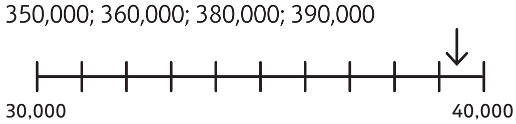
Unit I: Place value within I0,000,000

Lesson I: Numbers to I,000,000

➜ pages 6–8

1. a) 329,412
   b) 72,304
2. a) 123,000
   b) 439,286
   c) 97,103
   d) 305,246
3. a) 40 or 4 tens
   b) 4,000 or 4 thousands
   c) 3 or 3 ones
   d) 500,000 or 5 hundred thousands
   e) 4 or 4 ones
   f) 100 or 1 hundred
4. a) Answers will vary – any number using all six digits with a 4 or 8 in the ones column.
   b) Answers will vary – any number using all six digits with a 3, 5, 7 or 9 in the ones column.
   c) Answers will vary – any number using all six digits with a 5 in the ones column.
   d) Answers will vary – any number using all six digits with a 5 in the hundred thousands column.
5. a) Missing numbers from left to right along the number line: 310,000; 320,000; 340,000; 350,000; 360,000; 380,000; 390,000
   b) 

6. a) 74,400 73,500 73,410 73,390
   b) 750,167 660,167 649,167 651,167
7. Answers will vary – ensure that number is greater than 500,000, is odd, has the same digit in the ones and the thousands column and the digits total 26. Example answers: 853,163; 507,707.

Reflect

Answers will vary. Encourage children to write down facts they know about the number. Include information about odd and even, place value and comparing and ordering numbers or digits.

Lesson 2: Numbers to I0,000,000 (I)

➜ pages 9–11

1. a) 500,000
   b) 1,000,000
   c) 1,600,000
2. a) 2,903,471; two million, nine hundred and three thousand, four hundred and seventy-one
   b) 3,005,765; three million, five thousand, seven hundred and sixty-five
3. Counters drawn in columns:

a)

M	HTh	TTh	Th	H	T	O
6	I	4	6	0	0	5

b)

M	HTh	TTh	Th	H	T	O
0	5	7	0	2	3	0

4. a) 1,084,300
   b) 2,202,002
   c) 92,092
5. 643,506 or 6,*43,506 where * is any digit
6. Yes, Danny is correct. You can tell if a number is odd or even using just the ones digit – if the ones digit is 0, 2, 4, 6 or 8, then the number is even; if it is 1, 3, 5, 7 or 9, then the number is odd.

Reflect

The value of each digit in 8,027,361: 8,000,000 or 8 million; 20,000 or 2 ten thousands; 7,000 or 7 thousands; 300 or 3 hundreds; 60 or 6 tens; 1 or 1 one.

Lesson 3: Numbers to I0,000,000 (2)

➜ pages 12–14

1. a) 2,000,000 + 300,000 + 20,000 + 6,000 + 400 + 50 + 7 = 2,326,457
   Luis has £2,326,457.
   b) 300,000 + 50,000 + 30 + 7 = 350,037
   Bella has £350,037.
   c) Jamilla has £2,100,320.
2. a) 7,000; 10
   b) 60,320
3. a) 7
   b) 400 + 20 + 9
   c) 200,000 + 60,000 + 300 + 90 + 2
   d) 8,512
   e) 723,572
   f) 3,056,825
   g) 412,000

4. a) 3,098,828
   b) 3,099,728
   c) 3,108,728
   d) 2,098,728
   e) 2,998,728
5. a) 7 million or 7,000,000
   b) 7 hundred thousands or 700,000
   c) 7 thousands or 7,000
   d) 7 tens or 70
6. Answers will vary. One possible answer is 1,523,324.

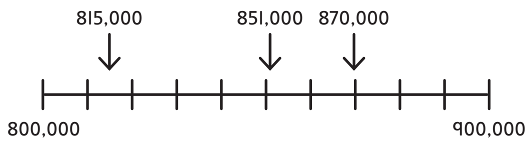
Reflect

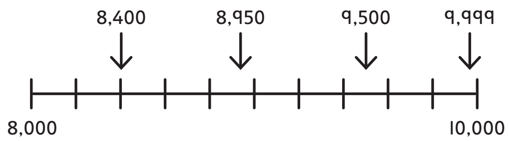
Answers will vary. Ensure that children have partitioned the number correctly. Parts should total 4,508,375 when recombined, for example:
4,000,000 + 500,000 + 8,000 + 300 + 70 + 5
3,000,375 + 1,508,000

Lesson 4: Number line to 10,000,000

➜ pages 15–17

1. a) 100,000s
   b) 1,000s
2. a) 5,700; 5,800; 5,900; 6,000; 6,100; 6,200
   b) 66,340; 66,350; 66,360
3. a) 130,520; 131,520; 132,520
   b) 720,700; 820,700; 920,700
   c) 7,100; 7,000; 6,900
   d) 3,230,000; 3,240,000; 3,250,000
4. a) 20,000; 70,000; 95,000
   b) 2,300,000; 2,550,000
   c) 620; 730; 785 approximately
5. Arrows drawn to number line:

a) 

b) 

6. a) Answer may vary ≈ 5,450,000
   b) Answer may vary ≈ 7,100,000
   c) Answer may vary ≈ 8,300,000

Reflect

Encourage children to use reasoning to explain their chosen number. The number is less than half-way between 200,000 and 300,000 so will be less than 250,000. Estimate ≈ 2,400,000.

Lesson 5: Comparing and ordering numbers to 10,000,000

➜ pages 18–20

1. Number A is greater. Explanations may vary, for example: Number A is greater because the two numbers have the same millions, hundred thousands and ten thousands, but A has the greater number of thousands than B.
2. a) 9,580 > 9,570   9,580 < 9,589
   9,580 < 9,680   9,580 < 10,000
   9,580 < 9,681   10,000 > 9,580
   b) 540,000 > 54,000   540,000 > half a million
   540,000 > 450,000   540,000 < 600,000
   540,000 > 540   540,000 < 3,000,000
3. D (£357,905); A (£370,500); C (£375,000); B (£429,700)
4. Benny is fed third.
5. 73,000; 725,906; 725,960; 728,000
6. a) 0, 1 or 2
   b) 6, 7, 8 or 9
   c) 4, 5, 6, 7, 8 or 9
   d) 0, 1, 2, 3, 4, 5, 6, 7 or 8
   e) 0
7. Answers may vary. Ensure that each number in the row is bigger than the previous number.
   First number: Missing digit can be any digit.
   Second number: First missing digit is 6; second missing digit is 8 or 9.
   Third number: First missing digit is 1, 2 or 3; second missing digit can be any digit.

Reflect

False – Ensure children know that to order numbers, we first need to look at the place value of each digit starting from the largest value place. In this case, the digit 1 in 120,000 is 1 hundred thousand compared to the digit 1 in 15,600, which is only 1 ten thousand. Therefore the numbers are not in descending order as 120,000 is bigger than 15,600.

Lesson 6: Rounding numbers

➜ pages 21–23

1. a) Olivia is incorrect. She needs to look at the hundreds column and then decide if she will need to round the thousands column up to 4 thousands or down to 3 thousands.
   b) 14,000
   13,700
2. The number rounds to 7,000,000 because it is closer to 7,000,000 than 6,000,000.

3. a) 100,000
100,000
200,000
200,000
b) 60,000
60,000
60,000
60,000

4.

Rounded to the nearest	128,381	1,565,900	72,308
100,000	100,000	1,600,000	100,000
10,000	130,000	1,570,000	70,000
1,000	128,000	1,566,000	72,000
100	128,400	1,565,900	72,300
10	128,380	1,565,900	72,310

5. Circled: 17,450; 16,790; 17,399; 16,500; 16,999; 17,098

6. a) 15,692
b) Answers will vary but must have 56, 59, 61 or 62 thousands.
c) 59,612 or 59,621

7. a) 10
b) Any digit
c) 25,497 rounded to the nearest 10 and 100 is 25,500.
d) 25,997 rounded to the nearest 10, 100 and 1,000 is 26,000.

Reflect

The answer is true. Explanations will vary. Encourage children to give two explanations to prove it, perhaps using a number line and using a 'rule' that they may have come up with.

Lesson 7: Negative numbers

➜ pages 24–26

1. a) 1 °C
b) 10 °C

2. 8 places

3. 14 metres

4. a) ⁻10 °C; ⁻5 °C; 5 °C; 10 °C; 25 °C
b) ⁻16; ⁻12; ⁻8; ⁻4; 4; 8; 12; 16
c) ⁻20; 0; 20; 40; 60; 80; 100; 140

5. a) 7 ➜ section H
17·5 ➜ section K
11 ➜ section I
⁻3 $\frac{1}{2}$ ➜ section D
⁻5 ➜ section D
⁻11·1 ➜ section B
b) Three numbers between ⁻12 and ⁻9

6. A = ⁻16
B = 8

7. a) 175
b) ⁻225

Reflect

A = ⁻50; B = 20. Explanations will vary. Encourage children to explain that between 0 and 40, there are 4 intervals, which means that each interval is worth 10. Now we know that B is 20 and if we count backwards in tens from zero, then A = ⁻50.

End of unit check

➜ pages 27–28

My journal

Answers may vary. Ensure that each number satisfies the statement.

Power puzzle

5,293,187

Unit 2: Four operations (I)

Lesson I: Problem solving – using written methods of addition and subtraction (I)

➜ pages 29–31

1.

	Th	H	T	O
	3	2	I	4
+		5	6	4
	3	7	7	8

2. Numbers from left to right along number line: 21,310; 21,312; 21,322
25,322 – 4,012 = 21,310

3. a) 1,141

	HTh	TTh	Th	H	T	O
	I	0	I	5	7	3
–	I	0	0	4	3	2
	0	0	I	I	4	I

b) 274,579

	HTh	TTh	Th	H	T	O
	2	3	4	5	0	I
+		4	0	0	7	8
	2	7	4	5	7	9

4. a) 2,438 – 1,330 = 1,108
She flew 1,108 km further on Monday than on Tuesday.
b) 2,438 – 227 = 2,211
2,438 + 1,330 + 2,211 = 5,979
She flew 5,979 km in total.

5. Max has added in the hundreds column instead of subtracting. In the ten thousands column, Max thinks that 2 take away 0 is 0. The correct answer is 23,048.

6.

	TTh	Th	H	T	O
	3	9	3	2	5
–	I	8	3	0	I
	2	I	0	2	4

	TTh	Th	H	T	O
	I	I	0	I	I
	2	4	0	I	4
+	6	I	0	2	4
	9	6	0	4	9

7. a) 9,090,909
b) 969,499

Reflect

The missing number is 53,305. Problems will vary. Encourage children to write a story where the unknown is the part that was taken away from the whole of 74,505 to leave 21,200 behind.

Lesson 2: Problem solving – using written methods of addition and subtraction (2)

➜ pages 32–34

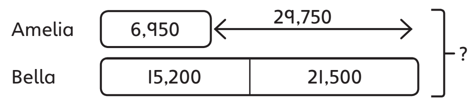
1. a) 14,321 – 1,234 = 13,087
b) Methods may vary, for example:
14,321 – (1,234 + 9,876) = 3,211 or
13,087 – 9,876 = 3,211
c) 1,234 – 909 = 325; 9,876 – 909 = 8,967;
14,321 – 909 = 13,412

2. 6 years. Methods may vary – encourage children to use mental strategies of counting on or back, which they can show on a number line.

3. C = 18,186
Total = 7,614 + 12,900 + 18,186 = 38,700
Alternatively, since B is mid-way, it is the average of the three numbers so the total is 3 × 12,900, which is 38,700.

4. a) 3,087
b) 6,419,754

5. 15,200 + 21,500 – 29,750 = 6,950
15,200 + 21,500 + 6,950 = 43,650



They scored 43,650 points altogether.

Reflect

Explanations may vary – encourage children to explain that both numbers have decreased by 1, meaning that the difference remains the same. However, the calculation has become simpler as there is no longer any exchange needed in the calculation.

5,000 – 1,728 = 4,999 – 1,727 = 3,272
50,000 – 26,304 = 49,999 – 26,303 = 23,696

Lesson 3: Multiplying numbers up to 4 digits by a I-digit number

➜ pages 35–37

1. a) 3 × 2,324 = 6,972
2,324 + 2,324 + 2,324 = 6,972
6,000 + 900 + 60 + 12 = 6,972
b) 2,153 × 5 = 10,765

	2,000	I00	50	3
5	I0,000	500	250	I5

c) 5,203 × 6 = 31,218
d) 7 × 1,593 = 11,151

2. 3,050 × 6 = 18,300

3. a) 251 × 7 = 1,757

b) 1,251 × 7 = 8,757

c) 1,251 × 8 = 10,008

4. a) 2 × 5,500 = 11,000; 11,000 + 1,350 = 12,350
The total mass of the boxes is 12,350 g.

b) 1,350 × 5 = 6,750
The total mass of the boxes is 6,750 g.

c) 5,500 × 3 = 16,500; 1,350 × 3 = 4,050;
16,500 + 4,050 = 20,550
Alternative method: 5,500 + 1,350 = 6,850;
6,850 × 3 = 20,550
The total mass of the boxes is 20,550 g.

5. a) Answers will vary. Ensure that children have taken the smaller product from the larger product to find the difference.

b) Biggest number = 8,765 × 9 = 78,885
Smallest number = 6,789 × 5 = 33,945

Reflect

Explanations may vary. Encourage children to notice the link between multiplying out each column in the short multiplication and where the answer is found on the grid method, for example: The 12,000 in the grid method can be seen as 1 ten thousand and 2 thousands in the column method. The 150 and 21 in the grid method combine in the column method to show 171 as 1 hundred, 7 tens and 1 one.

Lesson 4: Multiplying numbers up to 4 digits by a 2-digit number

→ pages 38–40

1. a) 3,125 × 15 = 46,875

		3	1	2	5	
×				1	5	
				2	5	5 × 5
			1	0	0	5 × 20
			5	0	0	5 × 100
	1	5	0	0	0	5 × 3,000
				5	0	10 × 5
			2	0	0	10 × 20
		1	0	0	0	10 × 100
	3	0	0	0	0	10 × 3,000
	4	6	8	7	5	

	3,000	100	20	5
10	30,000	1,000	200	50
5	15,000	500	100	25

b) 5,123 × 13 = 66,599

	5,000	100	20	3
10	50,000	1,000	200	30
3	15,000	300	60	9

		5	1	2	3	
×				1	3	
	1	5	3	6	9	3 × 5,123
	5	1	2	3	0	10 × 5,123
	6	6	5	9	9	

c) 1,972 × 24 = 47,328

2. a) 365 × 24 = 8,760
There will be 8,760 hours in 2021.

b) 3,600 × 24 = 86,400
There are 86,400 seconds in a day.

3. Column multiplication showing:
5,056 × 7 = 35,392; 35,392 × 2 = 70,784;
5,056 × 14 = 70,784
An explanation that 2 × 7 = 14 so you can first multiply 5,056 by 7 and then the answer by 2 and this will give the same answers as 5,056 × 14.

4. 17 × 379 = 6,443
The pool has 6,443 litres of water in it, so it is not full.

5. 3,629 × 55 = 199,595

Reflect

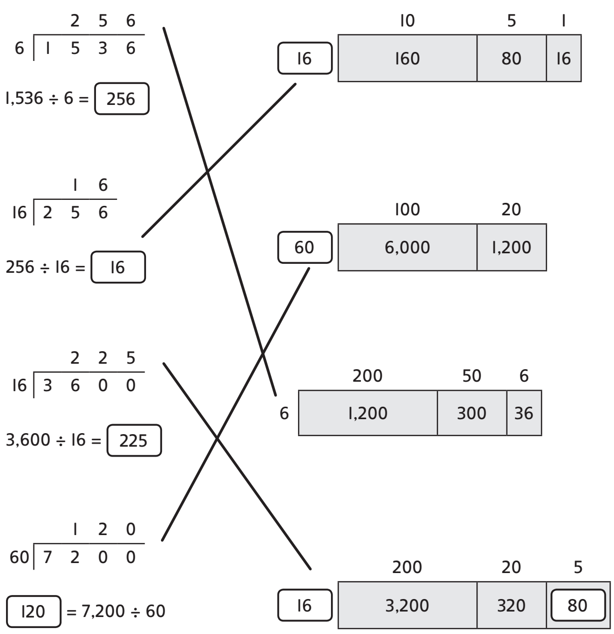
Reasoning may vary, for example:

1,254 × 21 = 26,334; 2,508 × 11 = 27,588 so 2,508 × 11 is larger.
2,508 × 11 = 1,254 × 2 × 11 = 1,254 × 22, which is larger than 1,254 × 21 so 2,508 × 11 is larger.

Lesson 5: Dividing numbers up to 4 digits by a 2-digit number (1)

→ pages 41–43

1.



2. a) 759 ÷ 33 = 23

b) 2,954 ÷ 14 = 211

3. 3,500 ÷ 25 = 140. Max can use 140 g of guinea pig food per day.

4. a) 468 ÷ 9 = 52
b) 4,689 ÷ 9 = 521
c) 378 ÷ 18 = 21
d) 3,798 ÷ 18 = 211

5.

	0	3	1	3
22	6	8	8	6

6,886 ÷ 22 = 313

	0	3	1	4
21	6	5	9	4

6,594 ÷ 21 = 314

Reflect

1,887 ÷ 17 = 111

Methods may vary. Children could use short division or the inverse grid method. Some children may already have an idea of the 'chunking' or 'partitioning' method and could show these too.

Lesson 6: Dividing numbers up to 4 digits by a 2-digit number (2)

➜ pages 44–46

1. a) 3,500 ÷ 7 = 500
500 ÷ 2 = 250
3,500 ÷ 14 = 250
There is 250 ml of juice in each glass.
b) 360 ÷ 6 = 60
60 ÷ 4 = 15
Aki can make 15 clay shells.

2. 1,260 ÷ 10 = 126; 126 ÷ 2 = 63; 1,260 ÷ 20 = 63
180 ÷ 3 = 60; 60 ÷ 5 = 12; 180 ÷ 15 = 12
960 ÷ 2 = 480; 480 ÷ 8 = 60; 960 ÷ 16 = 60
1,100 ÷ 11 = 100; 100 ÷ 2 = 50; 1,100 ÷ 22 = 50 or
1,100 ÷ 2 = 550; 550 ÷ 11 = 50; 1,100 ÷ 22 = 50

3. a) Factors may vary. 2,700 ÷ 18 = 150
b) Factors may vary. 7,200 ÷ 12 = 600
c) Factors may vary. 5,400 ÷ 36 = 150
d) Dividing by factors 7 and 2 (in either order)
5,600 ÷ 14 = 400

4. a) i) 480 ÷ 8 = 60
60 ÷ 2 = 30
So, 480 ÷ 16 = 30
ii) 960 = 480 × 2 and 32 = 2 × 16
Therefore, 960 ÷ 32 = 480 multiplied by 2, divided by 2 and divided by 16.
Multiplying by 2 and dividing by 2 are inverse operations so will cancel each other out.
So 960 ÷ 32 = 480 ÷ 16 = 30
b) Ambika is correct – encourage children to prove this using an example or by drawing a diagram, for example:
160 ÷ 4 = 40 and 160 ÷ 8 = 20. This means that if I double the divisor, the quotient is halved.
Bella is incorrect – encourage children to disprove using an example or a diagram, for example:
160 ÷ 4 = 40 and 320 ÷ 8 = 40. This means that if I double both the dividend and divisor, the quotient remains the same.

