2
2. A = 3 cm × 4 cm = 12 cm^2
   B = 6 cm × 2 cm = 12 cm^2
   C = 2 cm × 3 cm = 6 cm^2
   D = 12 cm × 1 cm = 12 cm^2
   Parallelogram C is the odd one out because it has an area of 6 cm^2 whereas the other shapes all have an area of 12 cm^2.
3. a) A = 10 cm × 12 cm = 120 cm^2
   B = 13 cm × 10 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 area of all of the parallelograms is the same because they all have the same base length (4 cm) and perpendicular height (4 cm). This is because the parallelograms are set within parallel lines and so the distance between the two lines (the perpendicular height of each parallelogram) is always the same.
6. Area of the path = 3 m^2

Reflect

C 30 cm^2

Explanations may vary; for example:

The base is 5 cm and the perpendicular height is 6 cm, so the area is 5 × 6 = 30 cm^2.

Lesson 5: Area of a triangle (I)

➜ pages 129–131

1. a) 4 rows in the rectangle formed.
   2 squares in each row.
   2 × 4 = 8
   Total number of squares = 8
   Area: 2 cm × 4 cm = 8 cm^2
   b) 1 rows in the rectangle formed.
   4 squares in each row.
   1 × 4 = 4
   Total number of squares = 4
   Area: 1 cm × 4 cm = 4 cm^2
   c) Area = 8 cm^2
2. Estimates may vary; for example:
   A = 8 cm^2 B = 7 cm^2 C = 3 cm^2 D = 3 cm^2
3. 7·5 cm^2
4. Sometimes true; the estimate of the area when you count squares may not be accurate but it could be smaller or larger than finding the area by turning the triangle into a rectangle. Look for children drawing diagrams to show this.
5. Jess is correct; the base for triangle B is double that of triangle A and the perpendicular height for both triangles is the same. So, the area of triangle B is double that of triangle A.
6. 20 cm^2

Reflect

Method 1: count the squares.

Method 2: change the triangle to a rectangle and find the area of the rectangle.

Lesson 6: Area of a triangle (2)

➜ pages 132–134

1. a) Area = 8 × 6 ÷ 2
   = 24 cm^2
   b) Area = 3 × 9 ÷ 2
   = 13·5 m^2
   c) Area = 5 × 8 ÷ 2
   = 20 cm^2
   d) Area = 10 × 4.5 ÷ 2
   = 22·5 m^2
2. Area of shape A = 4 × 5 ÷ 2 = 10 m^2
   Area of shape B = 3 × 4 ÷ 2 = 6 m^2
   Lexi used the length of 5 m to find her area for shape B, but this is not a perpendicular dimension.
3. A = 64 km^2 B = 60 cm^2 C = 44 mm^2 D = 44 cm^2
   Circled: Triangle A
4. 28 cm^2 (48 cm^2 – 20 cm^2)
5. 40 cm^2 (60 cm^2 – 20 cm^2)

Reflect

Explanations may vary; for example:

Find the area of the rectangle which would share three vertices with the triangle. Halve this to find the area of the right-angled triangle.

Lesson 7: Area of triangle (3)

➜ pages 135–137

1. Area of A = 5 × 6 ÷ 2 = 15 cm^2
   Area of B = 1·5 × 6 ÷ 2 = 4·5 m^2
   Area of C = 4 × 17 ÷ 2 = 34 km^2

2. Answers will vary; all 3 triangles should have a base of 4 cm and perpendicular heights of 4 cm.

3. a) Ben has correctly multiplied the base by the perpendicular height to get 24 cm^2 but he needs to half this to find the area of the triangle, which is 12 cm^2.

b) Alex has multiplied the length of two sides of the triangle and then halved, rather than multiplying the base (12 cm) by the perpendicular height (8 cm) and then halving. The correct answer is 48 cm^2.

4. a) 35 cm^2 b) 6 cm^2

5. The area of the parallelogram is perpendicular height × base. The 2 triangles make up the parallelogram, so the area of the triangle is half of the area of the parallelogram. The area of the triangle is 15 cm^2.

