

# Workbook answers

## Exercise 1.1

1 a  $-7$  b  $1$  c  $-5$  d  $5$

2 a  $-2$  b  $-9$  c  $9$  d  $1$

3

+	4	$-5$
2	6	$-3$
$-6$	$-2$	$-11$

4 a  $15$  b  $-25$  c  $-15$  d  $17$

5 a  $25$  b  $5$  c  $11$  d  $-23$

6 a  $-7$  b  $6$  c  $4$  d  $-10$

7 a  $9$  b  $5$  c  $2$  d  $-3$

8 a  $4$  b  $17$  c  $-20$  d  $6$

9 a  $-80$  b  $200$  c  $-800$  d  $-90$

10  $-6$

11 Two possible answers:  $-2$  or  $4$ .

12 a  $-3 + 4 = 1$  b  $-5 + 3 = -2$

c  $5 + -2 = 3$

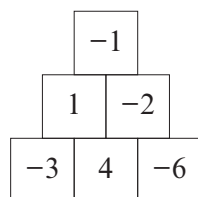
13

+	3	$-4$
2	5	$-2$
$-2$	1	$-6$

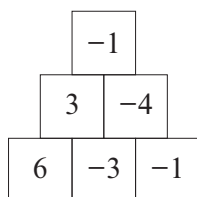
14

$-$	$-4$	6	2
3	7	$-3$	1
$-3$	1	$-9$	$-5$

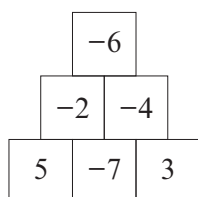
15 a



b



16



One method is to try different numbers in the bottom square. Try to get closer to  $-6$  each time.

## Exercise 1.2

1 a  $-30$  b  $-36$  c  $-55$  d  $-49$

2 a  $-12$  b  $-4$  c  $-5$  d  $-7$

3

$\times$	4	7
$-2$	$-8$	$-14$
$-6$	$-24$	$-42$

4 a  $-12$  b  $-30$  c  $-28$  d  $-30$

5 a  $-3$  b  $-7$  c  $-2$  d  $-6$

6 a  $-8$  b  $-3$  c  $13$  d  $5$

7 a  $9$  b  $-4$  c  $-36$  d  $32$

8 a  $-12$  b  $21$  c  $8$  d  $-3$

9 a  $-1200$  b  $-900$  c  $-1200$  d  $-200$

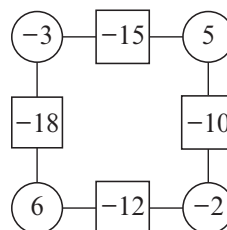
10 a  $-2$  and  $9$ ;  $3$  and  $-6$ ;  $-3$  and  $6$ ;  $1$  and  $-18$ ;  $-1$  and  $18$

b There are two more, as listed in part a.

11

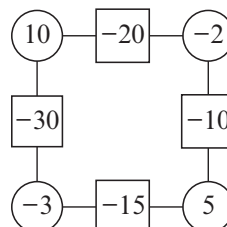
$\times$	6	4
$-5$	$-30$	$-20$
$-8$	$-48$	$-32$

12 a i

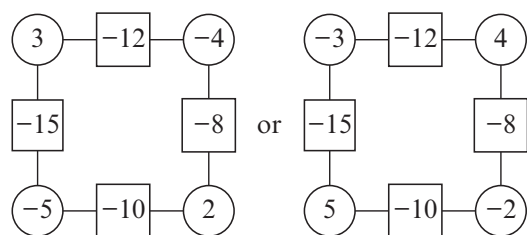


ii  $-55$

b i



ii  $-75$

**13 a****b** There are two solutions.**14 a**  $(3 + -5) \times 4$  or  $(-5 + 3) \times 4$ **b**  $(-4 + 7) \times 2 = 6$ . The other possibilities are negative numbers.**15 a** -1 and 20 have a sum of 19.**b** -1 and 30 have a sum of 29.**c** For any negative integer, the largest possible sum is the corresponding positive integer -1. For example: For -15, the largest sum is  $15 - 1 = 14$ .

### Exercise 1.3

**1 a** 4, 8, 12, 16**b** 7, 14, 21, 28**c** 12, 24, 36, 48**d** 30, 60, 90, 120**2** 9**3 a** 8, 16, 24, 32, 40, 48**b** 5, 10, 15, 20, 25, 30, 35, 40, 45**c** 40**4 a** 6, 12, 18, 24, 30**b** 6**c** 6**5 a** 12, 24, 36**b** 12**c** 12**6 a** 30**b** 20**c** 10**7** The multiples of 3 are 3, 6, 9, 12, 15, ...  
The multiples of 5 are 5, 10, 15, ... So 15 is the lowest common multiple and the multiples of 15 are common multiples.**8** 42**9 a i** 14**ii** 28**iii** 42**b** Multiply the two numbers.**c** It works unless the other number is a multiple of 7. For example: it works for 7 and 8, or 7 and 9, or 7 and 10, but not for 7 and 14, or 7 and 21.**10 a i** 90**ii** Yes**b i** 98**ii** No; the LCM is 14.**c i** 96**ii** No; the LCM is 24.**11** 30**12** 72**13 a** Because  $96 \div 4 = 24$  and  $96 \div 24 = 4$ .**b** No; the LCM is 24 because  $24 = 6 \times 4$ .**14** 5 and 9**15** 1 and 63; 7 and 9

### Exercise 1.4

**1 a** 1, 3, 7, 21**b** 1, 2, 4, 8, 16, 32**c** 1, 2, 5, 10, 25, 50**d** 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72**e** 1, 43**2 a** 1, 3, 17, 51**b** 1, 2, 4, 13, 26, 52**c** 1, 53**d** 1, 2, 3, 6, 9, 18, 27, 54**e** 1, 5, 11, 55**3 a** 1, 2, 4**b** 4**4 a** 1, 3, 5, 15**b** 15**5 a** 3**b** 9**c** 18**6 a** 9**b** 25**c** 8**d** 1**7 a** 7**b** 5**c** 14**8 a** 8**b**  $\frac{4}{5}$ **9 a** 13**b**  $\frac{4}{7}$ **10** 5 and 30; 10 and 25; 15 and 20**11 a**  $8 = 4 \times 2$  and  $12 = 4 \times 3$ **b** 8 is the HCF because  $16 = 2 \times 8$ .**c** 8 and 20; 8 and 28; 12 and 16; 12 and 20;  
12 and 28; 16 and 20; 16 and 28; 24 and 28**12** 3 or 6 or 12 or 15 or 21 or 24 ... Any multiple of 3 that is not a multiple of 9.**13 a i** 1**ii** 1**iii** 1**b** The HCF of two consecutive numbers is 1.**c** The LCM of two consecutive numbers is the product of the numbers. For example: the LCM of 4 and 5 is 20.

## Exercise 1.5

- 1  $28 \div 4 = 7$ ; 28 is divisible by 4 and so is 5328;  $5 + 3 + 2 + 8 = 18$ , which is divisible by 9.
- 2 **a** odd =  $9 + 7 = 16$ ; even =  $3 + 2 = 5$ ;  $16 - 5 = 11$   
**b** Yes, the sums are the same. This time odd = 5 and even = 16;  $5 - 16 = -11$ .
- 3 **a** The last two digits make the number 8, which is divisible by 4.  
**b** No, the last three digits are not divisible by 8 because  $108 \div 8 = 13 \text{ r. } 4$ .
- 4 The sum of the digits is  $14 + *$ . This is a multiple of 3 when it is 15, 18 or 21;  $* = 1$  or 4 or 7.
- 5 1, 7 and 11
- 6 **a i** Any number with these digits that ends in 5.  
**ii** Any number with these digits because the sum of the digits is always 12.  
**b i** No, because the sum of the digits is 12.  
**ii** Yes. For example: 1254 is a possible answer. The odd and even digit sums must be  $1 + 5$  and  $2 + 4$ .
- 7 For example:  $322 + 7 + 7 = 336$
- 8 It is divisible by 1.  $520 = 8 \times 65$ , so it is divisible by 2, 4, 8. It is also divisible by 3 and therefore also divisible by 6.  $2 + 5 + 2 + 0 = 9$ , so it is divisible by 3 and 9. The last digit is 0, so it is divisible by 5 and 10.  $2520 \div 7 = 360$ , so it is divisible by 7. Odd =  $0 + 5 = 5$  and even =  $2 + 2 = 4$ , so it is not divisible by 11. This shows that 11 is the smallest integer that is not a factor.
- 9 The numbers with an even number of digits. For example: 99, 9999, 999999, ...
- 10 **a** It ends in 5, so it is divisible by 5.  $7 + 9 + 0 + 5 = 21$ , so it is divisible by 3. Hence, it is divisible by 15.  
**b** The final digit must be 0 or 5. If it is 0, the other digit is 2, 5 or 8. If the final digit is 5, then the other digit is 0, 3, 6 or 9. These are the possible numbers: 20805, 20820, 20835, 20850, 20865, 20880, 20895.
- 11 1 is a factor. Another factor is 3 because the digit sum is 21, which is a multiple of 3. A third factor is 11 because  $9 + 7 = 16$ ,  $2 + 3 = 5$  and  $12 - 5 = 11$ .
- 12 It is odd, so it is not divisible by 2, 4, 6, 8 or 10.  
 It ends in 9, so it is not divisible by 5.  
 The sum of the digits is 32, so 3 and 9 are not factors. Odd digit sum = 15 and even digit sum = 17, so 11 is not a factor. The only other possibility is 7, so that must be a factor.
- 13 **a** 1234 or 3456 or 5678 **b** 3456 or 6789  
**c** 2345  
**d** There are none because odd – even always equals 2.

## Exercise 1.6

- 1 **a** 25 **b** 85 **c** 181
- 2 **a** 8 **b** 10 **c** 15 **d** 13
- 3 **a** 9 **b** 152 **c** 56
- 4 **a** 4 **b** 0 **c** -1
- 5 **a** 6 **b** 8 **c** 10 **d** 12
- 6 **a**  $\sqrt{400} = 20$  **b**  $\sqrt{625} = 25$   
**c**  $\sqrt{900} = 30$  **d**  $\sqrt{1225} = 35$
- 7 **a**  $\sqrt[3]{216} = 6$  **b**  $\sqrt[3]{1000} = 10$   
**c**  $\sqrt[3]{1331} = 11$  **d**  $\sqrt[3]{3375} = 15$
- 8 **a** 6 **b** 15 **c** 4
- 9 **a**  $\sqrt{90}$  is between 9 and 10  
**b**  $\sqrt{135}$  is between 11 and 12
- 10 144
- 11 **a** 121, 144, 169 and 196  
**b** 125
- 12 7
- 13 **a** 64 **b**  $\sqrt[3]{64} = 4$  and  $\sqrt{4} = 2$
- 14 361
- 15 2197
- 16 **a**  $\sqrt{64} = 8$  and  $\sqrt[3]{64} = 4$   
**b** 729 because  $\sqrt{729} = 27$  and  $\sqrt[3]{729} = 9$ .  
**c** Learner's own answer.

## Exercise 2.1

- 1 a 1  
b 3  
c  $c$  (or any other letter)  
d 6  
e  $a$  (or any other letter)
- 2 a 3  
b  $3, 3+2=5$   
c  $b, b+2$  (or any other letter)
- 3 A and iv, B and iii, C and ii, D and v, E and i
- 4 a  $t+4$  b  $t-2$   
c  $t+5$  d  $t \div 2$  or  $\frac{t}{2}$
- 5 a  $s+2$  b  $3s$   
c  $s-6$  d  $\frac{s}{2}$
- 6 a  $x+2$  b  $t-15$   
c  $i+t$  d  $2v$
- 7 a  $6n$  b  $\frac{n}{5}$  c  $5n+1$   
d  $7n-2$  e  $\frac{n}{10}+3$  f  $25-3n$
- 8 a  $a+c$  b  $a+3c$   
c  $4a+c$  d  $4a+5c$
- 9 a and vii; b and i; c and v; d and iii; e and ii; f and iv. Marcus is not correct, it should be 'Multiply  $x$  by 5, then subtract from 5.'
- 10 a  $7d+6c$ , where  $d$  is the number of drinks,  $c$  is the number of bags of potato chips.  
b  $6r$ , where  $r$  is the value of a ring.
- 11 a  $g+k$  b  $t-h$   
c  $8x+y$  d  $3ab$
- 12 a  $v$  added to 7 times  $u$   
b  $d$  subtracted from 8 times  $w$   
c 5 times  $x$  added to 3 times  $y$   
d  $7p$  times  $q$  or 7 times  $p$  times  $q$  or  $7q$  times  $p$
- 13 a  $8a+15+2b-3c$   
b  $8a+15-(2b-3c)$  or  $8a+15-2b+3c$

- 14 a When  $p=-12$  and  $q=10$ ,  $p+q=-12+10=-2$ , but  $pq=-12 \times 10=-120$ . This is not equal to  $-8$ .

b  $p=2$  and  $q=-4$

## Exercise 2.2

- 1 a E b F c E  
d F e F f E
- 2 a 7 b 8 c 9 d 10
- 3 a 4 b 5 c 6 d 7
- 4 A and iii; B and i; C and ii; D and v; E and iv
- 5 b true  
c false when  $p=2$ ,  $9p=18$ .  
d true  
e false when  $x=12$ ,  $\frac{x}{3}=4$ .
- 6 a 16 b 117 c 20 d 25  
e 60 f 7 g 13 h 9  
i 12 j 18 k 0 l 11
- 7 a \$80 b \$144
- 8 a i Number of hours = number of days  $\times$  24  
ii  $h=24d$   
b 96 hours
- 9 a i 20 ii 36  
b 13
- 10 a i Hours =  $\frac{\text{Minutes}}{60}$  ii  $H = \frac{M}{60}$   
b 6
- 11 a 3 hours b 3.5 hours
- 12 a i 750 newtons ii 103 440 newtons  
b i 150 newtons ii 20 688 newtons
- 13  $x=4$
- 14  $a=3$  because  $25 \times 3 = 75$  (or  $75 \div 3 = 25$ ).
- 15 a  $M=P \div h$  or  $M = \frac{P}{h}$  b  $M=14$
- 16 a 84 minutes or 1 hour 24 minutes  
b 280 minutes or 4 hours 40 minutes