Reflect

6,440 ÷ 20 = 322

Methods may vary, for example:
6,440 ÷ 2 = 3,220; 3,220 ÷ 10 = 322
6,440 ÷ 5 = 1,288; 1,288 ÷ 4 = 322

Lesson 7: Dividing numbers up to 4 digits by a 2-digit number (3)

➜ pages 47–49

1. a) 399 ÷ 19 = 21

	10	10	1
19	190	190	19

		2	1	
19	3	9	9	
	1	9	0	10
	2	0	9	
	1	9	0	10
		1	9	
		1	9	1
			0	

b) 385 ÷ 11 = 35
c) 888 ÷ 37 = 24

2. 992 ÷ 31 = 32
There are 32 classes.

3. a) 182 ÷ 13 = 14
b) 364 ÷ 13 = 28
c) 528 ÷ 11 = 48
d) 528 ÷ 22 = 24

4. Answers may vary.

Mo could have done:

			3	3	
37	⁰~~1~~	¹¹~~2~~	¹2	1	
		7	4	0	20
		4	8	1	
		3	7	0	10
		1	1	1	
		1	1	1	3
				0	33

Olivia could have done:

			3	3	
37	⁰~~1~~	¹¹~~2~~	¹2	1	
		3	7	0	10
		⁷~~8~~	¹5	1	
		3	7	0	10
		4	8	1	
		3	7	0	10
		⁰~~1~~	¹⁰~~1~~	¹1	
			7	4	2
			3	7	1
			3	7	
				0	33

5. 702 ÷ 26 = 27

Reflect

Answers may vary – encourage children to check the answer using the inverse calculation of 23 × 24.

Lesson 8: Dividing numbers up to 4 digits by a 2-digit number (4)

→ pages 50–52

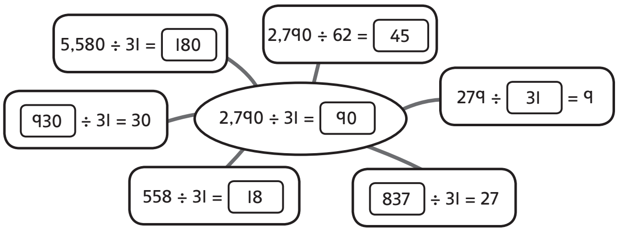
1. a) 735 ÷ 15 = 49
b) 1,890 ÷ 15 = 126
c) 5,610 ÷ 15 = 374

2. 1,331 ÷ 11 = 121
There will be 121 teams.

3. 2,444 ÷ 26 = 94, Jen cycles 94 km per day.
2,325 ÷ 25 = 93, Toshi cycles 93 km per day.
Jen cycles more kilometres per day than Toshi.

4. a) I know that 10 × 61 = 610, not 620. Ebo has made a mistake at 7 × 61, as it should be 427, not 437.
Number line corrections: 427, 488, 549, 610
b) 8,845 ÷ 61 = 145

5. 2,790 ÷ 31 = 90



Reflect

2,553 ÷ 23 circled. Explanations may vary – encourage children to notice that 23 is a prime number so there are no useful factors to divide by to make the calculation easier.

1,440 ÷ 30 = 48
2,553 ÷ 23 = 111

Lesson 9: Dividing numbers up to 4 digits by a 2-digit number (5)

→ pages 53–55

1. Aki is correct.
100 ÷ 13 = 7 remainder 9
Emma: 100 ÷ 14 = 7 remainder 2
Aki: 101 ÷ 13 = 7 remainder 10

2. 200 ÷ 15 = 13 remainder 5
Andy can fill up 13 pages and will have 5 stickers left over.

3. Lines drawn to match calculations to remainders:
450 ÷ 20 → 10
301 ÷ 10 → 1
955 ÷ 50 → 5
685 ÷ 25 → 10
335 ÷ 33 → 5

4. a) 300 ÷ 11 = 27 remainder 3
b) 300 ÷ 31 = 9 remainder 21
c) 750 ÷ 17 = 44 remainder 2
d) 850 ÷ 17 = 50

5. 475 ÷ 35 = 13 remainder 20
The ranger needs to buy 14 bags of seeds.

6. Answers will vary. Encourage children to use their knowledge of multiples to solve this. The missing number can be 1 less than any multiple of 41.
This will always leave a remainder of 40. For example:
41 × 10 = 410, so 409 ÷ 41 = 9 remainder 40

Reflect

Explanations may vary. Encourage children to use Reena's method and then check if 300 ÷ 21 has a remainder of 2. Reena is incorrect although her calculation is correct i.e. 300 ÷ 3 = 100; then 100 ÷ 7 = 14 remainder 2. However, this remainder as a fraction is $\frac{2}{7}$ and if you use equivalence and link it back to the original divisor, $\frac{2}{7} = \frac{6}{21}$. There the remainder is 6 and not 2.

Lesson 10: Dividing numbers up to 4 digits by a 2-digit number (6)

→ pages 56–58

1. a) 2,000 ÷ 75 = 26 remainder 50
Amelia can make 26 ice lollies. She will have 50 ml of juice left.
b) 2,500 ÷ 95 = 26 remainder 30
Bella has 30 ml of juice left, which is less than Amelia.
c) Amelia can make $\frac{50}{75}$ or $\frac{2}{3}$ of an ice lolly with her remaining juice.
Bella can make $\frac{30}{95}$ or $\frac{6}{19}$ of an ice lolly with her remaining juice.

2. a) 1,000 ÷ 11 = 90 remainder 10
b) 2,000 ÷ 11 = 181 remainder 9
c) 4,000 ÷ 22 = 181 remainder 18
d) 8,000 ÷ 22 = 363 remainder 14
Answers will vary, for example:
2,000 ÷ 11 = (2 × 1,000) ÷ 11. The answer will therefore be 2 × 90 with a remainder of 2 × 10. However, it does not make sense to have a remainder of 20 when dividing by 11. Instead this gives 1 more group of 11 with a remainder of 9. So, 2,000 ÷ 11 = 181 remainder 9.

3. 2,515 ÷ 20 = 125 remainder 15
So, working out the division exactly gives
$125\frac{15}{20}$ or $125\frac{3}{4}$. $\frac{3}{4}$ of £1 is 75p or £0·75
Each class gets £125·75.

4. Answers may vary. Encourage a systematic approach – make the divisor the largest possible number so that you can make larger remainders.
1,137 ÷ 95 = 11 remainder 92

Reflect

Answers will vary. Encourage children to work out a division equation that leaves a remainder of 10 first. They can then use this equation to create the story problem.

Encourage children to use multiplication to find a division calculation which will have a remainder of 10, for example: 35 × 20 = 700. Therefore 700 ÷ 35 = 20 so 710 ÷ 35 = 20 remainder 10.

End of unit check

→ pages 59–60

My journal

Answers will vary. Encourage children to use their number sense (in this case, knowing the patterns in multiples of 25) to help them find an equation that leaves a remainder of 10 when divided by 25.

Power puzzle

Children should find that, whatever numbers they begin with, they eventually find themselves 'stuck', constantly using and reusing the digits 6, 1, 4, 7.

Unit 3: Four operations (2)

Lesson 1: Common factors

➜ pages 61–63

1. a) 1 × 14 = 14
2 × 7 = 14
1 × 18 = 18
2 × 9 = 18
3 × 6 = 18
The factors of 14 are 1, 2, 7 and 14.
The factors of 18 are 1, 2, 3, 6, 9 and 18.

b) The common factors of 14 and 18 are 1 and 2.

c) Children can draw diagrams to show that 14 does not form into an array with rows of 6. So 6 is not a factor of 14 and it therefore cannot be a common factor of 14 and 18.

2. Factors of 40: 1 × 40; 2 × 20; 4 × 10; 5 × 8

Factors of 100: 1 × 100; 2 × 50; 4 × 25; 5 × 20; 10 × 10

The common factors of 40 and 100 are: 1, 2, 4, 5, 10, 20

3. 8 is in the wrong place because it is a factor of both 80 and 200. 8 × 10 = 80; 8 × 25 = 200

5 is in the wrong place because it is a factor of both 80 and 200. 5 × 16 = 80; 5 × 40 = 200

4 a)

Factors of 35	Factors of 50	Factors of 70
1	1	1
5	2	2
7	5	5
35	10	7
	25	10
	50	14
		35
		70

b) Answers may vary but must be a multiple of 60. The lowest common factor of 1, 2, 3, 4 and 5 is 60, so any multiple of 60 will be a common factor.

Reflect

Common factors of 15 and 60: 1, 3, 5, 15

No, you would not need to check all the numbers up to 60. All the common factors must be factors of 15 so you would only need to check all the numbers up to 15.

Lesson 2: Common multiples

➜ pages 64–66

1.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

The common multiples of 6 and 8 up to 100 are 24, 48, 72 and 96.

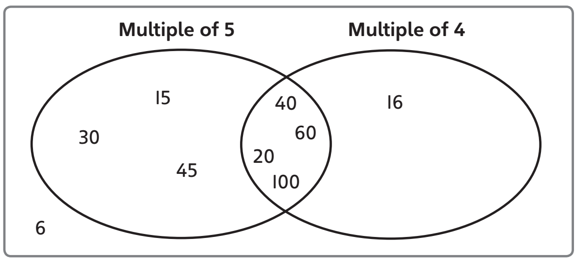
2. a)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

b)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

3.



Description may vary, for example: I notice that all the common multiples of 4 and 5 are multiples of 20.

4. 240, 300 and 360

5. a) The bar model shows that 48 is divisible by 12 exactly and it is also divisible by 4 exactly. Therefore 48 is a multiple of 12 and a multiple of 4, so it is a common multiple of 12 and 4.

b) No, the lowest common multiple of 4 and 12 is 12, so the common multiples up to 100 would be all multiples of 12 up to 100. Andy has missed out 12, 24, 36, 60, 72 and 84.

Reflect

Answers may vary but all must be multiples of 100.

Encourage children to find the lowest common multiple, which is 100. All other common multiples will be multiples of 100.

Lesson 3: Recognising prime numbers up to 100

➜ pages 67–69

1. Children to show 7 by 7 array to demonstrate that 49 has a factor of 7.
   49 ÷ 7 = 7.
   So, factors of 49 are 1, 7 and 49.
2. I know 51 is not a prime number because it has factors 1, 3, 17 and 51. (Alternatively, children may just give a factor which is not 1 or 51, for example they may say that 3 is a factor of 51).

   I know 55 is not a prime number because it has factors 1, 5, 11 and 55. (Alternatively, children may just give a factor which is not 1 or 55, for example they may say that 5 is a factor of 55.)

   53 is a prime number because it only has two factors, 1 and itself (53).
3.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

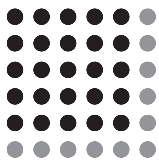
4. Children should write two numbers in each cell from the following possible answers:
   Top left cell: 2, 5
   Bottom left cell: 1, 4, 10, 20, 25, 50, 100
   Top right cell: Any prime number except 2 and 5
   Bottom right cell: Any non-prime numbers except 1, 4, 10, 20, 25, 50 and 100
   The top left section can have no more numbers in it as they are the only two factors of 100 that are also prime.
5. Explanations may vary, for example:
   No, I do not agree. I know that 99 has a factor of 3, so if I partition 123 into 99 + 24, I know that 24 also has a factor of 3. Therefore 123 must have a factor of 3 so it is not prime.
   This shows that if a number is prime, adding on 100 will not necessarily give a prime number.

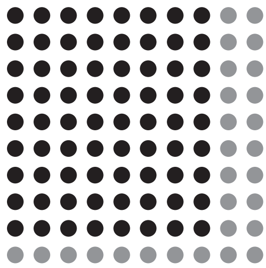
Reflect

Explanations may vary. Encourage children to explain that they can work out prime or composite numbers using times-table and division knowledge or by drawing arrays. 85 is not prime as it is in the 5 times-table, so it has a factor of 5. 89 is prime – a multiplication tables grid shows that it is not a multiple of any number between 2 and 10 and so it only has two factors, 1 and itself.

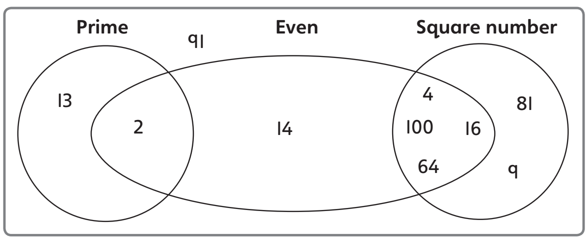
Lesson 4: Squares and cubes

➜ pages 70–72

1. a) 49 circled; 7 × 7 = 49
   b) 125 circled
2. a) 

   b) 
3. a) 81 b) 100 c) 121 d) 8 e) 4 f) 4 g) 1 h) 1 i) 2
4. 72 more cubes need to be added. Explanations may vary, for example:

   … because each layer is made from 6 × 6 cubes and you need 2 more layers to complete the big cube. 6 × 6 × 2 = 72.

   … because there are 6 × 6 × 4 = 144 cubes in the shape whereas 6 × 6 × 6 = 216. 216 – 144 = 72.
5. Bella is incorrect as 30 × 30 = 900. She only multiplied 30 by 3 and not by 30.
6. 

   All square numbers can be written as $a \times a$, for some whole number a. Square numbers (apart from 1) therefore have more than two factors since their factors include 1, a and the number itself. The square number 1 is not prime as it has only one factor, 1 (itself). So, there are no prime square numbers and the circles do not need to overlap.

Reflect

Corrected equations: $1^2 = 1$; $3^2 = 9$; $5^3 = 125$

Comments may vary, for example:

Danny has worked out 1 × 2 but this is not the same as 1^2. Danny needs to remember that when you square a number you multiply it by itself so $1^2 = 1 \times 1 = 1$.

$9^2 = 9 \times 9 = 81$ so it is not true that $9^2 = 3$. Danny has squared the wrong number as it is true that 3 × 3 = 9 so $3^2 = 9$.

Danny has worked out 5 × 3 but this is not the same as 5^3. Danny needs to remember that when you cube a number you multiply it by itself and then by itself again so $5^3 = 5 \times 5 \times 5 = 125$.

Lesson 5: Order of operations

➜ pages 73–75

1. Lines drawn to match:
3 × 2 + 6 → second image (towers of cubes)
3 + 2 × 6 → third image (bead string)
3 × 6 + 2 → first image (ten frames)

2. a) 5 + 1 × 5 = 10 Image should show 5 counters (1 group of 5) and another 5 counters.
b) 5 × 2 – 5 = 5 Image should show 5 groups of 2 counters (or 2 groups of 5 counters), with 5 counters crossed out.

3. a) 36 – 3 = 33
b) 20 + 140 = 160
c) 10 – 8 = 2
d) 800 – 8 = 792
e) 50 – 5 = 45
f) 64 – 56 = 8

4. a) 36; 180
b) 48; 320
c) 60; 5
d) 120; 5

5. a) 50
18
500
b) Answers will vary. Each calculation should have the same number in both boxes so that the answer to the division is 1.
Explanations will vary, for example:
Each pair of missing numbers involves the same number in each box.
The dividend and divisor are always the same number to give a quotient of 1.

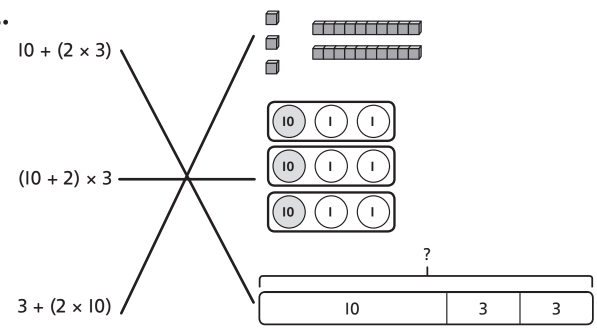
Reflect

Answers will vary – encourage children to write the multiplication and division part as the second operation in the calculation so that they cannot get it correct accidentally by just working from left to right.

Lesson 6: Brackets

➜ pages 76–78

1.



2. a) 100; 25 × 4 = 100
b) 9
c) 75
d) 3

3. a) Circled: 12 × (3 + 5)
b) (3 + 5) × 15 = 120
c) (5 × 3) + (3 × 5). This can also be written without brackets.

4. a) <
b) >
c) =

5. a) Answers may vary. Possible solutions include:
(2 + 2 + 2) × 2 = 12; 2 × (2 + 2 × 2) = 12
b) Answers may vary. Possible solutions include:
10 = 3 ÷ 3 + 3 × 3; 10 = (3 × 3) + (3 ÷ 3)

6. a) Answers may vary. Possible solutions include:
Greater than 100: (10 + 10) + (10 × 10) = 120;
10 × 10 + 10 ÷ 10 = 101; 10 × 10 × (10 + 10) = 2,000
Between 0 and 1: (10 ÷ 10) ÷ (10 × 10) = 0·01;
(10 – 10) × 10 × 10 = 0; (10 + 10 – 10) ÷ 10 = 1
Less than 0: (10 – 10) – 10 × 10 = $^{-}$100;
(10 ÷ 10) – (10 × 10) = $^{-}$99; 10 – 10 × 10 × 10 = $^{-}$990
b) Answers will vary as children are asked to give the largest and smallest results they can find.
Largest: 10 × 10 × 10 × 10 = 10,000
Smallest: 10 – 10 × 10 × 10 = –990

Reflect

Explanations may vary – encourage children to prove, by solving the calculations, that the left side is greater than the right side.

10 × (3 + 4) > 10 × 4 + 3
70 > 43

Lesson 7: Mental calculations (1)

→ pages 79–81

1. a) 57
   b) 396
   c) 35 × 9 = 315; 10 × 35 = 350
2. a) Kate receives 3p change.
   b) Ebo spends £4·75 in total. He receives £15·25 change.
3. a) 200
   b) 250
   c) 300
   d) 225
4. Explanations may vary, for example: Sofia rounded 98 to 100 and worked out 6 × 100 = 600. She added 2 cm to each length of wood, so she needs to subtract 6 × 2 from her answer. Sofia's mistake was that she subtracted 6 not 12. The correct answer is 588 cm or 5 m and 88 cm.
5. Explanations may vary – encourage children to use mental methods to work out that 9 × 49 = 9 × 50 – 9 = 441. Then use mental maths to solve 9 × 25 = 10 × 25 – 25 = 225. Use subtraction to work out 441 – 225 = 216 and use addition to work out 441 + 225 = 666.

Reflect

Answers may vary – encourage an explanation of using number sense. For example, if the numbers in a calculation are near multiples of 10 it may be efficient to use rounding then adjust the answer; if an addition or subtraction calculation does not involve exchange or only one simple exchange, it may be easy to do mentally; if numbers are close together when finding the difference, then a counting up mental strategy could be used.

Lesson 8: Mental calculations (2)

→ pages 82–84

1. a) 250 – 20 = 230
   250,000 – 20,000 = 230,000
   The remaining counters represents two hundred and thirty thousand.
   b) 115 + 5 = 120
   115,000 + 5,000 = 120,000
   Now Ambika can represent 120,000.
2. a) 354,000
   b) ninety-three thousand
   c) three hundred thousand
   d) 3,205,500
3. a) 49,000
   b) 800,000
   c) 850,000
4. a) 900
   b) 9,000
   c) 5
   d) 19,000
5.

1,000 less	100 less	Number	100 more	1,000 more
99,001	99,901	100,001	100,101	101,001
999,001	999,901	1,000,001	1,000,101	1,001,001
899,500	900,400	900,500	900,600	901,500
8,101	9,001	9,101	9,201	10,101

6. a) 424,900
   b) Solution can be any number between 1,800,010 and 2,000,010 (but not 1,800,010 or 2,000,010 themselves).

