DIVISION WITH REMAINDERS

Division with a remainder is a way of dividing when you don't have enough to make equal groups. It's like sharing things, and sometimes there's a little bit left over.

A DIVISION WITHOUT REMAINDERS

Definition **Division**

Division is

- **splitting** a total into equal groups:

$$\text{total} \div \text{number of groups} = \text{number in each group}$$

- **regrouping** a total into groups of equal size:

$$\text{total} \div \text{number in each group} = \text{number of groups}$$

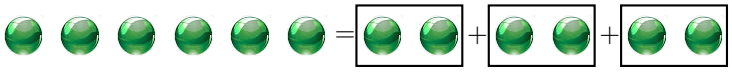
Division is the opposite of multiplication:

$$\text{total} = \text{number of groups} \times \text{number in each group}$$

Ex: Hugo has 6 marbles and he puts them into 3 equal groups.

How many marbles are in each group?

Answer:



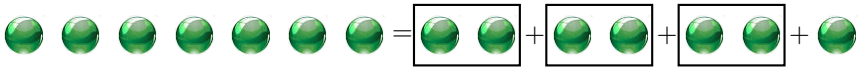
Because $6 = 3 \times 2$, then $6 \div 3 = 2$.
There are 2 marbles in each group.

B DIVISION WITH REMAINDERS

Discover: Let's look at our marble example again. Now, Hugo has 7 marbles and wants to make 3 equal groups.

How many marbles are in each group? And how many are left over?

Answer:



There are 2 marbles in each group and 1 left over; this is called the remainder. We write

$$7 \div 3 = 2\text{R}1$$

We can also write it as a multiplication plus the remainder:

$$7 = 3 \times 2 + 1$$

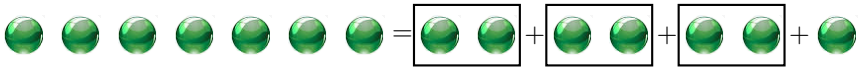
Definition **Division with remainder**

When you divide one number by another, sometimes there is something left over. The number that's left over is called the **remainder**.

$$7 \div 3 = 2\text{R}1$$

We can also write it as a multiplication plus the remainder:

$$7 = 3 \times 2 + 1$$



C LONG DIVISION

Discover:

- To divide 12 by 4, we write $12 \div 4 = \square$. Here's how to solve it:
  1. Think of the multiplication problem: $4 \times \square = 12$
  2. Find how many times 4 fits into 12: $4 \times 1 = 44 \times 2 = 84 \times 3 = 124 \times 4 = 164 \times 5 = 204 \times 6 = 244 \times 7 = 284 \times 8 = 324 \times 9 = 364 \times 10 = 40$, You can see that $4 \times 3 = 12$
  3. Answer: $12 \div 4 = 3$
- To divide with a remainder, like $13 \div 4 = \square\text{R}\square$, we do something similar:
  1. Think of the multiplication problem: $4 \times \square$
  2. Find how many times 4 fits into 13: $4 \times 1 = 44 \times 2 = 84 \times 3 = 124 \times 4 = 164 \times 5 = 204 \times 6 = 244 \times 7 = 284 \times 8 = 324 \times 9 = 364 \times 10 = 40$, find the multiplication that gives an answer close to 13, but not bigger.
     - $4 \times 3 = \boxed{12}$ is less than 13
     - $4 \times 4 = \cancel{16}$ is bigger than 13
  3. Calculate the difference: $13 - 4 \times 3 = 1$ which is the remainder.
  4. Answer: $13 \div 4 = 3\text{R}1$

Method **Column Division 1 Step**

To divide with a remainder, like $13 \div 4 = \square\text{R}\square$, follow these steps:

- $4\overline{)13}$ Set up the division problem
- $\begin{array}{r} 3 \\ 4\overline{)\,13} \\ -12 \end{array}$ How many times does 4 fit into 13? We know that: $4 \times 3 = \boxed{12}$ which is less than or equal to 13, $4 \times 4 = \cancel{16}$ which is bigger than 13

