

6 Decimals: Multiplication and Division

6.1 Multiplication of Whole Numbers

Here we start with multiplication of whole numbers, which is a useful technique for all sorts of problems.



Example

Jai spends £3 on sweets each week for 7 weeks. Calculate how much he spends altogether.



Solution

He spends (in £) $3 + 3 + 3 + 3 + 3 + 3 + 3$ ($= 21$), but it is easier to calculate

$$3 \times 7 = 21 \text{ is } \text{£}21.$$

You should know your multiplication tables up to 10×10 , but for revision, we include these here.

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100



Exercises

1. Find

(a) 2×3

(b) 5×7

(c) 6×3

(d) 3×7

(e) 5×4

(f) 9×2

(g) 8×5

(h) 6×6

(i) 9×4

(j) 8×7

(k) 9×8

(l) 7×9

(m) 6×7

(n) 9×9

(o) 8×6

2. Is each of these statements *true* or *false*?

(a) $5 \times 4 = 4 \times 5$

(b) $6 \times 5 = 6 \times 7$

(c) $8 \times 9 = 4 \times 36$

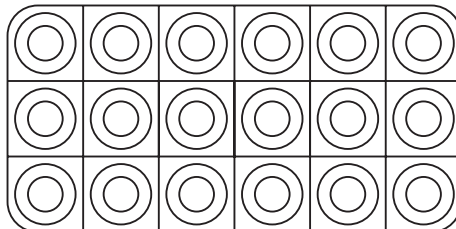
(d) $21 \times 5 = 7 \times 15$

3. Jamil saves £5 per month from his pocket money.

(a) How much does he save in 4 months?

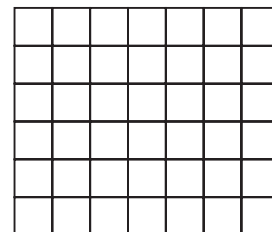
(b) How long will it take him to save £30?

4. How many bottles are there in this crate?



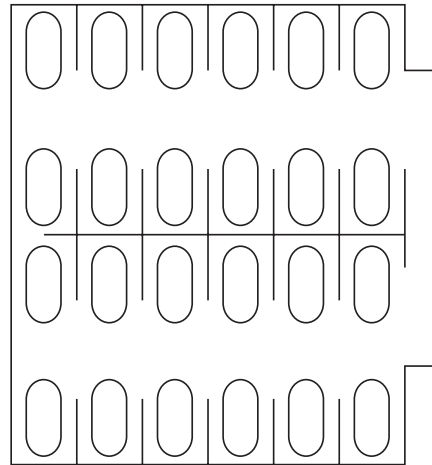
5. Emma, Rachel, Sarah and Hannah go to a disco. It costs £3 each to get in. How much do they pay altogether?

6. The picture shows the tiles on one wall in Sunnava's bathroom. How many tiles are on this wall?

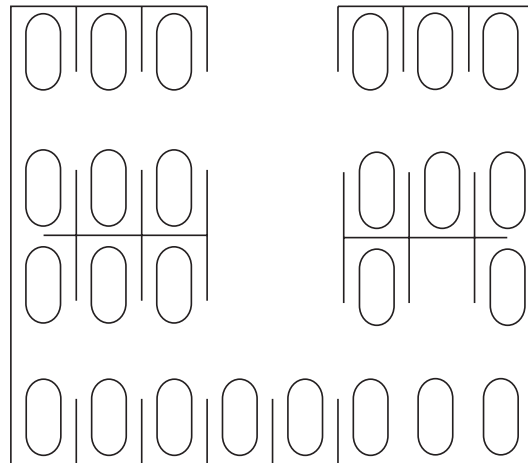


7. Packets of chewing gum are packed in a box. In a box there are 8 layers with 9 packets of chewing gum in each layer. How many packets are there in the box?