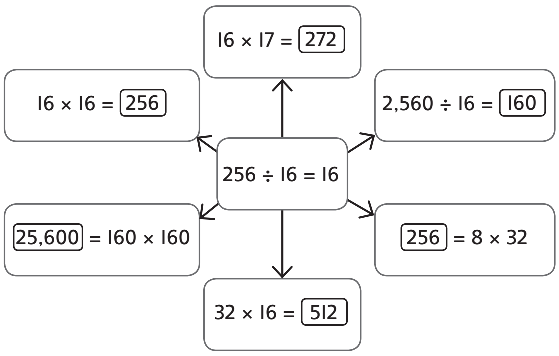
Reflect

Answers will vary – encourage an explanation that the calculations that can easily be solved mentally will involve limited exchange, for example, addition or subtraction of multiples of powers of 10. Calculations not easily solved mentally will involve multiple exchanges.

Lesson 9: Reasoning from known facts

→ pages 85–87

1. a) 5 × 6 × 7 = 210
   b) 6 × 5 × 5 = 150
   c) 3 × 7 × 9 = 189
   d) 5 × 8 × 7 = 280
2. a) 425 + 85 = 510
   b) 14 × 84 = 1,176
   c) 4 × 164 = 656
3. Jamilla has multiplied by the difference between 148 and 48, instead of adding 6 lots of the difference.
   To get the correct answer: 148 × 6 = (100 × 6) + (48 × 6).
   As she already knows 48 × 6 = 288,
   148 × 6 = 600 + 288 = 888.
4. a)



   b) Answers will vary – ensure that children have used the related fact for their new equations, for example: 16 × 15 = 240; 2,560 ÷ 160 = 16; 16^2 = 256

5. a) $251 \times 11 = 2,761$
b) $65^2 = 4,225$
c) $25 \times 81 = 2,025$

Reflect

Answers may vary – encourage children to write facts that include doubling or multiplying by a power of ten, and/or using the inverse, for example: $85 \times 6 = 510$; $255 \div 3 = 85$; $85 \times 30 = 2,550$.

End of unit check

→ pages 88–89

My journal

Olivia is correct as $30^2 = 30 \times 30 = 900$

Mo's idea is also correct, as $29 \times 30 = 30^2 - 30$.
So, $29 \times 30 = 900 - 30 = 870$

Power puzzle

Yes, you can make any whole number by adding 2 or 3 prime numbers.

Here are some possible solutions:

4 = 2 + 2	15 = 5 + 5 + 5
5 = 2 + 3	16 = 7 + 7 + 2
6 = 3 + 3	17 = 7 + 7 + 3
7 = 2 + 2 + 3	18 = 13 + 5
8 = 5 + 3	19 = 17 + 2
9 = 3 + 3 + 3	20 = 17 + 3
10 = 5 + 5	
11 = 5 + 3 + 3	100 = 97 + 3
12 = 5 + 5 + 2	101 = 97 + 2 + 2
13 = 5 + 5 + 3	
14 = 7 + 7	200 = 197 + 3

Unit 4: Fractions (1)

Lesson 1: Simplifying fractions (1)

➜ pages 90–92

1. a) 4 ($\frac{1}{4}$)
b) $\frac{5}{6}$; ÷ 7
c) ÷ 5; $\frac{5}{7}$; ÷ 5

2. a) $\frac{7}{12}$ c) $\frac{4}{9}$ e) 80 ($\frac{72}{80}$)
b) $\frac{2}{5}$ d) $\frac{3}{4}$ f) 18 ($\frac{18}{24}$)

3. $\frac{90}{120} = \frac{45}{60} = \frac{15}{20} = \frac{3}{4}$

4. a) One part shaded
b) Two parts shaded
c) Four parts shaded
d) Five parts shaded

5. Ebo has found equivalence by dividing both the numerator and denominator by 4, which gives a decimal number as denominator. However, writing a fraction in its simplest form involves finding the equivalent fraction with the smallest possible whole number numerator and denominator. So, the simplest form of $\frac{4}{6}$ is $\frac{2}{3}$.

6. a) Circled: $\frac{10}{20}$
b) Circled: $\frac{18}{24}$

7. a) $\frac{25}{40}$ b) $\frac{40}{64}$

8. a) 8
b) 22
c) $\frac{4}{5}$
d) Answers may vary, for example:
1 (missing number on top), 5 (missing number on bottom)
4 (missing number on top), 9 (missing number on bottom)
7 (missing number on top), 13 (missing number on bottom)

Reflect

To simplify $\frac{12}{18}$, first find the highest common factor of 12 and 18, which is 6. Then divide both the numerator and denominator by 6 to give $\frac{2}{3}$.

Lesson 2: Simplifying fractions (2)

➜ pages 93–95

1. $\frac{6}{10} = \frac{3}{5}$
So, $4\frac{6}{10} = 4\frac{3}{5}$

2. a) $\frac{2}{5}$
$1\frac{2}{5}$
$2\frac{2}{5}$
$32\frac{2}{5}$

b) $\frac{3}{5}$
$\frac{3}{5}$
$\frac{3}{5}$
$\frac{5}{3} = 1\frac{2}{3}$

Descriptions of patterns may vary, for example:
In part a) I noticed that the fraction part stayed the same, just the whole number changed.
In part b) I noticed that the first three fractions gave the same answer – they are all equivalent. The last fraction swapped the digits in the numerator and denominator and so made an improper fraction which could then be converted to a mixed number.

3. a) Emma has not simplified fully as she has not used the highest common factor. She needs to simplify further by dividing both the numerator and denominator by 3 to give $\frac{1}{2}$.
b) Emma has swapped the numerator and denominator when simplifying. The fraction correctly simplified is $\frac{2}{1}$ or just 2.
c) Emma has simplified the fraction part correctly by dividing the numerator and denominator by 2, however she has also divided the whole number part by 2 which is wrong. $8\frac{4}{10}$ should simplify to $8\frac{2}{5}$.

4. a) $6\frac{2}{3}$ c) $15\frac{1}{2}$ e) $2\frac{1}{2}$
b) $\frac{5}{12}$ d) $\frac{7}{11}$ f) $1\frac{1}{4}$

5. $\frac{42}{30}$

6. $\frac{20}{40}$

7. a) $\frac{67}{16}$ or $4\frac{3}{16}$
b) $\frac{419}{48}$ or $8\frac{35}{48}$

Reflect

Look at the fractional part and find the highest common factor of 16 and 24 which is 8. Now divide both the numerator and denominator by 8 to give $\frac{2}{3}$. The whole part cannot be simplified so, $4\frac{16}{24} = 4\frac{2}{3}$.

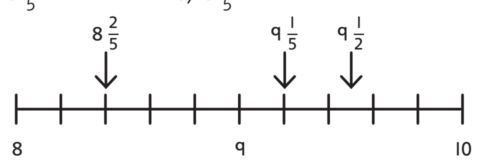
Lesson 3: Fractions on a number line

➜ pages 96–98

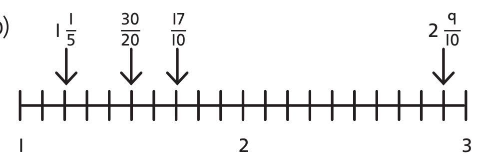
1. a) $\frac{2}{3}$; $1\frac{1}{3}$; $2\frac{2}{3}$ b) $9\frac{6}{8}$ c) $7\frac{1}{2}$; $8\frac{1}{4}$

2. a) $5\frac{4}{5}$ b) $5\frac{2}{5}$

3. a)



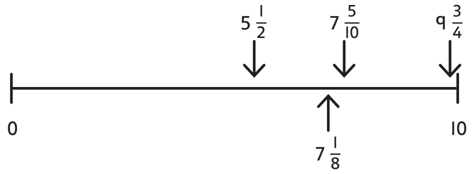
b)



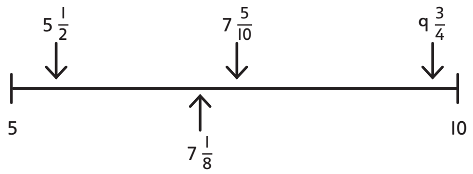
4. a) $12\frac{4}{6}, 13\frac{1}{6}, 13\frac{4}{6}, 14\frac{1}{6}, 14\frac{4}{6}$
b) $11\frac{1}{2}, 11\frac{5}{6}, 12\frac{1}{6}, 12\frac{1}{2}$
c) $14\frac{1}{6}, 13\frac{1}{2}, 12\frac{5}{6}, 12\frac{1}{6}, 11\frac{1}{2}$
d) $14\frac{1}{6}, 13\frac{1}{6}, 12\frac{1}{6}, 11\frac{1}{6}$

5. Answer d) circled. The differences between the fractions are $\frac{3}{4}$, $\frac{3}{4}$ and then $\frac{1}{2}$, so the pattern does not go up by the same amount each time.

6. a)



b)



Explanations will vary, for example: The two number lines are the same length but the top line represents the range 0 to 10 while the bottom line represents the range 5 to 10. A range of 1 on the top line is represented by $\frac{1}{10}$ of the top line but $\frac{1}{5}$ of the bottom line. So the distance between the numbers on the top line is half the distance between the same numbers on the bottom line.

Reflect

The first arrow is pointing to $3\frac{3}{4}$ – I know this because each whole is split into 4 equal parts on the number line, making each part one quarter. It is on the third part up from 3 so this will be $3\frac{3}{4}$.

The second arrow is pointing to $4\frac{1}{8}$ – I know this because half of $\frac{1}{4}$ is $\frac{1}{8}$. The arrow is pointing halfway between the first part after 4, so this will be $4\frac{1}{8}$.

Lesson 4: Comparing and ordering fractions (1)

➜ pages 99–101

1. a) The LCM of 2 and 4 is 4.
$\frac{1}{2} = \frac{2}{4}$
So $\frac{1}{2} < \frac{3}{4}$.
b) The LCM of 5 and 10 is 10.
$\frac{3}{5} = \frac{6}{10}$
So $\frac{3}{5} < \frac{7}{10}$.
c) The LCM of 8 and 3 is 24.
$\frac{3}{8} = \frac{9}{24}; \frac{2}{3} = \frac{16}{24}$
So $\frac{3}{8} < \frac{2}{3}$.
d) The LCM of 5 and 7 is 35.
$\frac{3}{5} = \frac{21}{35}; \frac{4}{7} = \frac{20}{35}$
So $\frac{3}{5} > \frac{4}{7}$.

2. a) 20 is the lowest common multiple as 20 is the smallest number which is in the 5, 10 and 4 times-tables.
b) $\frac{4}{5} = \frac{16}{20}; \frac{7}{10} = \frac{14}{20}; \frac{3}{4} = \frac{15}{20}$
$\frac{4}{5}$ is the biggest fraction. Explanations may vary, for example: I found equivalent fractions with a denominator of 20 and then compared the numerators.

3. D, C, A, B

4. a) $\frac{11}{15}, \frac{7}{10}, \frac{2}{3}, \frac{1}{2}$
b) $\frac{3}{3}, \frac{7}{8}, \frac{3}{4}, \frac{1}{6}$

5. I do not agree with the article. $\frac{3}{8} = \frac{15}{40}$ and $\frac{2}{5} = \frac{16}{40}$ so chocolate is the most popular flavour.

6. a) The missing digit could be 5, 6 or 7.
b) Answers may vary. Possible solution: $\frac{1}{2}; \frac{7}{12}; \frac{2}{3}; \frac{6}{8}$

Reflect

Lexi is incorrect.

Explanations may vary, for example:

$\frac{5}{8} = \frac{15}{25}$ and $\frac{5}{12} = \frac{10}{24}$ so $\frac{5}{8}$ is greater than $\frac{5}{12}$.
Dividing a whole into a larger number of equal pieces will mean that the size of each piece is smaller. Therefore $\frac{1}{12}$ is smaller than $\frac{1}{8}$. This means that $\frac{5}{12}$ will be smaller than $\frac{5}{8}$.

Lesson 5: Comparing and ordering fractions (2)

➜ pages 102–104

1. a) $4\frac{2}{3} = 4\frac{4}{6}; 4\frac{1}{2} = 4\frac{3}{6}$
So $4\frac{2}{3} > 4\frac{1}{2}$.
b) $\frac{11}{4} = \frac{22}{8}$
So $\frac{11}{4} > \frac{19}{8}$.
c) The LCM of 5 and 3 is 15.
$2\frac{1}{5} = 2\frac{3}{15}; 2\frac{1}{3} = 2\frac{5}{15}$
So $2\frac{1}{5} < 2\frac{1}{3}$.

2. a) $3\frac{3}{8} = \frac{27}{8}$, which is smaller than $\frac{29}{8}$, so $3\frac{3}{8} < \frac{29}{8}$.
Alternatively: $\frac{29}{8} = 3\frac{5}{8}$ which is greater than $3\frac{3}{8}$, so $\frac{29}{8} > 3\frac{3}{8}$.
b) Explanations may vary, for example:
$5\frac{1}{6}$ is bigger than $4\frac{5}{6}$ because 5 wholes is bigger than 4 wholes.
$5\frac{1}{6}$ is greater than 5 but $4\frac{5}{6}$ is smaller than 5, so $5\frac{1}{6} > 4\frac{5}{6}$.

3. a) The LCM of 3 and 7 is 21.
$8\frac{2}{3} = 8\frac{14}{21}; \frac{60}{7} = 8\frac{4}{7} = 8\frac{12}{21}$
So $8\frac{2}{3} > \frac{60}{7}$.
b) $\frac{11}{7} < 1\frac{11}{14}$
c) $\frac{35}{6} > \frac{45}{8}$

4. $8\frac{7}{15}, \frac{17}{2}, \frac{87}{10}, \frac{27}{3}$

5. $4\frac{1}{5}$

6. A = $\frac{4}{9}$; B = $\frac{10}{6}$; C = $\frac{8}{3}$

Reflect

Explanations may vary – encourage children to show that they could either turn both numbers into mixed number, find equivalent fractions with a common denominator and compare, or turn both into improper fractions, find equivalents with a common denominator and compare.

Lesson 6: Adding and subtracting fractions (I)

→ pages 105–107

1. a) The LCM of 4 and 10 is 20.
$\frac{3}{4} = \frac{15}{20}$; $\frac{1}{10} = \frac{2}{20}$; $\frac{15}{20} + \frac{2}{20} = \frac{17}{20}$
So $\frac{3}{4} + \frac{1}{10} = \frac{17}{20}$
b) The LCM of 8 and 12 is 24.
$\frac{7}{8} = \frac{21}{24}$; $\frac{5}{12} = \frac{10}{24}$; $\frac{21}{24} - \frac{10}{24} = \frac{11}{24}$
So $\frac{7}{8} - \frac{5}{12} = \frac{11}{24}$

2. $\frac{1}{20}$ of a metre remains.

3. Ambika has added both the numerator and denominator. To work out the calculation correctly, you need to find the lowest common denominator and find equivalent fractions using this denominator. You can then add the numerators but the denominator will stay the same. $\frac{3}{10} + \frac{1}{5} = \frac{3}{10} + \frac{2}{10} = \frac{5}{10}$ which can be simplified to $\frac{1}{2}$.

4. a) $\frac{13}{15}$ c) $\frac{1}{12}$
b) $\frac{23}{24}$ d) $\frac{13}{20}$

5. $\frac{6}{7}$

6. No, Richard is not correct. $\frac{5}{9} + \frac{2}{5} = \frac{25}{45} + \frac{18}{45} = \frac{43}{45}$.
This is less than the whole book as that would be $\frac{45}{45}$.

7. a) $\frac{1}{2} + \frac{3}{8} = \frac{7}{8}$ b) $\frac{1}{2} - \frac{1}{7} = \frac{5}{14}$

Reflect

Amelia found the lowest common denominator of 20, however, she forgot to multiply the numerators in order to find equivalent fractions. The correct calculation is $\frac{8}{20} + \frac{5}{20} = \frac{13}{20}$.

Lesson 7: Adding and subtracting fractions (2)

→ pages 108–110

1. a) Add the wholes: 4 + 1 = 5
Add the parts: $\frac{2}{3} = \frac{4}{6}$
$\frac{2}{3} + \frac{1}{6} = \frac{4}{6} + \frac{1}{6} = \frac{5}{6}$
So $4\frac{2}{3} + 1\frac{1}{6} = 5\frac{5}{6}$
b) Subtract the wholes: 3 – 1 = 2
Subtract the parts: $\frac{3}{4} = \frac{9}{12}$; $\frac{1}{6} = \frac{2}{12}$
$\frac{3}{4} - \frac{1}{6} = \frac{9}{12} - \frac{2}{12} = \frac{7}{12}$
So $3\frac{3}{4} - 1\frac{1}{6} = 2\frac{7}{12}$

2. a) $3\frac{11}{15}$ c) $4\frac{19}{20}$
b) $5\frac{7}{9}$ d) $8\frac{3}{20}$

3. a) $2\frac{2}{5}$ litres of water will leak out in 2 minutes.
b) $10\frac{1}{10}$ litres is left in the bucket after 2 minutes.

4. $11\frac{2}{3} + 3\frac{1}{4} = 14\frac{11}{12}$

5. Jamie's other number is $5\frac{17}{40}$. I can check by adding:
$16\frac{3}{8} + 5\frac{17}{40} = 16\frac{15}{40} + 5\frac{17}{40} = 21\frac{32}{40} = 21\frac{4}{5}$.

Reflect

Encourage children to explain the bar model. We know the total and a part so we need to use subtraction to find the missing part. ? + $5\frac{3}{4} = 7\frac{5}{6}$, so ? = $7\frac{5}{6} - 5\frac{3}{4}$. The missing number is $2\frac{1}{12}$.

Lesson 8: Adding fractions

→ pages 111–113

1. a) $6\frac{5}{12}$ b) $2\frac{2}{6} = 2\frac{1}{3}$

2. a) $9\frac{17}{30}$ b) 8

3. No, it is not the most efficient method as Kate is first converting to an improper fraction, which will result in quite large numerators. Then she will need to find equivalent fractions and this will make the numerators even bigger. She will then need to add the numerator before converting the answer back to a mixed number and/or simplifying. This involves a lot of calculation with big numbers. It will be more efficient to add the wholes and fraction parts separately then combine these and write the fraction as simply as possible.

4. Aki spends $4\frac{1}{12}$ of an hour on his homework.

5. The distance from the café to the beach is $5\frac{1}{10}$ km.

6. Mo needs $18\frac{9}{10}$ metres of fencing.
Mo needs to buy 5 packs of fencing.

Reflect

Explanations may vary – encourage children to first add the wholes and then add the parts, converting any improper fractions to mixed numbers as they go. Finally add all the wholes together and then add on the part.
$4\frac{5}{6} + 2\frac{3}{8} = 6 + \frac{20}{24} + \frac{9}{24} = 6 + \frac{29}{24} = 7\frac{5}{24}$.