6. Area of right-angled triangle forming half of square = 800 cm^2
Area of small white triangle is 440 cm^2
So, area of shaded triangle 800 cm^2 – 440 cm^2 = 360 cm^2

Reflect

Use the formula area = base × perpendicular height ÷ 2

Area = 5 × 2 ÷ 2 = 5 cm^2

Other answers might include counting the squares or making the triangle into a rectangle. Encourage children to understand that the formula method is the most efficient.

Lesson 8: Problem solving – area

→ pages 138–140

1. a) 56 cm^2 b) 18 cm^2 c) 80 cm^2

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

3. a) 6 cm^2 b) 30 cm^2

4. The carpet costs £17 per m^2.

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

6. 12 cm^2

Reflect

Answers will vary but look for answers including:

Area of a rectangle = length × width
Area of a triangle = perpendicular height × base ÷ 2
Area of a parallelogram = perpendicular height × base

Check that squared units (cm^2, m^2, km^2, etc.) are used to measure area.

Lesson 9: Problem solving – perimeter

→ pages 141–143

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

2. 48 cm

3. 38 cm

4. Area A has the longer perimeter.

5. Zac is not correct; the perimeter of shape B is 10 + 10 + 10 + 10 = 40 cm. The perimeter of shape A will be more than this since it contains the same 4 sides (of 10 cm) but also has 4 extra sides which add to the perimeter.

Reflect

Answers will vary; for example:

When I cut a rectangular piece of paper into two equal parts, the perimeters of the new shapes (triangles) will be more than half the perimeter of the rectangle since the triangles include the length and width of the rectangle but also the diagonal across the rectangle.

Lesson 10: Volume of a cuboid (1)

→ pages 144–146

1. a) There are 6 1 cm^3 cubes in the solid.
Volume = 6 cm^3
b) There are 8 1 cm^3 cubes in the solid.
Volume = 8 cm^3
c) There are 8 1 cm^3 cubes in the solid.
Volume = 8 cm^3

2. Circled: all shapes (A, B and C)

3. Shapes matched:
A → 4
B → 1
C → 3
D → 2

4. Lee has counted the cubes he can see, but there is also a cube at the back that he cannot see that needs to be included. So, there are 7 cubes and the volume is 7 cm^3.

5. Order of sides may vary:
a) Volume = 5 × 2 × 3
= 15 × 2
= 30 cm^3
b) Volume = 3 × 2 × 4
= 3 × 8
= 24 cm^3

6. Ella is not correct. To make a cube she needs to have the same dimension for the height, depth and width, so she can make a cube from 2 × 2 × 2 = 8 cubes or 3 × 3 × 3 = 27, but not 9 cubes.
7. Answers will vary; look for children recognising that the volume of the cube tower is 20 cm^3 and the width of the cylinder looks similar to the width of the tower. The volumes of the two shapes will not be the same, as they are different shapes, but 20 cm^3 will be a sensible rough estimate for the volume of the cylinder.

Reflect

Yes, a cube has the same dimensions of height, depth and width, so a larger cube can be made from 3 × 3 × 3 = 27 smaller cubes.

Lesson 11: Volume of a cuboid (2)

➜ pages 147–149

1. a) 8 cm^3
   b) Volume = 3 × 3 × 4
   = 36 cm^3
   c) Volume = 3 × 3 × 3
   = 27 cm^3
   d) Volume = 5 × 3 × 4
   = 60 cm^3
2. Answers may vary; for example:
   You can work out the volume of one layer (8 × 7 = 56) and then multiply that by the number of layers.
   56 × 5 = 280 cubes
   Alternatively, you can multiply the three dimensions together to give 8 × 7 × 5 = 280 cubes.
3. 440 cm^3
4. a) 8 cm b) 12 cm
5. 4 cm
6. Answers will vary; for example:
   2 cuboids drawn with labelled dimensions l = 8 m, h = 5 m, w = 2 and dimensions l = 10 m, h = 4 m, w = 2.
7. 3 × 2 × 6 = 36

   12 × 12 × 12 = 1,728

   1,728 ÷ 36 = 48

   48 packets fit into the box.

Reflect

Answers may vary; for example:

Volume is height × length × width so the volume of the cuboid is 4 × 1 × 3 = 12 cm^3.