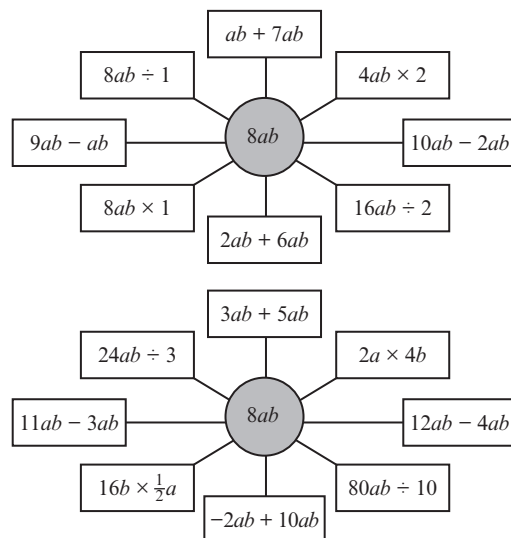
## Exercise 2.3

- 1 A and iii; B and v; C and vi; D and ii; E and i; F and iv

- 2 a true b false,  $6d$   
c false,  $10f$  d true  
e false,  $9h$  f true
- 3 A and ii; B and i; C and i; D and ii; E and ii
- 4 a false,  $5b$  b true c false,  $5f$   
d true e true f false,  $3v$
- 5 a  $\checkmark 6p$  b  $\times$   
c  $\times$  d  $\checkmark 7u$
- 6 a  $3x$  b  $2z$   
c  $2x + y$  d  $2z + x$   
e  $3x + 2y$  f  $2x + 2y + z$
- 7 a  $4a$  b  $7b$  c  $11c$   
d  $9d$  e  $13e$  f  $15f$   
g  $6g$  h  $h^2$  i  $8i$   
j  $6j$  k  $4k$  l  $y^3$
- 8 a top row  $18x$ , middle row  $8x$   
b middle row  $8x$ , bottom row (middle)  $3x$  and (right)  $5x$
- 9 a  $7x + 5y$  b  $10z + 6a$  c  $7a + 9b$   
d  $7x + 7$  e  $2d + 2$  f  $2f + 9g$   
g  $30 + 11w$  h  $4x + 6y$  i  $4a + b$   
j  $2w + 20y$  k  $200a + 5g + 30$
- 10 a  $6ab + 8xy$   
b  $6rd + 11th$   
c  $11tv + 4jk$   
d  $5ej + 3hy$   
e  $3v + 16rv$   
f  $3un$
- 11 a Maddi has collected unlike terms. She should have done  $2x + 7x = 9x$  and  $8 - 4 = 4$ , so answer is  $9x + 4$ .  
b Maddi hasn't collected together the letters  $rg$ , and she has incorrectly simplified  $4t - t$ . She should have done  $5rg + 2gr = 7gr$  and  $4t - t = 3t$ , so answer is  $7gr + 3t$ .
- 12 Second row:  $9a + 5b$   
Third row: left  $3a + 4b$ , right  $4a + 3b$   
Fourth row from the left:  $3b$ ,  $3a + b$ ,  $2a + 2b$

13 a  $\frac{a}{4}$  b  $\frac{b}{2}$  c  $\frac{22c}{7}$

- 14 a There are many different ways to complete this diagram. Two examples are:



- b No, there are many different ways to fill in the diagram.

15 a

8	1	6
3	5	7
4	9	2

b

$a + b$	$b - a - c$	$b + c$
$b + c - a$	$b$	$a + b - c$
$b - c$	$a + b + c$	$b - a$

## Exercise 2.4

- 1 a
- |          |    |    |
|----------|----|----|
| $\times$ | 10 | 3  |
| 5        | 50 | 15 |
- $5 \times 13 = 50 + 15 = 65$
- b
- |          |    |    |
|----------|----|----|
| $\times$ | 30 | 8  |
| 2        | 60 | 16 |
- $2 \times 38 = 60 + 16 = 76$

**c**

×	20	1
7	140	7

$$7 \times 21 = 140 + 7 = 147$$

**d**

×	10	7
4	40	28

$$4 \times 17 = 40 + 28 = 68$$

**2 a**  $3x$    **b**  $4p$    **c**  $9f$    **d**  $5m$

**3 b**

×	$x$	4
3	$3x$	12

$$3(x+4) = 3x + 12$$

**c**

×	$m$	1
5	$5m$	5

$$5(m+1) = 5m + 5$$

**d**

×	$n$	2
4	$4n$	8

$$4(n+2) = 4n + 8$$

**4 b**

×	$x$	-6
5	$5x$	-30

$$5(x-6) = 5x - 30$$

**c**

×	$y$	-4
2	$2y$	-8

$$2(y-4) = 2y - 8$$

**d**

×	$k$	-3
6	$6k$	-18

$$6(k-3) = 6k - 18$$

**5 a**  $3a+6$    **b**  $5b+15$

**c**  $3c+6$    **d**  $5d-5$

**e**  $4e-36$    **f**  $3f-24$

**g**  $8+4f$    **h**  $56+8z$

**i**  $27+9y$    **j**  $16-4x$

**k**  $7-7w$    **l**  $14-7v$

**6 a**  $10p+5$    **b**  $21q+14$

**c**  $18r+27$    **d**  $33s-44a+77$

**e**  $4t-10$    **f**  $20u-4$

**g**  $6+12v$    **h**  $48+32w-24g$

**i**  $60+70x$    **j**  $15-25x$

**k**  $20-15x$    **l**  $25k-40x-30h$

**7 a** Paul didn't multiply the 3 by 5. Correct answer is  $5a+15$ .

**b** Paul added the 3 and 5 instead of multiplying. Correct answer is  $12b-15$ .

**c** Paul expanded the brackets correctly but then combined unlike terms. Correct answer is  $12-4c$ .

**8** Odd one out is  $2(10x+8)$ , as this expands to  $20x+16$ . All the others expand to give  $18x+24$ .

**9 a**  $24x-36y$    **b**  $24+4x-6y$

**10 a**  $7x+6$    **b**  $12+4x$

**c**  $11x+7$    **d**  $10x-20$

**e**  $11x+23$    **f**  $19x+22$

**11** Left-hand side expanded:  
 $8x+28+18x-15=26x+13$

Right-hand side expanded:  $26x+13$

**12 a**  $9(3x+2)=3(9x+6)$

**b**  $5(8-6z)=10(4-3z)$

**13 a**  $4(2x+9)=8x+36$

**b**  $5(3x-7)=15x-35$

**c**  $8(6y-10)=48y-80$

**d**  $7(2y+6)=14y+42$

## Exercise 2.5

**1 a** 2   **b** 5   **c** 8

**d** 3   **e** 7   **f** 7

**2 a**  $x=4$    **b**  $x=8$    **c**  $x=5$

**d**  $x=11$    **e**  $x=8$    **f**  $x=6$

**3 a**  $x=6$    **b**  $x=11$    **c**  $x=11$

**d**  $x=17$    **e**  $x=18$    **f**  $x=9$

**4 a**  $y=3$    **b**  $y=2$

**5 a**  $x=4$    **b**  $x=3$    **c**  $x=7$

**d**  $x=6$    **e**  $x=15$    **f**  $x=10$

**g**  $x=27$    **h**  $x=4$    **i**  $x=10$

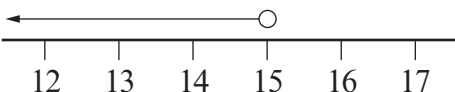
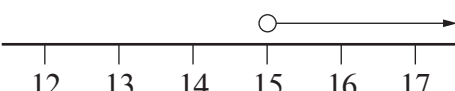
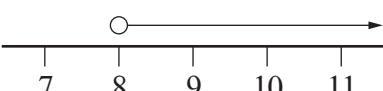
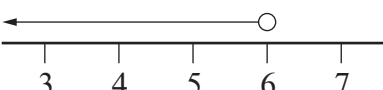
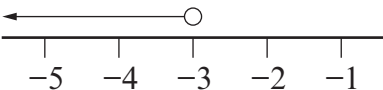
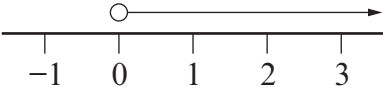
**j**  $x=7$

**6 a**  $x=11$    **b**  $x=4$    **c**  $x=18$

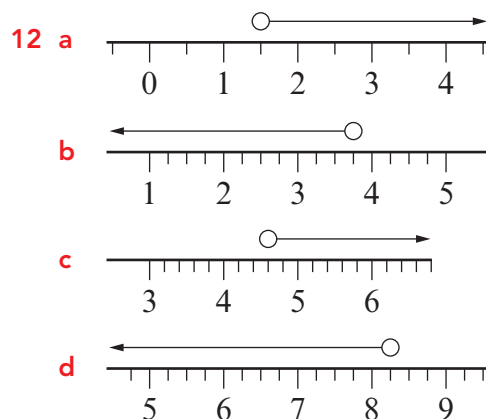
**d**  $x=25$    **e**  $x=7$    **f**  $x=5$

- 7 a**  $x + 5 = 21$ ,  $x = 16$   
**b**  $x - 5 = 21$ ,  $x = 26$
- 8 a**  $x + 14 = 20$ ,  $x = 6$   
**b**  $x - 17 = 20$ ,  $x = 37$   
**c**  $5x = 20$ ,  $x = 4$
- 9 a**  $a = 7$   
**b**  $a = 4$   
**c**  $b = 3$   
**d**  $b = 5$
- 10 a i**  $5x + 4x = 90^\circ$   
**ii**  $9x = 90^\circ$   
**iii**  $x = \frac{90}{9} = 10^\circ$   
**iv** Angles are  $50^\circ$  and  $40^\circ$ .  
**v**  $50 + 40 = 90^\circ$
- b i**  $6x + 4x = 180^\circ$   
**ii**  $10x = 180^\circ$   
**iii**  $x = \frac{180}{10} = 18^\circ$   
**iv** Angles are  $108^\circ$  and  $72^\circ$ .  
**v**  $108 + 72 = 180^\circ$
- c i**  $3x + 4x + 2x = 180^\circ$   
**ii**  $9x = 180^\circ$   
**iii**  $x = \frac{180}{9} = 20^\circ$   
**iv** Angles are  $60^\circ$ ,  $80^\circ$  and  $40^\circ$ .  
**v**  $60 + 80 + 40 = 180^\circ$
- d i**  $5x + 4x + 3x = 180^\circ$   
**ii**  $12x = 180^\circ$   
**iii**  $x = \frac{180}{12} = 15^\circ$ .  
**iv** Angles are  $75^\circ$ ,  $60^\circ$  and  $45^\circ$ .  
**v**  $75 + 60 + 45 = 180^\circ$
- 11 a**  $x = -18$       **b**  $y = 5$   
**c**  $z = -12$       **d**  $w = -6$
- 12**  $a = 2$ ,  $b = -12$ ,  $c = 3$ ,  $d = -7$   
 $a \times b = -24$ ,  $c + d = -4$   
 Zara is correct because  $-24$  is less than  $-4$ .
- 13 a**  $w = -8$       **b**  $x = -3$   
**c**  $y = -16$       **d**  $z = 6$

## Exercise 2.6

- 1 a** true    **b** false  
**c** false    **d** true
- 2** A and ii; B and iii; C and iv; D and i
- 3 a**  $x > 2$       **b**  $y > 5$   
**c**  $m < 15$       **d**  $b < 7$
- 4** A and iv; B and i; C and ii; D and iii
- 5 a**   
**b**   
**c**  $x > -2$   
**d**  $x < -2$
- 6 a**   
**b**   
**c**   
**d** 
- 7 a**  $x < 14$   
**b**  $x > 32$   
**c**  $x > -8$   
**d**  $x < -1$
- 8 a** C 6  
**b** C -6  
**c** A 11  
**d** B -2
- 9** No; Zara's list should be  $-6, -7, -8, -9, \dots$
- 10 a i** 9      **ii** 9, 10, 11, 12, ...  
**b i** -2      **ii** -2, -1, 0, 1, 2, ...  
**c i** 5      **ii** 5, 6, 7, 8, 9, ...

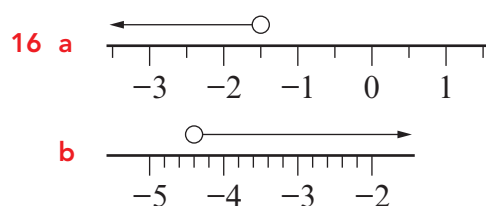
- 11 a i -2 ii -2, -3, -4, -5, ...  
 b i 15 ii 15, 14, 13, 12, ...  
 c i 3 ii 3, 2, 1, 0, -1, ...



- 13 a  $y > 0.5$  b  $y < 11.2$   
 c  $y < 3.8$  d  $y > 26.25$

14 It should be  $x > -3.5$ . Arun has misread the number line.

- 15 a  $w > -7.25$  b  $w < -11.8$



### Exercise 3.1

- 1 A and iii because  $1000 = 10^3$ .  
 B and v because  $100 = 10^2$ .  
 C and i because  $100\,000 = 10^5$ .  
 D and ii because  $10\,000\,000 = 10^7$ .  
 E and iv because  $10\,000 = 10^4$ .

- 2 a  $6 \times 10^4 = 6 \times 10\,000 = 60\,000$   
 b  $9 \times 10^4 = 9 \times 10\,000 = 90\,000$   
 c  $3 \times 10^4 = 3 \times 10\,000 = 30\,000$

- 3 a  $2 \times 10^5 = 2 \times 100\,000 = 200\,000$   
 b  $7 \times 10^5 = 7 \times 100\,000 = 700\,000$   
 c  $5 \times 10^5 = 5 \times 100\,000 = 500\,000$

- 4 a B b A c C

- 5 a 8 b 20 c 40  
 d 9 e 3 f 500

- 6 a A b C c B d C  
 7 a 5600 b 8 770 000 c 13 000 000  
 d 65 000 e 33 200 f 650 000

- 8 a 37 000 b  $10^3$  c 8.9 d  $10^7$

- 9 a 9 b 52 c 80

10

	$\div 10^2$	$\div 10^3$	$\div 10^4$	$\div 10^5$	$\div 10^6$
400 000	4000	400	40	4	0.4
56 000	560	56	5.6	0.56	0.056
3000	30	3	0.3	0.03	0.003
720	7.2	0.72	0.072	0.0072	0.00072

- 11 a B b A c C

12 No; it would be quicker for Arun to just multiply his starting number by 100 not 10.

- 13 a  $28\,000\text{ mg} = 28\text{ g}$   
 b  $750\text{ mg} = 0.75\text{ g}$   
 c  $2\,000\,000\text{ mg} = 2\text{ kg}$   
 d  $83\,000\text{ mg} = 0.083\text{ kg}$   
 e  $53\,000\,000\,000\text{ mg} = 53\text{ t}$   
 f  $2\,500\,000\text{ mg} = 0.0025\text{ t}$

- 14 a number of g = number of mg  $\div 10^3$   
 number of kg = number of mg  $\div 10^6$   
 number of t = number of mg  $\div 10^9$

- b i  $45\text{ g} = 45\,000\text{ mg}$   
 ii  $7.6\text{ kg} = 7\,600\,000\text{ mg}$   
 iii  $0.0657\text{ t} = 65\,700\,000\text{ mg}$

- 15 a Space station, weather satellite, Moon, Venus, Jupiter, Neptune.