Lesson 9: Subtracting fractions

➜ pages 114–116

1. a) $1\frac{3}{4}$ c) $6\frac{11}{12}$
b) $\frac{11}{15}$ d) $4\frac{17}{20}$

2. a) $3\frac{3}{5}$ b) $2\frac{2}{5}$

3. $1\frac{11}{15}$

4. The baby giraffe is $1\frac{13}{20}$ m tall.

5. Add together the difference of $\frac{1}{6} + 1 + \frac{1}{5} = 1\frac{11}{30}$.

6. $1\frac{7}{10}$

7. Heart = $4\frac{5}{12}$ (Star = $1\frac{11}{12}$)

Reflect

Methods may vary – children may choose to convert both mixed numbers to improper fractions, then find equivalent fractions with the same denominator, before doing the subtraction and simplifying/converting back to a mixed number.

or

Children may opt to exchange one whole into fifths to ensure the fraction part in the minuend is bigger than the fraction part in the subtrahend, before finding equivalence with the same denominator and subtracting.

or

Children could show finding the difference by counting on from the subtrahend to the minuend and adding the parts together, for example: $\frac{1}{4} + 2 + \frac{1}{5}$.

Solution: $5\frac{1}{5} - 2\frac{3}{4} = 2\frac{9}{20}$

Lesson 10: Problem solving – adding and subtracting fractions (1)

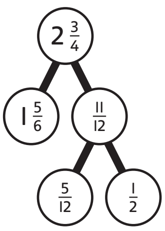
➜ pages 117–119

1. The total mass of the apple and pineapple is $\frac{9}{10}$ kg.

2. The perimeter of the triangle is $1\frac{5}{21}$ m.

3. There is $3\frac{9}{10}$ m of wood remaining.

4.



5. The total length of the pencils is $22\frac{7}{20}$ cm.

6. Georgia weighs $1\frac{4}{15}$ lbs more than Anna.

Reflect

Answers will vary – ensure that the calculation in the problem gives an answer of $2\frac{1}{3}$.

Lesson 11: Problem solving – adding and subtracting fractions (2)

➜ pages 120–122

1. The height of the tallest elephant is $2\frac{17}{20}$ metres.

2. The mass of the empty picnic basket is $\frac{1}{4}$ kg.

3. There were $11\frac{3}{4}$ million downloads in total.

4. The spider is $\frac{23}{30}$ metres from the top of the drain pipe.

5. The distance BC is bigger than the distance AB by $\frac{8}{9}$.

Reflect

Answers will vary – encourage children to spot their mistakes and learn from them. How could they make things easier? Would being fluent with their times-tables help?

End of unit check

➜ pages 123–125

My journal

1. A = $1\frac{7}{15}$ C = $1\frac{1}{24}$ E = $5\frac{7}{18}$
B = $\frac{19}{20}$ D = $8\frac{3}{20}$ F = $1\frac{1}{12}$

2. Danny's method is correct. Jamie's method is not quite correct as first she will need to exchange one whole for 4 quarters to ensure that the fraction part of the minuend is bigger than the fraction part of the subtrahend.

Solution: $1\frac{17}{20}$

Power puzzle

1. a) $6\frac{3}{7} + 3\frac{4}{5} = 9\frac{8}{35}$

b)

$1\frac{3}{10}$	$2\frac{1}{2}$	$3\frac{1}{5}$
$4\frac{3}{4}$	$\frac{2}{3}$	$1\frac{7}{12}$
$\frac{19}{20}$	$3\frac{5}{6}$	$4\frac{47}{60}$

Unit 5: Fractions (2)

Lesson 1: Multiplying a fraction by a whole number

→ pages 126–128

1. a) $\frac{7}{4} = 1\frac{3}{4}$ b) $\frac{8}{5} = 1\frac{3}{5}$ c) $\frac{12}{3} = 4$

2. a) $\frac{7}{2} = 3\frac{1}{2}$ c) $\frac{18}{8} = 2\frac{2}{8}$ or $2\frac{1}{4}$
b) $\frac{12}{5} = 2\frac{2}{5}$ d) $\frac{35}{10} = 3\frac{5}{10}$ or $3\frac{1}{2}$

3. $1 \times 3 = 3$
$\frac{3}{5} \times 3 = \frac{9}{5} = 1\frac{4}{5}$
$3 + 1\frac{4}{5} = 4\frac{4}{5}$
So $1\frac{3}{5} \times 3 = 4\frac{4}{5}$
and
$1\frac{3}{5} = \frac{8}{5}$
$\frac{8}{5} \times 3 = \frac{24}{5}$
$\frac{24}{5} = 4\frac{4}{5}$

4. a) $13\frac{1}{5}$ c) $8\frac{1}{4}$
b) $18\frac{2}{3}$ d) $20\frac{2}{5}$

5. Kate has multiplied the numerator and the denominator by 4. The denominator is the unit of that number and so does not change when you multiply a fraction. The answer should be $\frac{8}{3} = 2\frac{2}{3}$.

6. $\frac{11}{5} = 2\frac{1}{5}$
His owner needs to buy 3 bags of dog biscuits.

7. a) The total length of 12 double decker buses is $223\frac{1}{5}$ metres.
b) $\frac{1}{5} \times \boxed{4} = \frac{4}{5}$ $\frac{\boxed{2}}{7} \times 5 = \frac{10}{7}$ $\frac{2}{3} \times \boxed{5} = 3\frac{1}{3}$
$\frac{3}{5} \times \boxed{4} = \frac{12}{5}$ $\frac{\boxed{5}}{7} \times 3 = \frac{15}{7}$ $\frac{2}{3} \times \boxed{6} = 6$

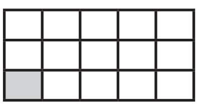
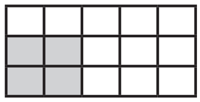
Reflect

Encourage children to prove that $1\frac{2}{3} \times 4 = 4\frac{8}{3} = 6\frac{2}{3}$. Children could show this with calculations and/or pictorial representations.

Lesson 2: Multiplying a fraction by a fraction (1)

→ pages 129–131

1. a) $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$
Zac uses $\frac{1}{8}$ of the bag of flour.
b) $\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$
Zac needs $\frac{3}{8}$ of the bag.

2. a) $\frac{1}{15}$

b) $\frac{2}{3} \times \frac{2}{5} = \frac{4}{15}$


3. a) $\frac{6}{20} = \frac{3}{10}$ b) $\frac{10}{18} = \frac{5}{9}$

4. a) $\frac{2}{3} \times \frac{6}{7} = \frac{12}{21} = \frac{4}{7}$ b) $\frac{3}{4} \times \frac{2}{5} = \frac{6}{20} = \frac{3}{10}$

5. This statement is always true because you are multiplying a number less than one by another number less than one. In other words, you are finding a part of a part.

Reflect

Children to show a pictorial representation of $\frac{1}{2} \times \frac{3}{5}$ – encourage children to explain that $\frac{1}{2}$ times $\frac{3}{5}$ is the same as $\frac{1}{2}$ of $\frac{3}{5}$.

Lesson 3: Multiplying a fraction by a fraction (2)

→ pages 132–134

1. a) $\frac{3}{8}$
b) You can multiply the numerators together and the denominators together.

2. a) $\frac{2 \times 1}{9 \times 4} = \frac{2}{36} = \frac{1}{8}$ b) $\frac{2 \times 3}{9 \times 4} = \frac{6}{36} = \frac{1}{6}$ c) $\frac{1 \times 10}{5 \times 11} = \frac{10}{55} = \frac{2}{11}$

3. a) $\frac{1}{12}$ c) $\frac{4}{15}$ e) $\frac{35}{48}$
b) $\frac{3}{28}$ d) $\frac{7}{16}$ f) $\frac{63}{230}$

4. a) $\frac{1}{3} \times \frac{2}{5} = \frac{2}{15}$ c) $\frac{3}{5} \times \frac{1}{2} \times \frac{3}{7} = \frac{9}{20}$
b) $\frac{1}{3} \times \frac{5}{6} = \frac{5}{18}$ or $\frac{5}{3} \times \frac{1}{6} = \frac{5}{18}$ d) $\frac{7}{12} \times \frac{1}{3} = \frac{1}{6} \times \frac{7}{6}$

5. a) Aki has added the numerators instead of multiplying them.
b) Kate has the correct answer of $\frac{6}{56}$, she has just simplified it to $\frac{3}{28}$.

6. a) Answers may vary.
Some possible solutions: $\frac{2}{3} \times \frac{4}{5}$; $\frac{1}{5} \times \frac{8}{3}$
b) Answers may vary.
Some possible solutions: $\frac{2}{3} \times \frac{6}{7}$; $\frac{3}{7} \times \frac{4}{3}$
c) Answers may vary.
Some possible solutions: $\frac{2}{4} \times \frac{2}{2}$; $\frac{3}{4} \times \frac{2}{3}$
d) Answers may vary.
Some possible solutions: $\frac{1}{2} \times \frac{3}{3} \times \frac{3}{8}$; $\frac{3}{4} \times \frac{1}{2} \times \frac{3}{6}$

Reflect

Answers may vary – encourage children to relate the shortcut method of multiplying numerators together and denominators together to using pictorials to help explain what is going on and why it works.

Lesson 4: Dividing a fraction by a whole number (1)

→ pages 135–137

1. a) $\frac{1}{12}$
$\frac{1}{12}$ of the circle is shaded.
b) $\frac{1}{10}$

2. $\frac{1}{16}$

3. a) $\frac{1}{12}$ b) $\frac{1}{12}$

4. a) $\frac{1}{3} \div 2 = \frac{1}{6}$ b) $\frac{1}{5} \div 3 = \frac{1}{15}$ c) $\frac{1}{2} \div 4 = \frac{1}{8}$

5. a) $\frac{1}{18}$ d) $\frac{1}{20}$ g) 2
b) $\frac{1}{18}$ e) $\frac{1}{28}$ h) 3
c) $\frac{1}{30}$ f) $\frac{1}{24}$ i) 3 ($\frac{1}{3}$)

6. a) Each person gets $\frac{1}{6}$ of the pizza.
b) Max gets $\frac{1}{12}$ of the bar.

7. Answers will vary. The two numbers written into the empty boxes each time should have a product of 48. Examples include:

$\frac{1}{\boxed{6}} \div \boxed{8} = \frac{1}{48}$ $\frac{1}{\boxed{12}} \div \boxed{4} = \frac{1}{48}$ $\frac{1}{\boxed{16}} \div \boxed{3} = \frac{1}{48}$

$\frac{1}{\boxed{2}} \div \boxed{24} = \frac{1}{48}$ $\frac{1}{\boxed{48}} \div \boxed{1} = \frac{1}{48}$ $\frac{1}{\boxed{4}} \div \boxed{12} = \frac{1}{48}$

Reflect

Explanations may vary.

It is false as dividing by 2 is the same as finding $\frac{1}{2}$ of $\frac{1}{10}$. This would be smaller than $\frac{1}{10}$. $\frac{1}{5}$ is actually twice as big as $\frac{1}{10}$ so it cannot be correct. $\frac{1}{10} \div 2 = \frac{1}{20}$.

Lesson 5: Dividing a fraction by a whole number (2)

→ pages 138–140

1. There are 2 twelfths in each group.
$\frac{2}{12}$

2. a) $\frac{2}{9}$ b) $\frac{3}{10}$ c) $\frac{4}{9}$

3. a) $\frac{2}{11}$ b) $\frac{1}{5}$

4. Answers may vary. Possible solution: $\frac{6}{9} \div 2 = \frac{3}{9}$

5. a) $\frac{1}{9}$ c) $\frac{3}{7}$
b) $\frac{1}{4}$ d) $\frac{4}{15}$

6. a) 2 ($\frac{2}{5}$) c) 7 d) 10
4 ($\frac{4}{5}$) 2 8
b) 6 ($\frac{6}{20}$) 14 2
15 ($\frac{15}{20}$) 1 5

7. The snail travels $\frac{4}{15}$ km each day.

8. 12 ($\frac{12}{18}$)
56 ($\frac{56}{60}$)
18 ($\frac{18}{24}$)

Reflect

The correct answer is $\frac{2}{15}$. Danny has divided both the numerator and denominator by 5. As the divisor is a factor of the numerator, the denominator, which is just the unit of that number, will not need to change here.

Encourage children to prove their calculation with a pictorial representation.

Lesson 6: Dividing a fraction by a whole number (3)

→ pages 141–143

1. a) $\frac{6}{8} \div 2 = \frac{3}{8}$ b) $\frac{6}{15} \div 3 = \frac{2}{15}$

2. a) $\frac{6}{10} \div 2 = \frac{3}{10}$ b) $\frac{6}{14} \div 2 = \frac{3}{14}$

3. a) $\frac{10}{16} \div 2 = \frac{5}{16}$ c) $\frac{15}{24} \div 3 = \frac{5}{24}$ e) $\frac{10}{45} \div 5 = \frac{2}{45}$
b) $\frac{12}{15} \div 3 = \frac{4}{15}$ d) $\frac{12}{40} \div 4 = \frac{3}{40}$ f) $\frac{10}{18} \div 2 = \frac{5}{18}$

4. a) $\frac{8}{20} \div 4 = \frac{2}{20} = \frac{1}{10}$ b) $\frac{6}{18} \div 3 = \frac{2}{18} = \frac{1}{9}$

5. $\frac{4}{50}$ or $\frac{2}{25}$ of the bottle of milk will be in each glass.

6. Square = $\frac{3}{16}$ Circle = $\frac{2}{5}$
Rhombus = 5 Triangle = 4
a) $\frac{3}{80}$ b) $\frac{2}{20}$ or $\frac{1}{10}$ c) $\frac{2}{25}$

Reflect

Explanations may vary. Children may explain that they will need to find equivalent fractions to make the numerator a multiple of the divisor 4 and then divide. Some children may have figured out a shortcut of multiplying the denominator by 4, but do ensure that children understand why it works. Some children may also see that 'dividing by 4' is the same as finding 'a quarter of' and so choose to do $\frac{2}{7} \times \frac{1}{4}$.
$\frac{2}{7} \div 4 = \frac{8}{28} \div 4 = \frac{2}{28} = \frac{1}{14}$

Lesson 7: Four rules with fractions

→ pages 144–146

1. a) $\frac{8}{3} = 2\frac{2}{3}$
The perimeter is $2\frac{2}{3}$ cm.
b) $\frac{3}{7} \times 6 = \frac{18}{7} = 2\frac{4}{7}$
The perimeter is $2\frac{4}{7}$ cm.

2. The area is $\frac{8}{35}$ cm^2.
The perimeter is $2\frac{6}{35}$ cm.

3. Richard walks $4\frac{2}{7}$ km in total.

4. a) $\frac{5}{12}$ b) $\frac{1}{15}$

5. Each side of the square is $\frac{1}{10}$ m.

6. $\frac{3}{20}$ of the middle rectangle is shaded.

Reflect

Max forgot about the order of operations. He should have done the multiplication calculation first and then the addition. So the correct answer is $\frac{5}{8}$.

Lesson 8: Calculating fractions of amounts

➜ pages 147–149

1. 8 of the buttons are blue.

2. Andy had £480 left.

3. Kate sells 5 more cookies than Ebo.

4. Sofia pays £2·88 more than Holly.

5. a) 153 km
b) 36 minutes (accept $\frac{3}{5}$ hour)
c) 50 metres or 0·05 kilometres

6. a) $<$ b) $<$

7. 9

Reflect

Answers will vary – encourage children to explain what they found challenging and how they might help themselves make it easier.

Lesson 9: Problem solving – fractions of amounts

➜ pages 150–152

1. 17 × 3 = 51
There are 51 animals in the field.

2. The number is 72.

3. Danny gets £7·50 pocket money.

4. Toshi earns £51 more per week.

5. a) 80 c) 200
b) 64 d) 108

6. Zac's number is 6·4.

7. a) There are 120 pages in Alex's book.
b) There are 60 pages in Lee's book.

Reflect

Answers will vary – although both equations involve $\frac{3}{4}$ of amounts, in one case you know the whole amount and are asked to find $\frac{3}{4}$ of it; in the other, you know the value of $\frac{3}{4}$ of the amount and are asked to find the whole amount.

Solutions: $\frac{3}{4}$ of 60 = 45; $\frac{3}{4}$ of 80 = 60

End of unit check

➜ pages 153–154

My journal

Answers will vary – encourage children to show step-by-step with reasoning to demonstrate their understanding of fractions and the four operations. Are they able to teach a partner?

Power puzzle

1.

A	B	C	D	E	F	G	H
36	18	27	15	4·5	8	2	$\frac{1}{20}$

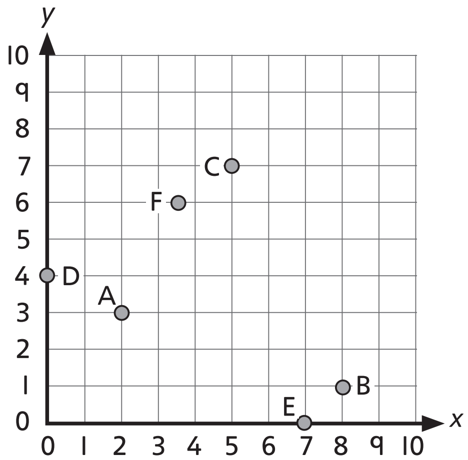
2.

Unit 6: Geometry – position and direction

Lesson 1: Plotting coordinates in the first quadrant

→ pages 155–157

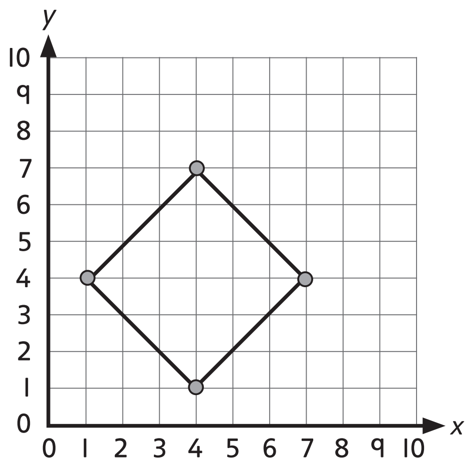
1.



2. A (4,7) D (2,5) G (10,5)
B (6,5) E (7,7) H (8,4)
C (4,3) F (9,7) I (6,5)

3. a) (4,10) and (1,10) or (4,4) and (1,4)
b) (8,4) and (8,2) or (0,4) and (0,2)

4. a)



b) The vertices of the square are:
(1,4)
(4,7)
(7,4)
(4,1)

5. Point A (2,4) Point D (11,1)
Point B (8,7) Point E (8,1)
Point C (11,4)

Reflect

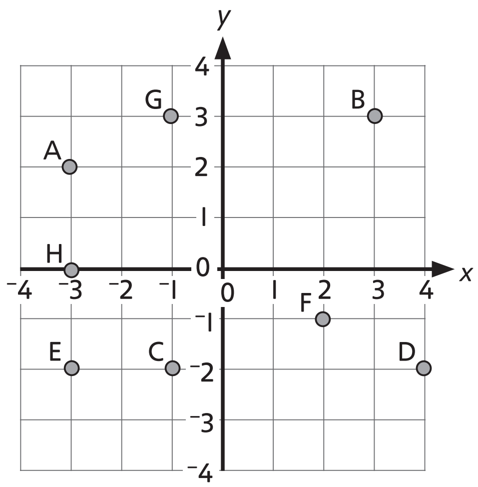
It tells me that the point lies on one of the axes. If the zero is the first coordinate, then the point lies on the *y*-axis; if the zero is the second coordinate, then the point lies on the *x*-axis.