End of unit check

➜ pages 150–152

My journal

1. a) I know that the area of this parallelogram is 108 cm^2 because the area is given by the formula perpendicular height × base.
   b) I know that the area of this triangle is 24·75 cm^2 because the area is given by the formula base × perpendicular height ÷ 2.
2. False.
   Explanations may vary; for example:
   A rectangle with sides 1 cm and 6 cm will have an area of 6 cm^2 but a perimeter of 14 cm, whereas a rectangle with sides 2 cm and 3 cm will have an area of 6 cm^2 but a perimeter of 10 cm.
3. a) Shape A is the odd one out.
   b) All the other shapes have an area of 12 cm^2.
   c) Answers will vary; for example:
   Shape B is the only shape with right angles.

Power puzzle

1. Yes, the volume of the water in the first tank is 64 cm^3 and the volume of the cube is 64 cm^3.
2. The volume of the water before putting the cube in is 20 × 20 × 2·5 = 1,000 cm^3 and the volume after is 20 × 20 × 5 = 2,000 cm^3, so the volume of the cube is 1,000 cm^3.
   10 × 10 × 10 = 1,000 cm^3
   Each side is 10 cm.

Unit 12: Ratio and proportion

Lesson 1: Ratio (1)

➜ pages 153–155

1. a) Fruit sorted into 3 groups, each group containing 1 apple and 2 pears.
b) For every 1 apple there are 2 pears.
For every 2 pears there is 1 apple.

2. a) For every 3 rulers there are 2 pencils.
b) For every 2 pencils there are 3 rulers.
c) $\frac{9}{15} = \frac{3}{5}$ of the objects are rulers.
d) $\frac{6}{15} = \frac{2}{5}$ of the objects are pencils.

3. a) Answers will vary; for example, children could draw 6 triangles and 2 circles.
b) Answers will vary; for example, children could draw 4 squares and 10 circles.

4. a) Shapes and descriptions matched:
Left-hand shape ➜ For every 1 grey square there are 2 white squares,
Middle shape ➜ For every 2 grey squares there is 1 white square,
Right-hand shape ➜ For every 1 grey square there is 1 white square
b) 10 squares shaded grey, leaving 2 white.

5. $\frac{1}{4}$
Yes, if the ratio of the red to white cubes is kept as ratio 3 : 1 then $\frac{1}{4}$ of the cubes will be white regardless of the size of the tower.

6. No, the ratio is 2 white marshmallows to 3 pink. This means that in every 5 marshmallows, 2 are white and 3 are pink. So, $\frac{2}{5}$ of the marshmallows are white and $\frac{3}{5}$ are pink.

Reflect

For every 2 apples there is 1 banana.

Lesson 2: Ratio (2)

➜ pages 156–158

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

2. The ratio of jars to tins is 1 : 2.
The ratio of tins to jars is 2 : 1.

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

4. Answers will vary but ensure that there are more than 6 shapes for each answer. For example:
a) 6 triangles and 2 circles
(or other multiples of 3 triangles and 1 circle)
b) 6 triangles and 4 circles
(or other multiples of 3 triangles and 2 circles)
c) 2 circles and 6 triangles
(or other multiples of 1 circle and 3 triangles)
d) 2 triangles to 8 circles
(or other multiples of 1 triangle and 4 circles)

5. a) No, the pencil is half the length of the straw.
b) Yes, the ratio of the length of the pencil to the length of the straw is 1 : 2 so the length of the straw is twice that of the pencil.

6. The ratio of orange juice to lemonade is 1 : 5 (250 : 1,250).

Reflect

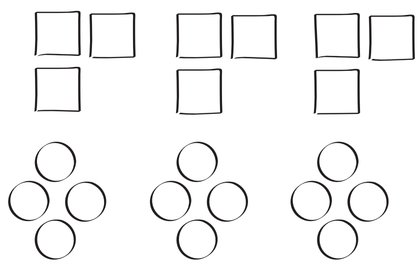
Yes and no. The ratio has the same digits, so describes the same relationship between quantities. However, the order is important as this tells you which quantity is double the other. For example:

In a bag of sweets there are twice as many mints to strawberry sweets. The ratio of mints to strawberry sweets is 2 : 1. This is the same as the ratio 1 : 2 if the order is reversed, i.e. strawberry sweets to mints.

Lesson 3: Ratio (3)

➜ pages 159–161

1. a)



b) 12

2.

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

There are 12 strawberry sweets in the jar.

