MULTIPLICATION

In math, we are always looking for faster ways to solve problems. Think about when you add the same number over and over again. This is called repeated addition. Multiplication is a powerful shortcut for repeated addition!

A WHAT IS MULTIPLICATION?

Definition Multiplication

Multiplication is a fast way to show repeated addition. We can show the idea of "**four** times **three** equals **twelve**" in many different ways:

- **With Numbers**:

$$4 \times 3 = 12$$

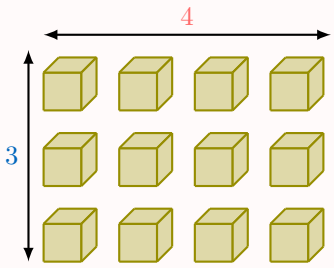
- **In Groups**:

$$4 \text{ groups of } 3 = 12$$

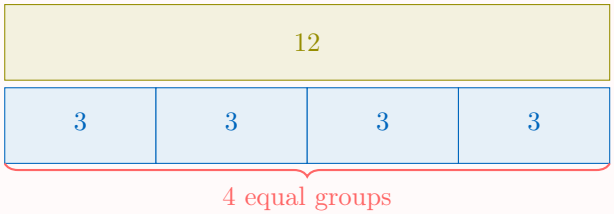
- **As Repeated Addition**:

$$3 + 3 + 3 + 3 = 12$$

- **With Cubes**:



- **With a Part-Whole Model**:



Ex: Write the repeated addition $5 + 5 + 5$ as a multiplication.

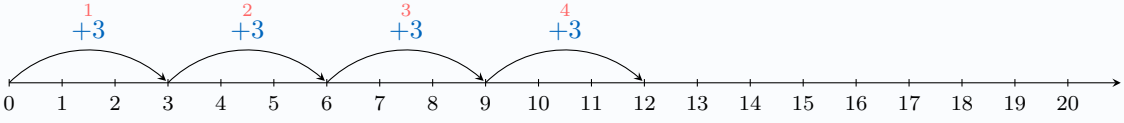
Answer: We are adding the number 5, and we are adding it 3 times. So, the multiplication is:

$$3 \times 5$$

B ON THE NUMBER LINE

Method Multiplication on the Number Line

We can show multiplication as "jumps" on a number line. To show 4×3, we can start at 0 and make 4 jumps of size 3.



Each jump represents adding 3. After 4 jumps, we land on 12. So, $4 \times 3 = 12$.

C MULTIPLICATION IN WORD PROBLEMS

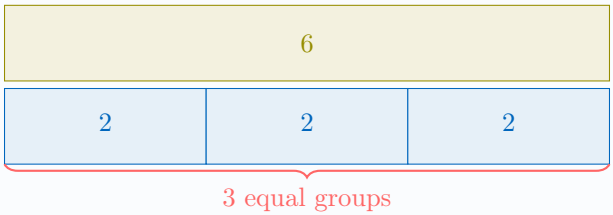
Method Finding the Total with Groups

In word problems, we can find the total by multiplying the number of groups by the number of items in each group.

$$\text{Number of groups} \times \text{Number in each group} = \text{Total}$$

For example, if there are 3 bags and each bag has 2 apples, the total number of apples is:

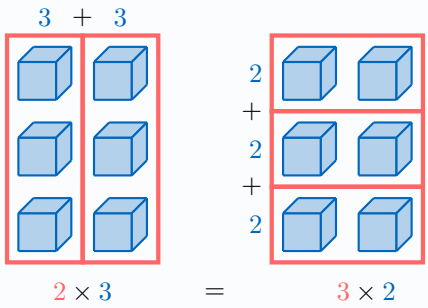
$$3 \times 2 = 6$$



D DOES THE ORDER MATTER?

Proposition Commutative Property

In multiplication, changing the order of the numbers does not change the result.

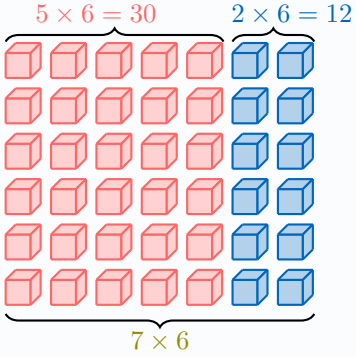


E DECOMPOSE WITH ADDITION

Method The "Break Apart" Strategy

This powerful strategy is called the **distributive property**. It means you can "break apart" a difficult multiplication into two easier ones, and then add the results.
For example, to solve 7×6, we can break the 7 into a 5 and a 2:

$$\begin{aligned} \text{Total for 7 groups} &= (\text{Total for 5 groups}) + (\text{Total for 2 groups}) \\ 7 \times 6 &= (5 \times 6) + (2 \times 6) \\ &= 30 + 12 \\ &= 42 \end{aligned}$$



F DECOMPOSE WITH SUBTRACTION

Method Using Subtraction to Break Apart

This is another way to use the distributive property. It's very useful when multiplying by numbers that are close to a multiple of ten (like 8, 9, 18, or 19).To solve 9×8, you can think of 9 as $(10 - 1)$:

$$\begin{aligned} \text{Total for 9 groups} &= (\text{Total for 10 groups}) - (\text{Total for 1 group}) \\ 9 \times 8 &= (10 \times 8) - (1 \times 8) \\ &= 80 - 8 \\ &= 72 \end{aligned}$$