Lesson 2: Plotting coordinates

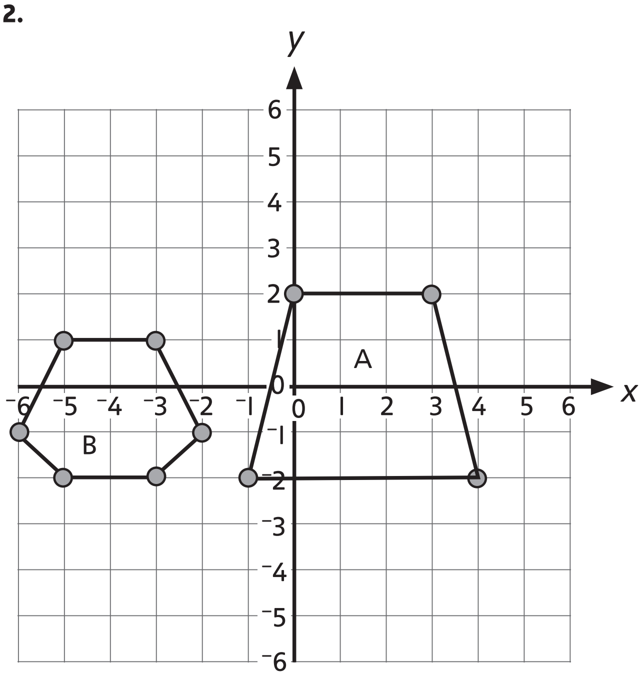
→ pages 158–160

1. a) Point A ($^{-}3$,2)
Point B (3,3)
Point C ($^{-}1$,$^{-}2$)
Point D (4,$^{-}2$)

b)



2.



Shape A is a trapezium.
Shape B is a hexagon.

3. Lucy is not correct. The first coordinate tells you how far the point is from the origin if you move in the *x*-direction (horizontally). The second coordinate tells you how far the point is from the origin in the *y*-direction (vertically). It therefore does matter which way round you write the coordinates as, for example, (2,5) is a different point to (5,2).

4. Mia needs to plot the point ($^{-}3$,$^{-}1$) to complete her rectangle.

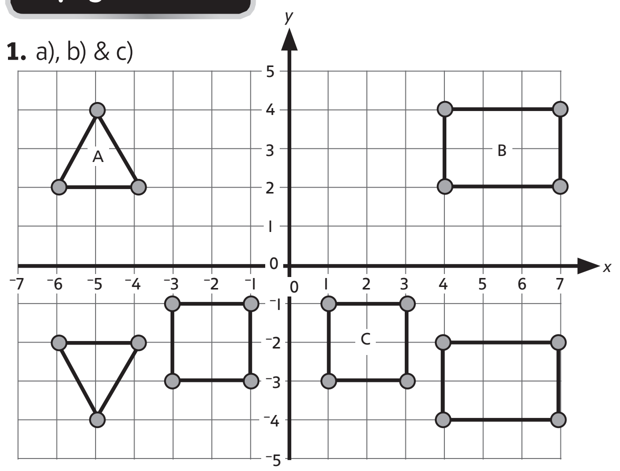
Reflect

Answers may vary; encourage children to justify their reasons and give examples. For example, children might argue that it is harder to plot coordinates in all four quadrants because you have to consider whether the point lies to the left or right of the origin and whether it lies above or below the origin.

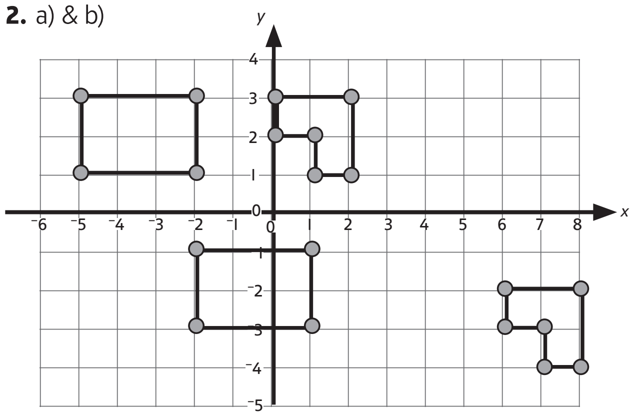
Lesson 3: Plotting translations and reflections

➜ pages 161–163

1. a), b) & c)



2. a) & b)

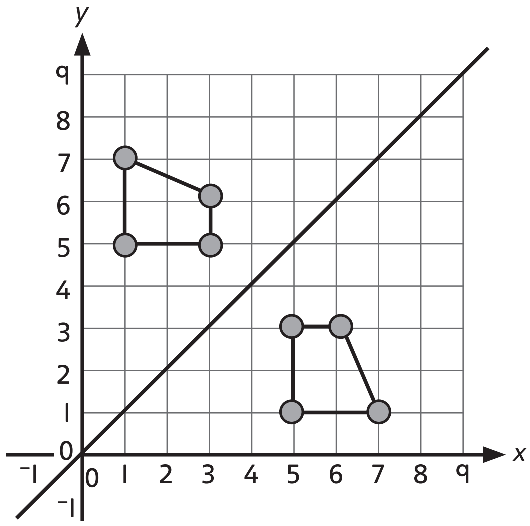


3. Shape A has been reflected in the *x*-axis to make shape B.

Shape C has been reflected in the *y*-axis to make shape D.

Shape E has been translated 6 units right and 3 units up to make shape F.

4.



5. $(^-1,5)$, $(^-1,2)$, $(^-5,2)$, $(^-5,5)$

6. a) The coordinates will be: (11,2), (9,3), (7,3), (6,2) and (8,1).

b) The coordinates will be: (5,2), (3,3), (1,3), (0,2) and (2,1).

Explanations will vary, for example: I do not get the same answers because the order you do reflections and translations matters.

Reflect

Yes, the shape is identical as you have not changed the dimensions of the shape – you have just changed its position (and possibly orientation).

Lesson 4: Reasoning about shapes with coordinates

➜ pages 164–166

1. $(^-4,1)$, $(^-4,^-1)$ or $(0,1)$, $(0,^-1)$

2. C $(^-3,^-2)$ D $(1,^-6)$

3. a) Point B (0,2)
Point C $(^-2,5)$

b) Point D $(1,^-5)$
Point E $(5,^-5)$

4. Point A $(1,^-5)$
Point B $(5,^-5)$

5. Point A (3,2)
Point B $(9,^-1)$
Point C $(5,^-4)$
Point D $(^-1,^-1)$

Reflect

Answers will vary; encourage children to think about which aspects were challenging and why. What could they do to help this become easier in the future?

End of unit check

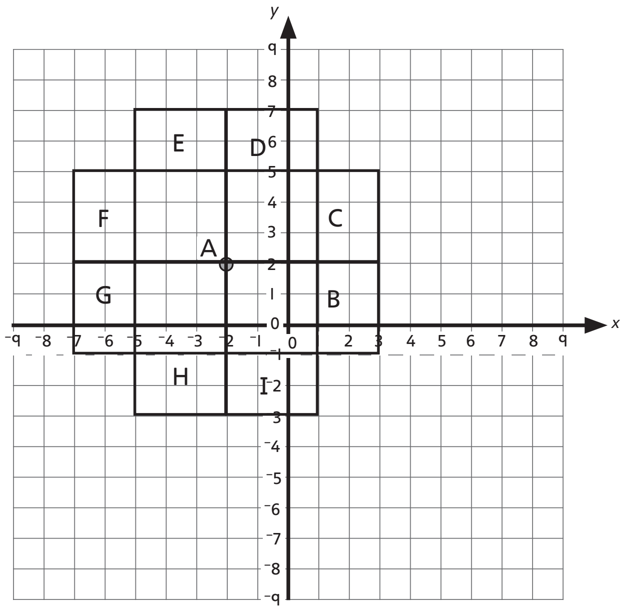
➜ pages 167–169

My journal

1. Reasons and justifications may vary. A possible response could be:

No, Kate is incorrect as we can work out any missing information. As the shape is a square, we can use the properties of a square to help us. When reflecting in the *y*-axis, there is no need to know the coordinates of the shape, as you are simply reflecting the same distance from the *y*-axis either side.

2.



Rectangle B (3,2), (3,⁻1), (⁻2,⁻1)
Rectangle C (3,2), (3,5), (⁻2,5)
Rectangle D (1,2), (1,7), (⁻2,7)
Rectangle E (⁻2,7), (⁻5,7), (⁻5,2)
Rectangle F (⁻2,5), (⁻7,5), (⁻7,2)
Rectangle G (⁻7,2), (⁻7,⁻1), (⁻2,⁻1)
Rectangle H (⁻5,2), (⁻5,⁻3), (⁻2,⁻3)
Rectangle I (⁻2,⁻3), (1,⁻3), (1,2)

Power play

Answers will vary depending on the squares drawn by the child and their partner.

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

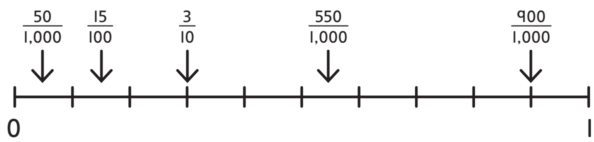
Answers will vary; for example: Danny has a rope that is 5·7 m in length and wants to cut 10 equal pieces. How long should each piece be? (5·7 ÷ 10 = 0·57)

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 (1)

→ 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)

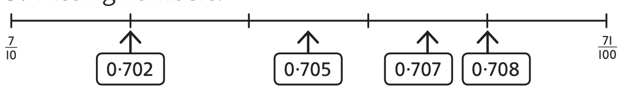
O	•	Tth	Hth	Thth
0	•	3	4	5

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 1	Between 1 and 10	Greater than 10
$\frac{2}{4} = 0{\cdot}5$	$\frac{500}{250} = 2$	$\frac{500}{25} = 20$
$\frac{2}{5} = 0{\cdot}4$	$\frac{500}{200} = 2{\cdot}5$	$\frac{250}{5} = 50$
$\frac{2}{25} = 0{\cdot}08$	$\frac{25}{5} = 5$	$\frac{50}{4} = 12{\cdot}5$
$\frac{5}{50} = 0{\cdot}1$	$\frac{200}{25} = 8$	$\frac{200}{4} = 50$

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) $\frac{1}{9} = 1 \div 9$ $\frac{2}{9} = 2 \div 9$

$\begin{array}{r} 0\,\cdot\,1\;1\;1\ldots \\ 9\overline{)1\,\cdot\,{}^{1}0\,{}^{1}0\,{}^{1}0} \end{array}$ $\begin{array}{r} 0\,\cdot\,2\;2\;2\ldots \\ 9\overline{)2\,\cdot\,{}^{2}0\,{}^{2}0\,{}^{2}0} \end{array}$

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

$\begin{array}{r} 0\,\cdot\,3\;3\;3\ldots \\ 9\overline{)3\,\cdot\,{}^{3}0\,{}^{3}0\,{}^{3}0} \end{array}$ $\begin{array}{r} 0\,\cdot\,4\;4\;4\ldots \\ 9\overline{)4\,\cdot\,{}^{4}0\,{}^{4}0\,{}^{4}0} \end{array}$

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:

$\begin{array}{r} 0\,\cdot\,6\;2\;5 \\ 8\overline{)5\,\cdot\,{}^{5}0\,{}^{2}0\,{}^{4}0} \end{array}$

So, $\frac{5}{8} = 0{\cdot}625$

$\frac{55}{100} = 0{\cdot}55$ (using decimal place value)

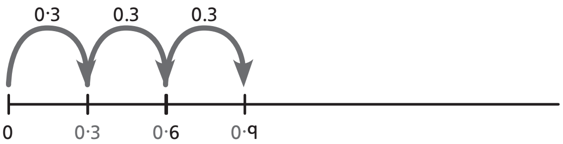
Comparing the tenths, 6 is more than 5, so $\frac{5}{8} > 0{\cdot}55$.

Lesson 6: Multiplying decimals (1)

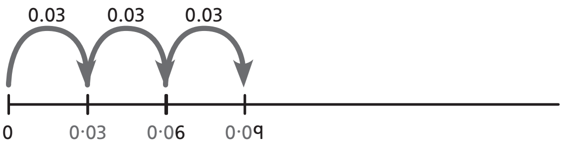
➜ pages 21–23

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:



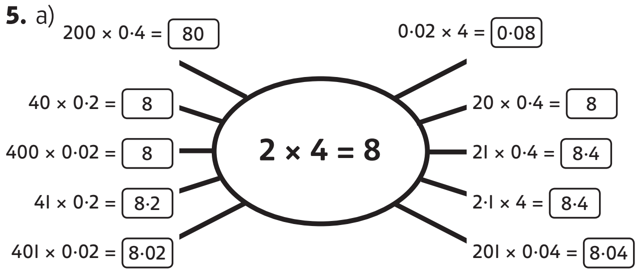
b) 3 × 0·03 = 0·09, 3 jumps of 0·03 on the number line to show 0·03, 0·06 and 0·09:



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

4. a) 21 × $\frac{2}{10}$ = $\frac{42}{10}$ = 4·2   201 × 0·03 = 6·03
310 × 0·02 = 6·2   31 × $\frac{3}{100}$ = 0·93
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   5·6 ÷ 7 = 0·8
0·7 × 8 = 5·6   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.

$\begin{array}{r} 1 \cdot 0\,6 \\ 4\overline{)4 \cdot 2\,{}^{2}4} \end{array}$ $4{\cdot}24 \div 4 = 1{\cdot}06$

$\begin{array}{r} 1 \cdot 4\,4 \\ 6\overline{)8 \cdot {}^{2}6\,{}^{2}4} \end{array}$ $8{\cdot}64 \div 6 = 1{\cdot}44$

$\begin{array}{r} 1 \cdot 1\,5 \\ 8\overline{)9 \cdot {}^{1}2\,{}^{4}0} \end{array}$ $9{\cdot}2 \div 8 = 1{\cdot}15$

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

$\frac{7{\cdot}7}{11} = 0{\cdot}7$

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:

$\begin{array}{r} 3\,0 \cdot 7\,5 \\ 4\overline{)1\,{}^{1}2\,3 \cdot {}^{3}0\,{}^{2}0} \end{array}$

Children might start from the division 123 ÷ 4 = 30 r 3 and then divide the remainder by 4.

$3 \div 4 = \frac{3}{4} = 0{\cdot}75$ 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 $\frac{0{\cdot}8}{20} = \frac{8}{200} = \frac{1}{25}$ which is the same as dividing by 25; for example:

$3 \div 25 = \frac{3}{25} = 0{\cdot}12$

Power play

Answers will vary.

Unit 8: Percentages

Lesson 1: Percentage of (1)

➜ 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

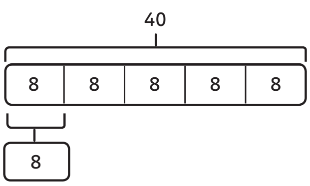
Answers will vary; for example:

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)

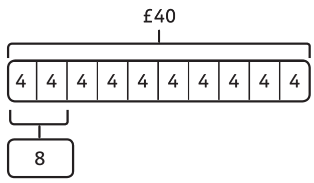
➜ pages 38–40

1. a)



40 ÷ 5 = 8
20% of £40 is £8.

b)



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

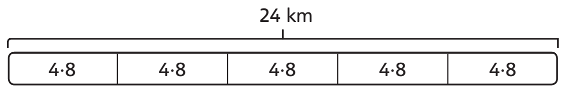
2. 20% of 15 = 3
3 circles should be shaded.

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.

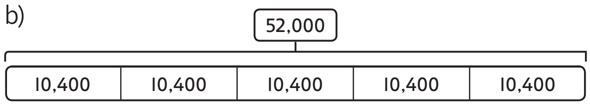
Starting number	10% of the number	20% of the number
400	40	80
410	41	82
41	4·1	8·2
401	40·1	80·2
14	1·4	2·8
20·5	2·05	4·1

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)

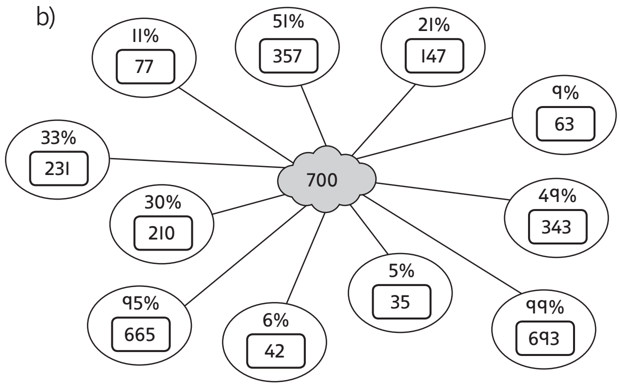
➜ pages 44–46

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:

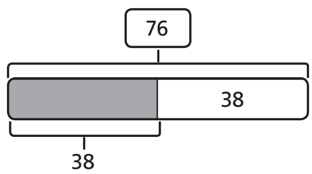
10% of 300 = 30, 5% of 300 = 15.
So 80% of 300 = 8 × 30 = 240, then add 5% to give 85% of 300 = 240 + 15 = 255.

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

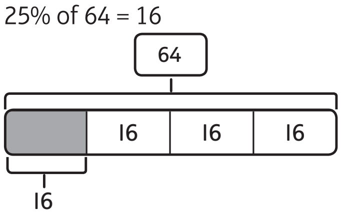
➜ pages 47–49

1. a) 50% of 76 = 38



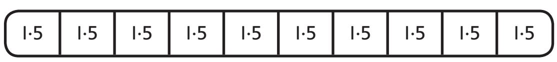
38 × 2 = 76

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

$540 \times 0{\cdot}2 = 20\%$ of $540 = 108$
$0{\cdot}75 \times 54 = 75\%$ of $54 = 40{\cdot}5$
$540 \times 0{\cdot}25 = 25\%$ of $540 = 135$
$5{,}400 \times 0{\cdot}99 = 99\%$ of $5{\cdot}400 = 5{,}346$

Reflect

Estimates will vary; for example:

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

$\frac{7}{10} = 0{\cdot}7 = 70\%$

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

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

6. a) Diagrams will vary.
Lexi has eaten $\frac{8}{9}$ of an apple altogether.
$\frac{8}{9} = 0{\cdot}888 = 88{\cdot}89\%$ (rounded to 2 dp)
Ebo has eaten 87% of an apple.
$88{\cdot}89 > 87$.
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.

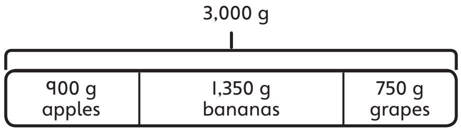
Lesson 9: Mixed problem solving

➜ 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 $n \times 3$ stars.

2.

Number of cakes	5	6	12	20	101	b
Number of stars	25	30	60	100	505	$b \times 5$

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

3. Patterns matched to rules:
Top pattern ➜ $n \times 4$
2nd pattern ➜ double n
3rd pattern ➜ $3 \times n$
Bottom pattern ➜ $n \times 5$

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) $b \times 8$
$x \times 3$
$m \times 7$
$k \times 52$
b) The number of days in d years is $365 \times d$.

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	$2 \times y \div 5$
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 $25 + 3 \times y$ 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	$50 - 4n$

After n weeks, he has $50 - 4 \times n$ 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, $1 + 2 \times n$ sticks are used.

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

5. a) For n squares, you need $2n + 2$ circles.
$n = 100$, so $2n = 200$
$2n + 2 = 202$ circles
b) Answers will vary; for example:
Two circles drawn in each square: For n squares, you need $2n$ 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:
$+ 10 \times 5$; $\times 10 \times 10$; $\times 2 + 80$
Children should complete the table according to their functions; for example:
$+ 10 \times 5$ 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

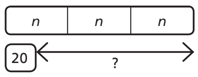
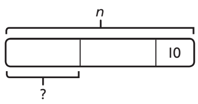
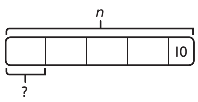
1. a) Length of ribbon left is $100 - 5y$.
b) There is 40 cm of ribbon left.

