Learner's book

Exercise 1.5

1 **a** $2+8+5+7+2=24$; this is a multiple of 3 but is not a multiple of 9.

b 28 575 has a total of 27, so is divisible by 9.

2 **a** $5+7+4+2+3=21$, which is a multiple of 3. 21 is odd, so 6 is not a factor.

b 0 or 6

3 **a** The final digit is even, so it is divisible by 2; the last two digits are 64 and this is divisible by 4, so the number is divisible by 4.

b The last three digits are 764 and $764 \div 8 =$ 95 r. 4, so it is not a multiple of 8.

4 **a** $2+5+3+2+0=12$, which is a multiple of 3; 20 is a multiple of 4.

b Possible answers are 2, 5, 6, 8 and 10.

5 **a–c** Learner's own answers.

6 **a** odd $9+4=13$; even $=2$; $13-2=11$

b odd $=4+0+6=10$; even $=8+1+1=10$; $10-10=0$, so it is a multiple of 11.

7 **a** $258-2\times3=252$ and $252\div7=36$

b $385-2\times2=381$ and $381\div7=54$ r 3

8 **a** The number is odd, so 2, 4, 6 and 8 are not factors. The last digit is 9, so 5 is not a factor. The sum of the digits is 27, so both 3 and 9 are factors. $22\,599\div7=3228$ r. 3, so 7 is not a factor. So, 3 and 9 are the only factors between 1 and 10.

b 99 522 has the same digits as 22 599 (the number in part **a**), so 3 and 9 are still factors. It is even, so 2 is a factor. 6 is also a factor, but 4 and 8 are not factors. 5 is not a factor. 7 is not a factor. The factors are 2, 3, 6 and 9.

9

Number	Factors between 1 and 10
12	2, 3, 4, 6
123	3
1234	2
12 345	3, 5
123 456	2, 3, 4, 6, 8

10 For example: 4675 because $4+7=6+5=11$. There are seven other possibilities.

11 **a** 2521 is odd and so not divisible by 2, 4, 6, 8 or 10. The sum of the digits is 10, so it is not divisible by 3 or 9. The last digit is 1, so it is not divisible by 5; $2521\div7=360$ r. 1. $1+5=6$ and $2+2=4$, so it is not divisible by 11.

b Any number with these digits that ends in 5.

c Any number with these digits that ends in 12 or 52.

d 2512 or 2152

e 2526

f 2530

12 **a** Because the last digit is 4, it is even and is divisible by 4.

b The last digit is always 4 and never 0 or 5.

c **i** 444 is possible.

ii 444 444 or 444 444 444 and so on because the sum of the digits is 24 and so on. Always a multiple of 3.

d i 44 is possible.

ii 4444 or 444 444 or . . . If there is an even number of digits, the difference calculated in the test is 0.

13 a It is false. 12 is divisible by 2 and 4, but it is not divisible by 8.

b It is true. A number divisible by 10 has a last digit of 0. Hence, it is even and also divisible by 5.

c It is true. Learner's own answer.

Exercise 1.6

1 a 9 **b** 25 **c** 64

d 100 **e** 225

2 a $\sqrt{9} = 3$ **b** $\sqrt{25} = 5$

c $\sqrt{64} = 8$ **d** $\sqrt{100} = 10$

e $\sqrt{225} = 15$

3 a 6 **b** 9 **c** 11 **d** 12

4 a 1 **b** 8 **c** 27 **d** 64

e 125

5 a $\sqrt[3]{1} = 1$ **b** $\sqrt[3]{8} = 2$

c $\sqrt[3]{27} = 3$ **d** $\sqrt[3]{64} = 4$

e $\sqrt[3]{125} = 5$

6 a 4 **b** 8 **c** 12

7 a $9^2 = 81$ and $10^2 = 100$

b 13 and 14 **c** 4 and 5

8 a 289 **b** $\sqrt{289} = 17$

9 a $\sqrt{324} = 18$ **b** $\sqrt{400} = 20$

c $\sqrt{529} = 23$ **d** $\sqrt{676} = 26$

10 a $\sqrt[3]{343} = 7$ **b** $\sqrt[3]{729} = 9$

c $\sqrt[3]{1000} = 10$ **d** $\sqrt[3]{1728} = 12$

11 a The factors are 1, 36, 2, 18, 3, 12, 4, 9, 6.

b i 1, 9, 3 ii 1, 16, 2, 8, 4

iii 1, 25, 5

c Usually factors come in pairs. For example, $2 \times 18 = 36$ gives two factors, 2 and 18. Only for a square number can you get a single factor from a product. $6 \times 6 = 36$, so the total number is odd.

d Impossible

e No; a counterexample is 8, which is 2^3 and has four factors, 1, 2, 4 and 8.

f Learner's own answer.

Reflection: Learner's own answer.

12 a The differences are 3, 5, 7, 9, 11, . . .

b They are odd numbers. They increase by two each time. Add the two numbers that are squared to find the difference.

c The differences are 7, 19, 37, 61, 91, . . .

13 a i 1 ii 3 iii 6

b The answer is the sum of the numbers cubed.

c Try adding 4^3 and so on.

d Learner's own answer.