8. The picture shows the cars parked in a car park. How many cars have been parked?



9. How many cars are there in this car park?



10. A hotel has 9 floors. On each floor there are 7 windows. How many windows are there in the hotel?

6.2 Long Multiplication

You are probably familiar with long multiplication. For example, you can find 35×19 in the following way:

$$\begin{array}{r}
 35 \\
 \times 19 \\
 \hline
 350 \\
 + 315 \\
 \hline
 665
 \end{array}$$

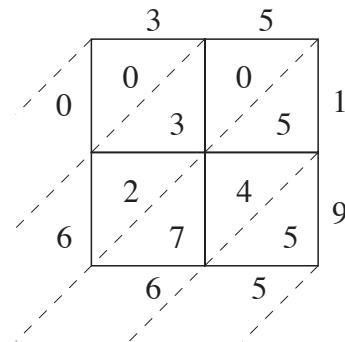
But there are many other ways of doing this sum.
For example,

(1) Napier's Method

Write the two numbers on the horizontal top and vertical side.

Multiply each digit together to give the two digit entries in the cell (write $3 \times 1 = 3$ as 03).

Now add up along the diagonals; carry digits in the usual way – this gives 0665, i.e. 665 as expected!



(2) Russian Multiplication

Write down the multiplication

$$35 \times 19$$

Divide left hand side by 2,
ignoring remainder, and multiply
right hand side (RHS) by 2

17 38

- 8 - - - - 76 -

Continue in this way until
1 is reached on left hand side (LHS)

- 4 - - - 152 -

- 2 - - 304 -

1 608

Cross out terms on RHS if there is an even number on LHS

Add up the remaining numbers on RHS

665 (again!)

(3) Box Method

	30	5	
10	$10 \times 30 = 300$	$10 \times 5 = 50$	$\left. \begin{array}{l} \\ \end{array} \right\}$
9	$9 \times 30 = 270$	$9 \times 5 = 45$	
			300 270 50 45 665



Exercises

1. Find, by any method:

- | | | |
|----------------------|----------------------|---------------------|
| (a) 3×42 | (b) 8×35 | (c) 6×22 |
| (d) 9×43 | (e) 12×62 | (f) 15×32 |
| (g) 84×22 | (h) 19×48 | (i) 62×18 |
| (j) 43×62 | (k) 172×42 | (l) 461×78 |
| (m) 184×192 | (n) 392×412 | (o) 494×72 |

2. Use Russian multiplication to find:

- | | | |
|--------------------|--------------------|--------------------|
| (a) 42×37 | (b) 62×81 | (c) 14×93 |
| (d) 27×43 | (e) 82×29 | (f) 38×46 |
| (g) 57×37 | (h) 29×49 | (i) 33×28 |

3. Use the box method or Napier's method to find:

- | | | |
|--------------------|--------------------|----------------------|
| (a) 12×15 | (b) 32×21 | (c) 89×42 |
| (d) 45×57 | (e) 62×91 | (f) 112×428 |

6.3 Multiplying with Decimals

We now extend our multiplication to decimals.



Example

You know that $35 \times 19 = 665$.

Deduce the value of

- (a) 3.5×19 (b) 3.5×1.9 (c) 350×1.9 (d) 350×190



Solution

$$\begin{aligned}
 \text{(a)} \quad 3.5 \times 19 &= \frac{35}{10} \times 19 \\
 &= \frac{35 \times 19}{10} \\
 &= \frac{665}{10} \\
 &= 66.5
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad 3.5 \times 1.9 &= \frac{35}{10} \times \frac{19}{10} \\
 &= \frac{35 \times 19}{100} \\
 &= \frac{665}{100} \\
 &= 6.65
 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad 350 \times 1.9 &= (35 \times 10) \times \frac{19}{10} \\
 &= \frac{35 \times 10 \times 19}{10} \\
 &= 665
 \end{aligned}$$

$$\begin{aligned}
 \text{(d)} \quad 350 \times 190 &= (35 \times 10) \times (19 \times 10) \\
 &= (35 \times 19) \times (10 \times 10) \\
 &= 665 \times 100 \\
 &= 66\,500
 \end{aligned}$$

Of course, in practice you do not need to write out the calculations in full like this, but simply write down the answers.