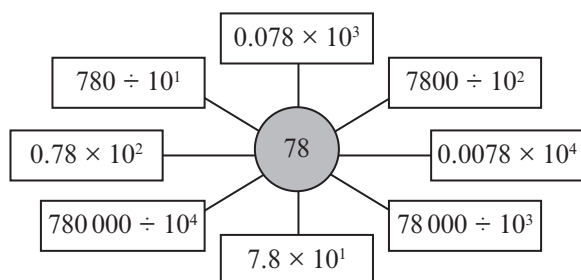
You can tell from the power on the 10. The smaller the power, the closer it is to Earth.

b

Object	Distance from Earth (km)
space station	408
weather satellite	36 000
Moon	384 400
Venus	41 400 000
Jupiter	628 700 000
Neptune	4 350 000 000



- 16** There are many different answers for this diagram. One example is given.



- 17 a** 41 000    **b** 9.24  
**c** 25    **d** 20.7

### Exercise 3.2

- 1 a** 4.5    **b** 3.7    **c** 8.8  
**d** 7.2    **e** 2.4    **f** 4.1
- 2 a** B    **b** B    **c** A  
**d** A    **e** B
- 3 a** 2.47    **b** 8.66    **c** 3.31  
**d** 8.07    **e** 1.94    **f** 2.42
- 4 a** B    **b** A    **c** A  
**d** B    **e** B
- 5 a** 4.98    **b** 9.04    **c** 24.33  
**d** 128.64    **e** 0.67    **f** 0.03
- 6 a** 7.285    **b** 65.882  
**c** 134.903    **d** 0.679  
**e** 300.004    **f** 0.009
- 7 a** 3.8826    **b** 61.8902  
**c** 143.5623    **d** 200.0068  
**e** 300.0006    **f** 18.2525
- 8 a** B    **b** A    **c** A
- 9** 0.00660 mm
- 10 a** 1.73    **b** 11.1538  
**c** 35.434
- 11 a** 480    **b** 477  
**c** 476.9    **d** 476.89  
**e** 476.893    **f** 476.8926  
**g** 476.89256    **h** 476.892564  
**i** 476.8925637    **j** 476.89256370

- 12 a**  $0.63636\ldots = 0.6364$  (4 d.p.)  
**b**  $1.5714\ldots = 1.571$  (3 d.p.)  
**c**  $1.444\ldots = 1.44$  (2 d.p.)  
**d i** Marcus = 8.285, Arun = 8.286  
**ii** no  
**iii** Arun's method. You need to find the number in the fourth decimal place so you know whether you need to round up or down the number in the third decimal place.

- 13** Any ten numbers in the interval  $45.6375 \leq \text{number} < 45.6385$ .

- 14 a** 25.246    **b** 25.247  
**c** No, because by rounding early, you lose accuracy.  
**d** By rounding at the end of a calculation and not during a calculation, you know the answer will be accurate.

### Exercise 4.1

- 1** 12, 23, 45, 176, 204, 498
- 2 a i** 215    **ii** 34, 59, 70, 152, 215, 251  
**b i** 39    **ii** 39, 67, 88, 95, 101, 321  
**c i** 10.9    **ii** 6, 8.2, 10.9, 14.5, 67, 100.7
- 3 a, b** 18.1, 18.3, 18.5, 18.6, 18.9  
**c** 9.2, 9.3, 9.5, 9.7, 9.8  
**d** 3.21, 3.32, 3.42, 3.56
- 4** 6.08, 6.1, 6.21, 6.5
- 5 a** 4.02, 4.21, 4.5, 4.67  
**b** 12.08, 12.3, 12.41, 12.9
- 6 a** 3.5    **b** 214.92  
**c** 34.56    **d** 336.9  
**e** 0.22    **f** 5.41  
**g** 25.67    **h** 0.013  
**i** 0.009    **j** 0.049
- 7 a** 9.58, 9.69, 9.72, 9.78, 9.79, 9.84  
**b** Asafa Powell
- 8 a** <    **b** >    **c** <    **d** >  
**e** >    **f** <    **g** >    **h** >

9 a = b ≠ c ≠

d = e = f ≠

10 a 2.66, 4.41, 4.46, 4.49

b 0.52, 0.59, 0.71, 0.77

c 6.09, 6.9, 6.92, 6.97

d 5.199, 5.2, 5.212, 5.219

e 42.4, 42.42, 42.441, 42.449

f 9.04, 9.09, 9.7, 9.901, 9.99

11 a 0.081 m, 8.15 cm, 83 mm

b 6.7 kg, 0.00672 t, 6750 g

c 3455 mm, 346 cm, 0.00347 km, 3.48 m

12 a Any three numbers in the range  
6.46 < number < 6.471.

b 10

c 6.461, 6.462, 6.463, 6.464, 6.465, 6.466,  
6.467, 6.468, 6.469, 6.470

13  $2000 \div 1000$ ,  $0.0208 \times 100$ ,  $0.23 \times 10$ ,  
 $2320 \div 1000$ ,  $1.9 \times 10$ ,  $2110 \div 100$

### Exercise 4.2

1 a 97 b 81 c 132

d 439 e 598 f 363

2 a 5.5 b 9.1 c 15.2

d 76.2 e 82.8 f 9.33

3 a 11.8 b 13.1

c 18.2 d 3.79

4 a 36 b 28 c 815

d 5.3 e 3.6 f 2.18

5 a 1.4 b 3.6 c 7.62

6 a 7.8 b 17.8 c 15.2

d 5.4 e 11.2 f 7

7 a B b A

8 a 9.2 b 17.6 c 12.1

d 4.4 e 5.1 f 4.7

9 a 7.82 b 13.32 c 30.18

d 122.17 e 2.22 f 1.8

g 19.08 h 39.04 i 20.73

10 a May b 8.98 kg

11 a 6.26 b 6.44

c 27.817 d 14.339

12 a \$4.10 b \$0.90

13 a 6.55 m b 1.45 m

14 a -4.24 b -3.52 c -7.66

d -5.827 e -12.29 f 12.27

15 a  $37.62 + 28.53 = 66.15$

b  $84.56 - 28.59 = 55.97$

### Exercise 4.3

1 a 8

b 60, 0.6

c 150, 15

d 350, 35, 3.5

e 1800, 180, 18, 1.8

f 4200, 420, 42, 4.2

2 Learner's own answers.

3 b  $2 \times 8 = 16$ , so  $0.2 \times 8 = 1.6$ .

c  $4 \times 4 = 16$ , so  $0.4 \times 4 = 1.6$ .

d  $7 \times 9 = 63$ , so  $0.7 \times 9 = 6.3$ .

e  $5 \times 5 = 25$ , so  $0.5 \times 5 = 2.5$ .

4 2.5, 3, 3.5, 4, 4.5, 5

5 a 22.4 b 9 c 7.2

d 18.4 e 44.5 f 18.4

6 a 0.6 b 0.8 c 2.4

d 3 e 4.9 f 4.8

7 a 0.18 b 1.8

c 0.018 d 18

8 a 0.6 b 4 c 0.5

d 6 e 3.8 f 0.4, 2

9 1.5 g

10 a 6608

b i 660.8 ii 66.08 iii 6.608

iv 660.8 v 66.08 vi 6.608

- 11 a**  $163.2, 5 \times 30 = 150$   
**b**  $999.6, 2 \times 500 = 1000$   
**c**  $22.72, 0.3 \times 70 = 21$   
**d**  $361.95, 0.6 \times 600 = 360$

**12** 0.77 g

**13** 1415.25 kg

**14** \$1482.66

- 15 a** 120.4      **b** 120.4  
**c** 120.4      **d** 1.204

### Exercise 4.4

- 1 a** 21      **b** 2.1      **c** 0.21  
**d** 14      **e** 1.4      **f** 0.14
- 2 a** 2.1      **b** 2.3      **c** 1.3  
**d** 2.8      **e** 0.7
- 3 a** 231      **b** 23.1      **c** 2.31  
**d** 352      **e** 35.2      **f** 3.52
- 4 a** 4.13  
**b** 3.11  
**c** 1.21  
**d** 3.11  
**e** 9.01
- 5 a** 1.232      **b** 3.172      **c** 1.122  
**d** 1.788      **e** 1.369      **f** 0.256
- 7 a** 2.314      **b** 1.321  
**c** 5.569      **d** 0.122

**8** \$1.49

**9** \$1.26

- 10 a** 3.226  
**b** 7.451

**11 a**

1	2	3	4	5	6	7	8	9
18	36	54	72	90	108	126	144	162

- b** 13.456  
**c**  $13.456 \times 18 = 242.208$

**12 a**

1	2	3	4	5	6	7	8	9
25	50	75	100	125	150	175	200	225

- b** \$32.32  
**c**  $\$32.32 \times 25 = \$808$

**13** It is better for Shaun to pay for his own food rather than a share of the bill. His own food costs \$13.60 and an equal share of the bill is \$13.72. He will save \$0.12.

- 14 a** Learner's own answer.  
**b** car A mean = 7.805 s, car B mean = 7.826 s  
**c** Learner's own answer.

- 15 a** 148  
**b** 14.8  
**c** 1.48  
**d** 0.148

- 16 a** 90      **b** 90  
**c** 9      **d** 900

- 17 a** 1.2  
**b** 1.63  
**c** 0.414

**18** 
$$\begin{array}{r} 1 \quad 1 \quad . \quad 6 \quad 2 \quad 3 \\ 8 \overline{) 9 \quad 12 \quad . \quad 49 \quad 18 \quad 24} \end{array}$$

### Exercise 4.5

- 1** A and v; B and vii; C and i; D and ix; E and ii; F and viii; G and iv; H and vi; I and iii
- 2 a** 2, 2, 30      **b** 3, 10, 3, 7, 3, 21  
**c** 6, 10, 6, 10, 10, 6, 12, 6, 72
- 3 a** 3, 3, 36      **b** 5, 100, 5, 9, 5, 45  
**c** 4, 100, 4, 100, 100, 4, 7, 4, 28
- 4 a** 10      **b** 25      **c** 8  
**d** 24      **e** 26      **f** 11.5
- 5 a**  $23 - 2.3 = 20.7$   
**b**  $57 - 5.7 = 51.3$
- 6 a** 27, 20, 7, 60, 21, 81  
**b** 43, 40, 3, 280, 21, 301
- 7 a** 252      **b** 200  
**c** 357      **d** 210

**8 a**

Item	Amount
Ayida	$0.4 \times \$650 = \$260$
Dayana	$0.6 \times \$650 = \$390$

**b**  $260 + 390 = 650$

**9 a** 61.2

**b** 42.3

**c** 113.4

**10 a** 25.2

**b** 39

**c** 50.4

**11 a**  $1.647 \div 3 = 0.549$

**b** 10, 10,  $8.925 \div 7 = 1.275$

**12** 14.1 m

**13 a**  $0.3816 \div 6 = 0.0636$

**b** 100, 100,  $6.765 \div 5 = 1.353$

**14 a i** \$18.57

**ii** \$19

**b** Answer from part **a ii** is the most suitable amount because \$19 each will cover the bill plus a little extra, but  $\$18.57 \times 40 = \$742.80$ , which isn't enough to cover the bill.

**15** 61.0 kg

### Exercise 5.1

**1 a**  $43^\circ$  **b**  $111^\circ$

**2 a**  $195^\circ$

**b**  $147^\circ$

**c**  $115^\circ$

**3 a**  $60^\circ$  **b**  $105^\circ$

**4**  $XY$  is not a straight line because  $54^\circ + 124^\circ \neq 180^\circ$ .

**5**  $75^\circ$

**6**  $a = 80^\circ$ ,  $b = 65^\circ$

**7**  $62^\circ$ ,  $118^\circ$ ,  $118^\circ$

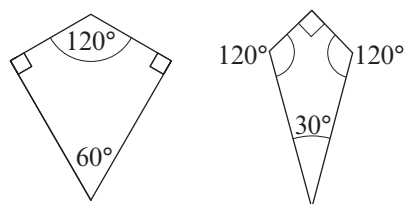
**8**  $95^\circ + 150^\circ + 125^\circ = 370^\circ$  and because this is more than  $360^\circ$  the diagram is impossible.

**9**  $y = 360^\circ - (60^\circ + 60^\circ + 90^\circ) = 150^\circ$

**10 a** The angles add up to  $680^\circ$ . This should be  $2 \times 360^\circ = 720^\circ$  if they are two quadrilaterals.

**b** The sum of the angles is  $720^\circ$ . One possible arrangement is  $20^\circ$ ,  $40^\circ$ ,  $140^\circ$ ,  $160^\circ$  on one quadrilateral and  $60^\circ$ ,  $80^\circ$ ,  $100^\circ$ ,  $120^\circ$  on the other quadrilateral. There are other possible arrangements.

**11** There are two answers possible. They are shown in these diagrams:



### Exercise 5.2

**1 a** perpendicular

**b** perpendicular

**c** parallel

**2**  $x = 38^\circ$ ,  $y = 142^\circ$ ,  $z = 38^\circ$

**3**  $a = 99^\circ$ ,  $b = 81^\circ$ ,  $c = 99^\circ$ ,  $d = 99^\circ$

**4**  $a = 69^\circ$ ,  $b = 57^\circ$ ,  $c = 54^\circ$

**5**  $a = 67^\circ$ ,  $b = 64^\circ$ ,  $c = 113^\circ$

**6**  $w = 75^\circ$ ,  $x = 105^\circ$ ,  $y = 80^\circ$ ,  $z = 25^\circ$

**7**  $x = 60^\circ$

**8** Statement C is correct. You do not know the angle between  $EF$  and  $CD$  or the angle between  $AB$  and  $GH$ . The lines are parallel if these angles are  $55^\circ$ .