3. There are 30 black buttons in the box.

4. There are 28 box fish in the tank.

5. Explanations may vary; for example:
7 squares would mean that there are 17·5 rectangles which is impossible.

6. There are 16 more cows than sheep in the field.

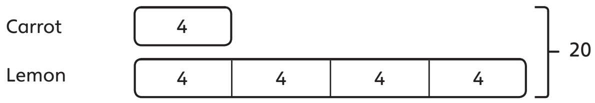
7. Josh has £2.

Reflect

Since there are 3 red balloons for every 4 blue balloons, there are more blue balloons in the bag than red balloons.

Lesson 4: Ratio (4)

➜ pages 162–164

1. 

There are 4 slices of carrot cake and 16 slices of lemon cake.

2. There are 18 footballs and 45 tennis balls.

3. 27 squares shaded red and 45 squares shaded blue.
Explanations may vary; for example:
Work out the number of squares in total (72).
There are 3 + 5 = 8 parts in each group.
72 ÷ 8 = 9
So, there are 9 groups of 3 red squares and 9 groups of 5 blue squares.
9 × 3 = 27 and 9 × 5 = 45, so there are 27 red squares and 45 blue squares.

4. a) There are 24 grey socks in the drawer.
b) 8 pairs of white socks can be made.

5. Zac receives £12 more than Jamie.

6. 4 parts = 560, so 1 part = 140
3 parts + 7 parts = 10 parts altogether
10 × 140 =1,400

Reflect

Explanations may vary; for example:

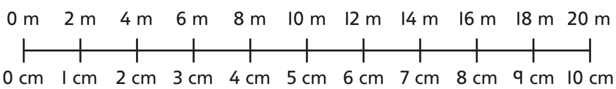
Add together 2 + 3 to get 5. This is the total number of parts.
1 part = 60 ÷ 5 = 12
So, sharing 60 into the ratio 2 : 3 gives 2 × 12 : 3 × 12, which is 24 : 36.

Alternatively, children may choose to draw a bar model to show their method.

Lesson 5: Scale drawings

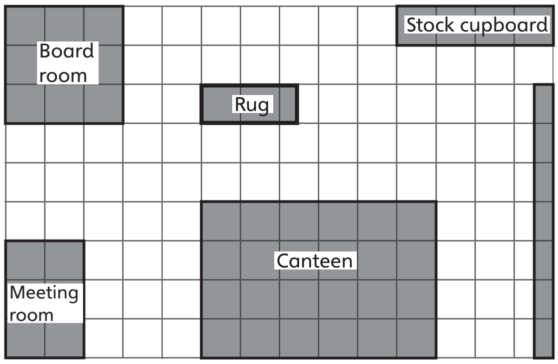
➜ pages 165–167

1. a)

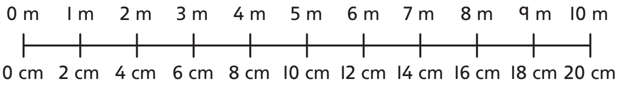


b) 12
c) 24

d) Rectangle with dimensions 1 cm × 2·5 cm drawn on the grid and identified as a rug. For example:



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



c) Width = 8 cm; height = 5 cm
8 + 8 + 5 + 5 = 26 cm
Ratio = 2 : 1, so 26 cm : 13 m
The perimeter is 13 m.

3. 1 cm : 5 km
11 × 5 = 55
Length of route = 55 km

4. 12 × 25,000 = 300,000
The actual distance between the two houses is 3 km (or 3,000 m or 300,000 cm).

5. 1 : 50
Explanations may vary; for example:
Ratio of perimeter is 20 squares : 8 squares = 2·5 : 1.
So, the scale for the shape on the left is 2·5 times smaller than the scale for the shape on the right.
20 × 2·5 = 50
So, the scale on the right is 1 : 50.