Exercises

1. Find:

- | | | |
|----------------------|----------------------|----------------------|
| (a) 3×0.8 | (b) 5×0.7 | (c) 3×2.6 |
| (d) 9×1.2 | (e) 6×1.5 | (f) 8×7.9 |
| (g) 2.1×3.2 | (h) 5.6×7.2 | (i) 8.4×2.1 |
| (j) 9.2×1.8 | (k) 1.2×6.2 | (l) 15×7.3 |
| (m) 22×9.4 | (n) 62×7.1 | (o) 74×5.3 |

2. Work out the following, using a quick method if possible.

- | | |
|-----------------------------|--------------------------------|
| (a) 6×10 | (b) 0.7×10 |
| (c) 12.2×100 | (d) 112×10 |
| (e) $2 \times 3.2 \times 5$ | (f) $2 \times 62 \times 50$ |
| (g) 1.47×1000 | (h) 18.41×10 |
| (i) 365×100 | (j) $200 \times 7200 \times 5$ |

3. Find:

(a) 2.47×1.6

(b) 3.25×11.1

(c) 3.42×6.19

(d) 7.24×5.16

(e) 8.21×15.1

(f) 32.1×0.47

6.4 Problems Involving Multiplication

We now see how multiplication helps when solving problems in context.



Example 1

In a train there are 6 coaches each with 68 seats and two coaches each with 42 seats. What is the total seating capacity of the train?



Solution

$$\begin{aligned} \text{The total number of seats} &= 6 \times 68 + 2 \times 42 \\ &= 408 + 84 \\ &= 492 \text{ seats} \end{aligned}$$



Example 2

Find the cost of 12 lunches, each costing £3.29.



Solution

You can use long multiplication to get the answer.

$$\begin{array}{r} 3.29 \\ \times 12 \\ \hline 3290 \\ + 658 \\ \hline \text{£}39.48 \end{array}$$



Exercises

1. It costs £9 to go on a school trip. A class of 28 children all go on the trip. How much do they pay in total?
2. Chocolate bars are packed in boxes. Each box contains 24 bars. Mrs Patel buys 8 boxes for the tuck shop. How many bars does she buy?
3. A train has 8 carriages. There are 52 seats in each carriage. How many seats are there on the train?
4. A milk crate contains 24 bottles of milk. There are 32 crates on a milk float. How many bottles are there on the milk float?
5. Matthew organises a trip to a concert. He buys 32 tickets which cost £35 each. How much does he spend on the tickets?
6. Shamil helps his parents build a patio. It is rectangular. There are 12 slabs along one side and 18 along the other side. How many slabs are there in the patio?
7. A burger costs £1.29. Find the cost of 10 burgers.
8. Alex earns £2.54 each day for his paper round. How much does he earn in 6 days?
9. A meal for an adult costs £4.99 and a meal for a child costs £2.25. Find the total cost of 2 adult and 4 child meals.
10. Rope is sold for £1.28 per metre. Find the cost of 10 metres of rope.
11. The price of a carpet is £4.99 per square metre. Find the cost of 8 square metres of carpet.
12. Chain is sold for £2.44 per metre. Find the cost of 3.2 metres of chain.
13. Apples are sold for £1.06 per kilogram. Find the cost of 2.4 kilograms of apples.
14. A factory makes 260 televisions in a day. How many televisions are made at the factory in a whole year? Give 3 possible answers, explaining each one.

6.5 BODMAS

It is important that we carry out operations in a calculation in the correct order, which can be summarised by using the acronym '**BODMAS**'. This stands for:

B Brackets first

O

D Divide

M Multiply

A Add

S Subtract



Example 1

Calculate (a) $16 \times 2 + 3$ (b) $16 \times (2 + 3)$.