**9** The angles opposite the four angles given are the four angles of a quadrilateral. The sum of these is  $360^\circ$ .

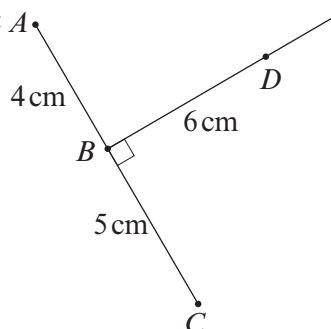
**10**  $AB$  and  $CD$  are not parallel because the acute angle between  $CD$  and the transversal is  $43^\circ$ .  $AB$  and  $EF$  are parallel because the acute angle between  $EF$  and the transversal is  $53^\circ$ .

**11 a** The angles of the five-sided shape are the angles of a triangle and a quadrilateral. The sum is  $180^\circ + 360^\circ = 540^\circ$

**b** It is true for any five-sided shape. Any five-sided shape can be divided into a quadrilateral and a triangle.

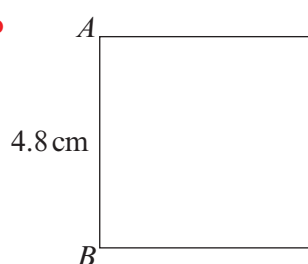
## Exercise 5.3

1 a–c



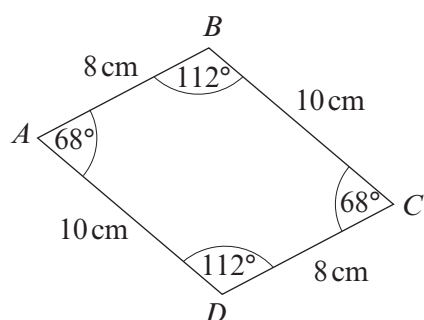
d 7.8 cm

2 a, b



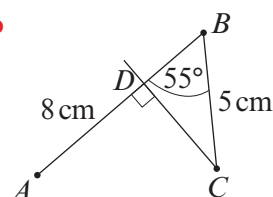
c 6.8 cm

3 a



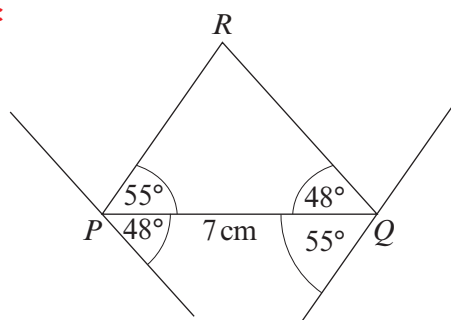
b 10.2 cm

4 a, b

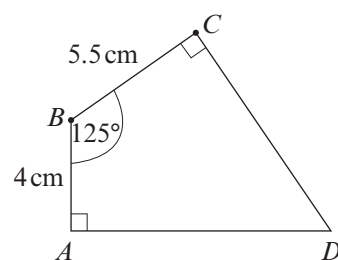


c 5.1 cm

5 a–c

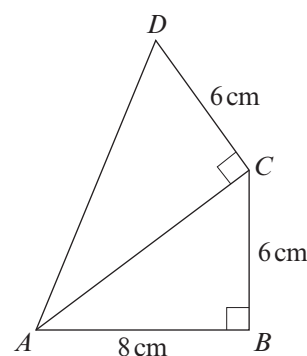


6 a

b  $55^\circ$ ; use the fact that the sum of the angles is  $360^\circ$ .

c 8.7 cm

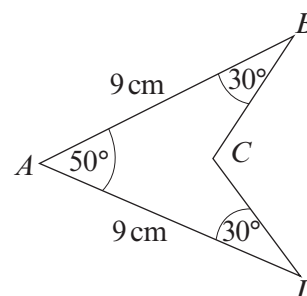
7 a



b 11.7 cm

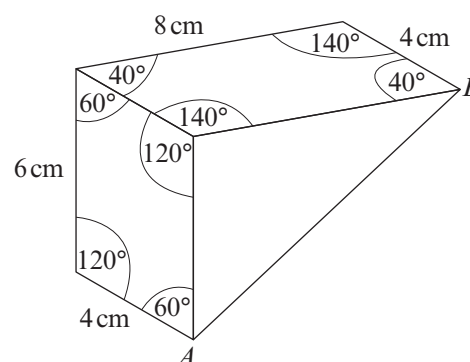
c  $68^\circ, 90^\circ, 143^\circ, 59^\circ$ ; the sum should be  $360^\circ$ .

8 a

b  $250^\circ$  c  $50^\circ + 30^\circ + 30^\circ + 250^\circ = 360^\circ$ 

d 5.5 cm

9 a



b 10.8 cm

## Exercise 6.1

- 1 a discrete  
b continuous  
c categorical

2 For example:

- a colour of walls, shape, type of furniture  
b number of chairs, number of windows  
c length of room, height of ceiling, temperature

3 a Question 1: Using a tick box or choosing a number is a better format. For example:

*Did you enjoy your visit to the gym today?*

Not at all ☐ Not very much ☐

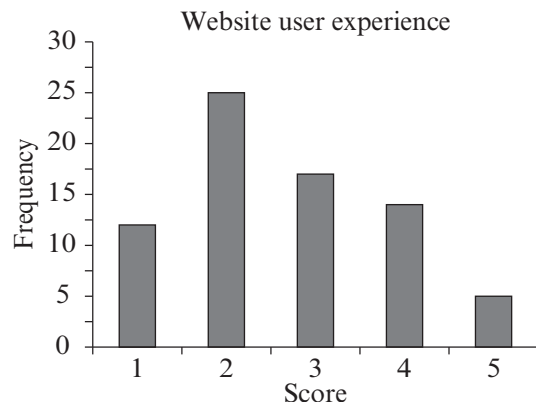
A little ☐ A lot ☐

- b Question 2: It is better to give a list of equipment and to ask for a tick for each one used.

4 a It was reasonably easy.

b 73 people

c



d 2

- e The prediction is not correct. For example: The mode is only 2, which means the website is not easy to use. Only 19 out of 75 users who answered the questionnaire gave a score of 4 or 5 to say that the website was easy or very easy to use. 37 out of 75 users said the website was not easy to use.

5 a

Mark	4	5	6	7	8	9	10
Frequency	4	8	6	3	11	5	3

b 8

c 7

d 6.9

- e The prediction is not correct. For example: the mean is less than 8. The median is less than 8. Only 19 learners out of 40 got a mark of 8 or more.

6 a It is a good idea to group the data first, otherwise the bar chart will have over 30 bars.

b

45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84

c eight bars

d The group with the tallest bar.

e The first two columns will be shorter than the rest.

f The percentage in the first two bars.

7 a There are lots of ways a customer could answer this and it will be difficult to analyse the answers. For example:

*How much did you enjoy shopping today?*

Not at all 1 2 3 4 5 A great deal

b The question is too vague. Tick boxes would be better. For example:

*On average, how often do you shop here?*

Every week ☐

Between once a week and once

a month ☐

Between once a month and once every

3 months ☐

Less than once every 3 months ☐

c This question is too personal. People are more likely to give an honest answer if you give an option of several age groups.

8 a For example: it gives a numerical answer; easy to use the data to draw conclusions; easy to answer.

b Learner's own answer.

c For example: people might have things to say that are not covered by the questions.

- 9 a No, because it does not give any details of the survey.  
 b For example: the number of people asked; details of the other brand; how the survey was carried out; did a range of people take part?

## Exercise 6.2

- 1 a There will probably not be a mode. The median is the middle height when the boys are listed in order. To find the mean, add up the heights and divide the answer by 5.  
 b Five is too small for a sample size. The five boys chosen might not be a good representation of the whole population.  
 c 1000 would be a good representation, but such a big number would take a long time to find and survey.
- 2 a The data collected can be analysed easily.  
 b 100 people  
 c Learner's own chart. For example: a bar chart or a pie chart.  
 d Median is 4; mode is 3; mean is 4.07.  
 e No. For example: Learners could give an average or compare in some way the number of people giving high scores with those giving low scores.
- 3 a For example: There are different possible answers. It is cheap; it is easy to send; it can be sent to a large number of people.  
 b For example: It is easy to order online; people are usually happy with their shoes; the shoes are delivered quickly; the website is very helpful.  
 c It is a good way to choose a sample because of the reasons given in part a. However, it may be that the customers who choose to complete the questionnaire are not representative of all shoppers.
- 4 a, b A two-way table could look like this:

		Age (in years)					
		17	18	19	20	21	22
Number of subjects	1						
	2						
	3						
	4		10				
	5						

- c There will be a very small number of students for each age. They will not be representative of the whole population.
- 5 a For example: Rosario could choose all the people using the library on one particular day. He could choose a particular number of people coming into the library each day for a week or more. He could take a sample from a list of registered users.  
 b 28  
 c Yes; more than half the people aged over 50 visited the library more than ten times. Only one person aged 21–35 visited the library more than ten times.  
 d The sample size is too small. 28 people are spread over nine categories. The results would be more convincing if they were from a larger sample.
- 6 a 50 or more employees would be a good sample size.  
 b For example: Choose the first employees using the restaurant on a particular day. Choose every tenth customer on one day. Choose a number of employees at random from several days. Choose names from a list of employees.  
 c For example: A questionnaire could be given to employees as they enter the restaurant. Questionnaires could be sent electronically. Employees could be interviewed individually to get more detailed replies.
- 7 a Group the data and draw a bar chart. Groups of ten would be suitable.  
 b You could use the chart to make a statement such as the modal age is 30–39 years. You should point out that you are assuming that the sample is a good representation of all 265 employees.
- 8 a They might not be a fair representation of the whole population of 150.  
 b For example: You could choose the same number from different classes. You could choose names at random, for example, by drawing names out of a hat.  
 c Learner's own answer.  
 d You should be able to use the answers to your question easily.

- 9 a** The means are 3.5, 3.25, 2, 3, 4.5, 2.5, 3.75, 2.75, 3, 3.75.  
**b** The means are 3, 3, 3.7, 3.1.  
**c** There is less variation in the answers in part **b**, which has a larger sample size. The value is more likely to be closer to the population mean, which is the mean you get for a very large number of spins.

### Exercise 7.1

- 1 a**  $27 \neq 29$       **b**  $36 = 36$   
**c**  $0.60 = 0.6$       **d**  $5.50 \neq 5.55$
- 2 a**  $\frac{2}{3} = \frac{2 \times 3}{3 \times 3} = \frac{6}{9}$   
**b**  $\frac{3}{5} = \frac{3 \times 2}{5 \times 2} = \frac{6}{10}$   
**c**  $\frac{1}{2} = \frac{1 \times 7}{2 \times 7} = \frac{7}{14}$
- 3 a**  $\frac{2}{3} \neq \frac{7}{9}$       **b**  $\frac{3}{5} = \frac{6}{10}$       **c**  $\frac{1}{2} \neq \frac{8}{14}$
- 4 a**  $\frac{7}{3} \rightarrow 7 \div 3 = 2 \text{ r}1 \rightarrow \frac{7}{3} = 2\frac{1}{3}$   
**b**  $\frac{15}{4} \rightarrow 15 \div 4 = 3 \text{ r}3 \rightarrow \frac{15}{4} = 3\frac{3}{4}$   
**c**  $\frac{9}{5} \rightarrow 9 \div 5 = 1 \text{ r}4 \rightarrow \frac{9}{5} = 1\frac{4}{5}$   
**d**  $\frac{7}{2} \rightarrow 7 \div 2 = 3 \text{ r}1 \rightarrow \frac{7}{2} = 3\frac{1}{2}$
- 5 a**  $\frac{7}{3} < 2\frac{2}{3}$       **b**  $\frac{15}{4} > 3\frac{1}{4}$   
**c**  $\frac{9}{5} > 1\frac{3}{5}$       **d**  $\frac{7}{2} < 4\frac{1}{2}$
- 6 a**  $\frac{2}{3} > \frac{3}{5}$       **b**  $\frac{2}{7} > \frac{1}{4}$   
**c**  $\frac{7}{8} > \frac{5}{6}$       **d**  $\frac{7}{11} < \frac{3}{4}$
- 7 a**  $\frac{1}{4} = \frac{2}{8}$   
**b**  $\frac{4}{5} \neq \frac{9}{10}$   
**c**  $\frac{2}{3} = \frac{10}{15}$   
**d**  $\frac{8}{20} \neq \frac{3}{5}$   
**e**  $\frac{20}{25} \neq \frac{3}{5}$   
**f**  $\frac{16}{24} = \frac{2}{3}$

- 8 a**  $\frac{21}{4} < 5\frac{3}{4}$       **b**  $4\frac{2}{7} > \frac{27}{7}$   
**c**  $\frac{29}{3} > 9\frac{1}{3}$       **d**  $5\frac{1}{8} < \frac{43}{8}$   
**9 a**  $\frac{17}{4} < 4\frac{1}{2}$       **b**  $\frac{17}{6} > 2\frac{2}{3}$   
**c**  $2\frac{3}{5} > \frac{38}{15}$       **d**  $7\frac{5}{6} < \frac{95}{12}$

**10 a**  $\frac{9}{2}$

**b**  $\frac{16}{3}$

**c**  $\frac{27}{5}$

**11 a i**  $\frac{11}{8} = 1.375$

**ii**  $\frac{9}{7} = 1.2857$

**iii**  $\frac{15}{11} = 1.363$

**b**  $\frac{9}{7}, \frac{15}{11}, \frac{11}{8}$

**12**  $\frac{17}{5}, \frac{31}{9}, \frac{47}{13}, \frac{11}{3}$

**13**  $\frac{5}{9}, \frac{3}{5}, \frac{80}{21}, \frac{23}{6}$

**14 a, b** First card:  $\frac{133}{28} < \text{fraction} < \frac{134}{28}$  or  $\frac{266}{56} < \text{fraction} < \frac{267}{56}$ , e.g.  $\frac{267}{56}$

Second card:  $\frac{201}{42} < \text{fraction} < \frac{203}{42}$ ,  
 e.g.  $\frac{202}{42} = \frac{101}{21}$

**15 a i**  $\frac{8}{9}, \frac{9}{10}$

**ii** The fractions are getting bigger because as the denominator is increasing, so is the numerator and the fractions are getting closer to 1.