Reflect

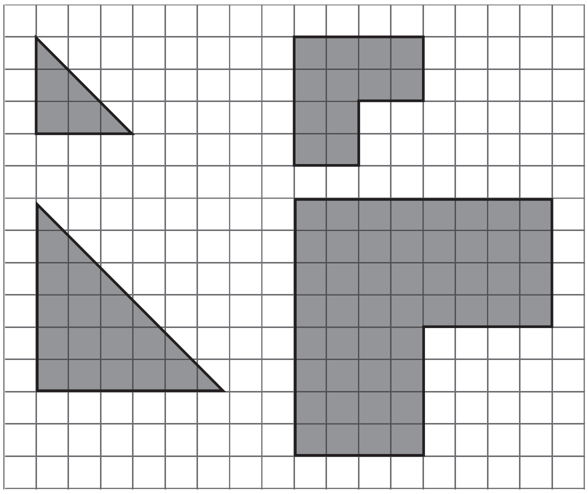
The scales are the same, since 1 : 200 = 1 cm : 200 cm = 1 cm : 2 m. However, the scale 1 : 200 does not contain any units whereas the scale 1 cm : 2 m contains units.

Lesson 6: Scale factors

➜ pages 168–170

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

2. Each side of the new shape is twice the length of each side of the old shape.

3. 

4.

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

5. a) The sale factor is $2\frac{1}{2}$.
b) The sale factor is $\frac{1}{4}$.

Reflect

When a shape is enlarged by a scale factor of $\frac{1}{2}$, each length on the shape is halved (multiplied by $\frac{1}{2}$), so each new side is half the length of the old side.

Lesson 7: Similar shapes

→ pages 171–173

1. a) Yes, they are similar as they have a scale factor of 2. The side of 3 squares has been enlarged to 6 squares (= 2 × 3) and the side of 4 squares has been enlarged to 8 squares (= 2 × 4).
b) No, they are not similar. The lengths have been enlarged but the widths are the same.

2. Answers will vary. Check one triangle is an enlargement of the other.

3. a) The scale factor is 3.
The length of side *a* is 15 cm.
b) The scale factor is 5.
The length of side *b* is 8 cm.

4. x = 2·5 cm y = 25 cm

5. a) 1 : 2
b) Children should have drawn a similar parallelogram on the grid with base length of 12 and perpendicular height of 9. The bottom left vertex of shape should sit three squares to the left of the top left vertex.
c) 18 cm

Reflect

Answers may vary; for example:

All sides in the shapes will be in the ratio 1 : 4 since the shapes are similar. One shape will have lengths 4 times longer than the other shape.

Lesson 8: Problem solving – ratio and proportion (1)

→ pages 174–176

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

2. The perimeter of the patio is 5·4 m.

3. a) 300 g flour
6 eggs
900 ml milk
3 tbsp oil
b) Toshi needs 250 g of flour.
c) 675 ml
d) Toshi can make 12 pancakes.

4. £15·60

5. 550 g

Reflect

Methods may vary; for example:

Method 1: Use a scale factor: since 9 is 6 + 3 (= 6 + half of 6), the scale factor is $1\frac{1}{2}$. The weight will also be scaled up by a factor of $\frac{1}{2}$, so 9 chocolates will weight 120 g × $1\frac{1}{2}$ = 180 g.
Method 2: Divide by 6 to find the weight of 1 chocolate and multiply by 9 to find the weight of 9 chocolates.
120 ÷ 6 = 20, 20 g × 9 = 180 g.

Lesson 9: Problem solving – ratio and proportion (2)

→ pages 177–179

1. There are 12 lilies.

2. a) There are 4 times more mint sweets than strawberry sweets. This is because the ratio is 4 : 1 so, for every strawberry sweet there are 4 mints.
b) 8

3. 40

4. 105 g

5. 35

6. 20

7. They have caught 39 fish.

Reflect

Answers will vary: look for children recognising that bar models are a useful way of representing the numbers given and their relationship to the whole or parts.

End of unit check

→ pages 180–181

My journal

1. a) Andy is incorrect. Some of the sides in shape B are double the length of the sides in shape A but some are the same.

b) 1 : 2
The sides in the second shape have been enlarged by a scale factor of 2.

Power play

a) The ratio is 1 : 5,000, so 1 cm represents 5,000 cm.
5,000 cm = 50 m
So, 1 cm represents 50 m in real life.

b) This is 3 squares on the map, which is 2·1 cm.
The scale is 1 : 5,000.
2·1 × 5,000 = 10,500 cm = 105 m
105 m is the shortest distance between Holly's house and the bus stop.

c) 350 ÷ 50 = 7, so any point 7 cm from Holly's house.