Solution

$$\begin{aligned} \text{(a)} \quad 16 \times 2 + 3 &= 32 + 3 && \text{(M before A)} \\ &= 35 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad 16 \times (2 + 3) &= 16 \times 5 && \text{(B before M)} \\ &= 80 \end{aligned}$$



Example 2

Calculate:

$$\text{(a)} \quad (3 + 2) \times 6 - 8 \quad \text{(b)} \quad 4 \times 6 + 18 \div 2 \quad \text{(c)} \quad (17 - 2) \div 5 + 6$$



Solution

$$\begin{aligned} \text{(a)} \quad (3 + 2) \times 6 - 8 &&& \text{(brackets first)} \\ &= 5 \times 6 - 8 && \text{(multiplication second)} \\ &= 30 - 8 && \text{(subtraction last)} \\ &= 22 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad 4 \times 6 + 18 \div 2 \\ &= 24 + 9 \\ &= 33 \end{aligned}$$

$$\begin{aligned}
 \text{(c)} \quad & (17 - 2) \div 5 + 6 && (\text{brackets first}) \\
 & = 15 \div 5 + 6 && (\text{division second}) \\
 & = 3 + 6 && (\text{addition last}) \\
 & = 9
 \end{aligned}$$



Example 3

State whether each one of the statements below is *true* or *false*:

- (a) $3 + 6 \times 2 = 15$
- (b) $30 - 7 \times 4 = 92$
- (c) $8 + 20 \div 2 = 14$



Solution

$$\begin{aligned}
 \text{(a)} \quad & 3 + 6 \times 2 = 3 + 12 \\
 & = 15
 \end{aligned}$$

Therefore the statement is *true*.

$$\begin{aligned}
 \text{(b)} \quad & 30 - 7 \times 4 = 30 - 28 \\
 & = 2
 \end{aligned}$$

Therefore the statement is *false*.

$$\begin{aligned}
 \text{(c)} \quad & 8 + 20 \div 2 = 8 + 10 \\
 & = 18
 \end{aligned}$$

Therefore the statement is *false*.



Exercises

1. Find

- | | | |
|-----------------|-----------------|-----------------|
| (a) $16 \div 4$ | (b) $12 \div 6$ | (c) $15 \div 5$ |
| (d) $20 \div 4$ | (e) $18 \div 9$ | (f) $40 \div 8$ |
| (g) $36 \div 9$ | (h) $15 \div 3$ | (i) $64 \div 8$ |
| (j) $42 \div 7$ | (k) $24 \div 6$ | (l) $32 \div 8$ |
| (m) $49 \div 7$ | (n) $56 \div 8$ | (o) $45 \div 5$ |

2. Is each of these statements *true* or *false*?

- | | |
|-----------------------------|--------------------------|
| (a) $10 \div 2 = 2 \div 10$ | (b) $12 + 8 \div 2 = 10$ |
| (c) $3 + 12 \div 4 = 6$ | (d) $6 \div 2 + 3 = 6$ |

3. Find:

- | | | |
|-----------------------------|-------------------------------|------------------------------|
| (a) $3 + 4 \times 8$ | (b) $8 + 3 \times 6$ | (c) $8 \times 6 - 4$ |
| (d) $12 \div 2 + 5$ | (e) $5 - 12 \div 3$ | (f) $14 \div 2 + 8$ |
| (g) $3 \times 2 + 8 \div 4$ | (h) $3 \times 6 - 15 \div 3$ | (i) $42 \div 7 + 3$ |
| (j) $16 \div 4 + 24 \div 6$ | (k) $8 \times 2 + 5 \times 3$ | (l) $8 \times 6 - 45 \div 5$ |

4. A pupil works out $200 \div 4$ by this method:

$$200 \div 2 = 100$$

$$100 \div 2 = 50$$

Use similar methods to find:

- | | | |
|------------------|-------------------|------------------|
| (a) $500 \div 4$ | (b) $52 \div 4$ | (c) $68 \div 4$ |
| (d) $128 \div 4$ | (e) $224 \div 4$ | (f) $104 \div 8$ |
| (g) $80 \div 16$ | (h) $112 \div 16$ | (i) $128 \div 8$ |