**b i**  $\frac{128}{256}, \frac{256}{512}$

**ii** The fractions aren't getting bigger or smaller because they are all equivalent to  $\frac{1}{2}$ .

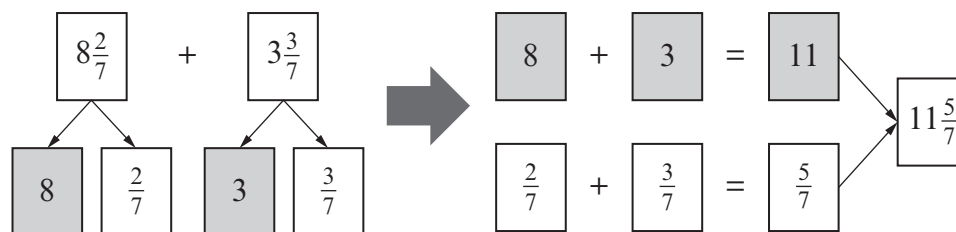
**c i**  $\frac{8}{13}, \frac{9}{12}$

**ii** The fractions are getting bigger because the numerator is increasing as the denominator is decreasing.

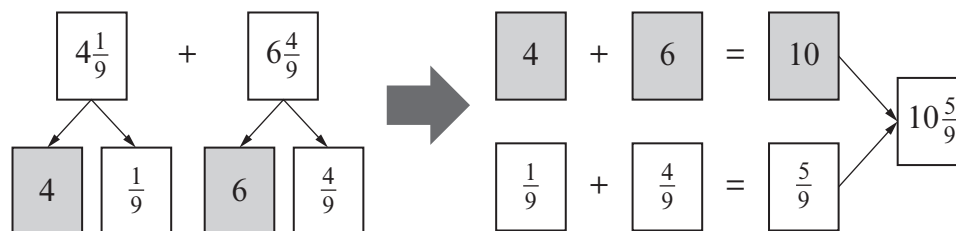


## Exercise 7.2

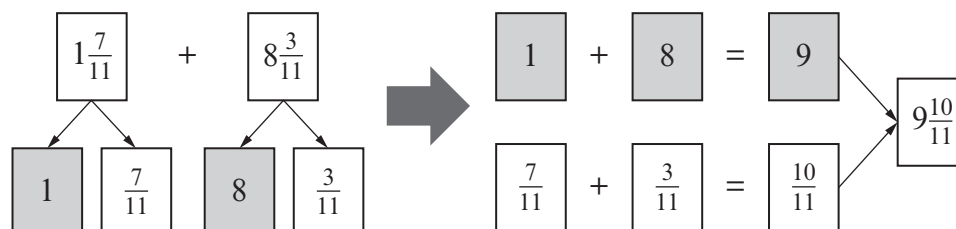
1 a



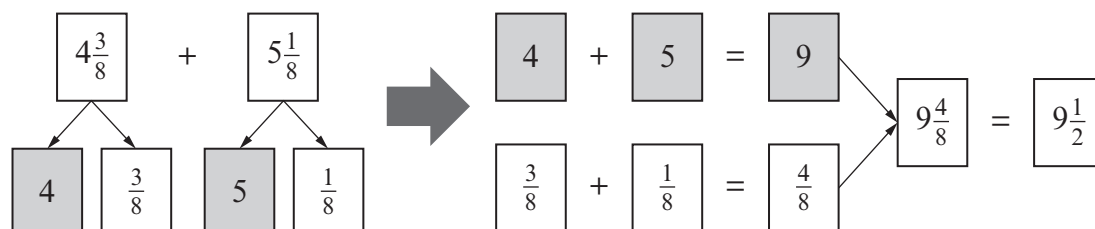
b



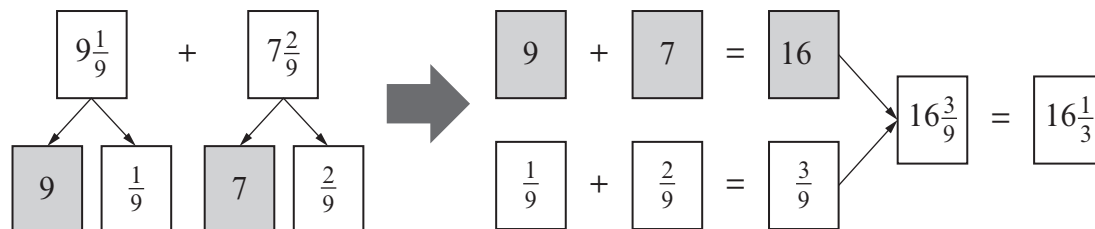
c

2 a  $1\frac{2}{3}$  b  $3\frac{1}{2}$  c  $6\frac{3}{4}$  d  $9\frac{1}{3}$ 

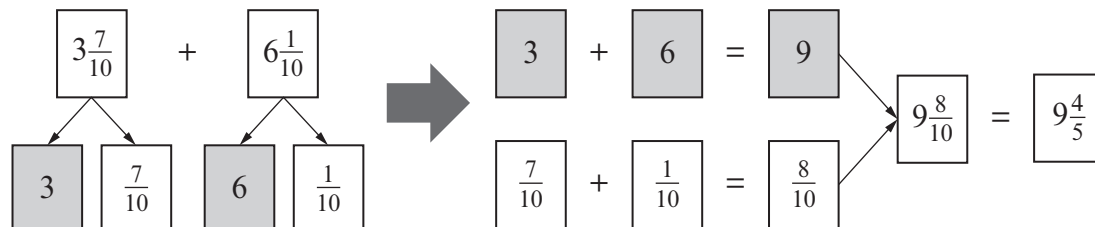
3 a

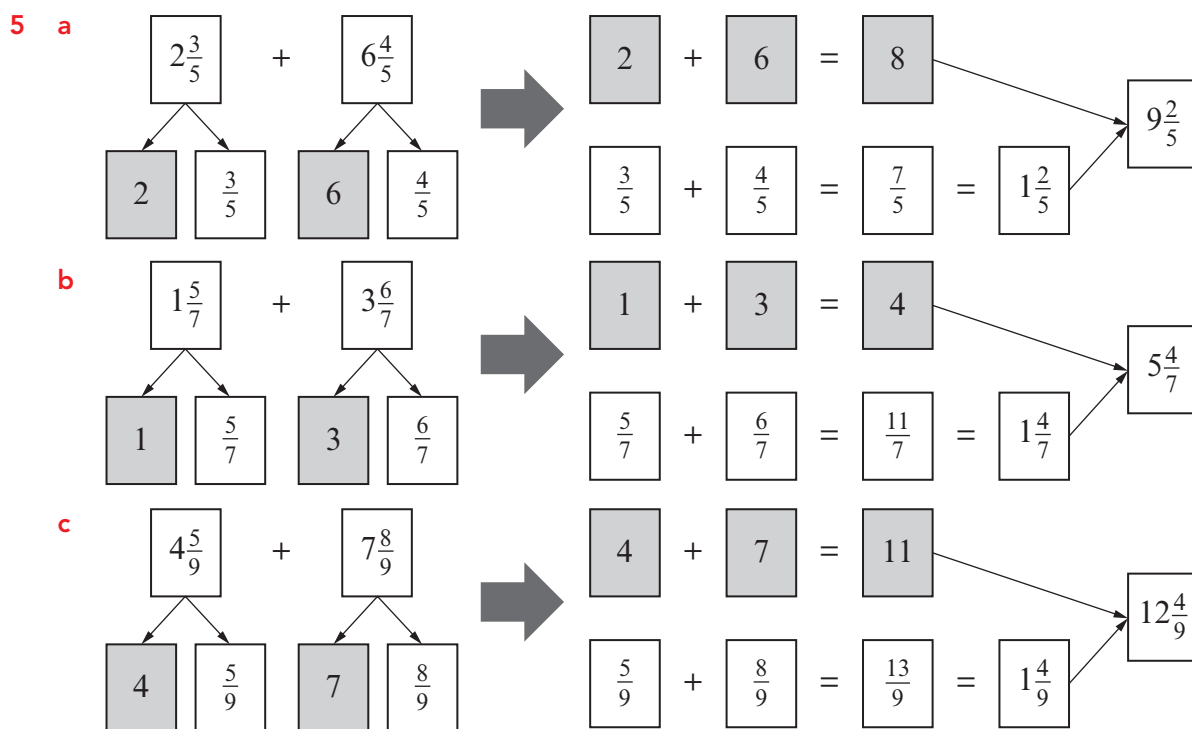


b



c

4 a i  $1\frac{1}{3}$  ii  $1\frac{1}{2}$  iii  $1\frac{2}{5}$ b i  $5\frac{1}{3}$  ii  $9\frac{1}{2}$  iii  $4\frac{2}{5}$



**6 a**  $7\frac{4}{9}$  **b**  $7\frac{2}{5}$  **c**  $10\frac{1}{13}$  **d**  $10\frac{1}{4}$  **15**  $151\frac{1}{20}\text{cm}$

**7**  $16\frac{3}{7}\text{m}$

**8 a**  $10\frac{3}{4}$  **b**  $7\frac{7}{8}$  **c**  $14\frac{2}{9}$  **d**  $10\frac{1}{4}$

**9 a**  $32\frac{3}{8}\text{km}$

**b** Yes, because  $32\frac{1}{4} = 32\frac{2}{8}$  and  $32\frac{3}{8} > 32\frac{2}{8}$ .

**10**  $16\frac{3}{10}\text{km}$

**11**  $14\frac{13}{24}\text{kg}$

**12 a** Step 2:  $\frac{9}{13} = \frac{45}{65}$  not  $\frac{35}{65}$  and  $\frac{4}{5} = \frac{52}{65}$  not  $\frac{54}{65}$ .  
Also  $\frac{89}{65} = 1\frac{24}{65}$  not  $1\frac{25}{65}$ .

**b**  $8\frac{32}{65}$

**13** middle row: left  $13\frac{7}{15}$ , right  $16\frac{5}{21}$ ;  
top row:  $29\frac{74}{105}$

**14 a**  $7\frac{3}{4}x$  **b**  $10\frac{1}{12}y + 6\frac{1}{2}x$

**c**  $5\frac{1}{3}a + 8\frac{5}{24}b$

**16** Yes; perimeter triangle =  $13\frac{7}{36}$ , quadrilateral  
=  $13\frac{4}{9} = 13\frac{16}{36}$  and  $13\frac{16}{36} - 13\frac{7}{36} = \frac{1}{4}\text{cm}$ .

### Exercise 7.3

**1 a**  $\frac{1}{4}$  **b**  $\frac{1}{6}$  **c**  $\frac{1}{8}$

**2 a**  $\frac{1}{10}$  **b**  $\frac{1}{12}$  **c**  $\frac{1}{14}$

**d**  $\frac{1}{15}$  **e**  $\frac{1}{18}$  **f**  $\frac{1}{21}$

**3 a** true **b** false,  $\frac{1}{20}$

**c** false,  $\frac{1}{25}$  **d** true

**4 a**  $\frac{3}{8}$  **b**  $\frac{5}{12}$  **c**  $\frac{3}{10}$

**d**  $\frac{2}{15}$  **e**  $\frac{5}{18}$  **f**  $\frac{5}{21}$

**5 a**  $\frac{2}{5}$  **b**  $\frac{1}{2}$  **c**  $\frac{6}{25}$  **d**  $\frac{5}{21}$

**6 a**  $\frac{1}{12}$  **b**  $\frac{9}{16}$  **c**  $\frac{5}{42}$

**d**  $\frac{9}{20}$  **e**  $\frac{6}{35}$  **f**  $\frac{5}{12}$

7 a  $\frac{2}{5}$  b  $\frac{2}{5}$  c  $\frac{3}{10}$

d  $\frac{1}{2}$  e  $\frac{7}{11}$  f  $\frac{2}{5}$

8  $\frac{5}{44} \text{ m}^2$

9  $\frac{4}{25} \text{ m}^2$

10 a  $\frac{3}{8}$  b  $\frac{3}{5}$

c  $\frac{1}{4}$  d  $\frac{3}{8}$

11 a  $\frac{3}{28}$

b  $\frac{5}{28}$

c  $\frac{5}{7}$

12 a  $\frac{3}{7}$  b  $\frac{2}{7}$

13 a Estimate  $\frac{5}{7}$  is greater than  $\frac{1}{2}$ , but is less than 1  
 $\frac{1}{2}$  of  $\frac{1}{10}$  is  $\frac{1}{20}$  and  $1 \times \frac{1}{10} = \frac{1}{10}$ .  
 So, the answer to  $\frac{5}{7} \times \frac{1}{10}$  must be greater than  $\frac{1}{20}$  but smaller than  $\frac{1}{10}$ .

Accurate  $\frac{5}{7} \times \frac{1}{10} = \frac{5 \times 1}{7 \times 10} = \frac{5}{70} = \frac{1}{14}$

$\frac{1}{14}$  is greater than  $\frac{1}{20}$  but is smaller than  $\frac{1}{10}$ . ✓

b Estimate  $\frac{2}{5}$  is greater than zero, but is less than  $\frac{1}{2}$ .

$0 \times \frac{1}{6} = 0$  and  $\frac{1}{2}$  of  $\frac{1}{6}$  is  $\frac{1}{12}$ .

So, the answer to  $\frac{2}{5} \times \frac{1}{6}$  must be greater than zero but is smaller than  $\frac{1}{12}$ .

Accurate  $\frac{2}{5} \times \frac{1}{6} = \frac{2 \times 1}{5 \times 6} = \frac{2}{30} = \frac{1}{15}$

$\frac{1}{15}$  is greater than zero but is smaller than  $\frac{1}{12}$ . ✓

14 a Any one of the following:

$$\frac{3}{5} \times \frac{9}{10} = \frac{27}{50}, \frac{3}{5} \times \frac{4}{7} = \frac{12}{35}, \frac{3}{5} \times \frac{7}{8} = \frac{21}{40}, \frac{9}{10} \times \frac{4}{7} = \frac{18}{35},$$

$$\frac{9}{10} \times \frac{7}{8} = \frac{63}{80}, \frac{4}{7} \times \frac{7}{8} = \frac{1}{2}$$

b i  $\frac{9}{10} \times \frac{7}{8} = \frac{63}{80}$  ii  $\frac{3}{5} \times \frac{4}{7} = \frac{12}{35}$

c i Multiply together the two largest fractions.

ii Multiply together the two smallest fractions

15 a  $\frac{1}{3}$  b  $\frac{1}{4}$  c  $\frac{1}{5}$

d  $\frac{1}{6}$  e  $\frac{1}{7}$

f

Part	Question	Answer
i	$\frac{1}{2} \times \frac{2}{3}$	$\frac{1}{3}$
ii	$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4}$	$\frac{1}{4}$
iii	$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5}$	$\frac{1}{5}$
iv	$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6}$	$\frac{1}{6}$
v	$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} \times \frac{6}{7}$	$\frac{1}{7}$

g The answer always has a numerator of 1 and the denominator is the same as the final fraction in the list.

h i  $\frac{1}{8}$  ii  $\frac{1}{11}$

16 Three examples are:  $\frac{1}{2} \times \frac{2}{5}$ ,  $\frac{1}{3} \times \frac{3}{5}$ ,  $\frac{1}{4} \times \frac{4}{5}$ .

