

Dividing Whole Numbers: math lesson, Grade 5 – download the PDF

Sharing 1,872 markers into packs, finding how many buses a field trip needs, or splitting a prize fairly: all of these are division problems, and the numbers are often big. In Grade 5 you learn several reliable ways to divide a multi-digit whole number, so you can choose the tool that fits the problem and always check that your answer makes sense.

1. Dividing by multiples of 10

A **multiple of 10** is a number like 20, 60, 300 or 4,000. Dividing by one is easier than it looks, because you can use a basic fact and then fix the zeros.

D Dividend, divisor, quotient

In $4,800 \div 60 = 80$, the number being shared, 4,800, is the **dividend**. The number you divide by, 60, is the **divisor**. The answer, 80, is the **quotient**. Anything left over after sharing is the **remainder**.

P Same zeros, same quotient

If you divide both the dividend and the divisor by 10, the quotient does not change. So $4,800 \div 60$ has the same quotient as $480 \div 6$.

Problem	Basic fact	Quotient
$4,800 \div 60$	$48 \div 6 = 8$	80
$3,000 \div 50$	$30 \div 5 = 6$	60
$81,000 \div 90$	$81 \div 9 = 9$	900

E Example 1

Find $5,600 \div 70$.

Cross out one zero in each number: $560 \div 7$. Since $56 \div 7 = 8$, we get $560 \div 7 = 80$.

Check: $70 \times 80 = 5,600$. The quotient is 80.

2. Estimating quotients

Before you divide, make a quick guess. An estimate tells you how big the answer should be, so you can catch a slip later. To estimate, replace the dividend with a nearby number that your divisor goes into easily. These are called **compatible numbers**.

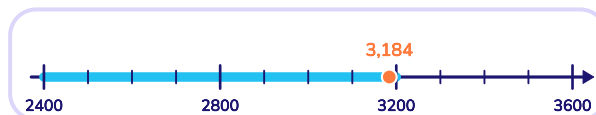
M**How to estimate a quotient**

1. Look at the divisor and think of its multiples.
2. Round the dividend to a nearby compatible number.
3. Divide the compatible numbers using basic facts.

E**Example 2**

Estimate $3,184 \div 8$.

We know $8 \times 4 = 32$, so **3,200** is compatible with 8. Then $3,200 \div 8 = 400$. The quotient of $3,184 \div 8$ is a little less than 400. The number line shows that 3,184 sits just below $8 \times 400 = 3,200$.

**!****Zyro's tip**

On my planet we say: guess first, calculate second. If my exact answer is far from my estimate, I look for a missing zero!

Estimating also helps you place the first digit of a quotient. If you estimate that $3,184 \div 8$ is about 400, you know the exact answer has three digits, with a 3 in the hundreds place. When your exact quotient has a different number of digits from your estimate, stop and look for a slip, such as a forgotten placeholder zero.

3. The partial quotients method

With **partial quotients** you take the divisor out of the dividend in friendly chunks, such as 100 groups, then 50 groups, and so on. Each chunk is easy to multiply. At the end you add the chunks.

M

Partial quotients, step by step

1. Pick a friendly multiple of the divisor that fits into the dividend.
2. Subtract it and write down how many groups you used.
3. Repeat with what is left until nothing (or less than the divisor) remains.
4. Add all the partial quotients.

E

Example 3

Find $936 \div 6$.

$$6 \times 100 = 600, \text{ and } 936 - 600 = 336.$$

$$6 \times 50 = 300, \text{ and } 336 - 300 = 36.$$

$$6 \times 6 = 36, \text{ and } 36 - 36 = 0.$$

Add the partial quotients: $100 + 50 + 6 = 156$. Check: $6 \times 156 = 936$. The quotient is **156**.

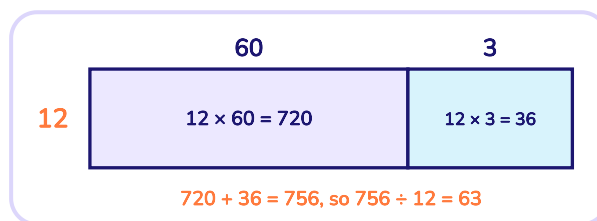
4. The area model for division

Multiplication can be pictured as the area of a rectangle: length $\times$ width. Division works backward. You know the area (the dividend) and one side (the divisor), and you look for the missing side (the quotient). You build that missing side in pieces.

E**Example 4**

Find $756 \div 12$ with an area model.

Start with the biggest friendly piece. $12 \times 60 = 720$ fits in 756, and $756 - 720 = 36$ is left. Since $12 \times 3 = 36$, the last piece is 3. The missing side is $60 + 3 = 63$.



The area model is the same idea as partial quotients, only drawn as a picture. The sizes of the columns in the drawing are not to scale, but the numbers are exact.