5. Calculate:

- | | |
|-----------------------------|----------------------------------|
| (a) $6 + 7 \times 2$ | (b) $8 - 3 \times 2$ |
| (c) $19 - 4 \times 3$ | (d) $3 \times 6 - 9$ |
| (e) $15 - 4 + 7 \times 2$ | (f) $11 \times 3 + 2$ |
| (g) $16 \times 4 - 3$ | (h) $6 + 7 \times 2 - 20 \div 4$ |
| (i) $18 \times 2 - (4 + 7)$ | (j) $16 - 5 \times 2 + 3$ |

6. State whether each one of the statements below is *true* or *false*. Calculate the correct answer for those that are *false*.

- | | |
|----------------------------|---------------------------------|
| (a) $6 \times 7 - 2 = 40$ | (b) $8 \times (6 - 2) + 3 = 56$ |
| (c) $35 - 7 \times 2 = 56$ | (d) $3 + 7 \times 3 = 30$ |
| (e) $18 - (4 + 7) = 21$ | (f) $43 - 3 + 2 = 42$ |
| (g) $80 \div 2 + 6 = 10$ | (h) $64 - 10 + 2 = 52$ |

7. Put brackets into each of the statements below to make it correct:

- | | |
|---------------------------|----------------------------|
| (a) $3 \times 6 + 1 = 21$ | (b) $5 + 6 \times 2 = 22$ |
| (c) $45 \div 6 + 3 = 5$ | (d) $49 - 3 + 2 = 44$ |
| (e) $7 \times 3 + 2 = 35$ | (f) $13 - 4 \times 2 = 18$ |

8. Write out each of the calculations below, filling in the missing numbers:

(a) $3 \times ? + 2 = 17$

(b) $? \times 5 - 8 = 22$

(c) $(4 + ?) \times 2 = 20$

(d) $6 - ? \times 2 = 0$

(e) $(7 - ?) \times 4 = 20$

(f) $? \div 3 + 4 = 8$

9. Jane writes down:

$$4 \times 7 + 2 \times 3 = 90$$

- (a) Explain why her answer is incorrect, and calculate the correct answer.
 (b) By using brackets Jane can make her calculation correct. Show how this can be done.
10. Esther and Andy are given this problem:

$$30 \div 6 - 3 + 1$$

Esther says the answer is 1.

Andy says the answer is 11.

- (a) Is either of them correct?
 (b) Show how Esther could insert brackets to give her answer.
 (c) Show how Andy could insert brackets to give his answer.
11. State whether each one of the statements below is *true* or *false*:
- (a) $(3 \times 6) \times 2 = 3 \times (6 \times 2)$ (b) $(4 + 2) + 7 = 4 + (2 + 7)$
 (c) $(8 - 2) - 1 = 8 - (2 - 1)$ (d) $(8 \div 2) \div 2 = 8 \div (2 \div 2)$

6.6 Division Methods for Whole Numbers and Decimals

Care must be taken when handling divisions, particularly when they involve decimals.



Example

Find

- (a) $1300 \div 100$
 (b) $1.75 \div 5$
 (c) $6.31 \div 4$



Solution

$$(a) \quad 1300 \div 100 = \frac{1300}{100}$$

$$= 13 \quad 0.35$$

$$(b) \quad 1.75 \div 5 = 0.35 \quad \text{since } 5 \overline{)1.75}$$

$$(c) \quad 631 \div 4 \quad \text{gives } 4 \overline{)157} \text{ r } 3, \text{ i.e. } 157 \text{ with remainder } 3$$