17  $\frac{3}{80}$

18  $2\frac{1}{4} \text{ m}^2$

### Exercise 7.4

1 a  $\frac{3}{4}$  b  $\frac{4}{5}$  c  $\frac{5}{6}$  d  $\frac{6}{7}$

2 a true b false,  $\frac{8}{9}$  c true

3 a  $\frac{5}{12}$  b  $\frac{5}{8}$  c  $\frac{15}{16}$  d  $\frac{9}{22}$

4 a  $\frac{1}{2}$  b  $\frac{2}{5}$  c  $\frac{7}{8}$  d  $\frac{3}{4}$

5 a  $\frac{1}{2}$  b  $\frac{2}{5}$  c  $\frac{7}{8}$  d  $\frac{3}{4}$

6 a  $\frac{3}{4}$  b  $\frac{5}{12}$  c  $\frac{6}{7}$

d  $\frac{35}{54}$  e  $\frac{18}{25}$  f  $\frac{7}{30}$

7 a  $1\frac{1}{2}$  b  $1\frac{1}{20}$  c  $1\frac{1}{6}$

d  $1\frac{5}{9}$  e  $4\frac{7}{12}$  f  $2\frac{10}{21}$

8 a  $1\frac{1}{4}$  b  $1\frac{1}{3}$  c  $1\frac{1}{2}$

d  $\frac{3}{5}$  e 3 f  $4\frac{2}{3}$

9 a Nova has forgotten to turn her second fraction upside down.

b  $1\frac{1}{20}$

10  $\frac{8}{9}m$

11 middle row: left  $\frac{4}{7}$ , right  $\frac{3}{8}$ ; top row:  $1\frac{11}{21}$

12  $\frac{9}{16}$

13  $\frac{3}{7}m$

14 a

Pattern	Working	Answer
$\frac{1}{2} \div \frac{2}{3}$	$\frac{1}{2} \div \frac{2}{3} = \frac{1}{2} \times \frac{3}{2} = \frac{3}{4}$	$\frac{3}{4}$
$\frac{2}{3} \div \frac{3}{4}$	$\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$	$\frac{8}{9}$
$\frac{3}{4} \div \frac{4}{5}$	$\frac{3}{4} \div \frac{4}{5} = \frac{3}{4} \times \frac{5}{4} = \frac{15}{16}$	$\frac{15}{16}$
$\frac{4}{5} \div \frac{5}{6}$	$\frac{4}{5} \div \frac{5}{6} = \frac{4}{5} \times \frac{6}{5} = \frac{24}{25}$	$\frac{24}{25}$
$\frac{5}{6} \div \frac{6}{7}$	$\frac{5}{6} \div \frac{6}{7} = \frac{5}{6} \times \frac{7}{6} = \frac{35}{36}$	$\frac{35}{36}$

b bigger

c No; the numerator is always one less than the denominator, so it will never be 1 because the numerator will never be the same as the denominator.

15  $\frac{2}{3}m$

16 a  $\frac{7}{88}m$  b  $\frac{16}{33}m$

## Exercise 7.5

1 a i  $6 = 2 \times 3$

iii  $10 = 2 \times 5$

v  $15 = 3 \times 5$

b i  $\frac{1}{6} = \frac{1}{2} \times \frac{1}{3}$

iii  $\frac{1}{10} = \frac{1}{2} \times \frac{1}{5}$

v  $\frac{1}{15} = \frac{1}{5} \times \frac{1}{3}$

ii  $4 = 2 \times 2$

iv  $9 = 3 \times 3$

vi  $14 = 2 \times 7$

ii  $\frac{1}{4} = \frac{1}{2} \times \frac{1}{2}$

iv  $\frac{1}{9} = \frac{1}{3} \times \frac{1}{3}$

vi  $\frac{1}{14} = \frac{1}{2} \times \frac{1}{7}$

2 a 9 b 30 c 15

d 14 e 30

3 Learner's choice of calculation:

a A 32 or B 48

b A 28 or B 21

c A 30 or B 18

d A 42 or B 18

4 a 16 b 7

c 6 d 6

5  $\frac{1}{5} = \frac{2}{10}$ ,  $\frac{2}{5} = \frac{4}{10}$ ,  $\frac{3}{5} = \frac{6}{10}$ ,  $\frac{4}{5} = \frac{8}{10}$

6 a 18 b 32 c 42 d 48

7 a 26 b 27 c 27 d 14

8 34

9 a Yes, Zara is correct.

b 37.5

10 a 54 b 128 c 132

11 656

12 a 105 b 225 c 105

13 a  $\frac{7}{24}$  b  $\frac{6}{11}$  c  $\frac{8}{23}$

14 No, Seb has changed 14 to  $7 \times 7$  instead of  $7 \times 2$ .

The solution should be:

$$\begin{aligned} \frac{7}{25} \times \frac{9}{14} &= \frac{7 \times 9}{25 \times 14} = \frac{7 \times 9}{25 \times 7 \times 2} = \frac{9 \times 7}{25 \times 2 \times 7} = \frac{9 \times 7}{50 \times 7} = \frac{9}{50} \times \frac{7}{7} \\ &= \frac{9}{50} \times 1 = \frac{9}{50} \end{aligned}$$

15 a 240 b 500 c 560 d 870

16 a  $1\frac{3}{10}$  b  $\frac{11}{36}$  c  $1\frac{2}{15}$

17 a  $\frac{8}{9} \times 720 = 640$

b  $\frac{11}{12} \times 840 = 770$

c  $\frac{19}{20} \times 800 = 760$

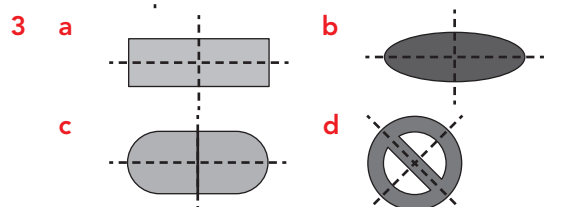
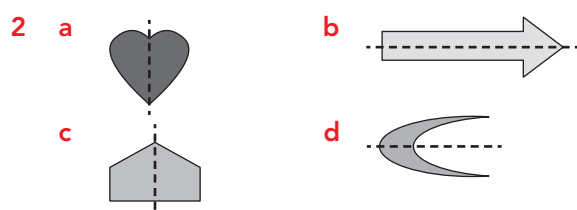
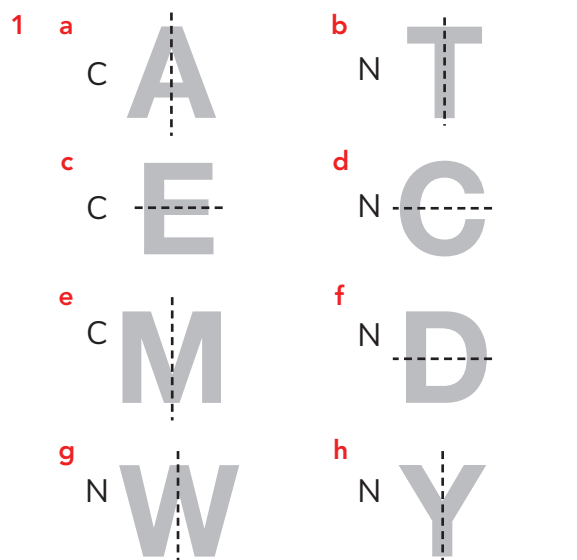
18 a Learner's own answers.

b Another alternative method is to use  $\frac{4}{5} = \frac{8}{10}$ . Then work out  $300 \times \frac{8}{10} = 240$ , then  $240 \times \frac{8}{10} = 192$ .

c i 64 ii 72

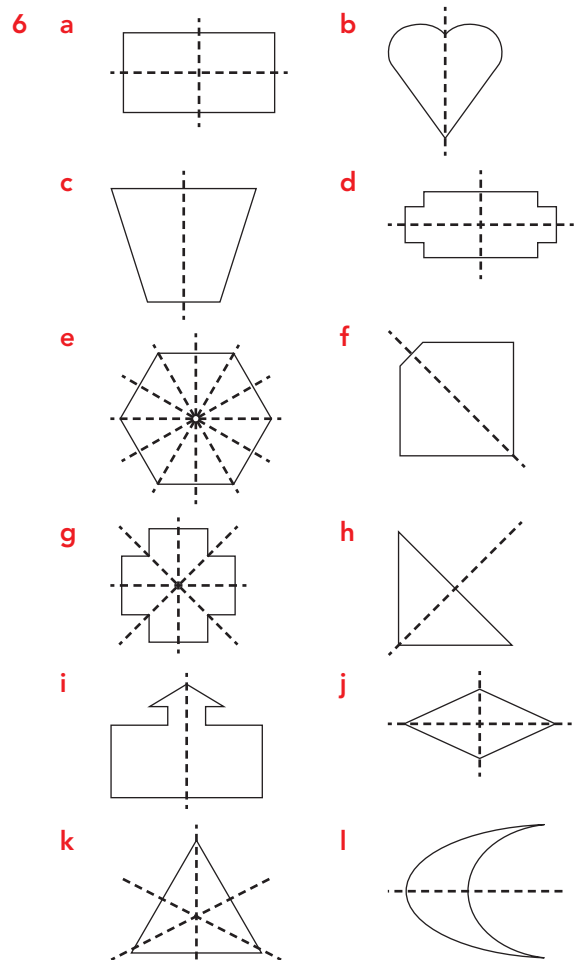
d i 320 ii 120

### Exercise 8.1

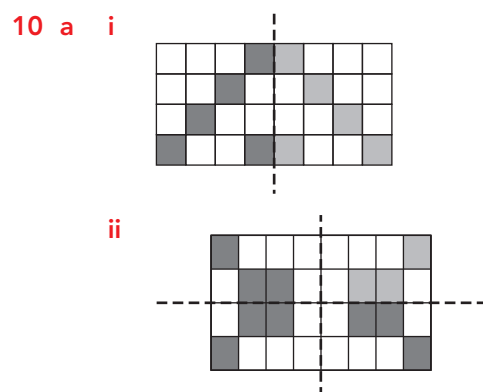


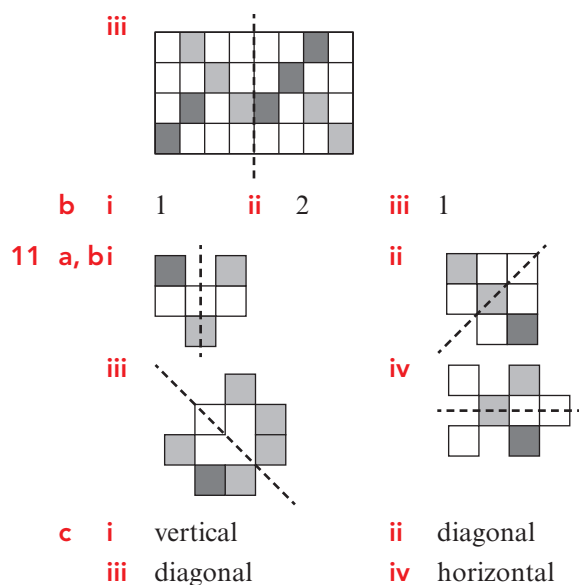
4 a 2 b 2 c 4  
d 3 e 2 f 1  
g 2 h 1 i 4

5 A and iii; B and i; C and iv; D and v; E and ii

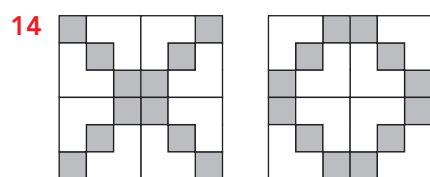
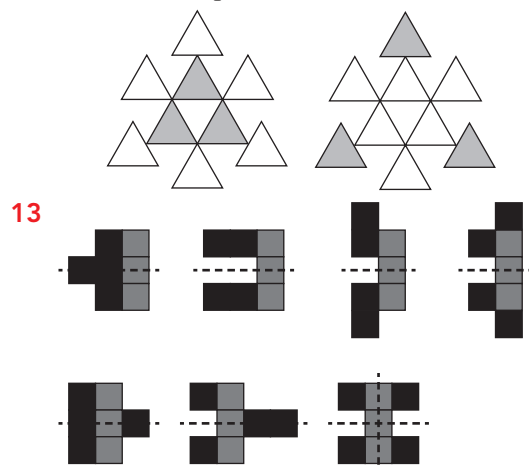


7 a 2 b 1 c 1 d 2  
e 6 f 1 g 4 h 1  
i 1 j 2 k 3 l 1  
8 a 2 b 5 c 0 d 2  
e 2 f 8 g 8 h 4  
9 a 2 b 5 c 2 d 2  
e 2 f 8 g 8 h 4

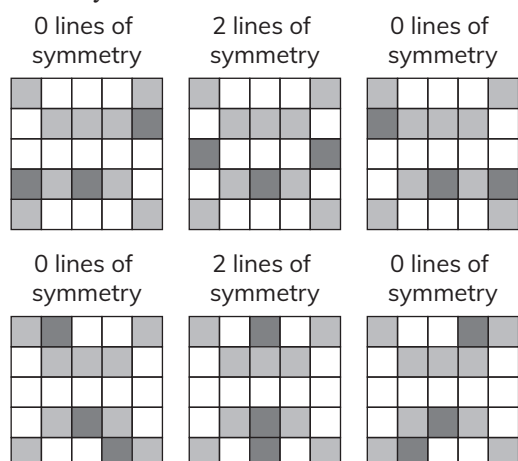




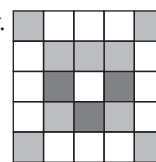
12 a, b For example:



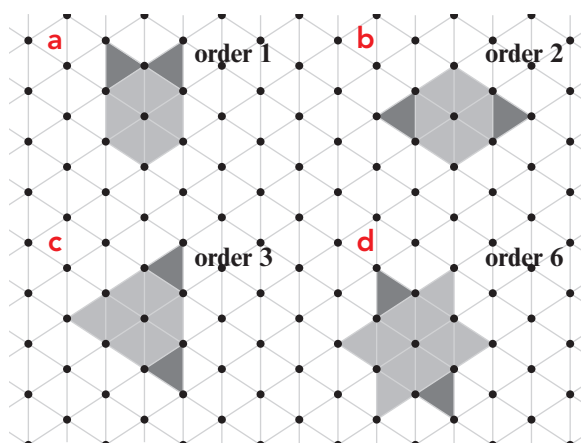
15 a Any three from:



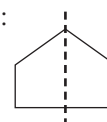
b It has 4 lines of symmetry.