14 a $\sqrt{1+3+5} = 3$

b $\sqrt{1+3+5+7} = 4$

c $\sqrt{1+3+5+7+9} = 5$ and so on.

d The numbers in each part are $1+3+5+7 = 16$, which equals a 4 by 4 square. Compare with part **b**.

Exercise 3.1

1 **a** **i** 1000 **ii** one thousand

b **i** 100 000

ii one hundred thousand

c **i** 10 000 000 **ii** ten million

d **i** 10 **ii** ten

2 **a** 10^2 **b** 10^5 **c** 10^4 **d** 10^{10}

3 **a** 30 000 **b** 5 000 000

c 4 500 000 **d** 291 000

4 Yes

5 **a** 2300 **b** 7 680 000 **c** 9 000 000

6 **a** 420 **b** 65 000

c 12 700 **d** 2 870 000

7 **a–c** Learner's own answers.

d Marcus' method doesn't work because the number being multiplied has decimal places.

8 **a** 47 000

b 91 500

c 3 300 000

9 **a** 1500 **b** 10^2 **c** 6.12 **d** 6

10 **a** 8 **b** 805

11 Yes, as long as there are enough zeros to cross off.

12 **a** 8 **b** 510 **c** 84 600

13 Learner's own answers.

14 **a** 23 **b** 2.3 **c** 0.23

d 0.023 **e** 6.5 **f** 0.65

g 0.065 **h** 0.0065 **i** 0.9

j 0.09 **k** 0.009 **l** 0.0009

15 **a** B **b** A **c** C

16 **a** 80 **b** 150

c 7000 **d** 3400

e 9 000 000 **f** 600 000

g 124 **h** 32 250 000

17 **a** 8 km

b number of km = number of mm $\div 10^6$

c **i** 90 **ii** 15.6 **iii** 0.77

18 **a** Group 1: $78\,000 \div 10^3$, $780 \div 10$, 0.0078×10^4; group 2: 7.8×10^3, $78\,000\,000 \div 10^4$, 780×10; group 3: 0.00078×10^6, $7\,800\,000\,000 \div 10^7$, 78×10. The left-over card is $780 \div 10^2$.

b For example: 0.078×10^2, 0.78×10, $78 \div 10$, $7800 \div 10^3$

Reflection: Learner's own answers.

Exercise 3.2

1 **b** 8.42 **c** 39.56 **d** 0.49

e 138.22 **f** 0.07

2 **a** Sofia

b Arun rounded to one decimal place, as he has only written one digit after the decimal place.

3 Any distance from 9.545 km to 9.554999999. . . km.

4 **a** 12.894 **b** 127.997

c 0.201 **d** 9.350

5 **a** Learner's own answers.

b Easy to follow method that shows workings. More difficult to make a mistake because the rounding is done in easy steps.

c Learner's own answers.

d Draw a line after the digit in the sixth decimal place, circle the digit in the seventh decimal place, then decide whether to increase the digit before the line by 1 (if the circled number is 5, 6, 7, 8 or 9) or leave it unchanged (if the circled number is 0, 1, 2, 3 or 4).

6 **a** B **b** C **c** A

7 **a** 126.9923 **b** 0.8

c 782.030 **d** 3.1415927

e 4.00 **f** 100.0

8 **a** A and c and iv; B and a and iii; C and e and i; D and b and vi; E and f and ii; F and d and v

b Advantage: you will get all the answers; disadvantage: this method takes a long time.

c You could start by matching the rounded numbers to the degree of accuracy. This is easy, just by counting the number of decimal places. You could then find which original number rounds to 6 d.p., then 5 d.p., then 4 d.p., etc.

9 **a** 1.29 **b** 4.5333 **c** 1.310

Workbook

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 $108 \div 8 = 13$ r. 4.

4 The sum of the digits is $14+*$. This is a multiple if 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 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 mg = 28 g

b 750 mg = 0.75 g

c 2 000 000 mg = 2 kg

d 83 000 mg = 0.083 kg

e 53 000 000 000 mg = 53 t

f 2 500 000 mg = 0.0025 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 g = 45 000 mg

ii 7.6 kg = 7 600 000 mg

iii 0.0657 t = 65 700 000 mg

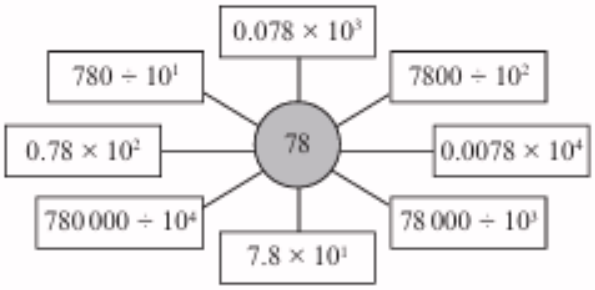
15 **a** Space station, weather satellite, Moon, Venus, Jupiter, Neptune.

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. . . = 0.6364 (4 d.p.)
b 1.5714. . . = 1.571 (3 d.p.)
c 1.444. . . = 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 $45.6375 \leq$ 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.