Alternatively, to get the answer in decimal form, write

$$4 \overline{)157.75} \quad \text{i.e. } 157.75$$



Exercises

1. Find:

$$(a) \quad 12 \div 10$$

$$(b) \quad 4200 \div 10$$

$$(c) \quad 600000 \div 10$$

$$(d) \quad 3714 \div 10$$

$$(e) \quad 5728 \div 10$$

$$(f) \quad 6000 \div 100$$

$$(g) \quad 7000 \div 1000$$

$$(h) \quad 75000 \div 100$$

$$(i) \quad 750 \div 100$$

$$(j) \quad 3714 \div 100$$

$$(k) \quad 8412 \div 100$$

$$(l) \quad 642130 \div 10000$$

2. Carry out the following divisions.

$$(a) \quad 69 \div 3$$

$$(b) \quad 4545 \div 9$$

$$(c) \quad 6612 \div 3$$

$$(d) \quad 2947 \div 7$$

$$(e) \quad 7404 \div 6$$

$$(f) \quad 37050 \div 5$$

$$(g) \quad 2208 \div 12$$

$$(h) \quad 13488 \div 24$$

$$(i) \quad 1792 \div 32$$

$$(j) \quad 10530 \div 45$$

$$(k) \quad 4284 \div 18$$

$$(l) \quad 10496 \div 41$$

3. Carry out the following divisions.

$$(a) \quad 2.54 \div 2$$

$$(b) \quad 21.63 \div 3$$

$$(c) \quad 10.24 \div 4$$

$$(d) \quad 87.5 \div 5$$

$$(e) \quad 918.4 \div 7$$

$$(f) \quad 49.24 \div 4$$

$$(g) \quad 388.5 \div 15$$

$$(h) \quad 123.84 \div 12$$

$$(i) \quad 714.84 \div 6$$

4. Carry out the following divisions, giving your answers as decimals.

$$(a) \quad 21 \div 4$$

$$(b) \quad 81 \div 2$$

$$(c) \quad 162 \div 4$$

$$(d) \quad 263 \div 4$$

$$(e) \quad 84 \div 8$$

$$(f) \quad 241 \div 8$$

6.7 Division Problems

As with multiplication, division is often needed in practical problems.



Example

45 sweets are divided equally between 9 children. How many do they each get?



Solution

Each child gets $45 \div 9 = 5$ sweets.



Exercises

1. A mini chocolate bar costs 8p. How many bars can be bought with 72p?
2. A multistorey car park has 4 levels, each taking the same number of cars. When full it holds 124 cars. How many cars can park at each level?
3. A train can carry 384 passengers. If has 8 carriages, each with the same seating capacity. How many people can each carriage hold?
4. Rafiq borrows £50 from his Dad. He pays it back in 10 equal weekly instalments. How much does he pay back each week?
5. £375.69 is raised at a jumble sale. This is divided equally between 3 charities. How much does each of the charities get?
6. Grace and her 3 brothers are given £37 to share equally between them. How much do they get each?
7. Charlotte has 24 sweets. She shares them out equally between herself and her 3 friends. How many sweets do they get each?
8. Three children are paid £15 for working in a garden. They share the money equally between them. How much do they get each?
9. Karen buys 6 tickets, each costing the same, for the theatre. She pays a total of £54 for the tickets. How much does each ticket cost?
10. A rope is 22.48 m long. It is cut into 4 parts of equal length. How long is each part?

11. A baker mixes 1944 grams of dough. It is used to make 12 small loaves of equal weight. How much dough is used in each loaf?
12. Rachel, Ben, Emma and Hannah are given £5.50 to share equally between them. Describe the problem they have.
13. 40 children want to go on a school trip to Wimbledon. They will be taken in minibuses that each hold 13 passengers. How many minibuses will be needed for the trip?
14. How many chocolate bars costing 23p each can I buy with £2?
15. The 'Oblivion' ride at Alton Towers takes 16 people each time it goes around. How many times must it go around if 70 people want to have a go?
16. A teacher has 240 grams of clay. She cuts off lumps of mass 35 grams each.
 - (a) How many lumps can she make?
 - (b) How much clay is left over?
17. John sees some cassette tapes that cost 85p each. He has £5.
 - (a) How many tapes can he buy?
 - (b) If he buys as many tapes as he can, how much change will he have?
18. A text book costs £7.50. A teacher has £149 to spend on books. How many copies of this text book can she buy?