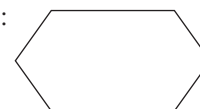
16 For example:



17 a For example:



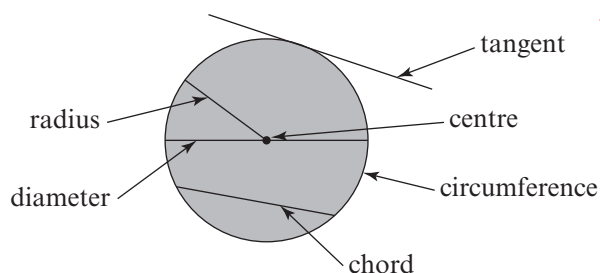
b For example:



## Exercise 8.2

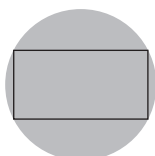
- chord
  - tangent
  - tangent
  - chord
- Alun has labelled the chord as the tangent and he has labelled the tangent as the chord.
- Ffion's tangent doesn't touch the circle, it crosses it. Her chord doesn't go all the way across the circle. She has drawn a radius not a chord.
- Learner's own diagram.
- Learner's own diagram.
- A tangent to a circle and the radius of a circle always meet at  $90^\circ$ .
- is a pentagon and has 5 sides.
  - is a hexagon and has 6 sides.
  - is an octagon and has 8 sides.
  - is a decagon and has 10 sides.

8

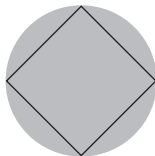


9 For example:

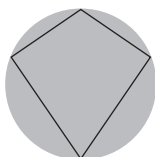
a



b



c



10 For example:

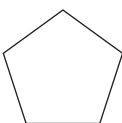
a



For the example given in part a:

- b** My triangle is called a scalene triangle.  
 My triangle has 0 sides the same length.  
 My triangle has 0 angles the same size.  
 My triangle has 0 lines of symmetry.  
 My triangle has order 1 rotational symmetry.

11 a



- b** A regular pentagon has: five sides the same length; five angles the same size; five lines of symmetry; rotational symmetry of order 5.

12 12, 12, 12, 12

13 a The line  $CD$  is a radius of the circle.b  $90^\circ$ c  $58^\circ$ 14 No; there are six sides, each is 5 cm. So the perimeter is  $6 \times 5 = 30$  cm.

15 12 mm

16 a  $x = 60^\circ$ ,  $y = 60^\circ$ ,  $z = 120^\circ$ 

b

Name of regular polygon	Number of triangles	$x$	$y$	$z$
pentagon	5	$72^\circ$	$54^\circ$	$108^\circ$
hexagon	6	$60^\circ$	$60^\circ$	$120^\circ$
octagon	8	$45^\circ$	$67.5^\circ$	$135^\circ$
nonagon	9	$40^\circ$	$70^\circ$	$140^\circ$
decagon	10	$36^\circ$	$72^\circ$	$144^\circ$

c  $z = 2 \times y$   $x + z = 180^\circ$ 

## Exercise 8.3

1 a C b B c A d C

2 B, D, G, H

3 The two squares are not congruent because they are not the same size. Although they are both squares, one has a side length of 3 cm and the other is 5 cm. To be congruent they must have the same side length.

4 a 3 cm b 5 cm

5 a 8 cm b 5 cm

6 C and F

7 a 7 cm b 2 cm

8 a i 10 cm ii 6 cm iii 8 cm

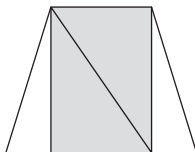
b  $62^\circ$ c i  $28^\circ$  ii  $62^\circ$ d i Side  $KM$  corresponds to side  $DF$ .ii Side  $KL$  corresponds to side  $DE$ .iii Side  $LM$  corresponds to side  $EF$ .iv  $\angle KLM$  corresponds to  $\angle DEF$ .v  $\angle KML$  corresponds to  $\angle DFE$ .vi  $\angle LKM$  corresponds to  $\angle EDF$ .

9 a i 10.3 m ii 5.1 m iii 12 m

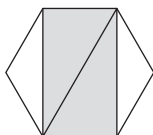
b i  $96^\circ$  ii  $25^\circ$  iii  $59^\circ$ 10 a i  $WX$  ii  $XY$ iii  $PQ$  iv  $PS$ b i  $\angle XYZ$  ii  $\angle WXY$ iii  $\angle PSR$  iv  $\angle QPS$

11 For example:

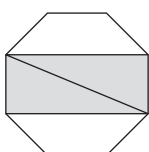
b



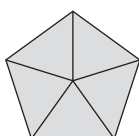
c



d



e



12 a 12 cm

b 17 cm

c i 30° ii 42°

d 108°

13 125°

14 a Q(3, 4), S(3, -1) b Q(2, -3), S(2, 2)

### Exercise 8.4

1 Faces are the flat sides of a solid shape.

Edges are the lines where two faces meet.

Vertices are the corners of a solid shape.

2 6, 8, 12, 90°

12 a

Original shape	Number of sides	Shape of base of pyramid	Number of faces	Number of vertices	Number of edges
triangle	3	triangular	4	4	6
square	4	square	5	5	8
pentagon	5	pentagonal	6	6	10
hexagon	6	hexagonal	7	7	12
heptagon	7	heptagonal	8	8	14
octagon	8	octagonal	9	9	16

b Yes; regardless of how many sides the base has, there are that many triangular faces to the pyramid plus the base itself, giving the total number of faces.

3 4, 4, 6, 60°

4 a cone, cylinder

b sphere, cone, cylinder

c sphere, cylinder

5 I have a total of six faces.

One of my faces is a pentagon and the other five faces are congruent triangles.

I have ten edges and six vertices.

6 a and D and ii; b and A and iii; c and B and iv; d and C and i

7 A cylinder has two circular faces and one curved surface. It has no vertices and two edges.

8 a No; it is an equilateral triangular prism.

b The fact that the two triangular faces are equilateral triangles.

9 a K b H c K

d G e I f J

10 a cube

b triangular prism

c sphere

d tetrahedron

11

top view



front view



side view



Number of faces of pyramid = number of sides of original shape + 1

c Number of vertices of pyramid = number of sides of original shape + 1



**d** Number of edges of pyramid = number of sides of original shape  $\times 2$

**e** The number of edges of a pyramid is always a multiple of 2.

**13 a** nine faces, 16 edges, nine vertices

**b**

Shape	Number of faces	Number of edges	Number of vertices
cube	6	12	8
pyramid	5	8	5
new shape	9	16	9

**c** 11 faces, 20 edges, 11 vertices

**d**

Shape	Number of faces	Number of edges	Number of vertices
pentagonal prism	7	15	10
pentagonal pyramid	6	10	6
new shape	11	20	11

**e i** Where the two shapes join, the two faces that go together are now inside the shape, so are no longer counted as faces.

**ii** Number of edges on new shape = edges on prism +  $\frac{1}{2} \times$  edges on pyramid

Where you join the pyramid to the prism, the two sets of edges now become one, so the base edges of the pyramid can be ignored. This leaves only the side edges of the pyramid to be added to the edges of the prism.

**iii** Number of vertices on new shape = vertices on prism + 1

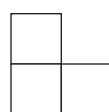
Where you join the pyramid to the prism, the two sets of vertices now become one, so the base vertices of the pyramid can be ignored. This leaves only the top vertex of the pyramid to be added to the vertices of the prism.

**f**

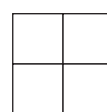
Shape	Number of faces	Number of edges	Number of vertices
hexagonal prism	8	18	12
hexagonal pyramid	7	12	7
new shape	$8 + 7 - 2 = 13$	$18 + \frac{1}{2} \times 12 = 24$	$12 + 1 = 13$

**14 a**

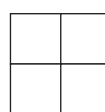
front view



side view

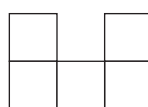


top view

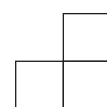


**b**

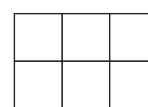
front view



side view

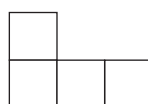


top view

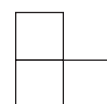


**c**

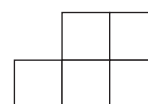
front view



side view

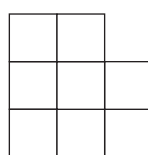


top view

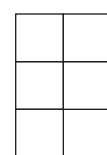


**d**

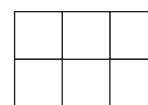
front view



side view



top view



## Exercise 9.1

**1 a** 25, 30; add 5

**b** 9, 11; add 2

**c** 22, 26; add 4

**d** 52, 60; add 8

**e** 6, 5; subtract 1

**f** 4, 1; subtract 3

**g** 12, 10; subtract 2

**h** 30, 25; subtract 5

**2 a** 5, 8, 11, 14, 17

**b** 2, 8, 14, 20, 26

**c** 12, 22, 32, 42, 52

**d** 0, 7, 14, 21, 28

- e** 12, 10, 8, 6, 4      **f** 25, 20, 15, 10, 5  
**g** 13, 12, 11, 10, 9      **h** 100, 80, 60, 40, 20
- 3 a** 22 and 34      **b** 41 and 35
- 4 a i** Add 2    **ii** 20, 22    **iii** 30  
**b i** Add 3    **ii** 17, 20    **iii** 32  
**c i** Subtract 4      **ii** 30, 26  
**iii** 10
- 5 a** 4, 7, 10      **b** 30, 25, 20  
**c** 4, 8, 16      **d** 80, 40, 20
- 6 a** 12, 18      **b** 24, 31, 45  
**c** 39, 33, 15      **d** 23, 20, 11, 8, 5
- 7 a** finite  
**b** infinite  
**c** finite
- 8 a** 5, 13, 29  
**b** 7, 9, 15  
**c** 30, 14, 6
- 9 a** \$112  
**b** \$124, \$136, \$148

**10** No, the term after 6 is 17, but  $6 + 3 = 9$  and  $6 \times 2 = 12$ .

**11** There are many different answers. For example:

- a** ① Add 2 would give 1, 3, 5, 7, ...  
 ② Multiply by 4 and subtract 1 would give 1, 3, 11, 43, ...  
 ③ Multiply by 3 would give 1, 3, 9, 27, ...
- b** ① Add 3 would give 3, 6, 9, 12, ...  
 ② Multiply by 3 and subtract 3 would give 3, 6, 15, 42, ...  
 ③ Multiply by 2 would give 3, 6, 12, 24, ...
- c** ① Add 7 would give 1, 8, 15, 22, ...  
 ② Multiply by 2 and add 6 would give 1, 8, 22, 50, ...  
 ③ Multiply by 8 would give 1, 8, 64, 512, ...

- d** ① Add 6 would give 5, 11, 17, 23, ...  
 ② Multiply by 3 and subtract 4 would give 5, 11, 29, 83, ...  
 ③ Multiply by 2 and add 1 would give 5, 11, 23, 47, ...

**12** 3

**13** 5

**14** Multiply by 3 then subtract 2.

**15** There are many different answers. For example:

4, 8, 12, 16, ...; add 4.

4, 6, 8, 10, 12, 14, ...; add 2.

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, ...; add 1.

4, 6, 12, 30, ...; multiply by 3 then subtract 6.

**16 a** subtract 3; -8, -11

**b** add 6; -26, -20

**c** multiply by 2 then add 1; -17, -33

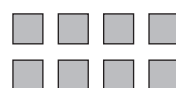
**d** divide by 2 then subtract 1; -5, -3.5

## Exercise 9.2

**1 a i** 2      **ii** 4      **iii** 6

**b** Zara is correct. The term-to-term rule is 'Add 2'.

**c** pattern 4



pattern 5



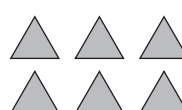
Pattern number	1	2	3	4	5
Number of squares	2	4	6	8	10

**e** 2, 4, 6, 8, 10, ...

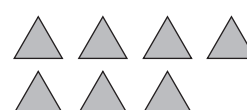
**2 a i** 3      **ii** 4      **iii** 5

**b** Add 1

**c** pattern 4



pattern 5

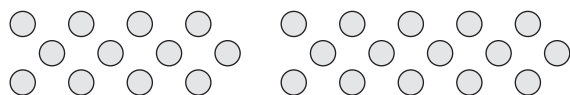


**d**

Pattern number	1	2	3	4	5
Number of triangles	3	4	5	6	7

**e** 3, 4, 5, 6, 7, ...

**3 a**



**b** 3, 6, 9, 12, 15

**c** Add 3

**d** Three extra dots are added.

**4 a**



**b**

Pattern number	1	2	3	4	5
Number of squares	3	5	7	9	11

**c** Add 2

**d i** 13 **ii** 17

**5 a**



**b**

Pattern number	1	2	3	4	5
Number of blocks	5	7	9	11	13

**c** Add 2

**d i** 15 **ii** 21

**6 a**

Pattern number	1	2	3	4	5
Number of dots	3	7	11	15	19

**b i** 39 **ii** 71

**7 a**

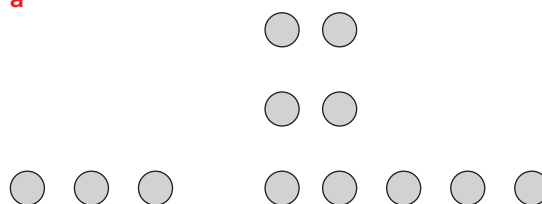
Pattern number	1	2	3	4	5
Number of hexagons	3	6	9	12	15

**b** Yes because 51 is a multiple of 3. Pattern 17 will have 51 hexagons.

**c** 92 is not a multiple of 3.

**d** The number of hexagons used in this sequence of patterns is always a multiple of 3.

**8 a**



**b** 18

**9** Sofia;  $1 \times 3 + 2 = 5$ ,  $2 \times 3 + 2 = 8$ ,  $3 \times 3 + 2 = 11$  and  $4 \times 3 + 2 = 14$ .

**10** Learner's own patterns that have the following sequences:

**a** 4, 6, 8, ...

**b** 1, 4, 7, ...

**c** 3, 8, 13, ...

**11 a**

Pattern number	1	2	3	4	5
Number of grey triangles	3	7	11	15	19
Number of white triangles	1	3	5	7	9
Total number of triangles	4	10	16	22	28

**b i** Add 4 **ii** Add 2 **iii** Add 6  
Add 4 + Add 2 = Add 6 or  $i + ii = iii$ .

**c** 39

**d** 23

**e** 124

12 a

Pattern number	1	2	3	4	5
Number of grey octagons	6	12	18	24	30
Number of white squares	2	6	10	14	18
Total number of shapes	8	18	28	38	48

**b** i Add 6    ii Add 4    iii Add 10  
Add 6 + Add 4 = Add 10 or i + ii = iii.

c 72

d 78

e 498

## Exercise 9.3

1 a 2, 4, 6, 8, 10, ...