2. a) The total height is $15 + 10n$.
b) $15 + 10 \times 8 = 15 + 80$
The height is 80 cm.

3. a) A: $a + 50$, C: $\frac{a}{4}$ or $a \div 4$
B: $a - 50$ D: $50 + 3a$
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 ➜ $2y$

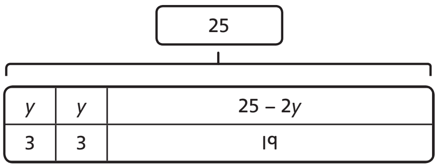
5.

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

Reflect

When $y = 3$, $25 - 2y = 25 - 6 = 19$

Bar models may vary; for example:



Lesson 6: Formulae

➜ pages 79–81

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

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

3. $200 \times 48 = 9{,}600$
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 $6a$; for example:
$a = 2$ cm, so perimeter of the new shape is
$6 \times 2 = 12$ 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: $99 \times 3 = 100 \times 3 - 3$,
$99 \times 4 = 100 \times 4 - 4$
$99 \times b = 100 \times b - b$
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

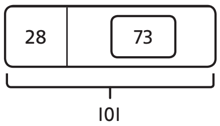
The formula for the perimeter is $2x + y$.

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) $c = 101 - 28 = 73$

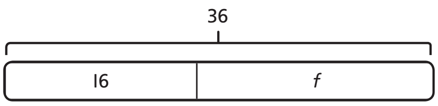


$c = 73$

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) $300 = 10y$
$y = 300 \div 10 = 30$
c) $z \div 10 = 300$
$z = 300 \times 10 = 3{,}000$

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) $3c = 150$
   $\div$ 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) $f = 3$ d) $i = 250$
   b) $g = 2{\cdot}5$ e) $j = 36$
   c) $h = 363$ f) $k = 1$
4. Answers will vary; for example:
   $y + 8 = 10$ $80 \div y = 8$
   $y = 2$ $y = 10$
   $24 - y = 10$ $80 \times y = 240$
   $y = 14$ $y = 3$

Reflect

Answers will vary; for example:

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

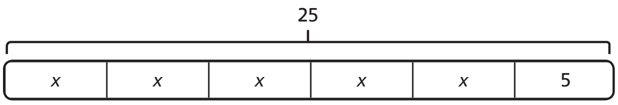
Other diagrams could include balance scales with 100 on one side and 90 and x on the other.

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) $a = 20$ c) $b = 14$
   b) $c = 65$ 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

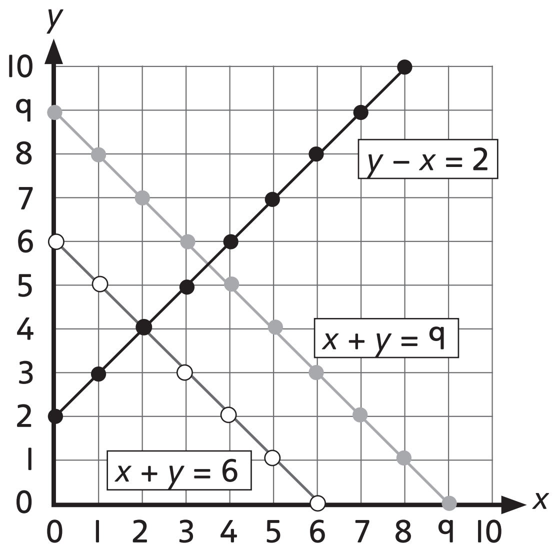
   b) The greatest area, of 9 cm^2, occurs when $j = 3$ cm and $k = 3$ cm.
2. Equation: $a + b = 4$
   Table completed showing pairs that total 4 kg.
   Answers may vary; for example:

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 km

8 km	8 km	8 km	8 km	8 km	8 km	8 km	8 km	8 km
5 miles	5 miles	5 miles	5 miles	5 miles	5 miles	5 miles	5 miles	5 miles

45 miles

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;
$1{\cdot}6 \times 2 = 3{\cdot}2$.
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 II: Measure – perimeter, area and volume

Lesson I: 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	I6	I2	8
W cm	I	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 (I)

➜ pages 120–122

1. a)

Shape	Perimeter (cm)	Area (cm^2)
A	4 × 4 = I6	4 × 4 = I6
B	3 × 2 + 6 × 2 = I8	3 × 6 = I8
C	6 + I + 2 + 4 + 4 + 5 = 22	4 × 5 + I × 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	I4
B	6	I4
C	5	I2
D	5	I2

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 (cm²)
A	I6	8
B	I6	I4
C	I6	I6
D	I6	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 $2 \times 2 \times 2 = 8$ cubes or $3 \times 3 \times 3 = 27$, 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 $3 \times 3 \times 3 = 27$ smaller cubes.

Lesson 11: Volume of a cuboid (2)

→ pages 147–149

1. a) 8 cm^3
b) Volume = $3 \times 3 \times 4$
= 36 cm^3
c) Volume = $3 \times 3 \times 3$
= 27 cm^3
d) Volume = $5 \times 3 \times 4$
= 60 cm^3

2. Answers may vary; for example:
You can work out the volume of one layer ($8 \times 7 = 56$) and then multiply that by the number of layers.
$56 \times 5 = 280$ cubes
Alternatively, you can multiply the three dimensions together to give $8 \times 7 \times 5 = 280$ 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. $3 \times 2 \times 6 = 36$

$12 \times 12 \times 12 = 1{,}728$

$1{,}728 \div 36 = 48$

48 packets fit into the box.

Reflect

Answers may vary; for example:

Volume is height × length × width so the volume of the cuboid is $4 \times 1 \times 3 = 12$ 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 $20 \times 20 \times 2{\cdot}5 = 1{,}000$ cm^3 and the volume after is $20 \times 20 \times 5 = 2{,}000$ cm^3, so the volume of the cube is 1,000 cm^3.
$10 \times 10 \times 10 = 1{,}000$ 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

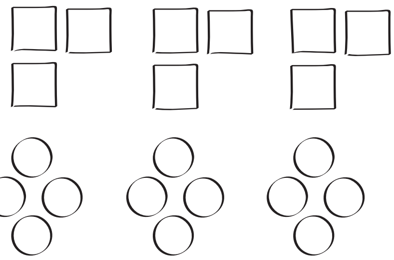
Yes and no. The ratio has the same digits, so describes the same relationship between quantities. However, the order is important as this tells you which quantity is double the other. For example:

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

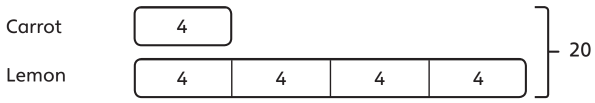
   There are 12 strawberry sweets in the jar.
3. There are 30 black buttons in the box.
4. There are 28 box fish in the tank.
5. Explanations may vary; for example:
   7 squares would mean that there are 17·5 rectangles which is impossible.
6. There are 16 more cows than sheep in the field.
7. Josh has £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:

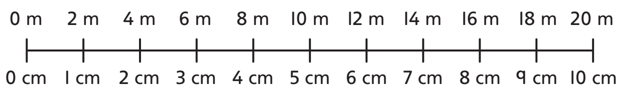
Add together 2 + 3 to get 5. This is the total number of parts.
1 part = 60 ÷ 5 = 12
So, sharing 60 into the ratio 2 : 3 gives 2 × 12 : 3 × 12, which is 24 : 36.

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

Lesson 5: Scale drawings

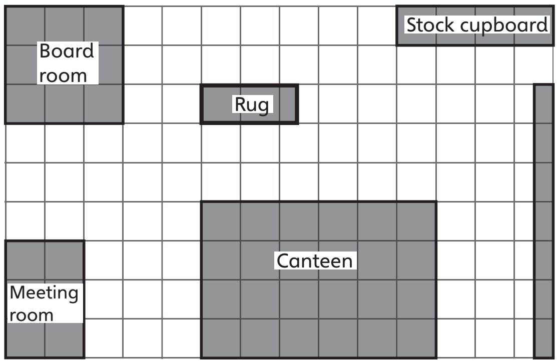
→ pages 165–167

1. a)

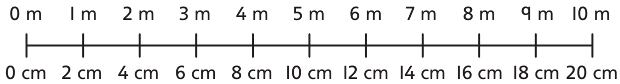


b) 12
c) 24

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.

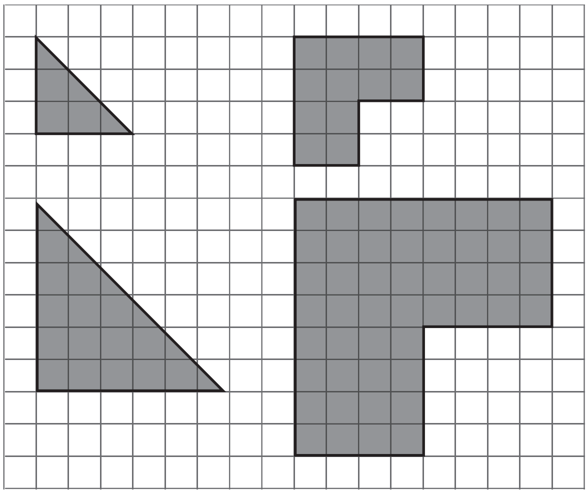
Lesson 6: Scale factors

→ 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.

Unit 13: Geometry – Properties of shapes

Lesson 1: Measuring with a protractor

→ pages 6–8

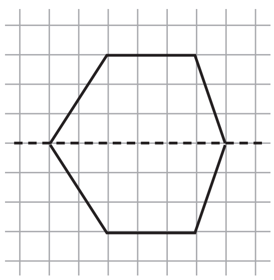
1. a) 130° c) 90°
b) 25° d) 73°

2. 1st angle = 110°
2nd angle = 75°
3rd angle = 72°
4th angle = 113°

3. a) Angles clockwise from top left: 77°, 132°, 111°, 116°, 104° (total 540°);
66°, 230°, 66°, 112°, 134°, 112° (total 720°)
b) B. All angles are the same size (120°) and all sides are the same length.

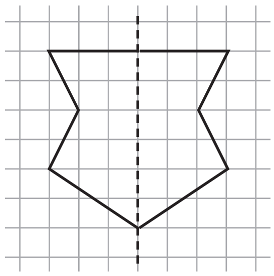
4. No, all the angles are the same size (38°).

5. a)



Angles clockwise from top left: 122°, 109°, 142°, 109°, 122°, 116° (total 720°).

b)



Angles clockwise from top left: 65°, 65°, 235°, 95°, 95°, 110°, 235° (total 900°).

Reflect

Look for answers identifying using wrong scale or misreading the scale; placing the protractor incorrectly or inaccurately.

Lesson 2: Drawing shapes accurately

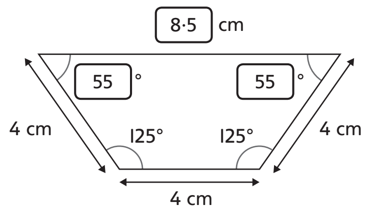
→ pages 9–11

1. a)

b)

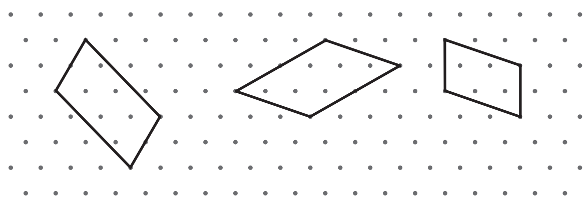
c)

2.



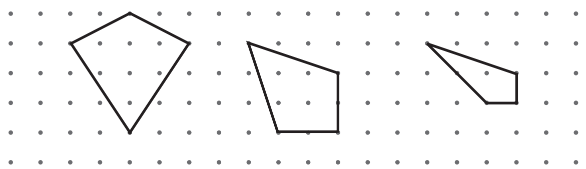
Missing angles are both 55°. Missing length is 8·5 cm.

3.

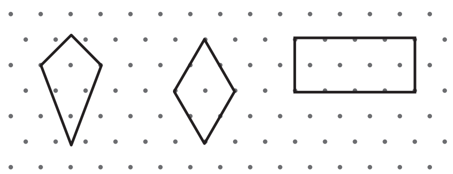


Answers will vary for the third parallelogram.

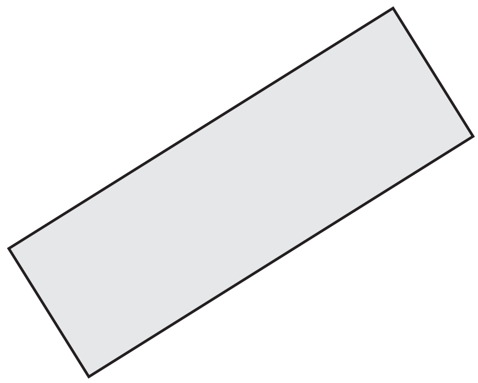
4.



5. Answers will vary; for example:

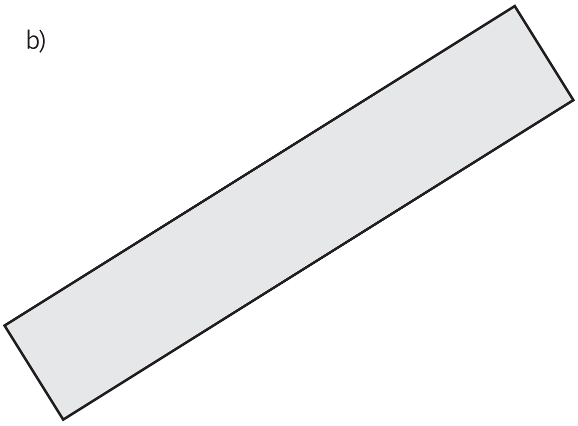


6. a)



Rectangle 6 cm by 2 cm

b)



Rectangle 8 cm by 1·5 cm

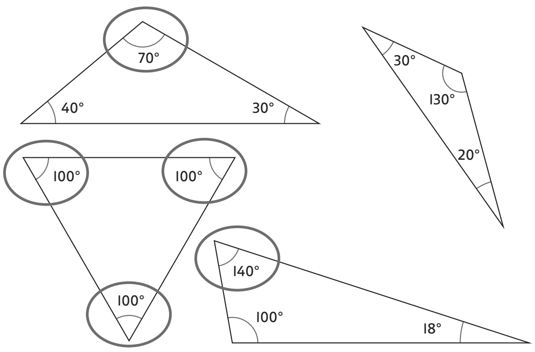
Reflect

Answers will vary; for example: Lee needs to read the correct scale and to place the protractor accurately.

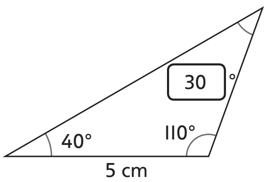
Lesson 3: Angles in triangles (1)

➜ pages 12–14

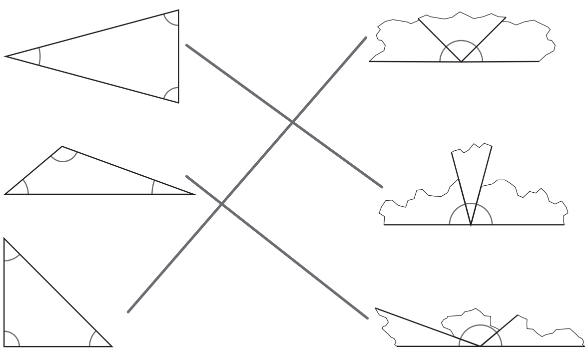
1. a)



b)



2.



3.

A triangle has …	Always true	Sometimes true	Never true
… three acute angles.		✔	
… two right angles.			✔
… a right angle and an obtuse angle.			✔
… three different angles.		✔	
… angles that add up to 180°.	✔		
… at least two acute angles.	✔		

4. Answers will vary; for example: 45°/45°/90°. Check angles add to 180° and any isosceles triangles have two angles the same.

Reflect

180-degree angles in a triangle can be shown to make a straight line. Angles on a straight line add to 180°.

Lesson 4: Angles in triangles (2)

➜ pages 15–17

1. a) 80° c) 25°
b) 39° d) 30°

2. a = 70° b = 45° c = 65°

3. p = 18° q = 108° r = 54°

4. Groups will vary; for example: 40°/80°/60°; 85°/35°/60°; 50°/45°/85°; 25°/35°/120°

5. a = 90° b = 260°
x = 40° y = 65°

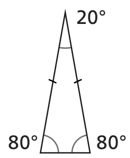
Reflect

Children should mention that the other angles in the triangle have to make 130°.

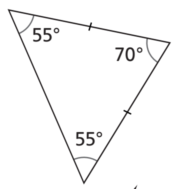
Lesson 5: Angles in triangles (3)

➜ pages 18–20

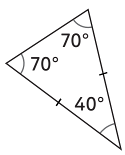
1. a)



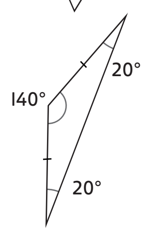
c)



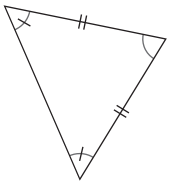
b)



d)

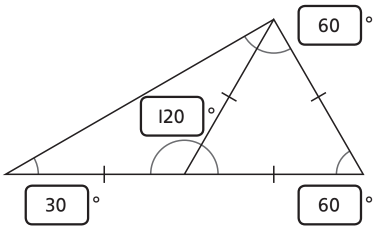


2. a) 65°, 65° b) 12°, 156° c) 45°, 45°

3. 

4. Amelia: 2 solutions: 56° / 56° / 68° and 56° / 62° / 62°
Bella: 1 solution: 156° / 12° / 12°. Double 156° > 180° so cannot be one of the equal angles.

5. a) 335° c) 55°
b)



Reflect

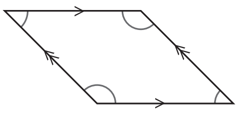
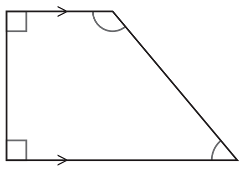
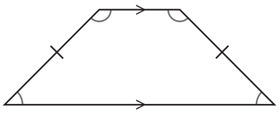
Answers will vary.

Lesson 6: Angles in polygons (1)

→ pages 21–23

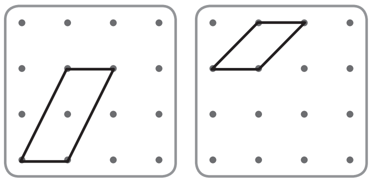
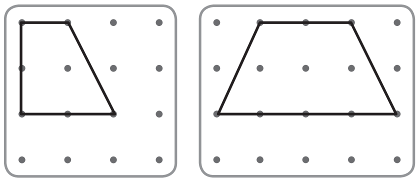
1. a) Right-angled trapezium
b) Scalene trapezium
c) Isosceles trapezium
d) Parallelogram

2. a) Angles from top left clockwise: 70°, 110°, 70°, 110°
b) 93°, 93°

3. a) 
b) 
c) 

4. a) 125°, 125° b) 114°, 114°

5. A parallelogram has three acute angles: Never true: It has 2 equal acute and 2 equal obtuse, 1 acute + 1 obtuse = 180°;
A trapezium has four different angles: Sometimes true: Scalene trapezium only

6. Answers will vary; for example:
a) 
b) 
c) Both are quadrilaterals, both can be split into two triangles: 2 × 180° = 360°

Reflect

Look for indicators of equal angles and shapes split into 2 triangles.

