

Dividing Multi-Digit Whole Numbers: math lesson, Grade 4 – download the PDF

Sharing 84 trading cards among 4 friends, packing 250 eggs into cartons, planning how many buses a field trip needs: all of these are division problems. In Grade 4 you divide numbers with up to four digits by a one-digit number. You will learn three ways to do it (area models, partial quotients and long division), and you will learn what to do with the leftovers.

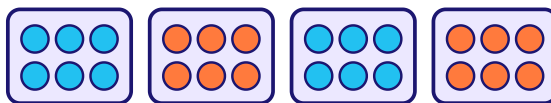
1. Division as equal groups

Division answers two kinds of questions. Either you know the total and the number of groups, and you look for the size of each group. Or you know the total and the size of each group, and you look for the number of groups.

D

Division

Dividing a total into equal groups. In $24 \div 4 = 6$, the number **24** is the *dividend*, **4** is the *divisor* and **6** is the *quotient*.



24 counters $\div$ 4 groups = 6 counters in each group

Division is the **inverse operation** of multiplication: they undo each other. Because $4 \times 6 = 24$, we know that $24 \div 4 = 6$ and $24 \div 6 = 4$. A multiplication fact always gives you a whole family of division facts, and that is the best way to check an answer.

P Checking a division

If **dividend $\div$ divisor = quotient**, then **divisor $\times$ quotient = dividend**. When there is a remainder, **divisor $\times$ quotient + remainder = dividend**.

I 2. Dividing multiples of 10 and 100

Big numbers can be easy when you use a basic fact and think in tens or hundreds. Since $24 \div 6 = 4$, then 24 tens divided by 6 is 4 tens, and 24 hundreds divided by 6 is 4 hundreds.

Basic fact	Tens	Hundreds
$24 \div 6 = 4$	$240 \div 6 = 40$	$2,400 \div 6 = 400$
$35 \div 7 = 5$	$350 \div 7 = 50$	$3,500 \div 7 = 500$

E Example 1

Find $4,200 \div 7$.

Think: 42 hundreds divided by 7. Since $42 \div 7 = 6$, we get 6 hundreds. So $4,200 \div 7 = 600$. Check: $7 \times 600 = 4,200$.

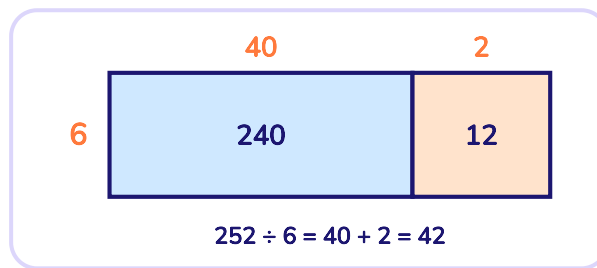
I 3. Area models for division

A rectangle has an area equal to its length times its width. If you know the area and one side, dividing gives the other side. Splitting the area into friendly pieces makes the work easy.

E**Example 2**

A rectangle has an area of 252 square feet and a width of 6 feet. Find its length.

Choose the biggest ten-multiple that fits: $6 \times 40 = 240$. The leftover area is $252 - 240 = 12$, and $6 \times 2 = 12$. So the length is $40 + 2 = 42$ feet.

**4. Partial quotients**

The **partial quotients** strategy is the area model written as a list. You take away easy multiples of the divisor one at a time, and you add up how many you took.

M**Method: partial quotients**

1. Pick an easy multiple of the divisor that fits in what is left (10 times, 50 times, 100 times, and so on).
2. Subtract it from the dividend.
3. Repeat with what is left until it is smaller than the divisor.
4. Add the partial quotients. Anything left is the remainder.

E**Example 3**Find $628 \div 4$.

Step	Take away	Left	Partial quotient
1	$4 \times 100 = 400$	$628 - 400 = 228$	100
2	$4 \times 50 = 200$	$228 - 200 = 28$	50
3	$4 \times 7 = 28$	$28 - 28 = 0$	7

Add: $100 + 50 + 7 = 157$. So $628 \div 4 = 157$. Check: $4 \times 157 = 628$.