Position number	1	2	3	4	5
$\times 2$	$\times 2$	$\times 2$	$\times 2$	$\times 2$	$\times 2$
Term	2	4	6	8	10

Term =  $2 \times$  position number, so  $n$ th term rule is:  $n$ th term =  $2n$ .

b 3, 6, 9, 12, 15, ...

Position number	1	2	3	4	5
$\times 3$	$\times 3$	$\times 3$	$\times 3$	$\times 3$	$\times 3$
Term	3	6	9	12	15

Term =  $3 \times$  position number, so  $n$ th term rule is:  $n$ th term =  $3n$ .

c 4, 8, 12, 16, 20, ...

Position number	1	2	3	4	5
$\times 4$	$\times 4$	$\times 4$	$\times 4$	$\times 4$	$\times 4$
Term	4	8	12	16	20

Term =  $4 \times$  position number, so  $n$ th term rule is:  $n$ th term =  $4n$ .

2 a 2, 3, 4, 5, 6, ...

Position number	1	2	3	4	5
+ 1	+ 1	+ 1	+ 1	+ 1	+ 1
Term	2	3	4	5	6

Term = position number + 1, so  $n$ th term rule is:  $n$ th term =  $n + 1$ .

b 3, 4, 5, 6, 7, ...

Position number	1	2	3	4	5
+ 2	+ 2	+ 2	+ 2	+ 2	+ 2
Term	3	4	5	6	7

Term = position number + 2, so  $n$ th term rule is:  $n$ th term =  $n + 2$ .

c 7, 8, 9, 10, 11, ...

Position number	1	2	3	4	5
+ 6	+ 6	+ 6	+ 6	+ 6	+ 6
Term	7	8	9	10	11

Term = position number + 6, so  $n$ th term rule is:  $n$ th term =  $n + 6$ .

3 a  $n$ th term =  $5n$  When  $n = 1$ ,  $5 \times 1 = 5$ .When  $n = 2$ ,  $5 \times 2 = 10$ .When  $n = 3$ ,  $5 \times 3 = 15$ .When  $n = 4$ ,  $5 \times 4 = 20$ .

First four terms of sequence are 5, 10, 15, 20.

b  $n$ th term =  $n + 3$  When  $n = 1$ ,  $1 + 3 = 4$ .When  $n = 2$ ,  $2 + 3 = 5$ .When  $n = 3$ ,  $3 + 3 = 6$ .When  $n = 4$ ,  $4 + 3 = 7$ .

First four terms of sequence are 4, 5, 6, 7.

4 a 40    b 80

c 14    d 18

5 a  $9n$     b  $10n$     c  $12n$     d  $30n$ 

6 a i 90    ii 180

b i 100    ii 200

c i 120    ii 240

d i 300    ii 600

7 a  $n + 7$     b  $n + 10$ c  $n + 13$     d  $n + 19$ 

8 a i 19    ii 32

b i 22    ii 35

c i 25    ii 38

d i 31    ii 44

9 Yes, when  $n=1$ ,  $1-7=-6$ . When  $n=2$ ,  $2-7=-5$ . When  $n=3$ ,  $3-7=-4$ , etc.

10 a  $-7, -6, -5, -4, -3$

b 25, 26, 27, 28, 29

c 50, 100, 150, 200, 250

d  $-9, -8, -7, -6, -5$

11

$n$ th term rule	5th term in sequence	10th term in sequence	20th term in sequence
$n$ th term = $n+30$	35	40	50
$n$ th term = $n-12$	-7	-2	8
$n$ th term = $5n$	25	50	100
$n$ th term = $n+14$	19	24	34
$n$ th term = $n-20$	-15	-10	0
$n$ th term = $40n$	200	400	800

12 A and iii; B and iv; C and ii; D and v; E and i

13 a i  $-4, -3, -2, -1, 0$  ii  $4, 3, 2, 1, 0$

b i  $-10, -9, -8, -7, -6$  ii  $10, 9, 8, 7, 6$

c Parts i and ii have the same numbers except that one set is positive and one set is negative.

When  $n$ th term =  $n$  - 'a number' and  $n$ th term = 'a number' -  $n$ , where 'a number' is the same number, one set of numbers will be the negative of the other set of numbers.

14 a C; when  $n=26$ ,  $2-n=-24$ . When  $n=22$ ,  $2-n=-20$ . When  $n=14$ ,  $2-n=-12$ .

When  $n=12$ ,  $2-n=-10$ . When  $n=9$ ,  $2-n=-7$ . When  $n=2$ ,  $2-n=0$ .

When  $n=1$ ,  $2-n=1$ .

b  $-20$ . In A, when  $n=5$ ,  $-4n=-20$ . In B, when  $n=2$ ,  $n-22=-20$ .

In C, when  $n=22$ ,  $2-n=-20$ . In D, when  $n=4$ ,  $-5n=-20$ .

c  $-12$ . In A, when  $n=3$ ,  $-4n=-12$ . In B, when  $n=10$ ,  $n-22=-12$ . In C, when  $n=14$ ,  $2-n=-12$ .

$-10$ . In B, when  $n=12$ ,  $n-22=-10$ . In C, when  $n=12$ ,  $2-n=-10$ . In D, when  $n=2$ ,  $-5n=-10$ .

d D because there are only two multiples of 5 in the list. There are three multiples of 4, so it is not A. C has all the numbers in the list and B has five of the numbers in the list.

## Exercise 9.4

1 a 6 b 5 c 0, 2

d 10, 40 e 6, 9, 21

2 a 1 b 3 c 8, 11

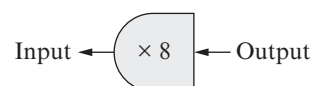
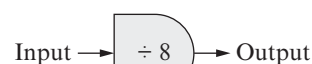
d 6, 20 e 3, 7, 23

3 a input: 9; output: 8, 12

b input: 14; output: 3, 13

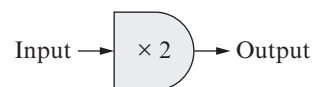
c input: 7, 20; output: 50

4 a

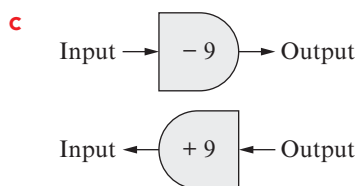


Input	24	64	80
Output	3	8	10

b

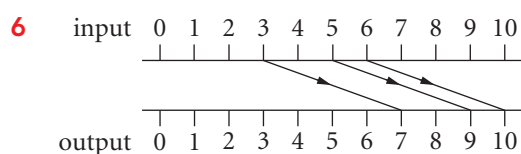


Input	8	13	30
Output	16	26	60



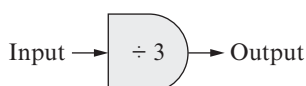
Input	10	23	34
Output	1	14	25

**5 a**  $+3$  **b**  $\div 3$  **c**  $\times 7$



**7**

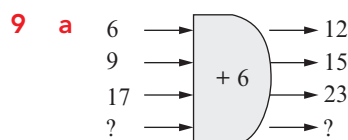
Input	3	6	9
Output	1	2	3



**8**  $\div 4$  or  $-15$

Learner's own justification.

Example:  $20 \div 4 = 5$  and  $20 - 15 = 5$



**b** It is not possible to work out all the numbers. Learner's own answers.  
Example: You can have any pair of numbers as long as the output is 6 more than the input. For example, 20 and 26, 35 and 41, etc.

## Exercise 10.1

**1 a, b**  $10\% = \frac{1}{10}$ ,  $20\% = \frac{1}{5}$ ,  $30\% = \frac{3}{10}$ ,  $40\% = \frac{2}{5}$ ,  
 $50\% = \frac{1}{2}$ ,  $60\% = \frac{3}{5}$ ,  $70\% = \frac{7}{10}$ ,  $80\% = \frac{4}{5}$ ,  $90\% = \frac{9}{10}$

**2 a**  $\frac{18}{25}$  **b**  $\frac{73}{100}$  **c**  $\frac{37}{50}$

**d**  $\frac{3}{4}$  **e**  $\frac{19}{25}$

**3** For example:  $6\% = 0.06$  and  $60\% = 0.6$ .

**4**  $\frac{17}{25}$ ,  $70\%$ ,  $0.71$ ,  $\frac{3}{4}$ ,  $\frac{38}{50}$ ,  $77\%$ ,  $0.8$

**5 a**  $60\%$  **b**  $30\%$  **c**  $26\%$

**d**  $92\%$  **e**  $66\%$

**6 a**  $35\%$  **b**  $42\text{ cm}^2$

**7 a i** \$72 **ii** \$168

**iii** \$12 **iv** \$228

**b**  $\$240 - \$12 = \$228$

**8 a**  $50\% = \$3$ ;  $25\% = \$1.50$ ;  $10\% = \$0.60$ ;  
 $20\% = \$1.20$

**b** Learner's own answers.

**9** Learner's own answers.

**10 a**  $2 \times 8.12\text{ m} = 16.24\text{ m}$

**b** Half of  $8.12\text{ m} = 4.06\text{ m}$

**c**  $3 \times 8.12\text{ m} = 24.36\text{ m}$

**11 a**  $20\% = \frac{1}{5}$  and  $\frac{1}{5}$  of 50 is 10;  $50\% = \frac{1}{2}$  and  $\frac{1}{2}$  of 20 is 10; both have the same answer.

**b**  $70\%$  of 30 is  $\frac{7}{10} \times 30$  and  $30\%$  of 70 is  $\frac{3}{10} \times 70$ ; both have the same answer.

**12**

Fraction	$\frac{3}{5}$	$\frac{3}{10}$	$\frac{3}{20}$	$\frac{3}{40}$	$\frac{3}{80}$
Percentage	60%	30%	15%	7.5%	3.75%

## Exercise 10.2

**1 a**  $\frac{1}{1000}$  **b**  $\frac{1}{500}$  **c**  $\frac{3}{1000}$

**d**  $\frac{1}{250}$  **e**  $\frac{1}{200}$

**2 a** \$36 **b** \$3.60 **c** \$0.36

**3 a** 2.4

**b i** 1.20 **ii** 0.24 **iii** 0.48

**4 a**  $\frac{1}{40}$  **b**  $\frac{3}{40}$  **c**  $\frac{1}{8}$  **d**  $\frac{7}{40}$

**5 a**  $20\%$  **b**  $56\%$  **c**  $92.5\%$

- 6 a possible  
b Impossible; it cannot go down by more than 100%.  
c possible

- 7 a 1.3 and 130%      b 1.8 and 180%  
c 1.07 and 107%      d 1.05 and 105%  
e 2.12 and 212%

8

Percentage	20%	40%	65%	130%	175%	190%
Fraction	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{13}{20}$	$1\frac{3}{10}$	$1\frac{3}{4}$	$1\frac{9}{10}$
Decimal	0.2	0.4	0.65	1.3	1.75	1.9

- 9 a  $1\frac{1}{10}$       b  $1\frac{4}{5}$       c  $1\frac{7}{20}$       d  $2\frac{3}{20}$

10

Percentage	45%	60%	75%	90%	105%	120%	135%
Fraction	$\frac{9}{20}$	$\frac{3}{5}$	$\frac{3}{4}$	$\frac{9}{10}$	$1\frac{1}{20}$	$1\frac{1}{5}$	$1\frac{7}{20}$

- 11 a 65%      b 35%  
12 a 133 cm      b 161 cm  
13 a  $\frac{3}{8}$       b \$550      c \$750  
14 Learner's own answers.  
15 25% of \$144; 200% of \$18; 150% of \$24; 80% of \$45; 20% of \$180; 50% of \$72  
16 a 300%      b 200%

### Exercise 11.1

- 1 a 27      b 9.5  
c 22      d  $y = x - 3$   
2 a 44 cm      b 25 cm      c  $l = 4w$   
3 a \$21      b  $\$(b + 12)$   
c  $t = b + 12$   
4 a Learner's own answer.  
b  $y = 0.5x$

5 a

Zara (min)	10	15	23	7	31
Marcus (min)	20	25	33	17	41

b  $y = x + 10$

- 6 a 22.5 cm

b

Small plate (x cm)	15	16	17	18	20	21
Large plate (y cm)	22.5	24	25.5	27	30	31.5

c  $y = 1.5x$

- 7 a 35 cm

b 24 cm

c B and C are both correct.

- 8 a i 10 cm

ii 30 cm

b i 13 cm

ii 39 cm

c  $l = 2w$

d  $p = 6w$

- 9 a Learner's own table.

b \$11.95

c B and D are both correct.

- 10 a \$170

b  $c = 17n$

c \$612

d 58

- 11 a 135 crowns

b  $c = 13.5d$ , where  $c$  is the number of crowns and  $d$  is the number of dollars.

- 12 a 25 g

b  $y = 2.5n$

c  $z = 10n$

- 13 a i \$60      ii \$30      iii \$3

b  $c = 3x$

c \$100.50