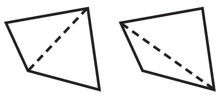
Lesson 7: Angles in polygons (2)

→ pages 24–26

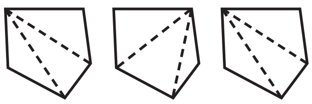
1. a) a = 25° c) c = 50°
b) b = 100° d) d = 27°

2. a) b = 150° b) d = 21°

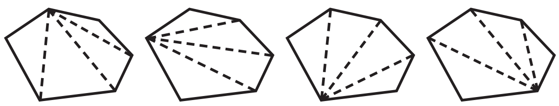
3. Diagonals must start at the same vertex for each polygon. Children should show one of the possible images for each polygon.
a) angle total = 360°



b) angle total = 540°



c) angle total = 720°



4. She has used more than one vertex to draw the diagonals.

5. angle total = 1,440° (8 × 180°)
each interior angle = 144° (1,440 ÷ 10)

6. a) a = 30° b = 60°
b) Interior angles of pentagon = 108°; angles in all surrounding triangles: 30°, 60° and 90°.

Reflect

Answers will vary.

Lesson 8: Vertically opposite angles

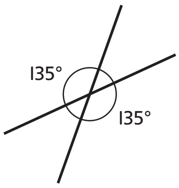
➜ pages 27–29

1. 1st missing angle = 110°
2nd missing angle = 70°
3rd missing angle = 55°
4th missing angle = 125°

2. Third diagram should be circled.

3. Missing angles from the top going clockwise:
a) 135°, 45°, 135°
b) 142°, 142°, 38°
c) 114°, 66°, 66°

4.



5.

	Angle a	Angle b	Angle c	Angle d
Experiment 1	80°	100°	80°	100°
Experiment 2	120°	60°	120°	60°
Experiment 3	30°	150°	30°	150°

6. Missing angles from the top going clockwise:
a) 70°, 25°, 25°, 85° c) 61°
b) 14°, 104°, 76°

Reflect

Children should mention that two pairs of angles on a line = 180° such as a + b = 180°, b + c = 180° so a = c.

Lesson 9: Equal distance

➜ pages 30–32

1. The dots children draw should form a circle. The dots are on a circle with a radius of 25 mm.

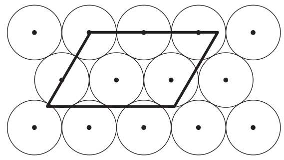
2. a) Radius; Radius = 13 mm, Diameter = 26 mm
b) Diameter; Radius = 4 mm, Diameter = 8 mm
c) Diameter; Radius = 20 mm, Diameter = 40 mm

3. Second and third statements ticked:
The diameter passes through the centre of the circle.
If the radius is x, then the diameter is x + x.

4. a) 4 mm c) 3·4 cm
b) 5·5 cm d) 4·95 m

5. a) Radius = 1·3 cm
b) The line is 72 mm.

6. a) The radius of one of the circles is 1·4 cm.
b) Answers will vary: The perimeter needs to be 14 radii altogether (19·6 ÷ 1·4) or 7 diameters (19·6 ÷ 2·8). Side lengths therefore need to be a total of 7 radii or 3·5 diameters. For example:



Reflect

Use a pair of compasses set at a radius of 2 cm.

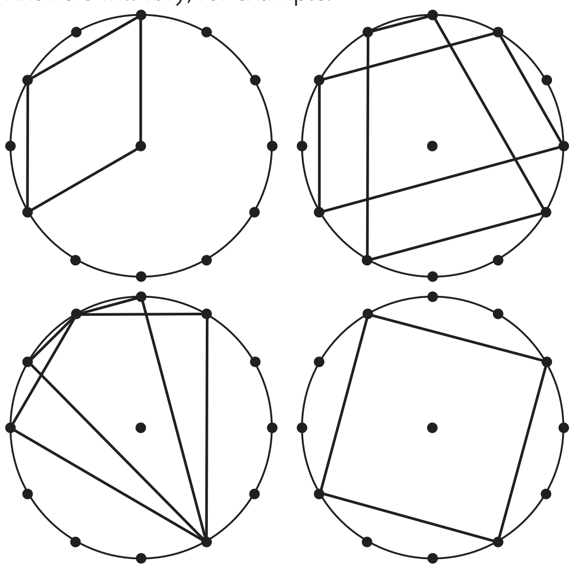
Lesson 10: Parts of a circle

➜ pages 33–35

1. Third diagram ticked.

2. a) Answers will vary.
b) Isosceles triangles

3. Answers will vary; for example:



4. The angle formed on the circumference will be 90°; the other two angles should add to 90°.

5. Children should count the whole and more than half squares; the area is approximately 112–115 cm^2.

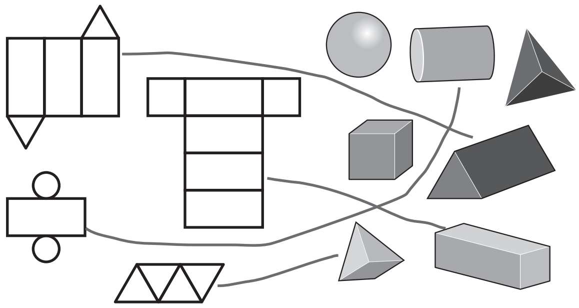
Reflect

Answers will vary; children should mention using the radii for the equal sides and diameter for 3rd side.

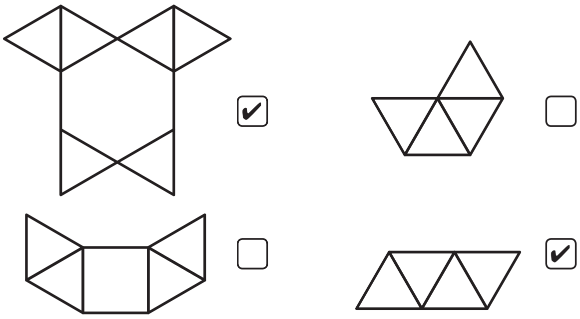
Lesson 11: Nets (1)

➜ pages 36–39

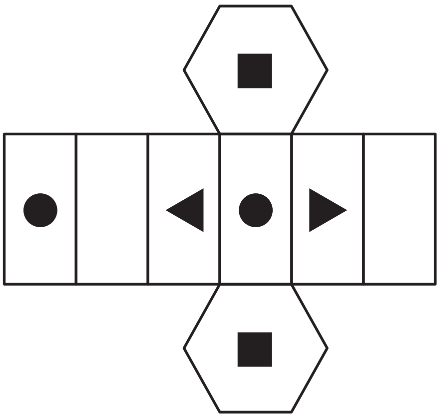
1.



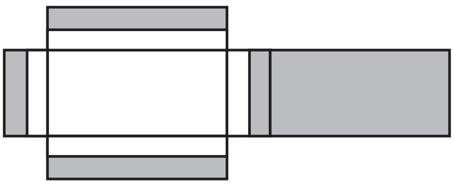
2.



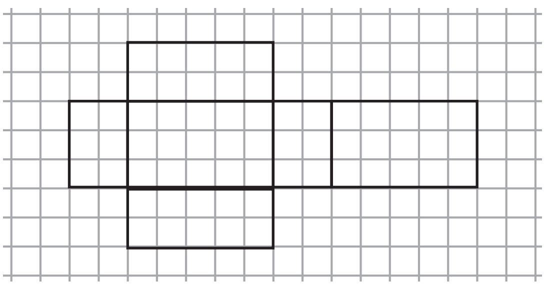
3.



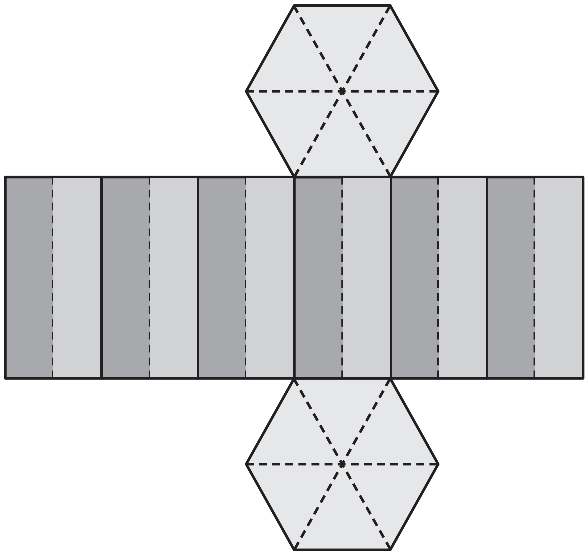
4.



5. Answers will vary; for example:

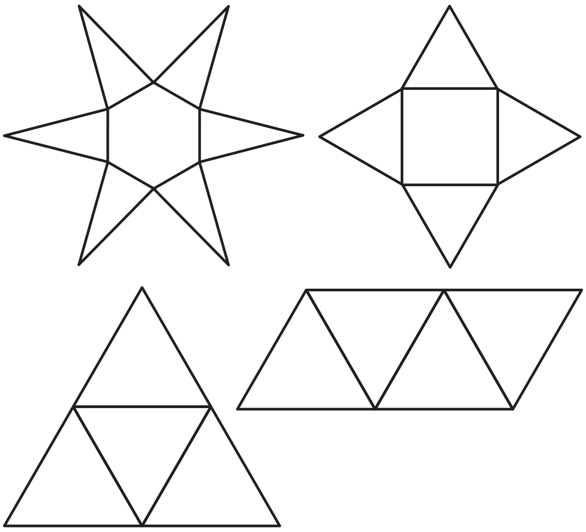


6. Answers will vary; for example:



Reflect

Answers will vary; for example:

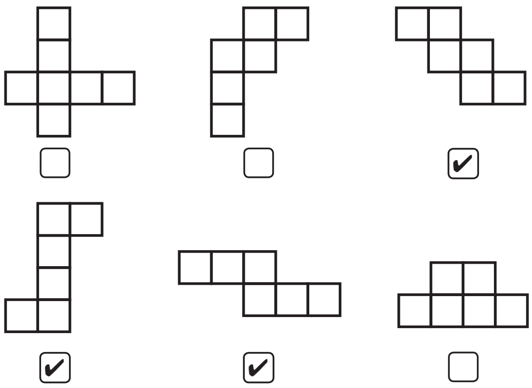


The easiest way is to show a base with the same number of triangles as sides on the base.

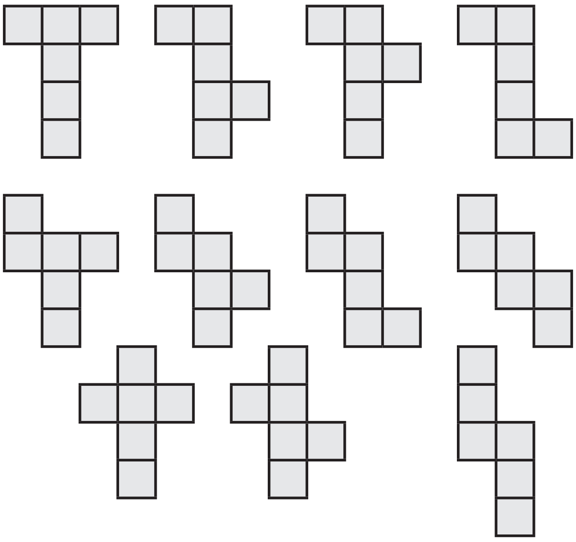
Lesson 12: Nets (2)

➜ pages 39–41

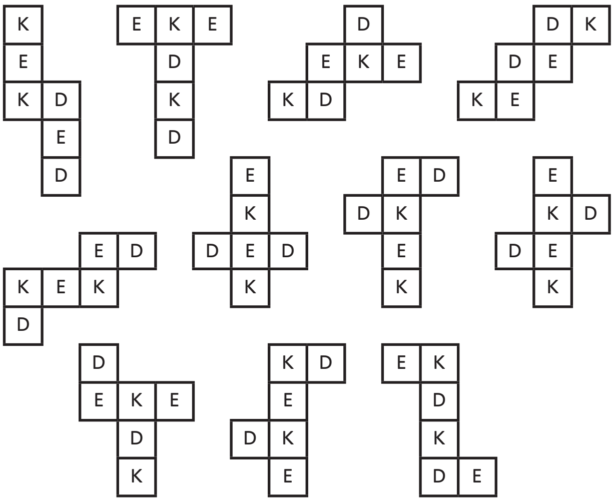
1.



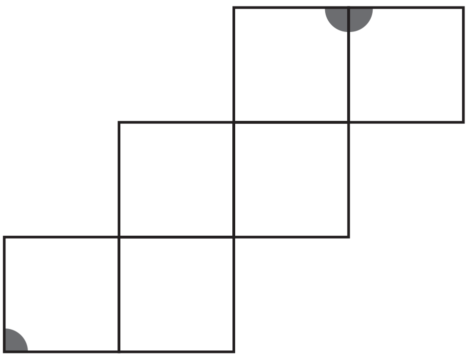
2. Answers will vary but should be one of these shapes (in any orientation):



3. Answers will vary but pairs of letters show where the opposites are. The letters can be interchanged.



4.



5. The volume is 1,000 cm^3.

Reflect

Answers will vary; for example: The net will have 6 identical square faces. There will generally be a middle row of square faces, with at least one face on either side.

End of unit check

➜ pages 42–44

My journal

1. a = 63° b = 63° c = 99°
d = 72° e = 81° f = 117°
g = 81° h = 63° i = 81°
Explanations will vary but look for: opposite angles are equal; angles on a line add to 180°; angles in a quadrilateral add to 360°. Angles in a square are right angles.

2. A: Does not make a 3D shape
B: Pyramid
C: Pyramid
D: Cube
E: Prism
F: Does not make a 3D shape
G: Prism
H: Prism

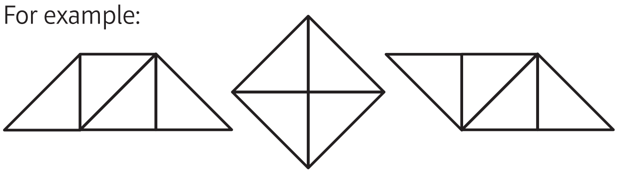
Power puzzle

Look for evidence of a variety of different shapes – not the same ones in different orientations.

Children may group in many different ways, so talk to them about which properties they were thinking about. Could they group them differently?

They should find plenty of parallelograms, rectangles, squares, trapeziums, kites and rhombii.

For example:



Unit 14: Problem solving

Lesson 1: Problem solving – place value

→ pages 45–47

1. a) Max's score < Jamilla's score
b) Richard's score < Emma's score
c) Richard's score < Emma's score < Max's score < Jamilla's score

2. Rounds down to the nearest 10,000; Rounds up to the nearest 100

3. 6,937, 6,973, 7,369, 7,639, 7,693, 7,963

4. The *y*-axis intervals should be labelled in 200s (for every marker) or 400s (for the bold markers).

Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Sales in £	1,800	2,800	2,600	1,400	3,000	3,800

5. Children should refer to numbers that round up for City X and numbers that round down for City Y; For example: the smallest possible population of City X is 482,500 and the largest possible population of City Y is 484,999 so City Y could be larger than City X.

Reflect

Answers will vary.

Check that the left circle number has fewer than 5 hundreds (for example, 3,498); the middle number is greater than 50,000 and has fewer than 5 hundreds (for example, 50,368); the right circle number is greater than 50,000 and has 5 or more hundreds (for example, 50,500).

123,412 is greater than 50,000 and it rounds down to 123,000 (to the nearest 1,000).

Lesson 2: Problem solving – negative numbers

→ pages 48–50

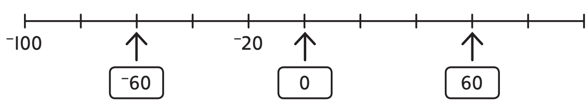
1. Answer b) should be ticked.

2. a) $^-23$, $^-16$, $^-9$, $^-2$, 5, 12
b) 19, 13, 7, 1, $^-5$, $^-11$
c) $^-35$

3. a) London
b) London and Oslo

4. winter temperature = $^-20$ °C
summer temperature = 28 °C

5.



6.
$^-13$ — 3
$^-4$ — $^-20$
5 — $^-11$

Reflect

Answers will vary; for example:

Find the difference (24 + 40 = 64), halve the difference (32), then add 32 to $^-40$ or subtract 32 from 24 ($^-8$).
or
Add the two numbers together (24 + $^-40$ = $^-16$) then halve the answer ($^-8$).

Lesson 3: Problem solving – addition and subtraction

→ pages 51–53

1. There are 3,210 visitors in the park.

2. The third number is 3,037.

3. a) 1,100 more children than adults visited the park on Saturday.
b) The difference is 1,200.

4. They sell 186 cakes in total.

5. a)

	H	T	O	·	Tth	Hth
		5	3	·	1	9
+		7	8	·	8	2
	1	3	2	·	0	1
	1	1	1		1	

b)

	Th	H	T	O
	$^8\cancel{9}$	^{10}	$^6\cancel{7}$	^{11}
−	6	1	5	3
	2	9	1	8

6. △ = 250 □ = 350 ⬠ = 750

Reflect

Answers will vary; for example:

117	
69	48

117 + 69 = 186

Lesson 4: Problem solving – four operations (1)

→ pages 54–56

1. An adult ticket costs £15. A child ticket costs £8·50.

2. 11 van trips are needed.

3. a) 42 mixed bags can be made.
b) 3 lemons and 1 lime are needed to complete another bag.

4. Jen uses 625 ml more water for the mugs.

5. Multiplying by 6 then dividing by 3 is the same as multiplying by 2 (doubling).

6. There are 12 tins of red paint.

Reflect

Answers will vary; for example: read the question carefully, write down all the number sentences needed to solve the problem, use bar models, check that you have answered the question.

Lesson 5: Problem solving – four operations (2)

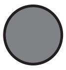
➜ pages 57–59

1. One spotty bead costs 23p.

2. The tower is 420 cm high.

3. a) The capacity of a small bottle is 450 ml.
b) 2·7 l more water fills 10 large bottles.

4. 94 × 8 + 3; 98 × 4 + 3; 48 × 9 + 3; 49 × 8 + 3

5.  = 12 cm  = 16 cm  = 20 cm

Reflect

Most efficient strategy is 10 times the difference (10 × 270) rather than 10 × 720 – 10 × 450.

25 × 270 = 6,750 ml = 6·75 l

Lesson 6: Problem solving – fractions

➜ pages 60–62

1. $\frac{2}{6} < \frac{1}{2} < \frac{3}{4}$

2. a) They sold 84 cookies altogether.
b) $\frac{2}{9}$ of the cookies were left.

3. $\frac{7}{18}$

4. $3\frac{7}{20}$ km

5. There are 96 marbles in the bag.

6. $\frac{4}{8} \times \frac{2}{3} = \frac{1}{3}$ $\frac{3}{5} + \frac{4}{4} = 1\frac{3}{5}$ $\frac{3}{10} + 4 = 4\frac{3}{10}$

Reflect

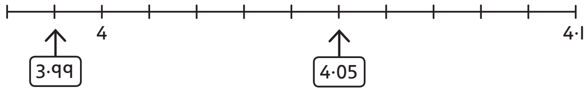
$\frac{7}{12}$ is larger than $\frac{1}{2}$. 7 is more than half of 12; the other numerators are less than half of their denominator.

Lesson 7: Problem solving – decimals

➜ pages 63–65

1. The mass of 1 bag of popcorn is 0·18 kg.

2. a) A carton of juice costs 65p.
b) 8 bags of popcorn cost £9·20 more than 8 cartons of juice.

3. 

4. The mass of 1 tin of nuts is 0·27 kg (to two decimal places).

5.