  Write 3 above the line and the product 12 under the 13
- $\begin{array}{r} 3 \\ 4\overline{)\,13} \\ \underline{12} \\ 1 \end{array}$ Subtract $13 - 12 = 1$
- $13 \div 4 = 3\text{R}1$ and $13 = 4 \times 3 + 1$

Method **Column Division 2 Steps**

For the division with a remainder of $130 \div 4 = \square\text{R}\square$, follow these steps:

1. $4\overline{)130}$ Set up the division problem
2. $\begin{array}{r} 3 \\ 4\overline{)\,130} \\ -12 \end{array}$ How many times does 4 fit into 13? We know that: $4 \times 2 = 8$, $4 \times 3 = \boxed{12} \leqslant 13$, $4 \times 4 = \cancel{16} > 13$
3. $\begin{array}{r} 3 \\ 4\overline{)\,130} \\ -\underline{12}\downarrow \\ 10 \end{array}$ Subtract $13 - 12 = 1$ and bring down the next digit

4. $\begin{array}{r} 32 \\ 4\overline{)\,130} \\ \text{-}\underline{12}\downarrow \\ 10 \\ \text{-}\underline{8} \\ \end{array}$ How many times does 4 fit into 10? We know that: $4 \times 1 = 4$, $4 \times 2 = \boxed{8} \leqslant 10$, $4 \times 3 = \cancel{12} > 10$

5. $\begin{array}{r} 32 \\ 4\overline{)\,130} \\ \text{-}\underline{12}\downarrow \\ 10 \\ \text{-}\underline{8} \\ 2 \end{array}$ Subtract: $10 - 8 = 2$

6. $130 \div 4 = 32\text{R}2$

D TWO WAYS TO THINK ABOUT DIVISION

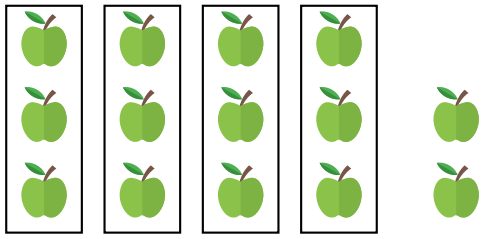
Method **Finding number in each group and remainder**

If we know the total quantity and the number of groups, division tells us how many are in each group and how many are left over:

$$\text{total} \div \text{number of groups} = \text{number in each group}\text{R}\text{leftovers}$$

$$\text{total} = \text{number of groups} \times \text{number in each group} + \text{leftovers}$$

For example, we have 14 apples and we share them equally among 4 friends.



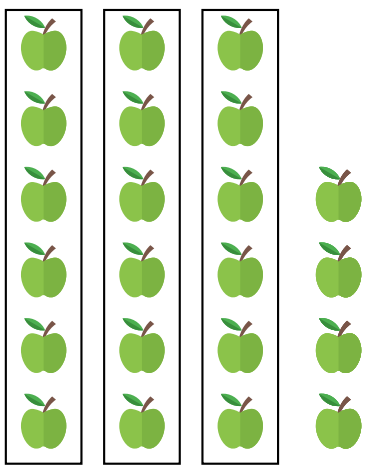
Because $14 = 4 \times 3 + 2$, we have $14 \div 4 = 3\text{R}2$.
Each friend gets 3 apples.
There are 2 apples left over.

Method **Finding number of groups and remainder**

If we know the total quantity and the number in each group, division tells us how many groups we can make and how many are left over:

$$\text{total} \div \text{number in each group} = \text{number of groups}\text{R}\text{leftovers}$$

For example, we have 22 apples and we pack them in boxes such that each box contains 6 apples.



Because $22 = 3 \times 6 + 4$, we have $22 \div 6 = 3\text{R}4$.

We pack 3 boxes.
There are 4 apples left over.