5. Long division with 1-digit divisors

Long division is a short, tidy version of partial quotients. You work one place value at a time, from left to right.

M**Divide, multiply, subtract, bring down**

1. **Divide** the first digits that are large enough: how many times does the divisor fit?
2. **Multiply** the digit you found by the divisor.
3. **Subtract** to find what is left.
4. **Bring down** the next digit and repeat.

E

Example 5

Find $2,184 \div 6$.

2 is less than 6, so start with 21: $21 \div 6 = 3$, and $3 \times 6 = 18$, so $21 - 18 = 3$. Bring down 8 to make 38: $38 \div 6 = 6$, and $6 \times 6 = 36$, so $38 - 36 = 2$. Bring down 4 to make 24: $24 \div 6 = 4$, and $4 \times 6 = 24$, so nothing is left. The quotient is **364**.

$$\begin{array}{r}
 \overline{364} \\
 6 \overline{) 2184} \\
 \underline{18} \\
 38 \\
 \underline{36} \\
 24 \\
 \underline{24} \\
 0
 \end{array}$$



Watch the zeros

If a number you bring down is too small to divide, write a 0 in the quotient. For example, $4,218 \div 7$: after 42 you bring down 1, and 1 is less than 7, so the quotient has a 0 in the tens place.

6. Long division with 2-digit divisors

The steps are the same; the only new challenge is guessing each digit of the quotient. Use your estimation skills: to divide by 35, think of how many times 30 or 40 fits.

E**Example 6**Find $4,725 \div 35$.

The first two digits, 47, are big enough to divide by 35: $47 \div 35 = 1$, and $47 - 35 = 12$. Bring down 2 to make 122: $35 \times 3 = 105$ and $122 - 105 = 17$. Bring down 5 to make 175: $35 \times 5 = 175$, so nothing is left. The quotient is **135**.

$$\begin{array}{r}
 135 \\
 35 \overline{) 4725} \\
 \underline{35} \\
 122 \\
 \underline{105} \\
 175 \\
 \underline{175} \\
 0
 \end{array}$$

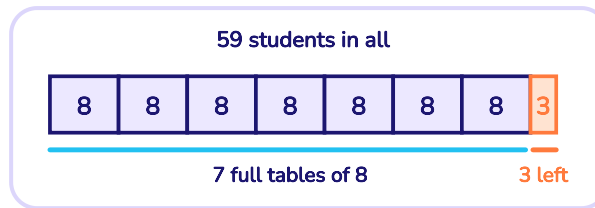
!**Too big or too small?**

If the product is bigger than the number you are dividing, your digit is too big: lower it by 1. If the remainder is as big as the divisor or bigger, your digit is too small: raise it by 1.

7. Interpreting remainders

When a division does not come out even, you get a remainder. We write it as $59 \div 8 = 7 \text{ R } 3$, which means $8 \times 7 + 3 = 59$. The remainder is always smaller than the divisor. What you do

with the remainder depends on the question.



P

Three ways to use a remainder

- **Ignore it** when you only want full groups: how many full tables? 7.
- **Round the quotient up** when every item needs a place: how many tables are needed for all 59 students? 8.
- **Keep it as the leftover** when the question asks what is left: 3 students sit at the last table.

E

Example 7

A bakery has 275 rolls and puts 12 in each bag. $275 \div 12 = 22 \text{ R } 11$, because $12 \times 22 = 264$ and $275 - 264 = 11$. The bakery fills **22 full bags** and has **11 rolls** left over.

8. Division word problems

To solve a word problem, read it twice, decide whether the numbers are being shared equally or put into groups, estimate, calculate, and finally answer with a full sentence and the unit.

E**Example 8**

A school buys 1,872 markers in packs of 24. How many packs is that?

Estimate: $1,800 \div 24$ is about 75. Now divide: $24 \times 70 = 1,680$,

$1,872 - 1,680 = 192$, and $24 \times 8 = 192$. So $70 + 8 = 78$. Check: $24 \times 78 = 1,872$.

The school buys **78 packs**, and 78 is close to the estimate of 75.

**Common mistakes**

Do not forget the zero placeholders in the quotient. Do not leave a remainder that is as big as the divisor. Always check with multiplication:

divisor $\times$ quotient + remainder = dividend.

Key takeaways

- Dividing by a multiple of 10: use a basic fact, then cross out the same number of zeros from both numbers.
- Estimate with compatible numbers before you calculate, and compare the exact answer with the estimate.
- Partial quotients and the area model split the dividend into friendly chunks and add the pieces of the quotient.
- Long division repeats: divide, multiply, subtract, bring down.
- The remainder is less than the divisor; the question decides whether to ignore it, round up, or report it.
- Check: **divisor $\times$ quotient + remainder = dividend.**



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