Every student can choose different partial quotients and still get the same answer. Fewer, bigger steps are faster, but any steps that work are correct.

5. Long division with a one-digit divisor

Long division is a short and tidy way to record the same thinking. You work from the left, one place value at a time.

M**Method: long division**

1. **Divide** the first digit (or first two digits) by the divisor.
2. **Multiply** the digit you wrote in the quotient by the divisor.
3. **Subtract** to see what is left.
4. **Bring down** the next digit and repeat.

$ \begin{array}{r} 252 \\ 3 \overline{) 756} \\ \underline{6} \\ 15 \\ \underline{15} \\ 06 \\ \underline{06} \\ 0 \end{array} $	Divide $7 \div 3 = 2$, multiply $2 \times 3 = 6$ Subtract $7 - 6 = 1$, bring down the 5 Divide $15 \div 3 = 5$, multiply $5 \times 3 = 15$ Subtract $15 - 15 = 0$, bring down the 6 Divide $6 \div 3 = 2$, multiply $2 \times 3 = 6$ Subtract $6 - 6 = 0$: no remainder
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Look at the figure: $756 \div 3$. The 7 hundreds are shared first (2 hundreds each, 1 hundred left), then the left-over hundred is traded for tens and joins the 5 tens, and so on. The answer is 252.



Watch out for zeros in the quotient

In $2,412 \div 4$, after $24 \div 4 = 6$ and bringing down the 1, we get $1 \div 4 = 0$. You must write that 0 in the quotient, then bring down the 2: $12 \div 4 = 3$. The answer is 603, not 63.

6. Remainders and what they mean

Not every division comes out evenly. What is left over is the **remainder**, and it is always smaller than the divisor. For $853 \div 6$, we get $6 \times 142 = 852$, and 1 is left, so $853 \div 6 = 142 \text{ R } 1$. Check: $6 \times 142 + 1 = 853$.

In a word problem, you have to decide what the remainder means in the story. There are three common cases.

- **The remainder is the answer:** how many are left over.
- **Drop the remainder:** only full groups count.
- **Add one more group:** everybody needs a place, so you round the quotient up.

E**Example 4**

A school takes 62 students on a trip. Each van holds 8 students. How many vans are needed?

$62 \div 8 = 7 \text{ R } 6$ because $8 \times 7 = 56$ and $62 - 56 = 6$. Seven vans hold only 56 students, and 6 students would be left behind, so the school needs **8 vans**.

7. Estimating quotients

Before you divide, make a quick estimate with **compatible numbers**: numbers close to the real ones that divide easily. The estimate tells you how many digits the answer should have and whether your result is sensible.

E**Example 5**

Estimate $1,789 \div 6$. The number 1,789 is close to 1,800, and $1,800 \div 6 = 300$. So the quotient is about 300. The exact answer is **298 R 1**, which is very close.

!**Zyro's tip**

On my planet we always estimate first. If your estimate is 300 and you get 30 or 3,000, you know right away that a digit went missing or a zero was added by mistake!

8. Division word problems

Read the story, find the total and what is being shared, and draw a bar model if it helps. A bar model shows the total as one long bar and cuts it into equal parts.



E Example 6

A gardener plants 258 tulip bulbs in 6 equal rows. How many bulbs are in each row?

$258 \div 6 = 43$, because $6 \times 40 = 240$ and $6 \times 3 = 18$, and $240 + 18 = 258$. There are **43 bulbs** in each row.

When a problem has several steps, solve one step at a time and write what each answer means. Finish with a full sentence that includes the unit.

Key takeaways

- Division splits a total into equal groups, and it is the inverse of multiplication.
- Use basic facts to divide multiples of 10 and 100: $2,400 \div 6 = 400$.
- Area models and partial quotients break a big division into easy pieces.
- In long division, repeat divide, multiply, subtract and bring down.
- The remainder is always smaller than the divisor; check with **divisor $\times$ quotient + remainder**.
- Estimate with compatible numbers before and after you divide.
- In a word problem, decide whether to keep, drop or round up the remainder.



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