4·6	7·1	4·8
5·7	5·5	5·3
6·2	3·0	6·4

Reflect

0·87 is closest to 0·9 as it is only 0·03 away from 9.

Lesson 8: Problem solving – percentages

➜ pages 66–68

1. The washing machine is £238 in the sale.

2. 54 children walk to school.

3.

Destination	Number of flights	Percentage of total flights
Other French cities	72	30%
European cities	132	55%
Cities outside Europe	36	15%

4. There were 4,500 visitors altogether.

5. 35% of 180 = 30% of 210

Reflect

$\frac{3}{5} = \frac{12}{20} = 60\%$

Lesson 9: Problem solving – ratio and proportion

➜ pages 69–71

1. a) $\frac{3}{8}$ of the box is pens.
b) He will have 18 fewer pens than pencils.

2. a) 30 cakes can be made.
b) 625 g of flour is needed.

3. 9 : 3 or 3 : 1

4. On the map the two cities are 13 cm apart.

5. There are 3 boys for every 5 girls.

6. A large tin has a mass of 560 g.

Reflect

24 ÷ 3 × 5 = 40

Lesson 10: Problem solving – time (1)

→ pages 72–74

1. a) Max must wait 2 hours and 25 minutes.
b) Jen watches TV for 50 minutes.
c) Viewers must wait 10 full weeks.

2. a) The teacher makes 21 appointments.
b) The last appointment on Wednesday ends at 19:55.

3. Olivia raises £40.

4. 12 intervals of 45 minutes = 9 hours, which is longer than one third of a day (8 hours).

5. a) 2,904 hours = 121 days
b) The puppy was born on 17 June.

Reflect

10 minutes past 10; 22:10; 10:10 pm

Lesson 11: Problem solving – time (2)

→ pages 75–77

1. a) The journey on the 16:12 bus is 3 minutes shorter.
b) It is quicker for Max to walk.

2. Children spend 4 hours 15 minutes longer in lessons.

3. a) He travelled 125 km.
b) The break was 1 hour 15 minutes long.
c) He stopped for lunch at 1:05 pm (13:05).

4. Taxi company A will be the cheapest. A is 60p a minute, so £18; B is 15 minutes for £9·75 so £19·50 for 30 mins; C is 64p per minute (or £3·20 for 5 minutes) so £19·20 for 30 minutes.

Reflect

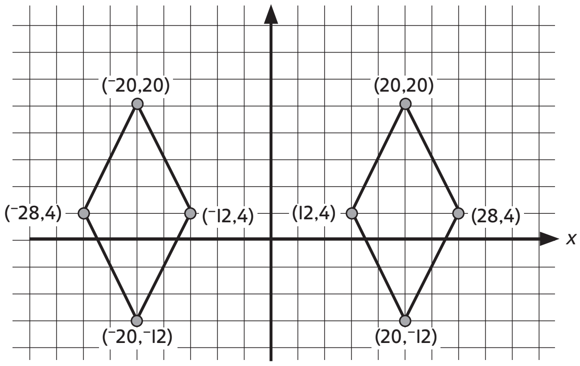
She has used column addition forgetting that there are 60 mins in an hour, not 100. The correct time is 1:40 (13:40).

Lesson 12: Problem solving – position and direction

→ pages 78–80

1. B($^{-}$1,5)
D(3,1)

2. a)



b) (12,4), (20,20), (20,$^{-}$12) and (28,4)

3. a) A(12,14)
B(12,2)
C(19,2)
b) (12,8)
c) Circled: (16,12)

4. ($^{-}$1,4); (2,$^{-}$5); ($^{-}$1,5); ($^{-}$4,$^{-}$4)

Reflect

Add each part of the coordinate then divide by 2.
7 + 7 = 14; 14 ÷ 2 = 7; 2 + 10 = 12, 12 ÷ 2 = 6.
The half-way point is (7,6).

Some children will notice that the *x*-coordinate will be 7 as well, as the line is horizontal, parallel to *x*-axis.

Lesson 13: Problem solving – properties of shapes (1)

→ pages 81–83

1. a = 30°, b = 42°, c = 68°, d = 68°

2. a) a = 55°, b = 35°
b) Answers will vary; for example: c = 180° – 35° (angle b) = 145°, d = c (opposite angles).

3. angle x = 28°, angle y = 100°, angle z = 52°

4. angle x = 100°, angle y = 60°, angle z = 200°

5. angle a = 40°, angle b = 140°, angle c = 40°

Reflect

Answers will vary.

Angles b + c = 92° (180 – 88). For example: 46° and 46°; 80° and 12°.

Lesson 14: Problem solving – properties of shapes (2)

➜ pages 84–86

1. External angle is 360° ÷ number of sides; 360 ÷ 8 = 45 or internal angle sum: 6 × 180 = 1,080; 1,080 ÷ 8 = 135; 180 – 135 = 45
   m = 45°
2. Shapes in the wrong place: trapezium, rhombus, regular pentagon and regular hexagon.

	Interior angles add up to 360°	Interior angles do not add up to 360°
Have at least one pair of parallel sides	rectangle parallelogram	rhombus regular pentagon
Have no pairs of parallel sides	kite trapezium	triangle regular hexagon

3. Internal angle of hexagon = 120°, 3 × 120° = 360°
4. angle a = 120° (adjacent angles in parallelogram = 180° or opposite angles are equal), angle b = 47° (internal angles in a pentagon = 108°; angles round a point = 360°)
5. angle e = 80°, angle f = 40°

Reflect

A regular pentagon has 5 angles each of 108°.
330 ÷ 3 = 110°, not 108. Alternatively: all angles must be equal in regular shapes: 330 ÷ 3 = 110°, leaving only 210° for the other two angles, not enough for both to be 110° (angle sum of pentagon = 3 × 180 = 540).

End of unit check

➜ pages 87–88

My journal

He will save £7,776.

Children need to find 25% and $\frac{3}{10}$ of 1,200 to find how much is left (540) then split into the ratio 3 : 2 to find out how much he saves each month (540 ÷ 5 = 108; 2 × 108 = 216 saved) then multiply by the number of months: 216 × 36 months = 7,776

Power play

	Money spent	Arrival time	Departure time
Jamie	£7·50	13:00	14:15
Max	£2·50	10:30	13:30
Zac	£10	11:15	13:15

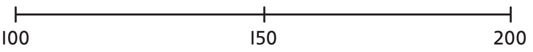
Children should fill in any information given in the speech bubble first: Max's times and Zac's spend, using that to work out the rest.

Unit 15: Statistics

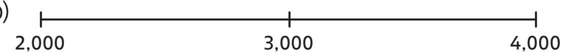
Lesson 1: The mean (1)

➜ pages 90–92

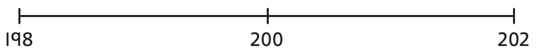
1. a) Children should draw 3 bars each 5 squares high.
   b) Children should draw 4 rows of 5 counters.
2. The mean number of marbles = 4.
3. Children should match groups A and D, and B and C.
4. a) 25 cm b) 250 ml c) 251 kg
5. Circled: Group A.
6. a)



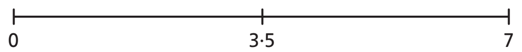
b)



c)



d)



Each time the mean is the same as the number half-way between the two given numbers.

Reflect

Answers will vary; for example: add together and divide by 3 or take one off the 6 and add it to the 4.

Lesson 2: The mean (2)

➜ pages 93–95

1. a)

2	4	6	4
4	4	4	4

$2 + 4 + 6 + 4 = 16$
$16 \div 4 = 4$

b)

1	5	6	2
3·5	3·5	3·5	3·5

The mean = 3·5

c)

1	2	3	4	5	3	
3	3	3	3	3	3	

The mean = 3

2. The mean capacity = 1·25 l
3. The Brown family has the greater mean weekly spend.
4. The mean length = 1·6 m
5. First: Lexi Second: Bella Third: Amelia

Reflect

Answers will vary; for example: To find the mean of a set of numbers, you add the numbers then divide by the amount of numbers.

Lesson 3: The mean (3)

➜ pages 96–98

1. Children should draw a tower of 7 cubes in the left-hand group and a tower of 4 cubes in the right-hand group.
2. Emma has 1 pet.
3. The fourth group collected £2·50.
4. a) 2
   b) Answer will vary but the sum of both missing numbers must be 4·5; for example: 0 and 4·5; 2 and 2·5.
5. Answer will vary but the total water added in Jugs B and E must be 550 ml; for example: B = 350 ml and E = 200 ml; B = 150 ml and E = 400 ml
6. 6 and 4; 2 and 8

Answers will vary but must have a total of 15; for example: 5, 5, 5; 3, 5, 7; 1, 5, 9; 1, 3, 11
Answers will vary but are limited to 0 and 10 or 1 and 11 as the greatest / least; for example: 0, 2, 4, 10; 0, 3, 3, 10; 1, 2, 2, 11; 1, 1, 3, 11
Answers will vary; for example: 2·5, 3·5, 4·5, 5·5.

Reflect

Many variations. Look for an easy method: two cards totalling 15, 4 cards totalling 30.

Lesson 4: Introducing pie charts

➜ pages 99–101

1. More than half the children in Club C play football.
2.

	True	False
Less than half want to be a pop star.	✔	
The least popular job is vet.		✔
More children want to be a sportsperson than a teacher.	✔	

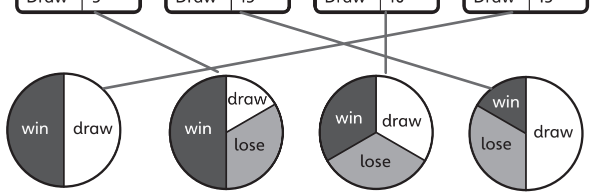
3.

Team A	
Win	15
Lose	10
Draw	5

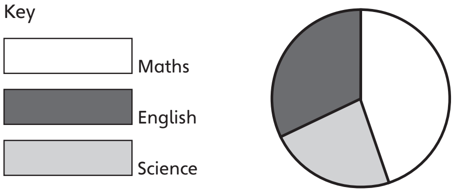
Team B	
Win	5
Lose	10
Draw	15

Team C	
Win	10
Lose	10
Draw	10

Team D	
Win	15
Lose	0
Draw	15



4. Key



5. Answers will vary; for example:
Questions to be answered using a pie chart: questions relating to most/least; fractions or percentages etc.
Questions to be answered using a bar chart: questions relating to most/least popular, how many, how many more, totals etc.

Reflect

Answers will vary; for example: pie charts are better for an overall view of the data and for proportions of the whole (fraction/percentages); bar charts are better for showing specific amounts for the individual categories and for comparing numerically.

Lesson 5: Reading and interpreting pie charts

→ pages 102–105

1. a) Children should colour 5 sections for banana, 1 for kiwi and 4 for strawberry.
b) Children should colour 1 section for orange, 1 for lemon and 3 for chocolate.
c) Children should colour 1 section for rabbits and 3 for cats.

2. a) The best team has 4 more points than the worst team.
b) 5 possible answers: 5 wins and 1 draw; 4 wins and 4 draws; 3 wins and 7 draws; 2 wins and 10 draws; 1 win and 13 draws.

3. Children should shade the pie chart to show 2 sections each for 'once a week' and 'sometimes', 1·5 sections for 'every day' and 2·5 sections for 'never'.

4. Shading to show 6 sections for boys and 4 sections for girls.

Reflect

Answers will vary; Children should mention dividing the total by the number of sections.

Lesson 6: Fractions and pie charts (1)

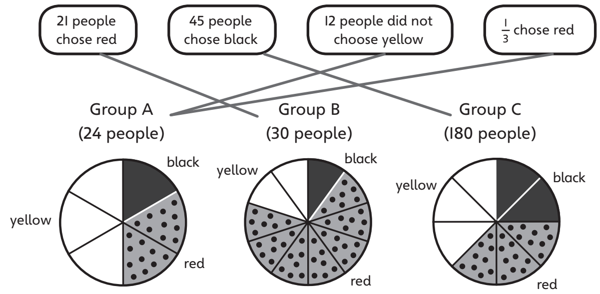
→ pages 105–107

1. The horse spends $\frac{1}{6}$ of the day sleeping.
The cat spends $\frac{1}{2}$ of the day sleeping.
The boy spends $\frac{2}{3}$ of the day awake.
The cat sleeps most in a day and sleeps for 12 hours.

2. Jamilla = $\frac{5}{16}$, Isla = $\frac{6}{16} = \frac{3}{8}$, Aki = $\frac{4}{16} = \frac{1}{4}$, Bella = $\frac{1}{16}$

3. Amelia is correct. The Tigers have lost $\frac{1}{4}$ of 48 = 12; The Bears have lost $\frac{1}{2}$ of 20 = 10.

4.



5. a) Answers will vary but should be close to the following and total 1: cat food = $\frac{3}{20}$, dog food = $\frac{2}{5}$ and bird seed = $\frac{9}{20}$.
b) Answers will depend on the children's fractions in part a) but should be approximately: cat food = £45, dog food = £120 and bird seed = £135.

Reflect

Answers will vary; look for children mentioning twelfths, quarters and two-thirds.

Lesson 7: Fractions and pie charts (2)

→ pages 108–110

1.

Type of tree	Number seen
birch	16
oak	12
pine	4
fir	8
Total	40

2. a) 60 birds were sighted altogether.
b) 15 blackbirds were sighted.

3. Bella threw more than 70 times. False
Max threw fewer beanbags than Bella. True
Bella scored 3 more bullseyes than Max. False

4. $\frac{5}{12}$ like curry.
288 children like pizza and curry.

5. a) $\frac{1}{14}$ is mango.
b) 50 ml more pineapple is needed.

Reflect

Answers will vary.

Lesson 8: Percentages and pie charts

→ pages 111–113

1. 25%; 16%; 30%
2. Bella = 15 votes; Zac = 21 votes; Isla = 12 votes; Reena = 12 votes
3. 24 more people shop online than in second-hand shops.
4. Both teams were 60% successful.
5. There are 30 more birch trees in Lanhay Forest than in Hetiddy Woods.

Reflect

Children's pie charts should show $\frac{1}{4}$ (= 25%), 10% ($\frac{1}{10}$) and 15% ($\frac{3}{20}$) with the remainder $\frac{1}{2}$ or 50%.

Lesson 9: Interpreting line graphs

→ pages 114–116

1. a) 2:30 = 15 °C 5 pm = ⁻3 °C
   b) It decreases by 24·5 °C.
   c) 4:45–4:48 pm
   d) (Approximately) ⁻5·75 °C
2. 1995: answers from 65,000–74,000
   2005: answers from 200,150–200,250
3. a) 110 km
   b) The cyclist slowed to climb a steep hill between 30 minutes and 90 minutes.
   The cyclist rested for 10 minutes after 120 minutes of racing.
   After 102–105 minutes the cyclist had completed half the distance.
   The cyclist raced most quickly between 130 minutes and 160 minutes.
4. a) $\frac{1}{3}$
   b) Answers approximately 30% +/– 3%
   c) Answers approximately 60% +/– 3%

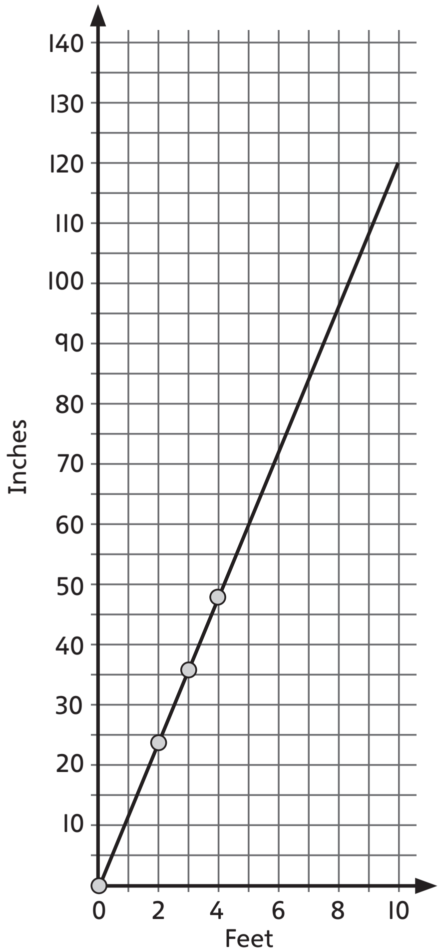
Reflect

Answers will vary. Children should mention the scales on the axes and how to read in between the marked intervals.

Lesson 10: Constructing line graphs

→ pages 117–119

1.



1 foot = 12 inches

10 feet = 120 inches

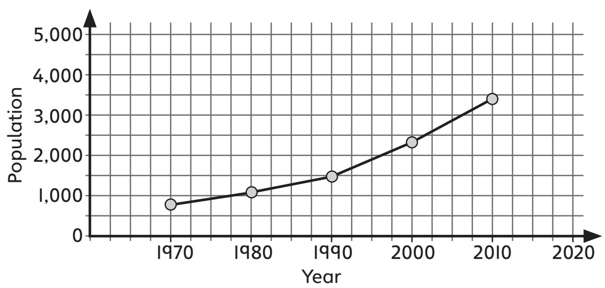
$3\frac{1}{2}$ feet = 42 inches

$5\frac{1}{4}$ feet = 63 inches

30 inches = $2\frac{1}{2}$ feet

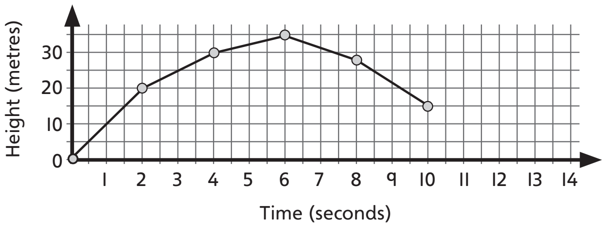
100 inches = $8\frac{1}{3}$ feet

2.



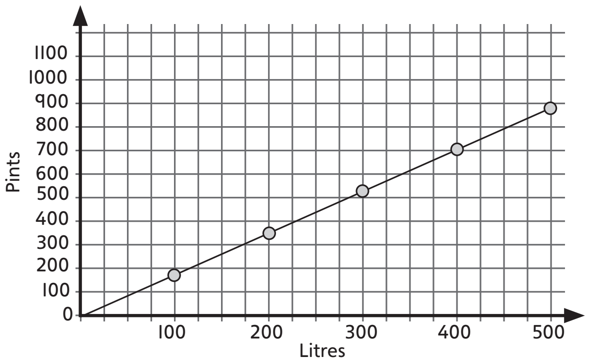
Predictions for the population in 2020 should be accurately read off the children's graph. Approximately 4,000–5,000.

3.



Predictions for when the firework will land should be accurately read off the children's graph. Approximately 11–12 seconds.

4.



Answers close to:

Pints	100	85	25	5·5
Litres	176	150	44	10

Reflect

Answers will vary. Children should mention deciding the scales on the axes and the fact that it would be a straight line.

End of unit check

➜ pages 120–122

My journal

1. There is room for 1–1 on the scale but some children may labels in 2s. $19 at this rate = approximately £12·50, exactly £12·67.
2. Answers will vary; for example:

   Pie chart: to compare quickly each part to the whole, using fraction or percentages, to tell quickly the most/least popular, etc.

   Tally chart: to work out exact figures. They are usually then used to draw other graphs.

   Line graph: to show a trend in time or temperature, to convert between units, to show a relationship between two things, etc.

   Bar chart: to compare amounts and find total and differences easily.

Power play

Children should play the game and then adapt it. Answers will vary.