6 Arithmetic: Multiplication of Decimals

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

$$3\times 7 = 21 \text{ is £21.}$$

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

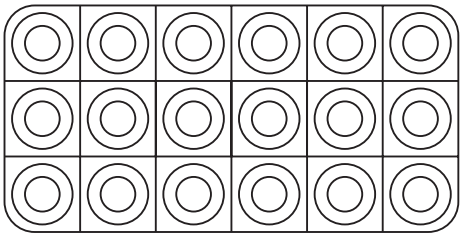
(a)	2×3	(b)	5×7	(c)	6×3
(d)	3×7	(e)	5×4	(f)	9×2
(g)	8×5	(h)	6×6	(i)	9×4
(j)	8×7	(k)	9×8	(l)	7×9
(m)	6×7	(n)	9×9	(o)	8×6

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

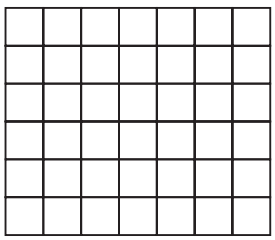
3. Jamil saves £5 per month from his pocket money.
   (a) How much does he save in 4 months?
   (b) How long will it take him to save £30?

4. How many bottles are there in this crate?



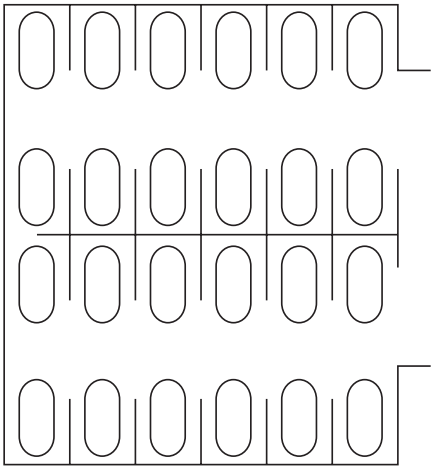
5. Emma, Rachel, Sarah and Hannah go to a disco. It costs £3 each to get in. How much do they pay altogether?

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

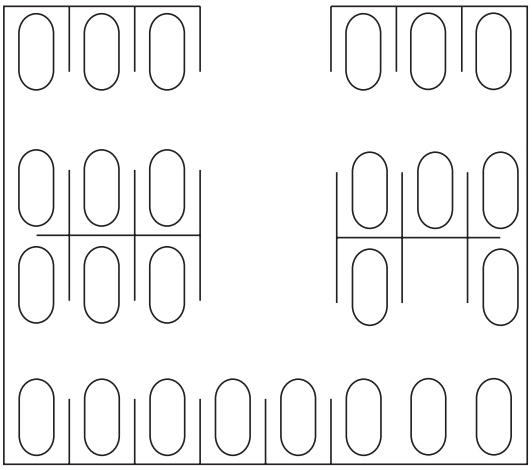


7. Packets of chewing gum are packed in a box. In a box there are 8 layers with 9 packets of chewing gum in each layer. How many packets are there in the box?

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:

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

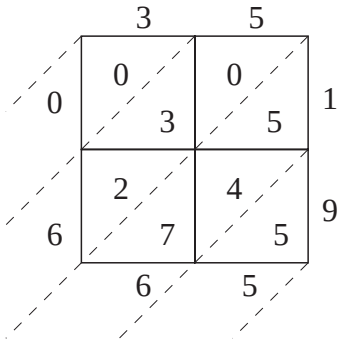
But there are many other ways of doing this sum.
For example,

(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 × 19

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

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

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

Add up the remaining numbers on RHS

17	38
~~8~~	~~76~~
~~4~~	~~152~~
~~2~~	~~304~~
1	608
	665

(again!)

(3) Box Method

	30	5	
10	$10 \times 30 = 300$	$10 \times 5 = 50$	300
9	$9 \times 30 = 270$	$9 \times 5 = 45$	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

(a) $3.5 \times 19 = \dfrac{35}{10} \times 19$

$= \dfrac{35 \times 19}{10}$

$= \dfrac{665}{10}$

$= 66.5$

(b) $3.5 \times 1.9 = \frac{35}{10} \times \frac{19}{10}$

$= \frac{35 \times 19}{100}$

$= \frac{665}{100}$

$= 6.65$

(c) $350 \times 1.9 = (35 \times 10) \times \frac{19}{10}$

$= \frac{35 \times 10 \times 19}{10}$

$= 665$

(d) $350 \times 190 = (35 \times 10) \times (19 \times 10)$

$= (35 \times 19) \times (10 \times 10)$

$= 665 \times 100$

$= 66\,500$

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

The total number of seats $= 6 \times 68 + 2 \times 42$

$= 408 + 84$

$= 492$ seats

Example 2

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

Solution

You can use long multiplication to get the answer.

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

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.