I - Generalities, definitions

Definition 1 :
Two quantities are said to be in **a proportional relationship** (or **directly proportional**) if one is obtained by multiplying the other by a constant number.

Definition 2 :
This number is called the **constant of proportionality**.

Example 1 :
If a car travels at a constant speed of 60 km/h, the distance traveled is proportional to the time : in 1 hour the car travels 60 km, in 2 hours 120 km, in 3 hours 180 km etc.

Here, the constant of proportionality is 60.

Key Vocab :
Proportional relationship : Relation proportionnelle.
Constant of proportionality : Coefficient de proportionnalité.

II - Table of Proportionality

Definition 1 :
A table represents a proportional situation if the ratio between the corresponding values in each column is equal.

Property 1 :
The given ratio is the **constant of proportionality**.

Example 1 :

Quantity (kg)	1	3	5
Price (£)	3	9	15

Here, the situation is proportional because:

$$\frac{3}{1} = \frac{9}{3} = \frac{15}{5} = 3$$

The constant of proportionality is 3.

Key Vocab :
Table of proportionality : Tableau de proportionnalité.
Rows : Lignes.
Columns : Colonnes.
Constant of proportionality : Coefficient de proportionnalité.

III - Cross-Multiplication

Property 1 :
In a table of proportionality we have the following result :

Quantity A	a_1	a_2
Quantity B	b_1	b_2

$$a_1 \times b_2 = b_1 \times a_2$$

This is called the **cross product method** (or **cross-multiplication**).

Method 1 : (Filling a table using the cross product method)
Here is a partially filled table, fill it with the right numbers using the cross product propriety :

Quantity A	7	a	11
Quantity B	84	252	b

Firstly we have :

$$7 \times 252 = 84 \times a$$

So :

$$a = \frac{7 \times 252}{84} = 21$$

Then we have :

$$a \times b = 252 \times 11$$

$a = 21$, so :

$$b = \frac{252 \times 11}{21} = 132$$

Key Vocab :
Table of proportionality : Tableau de proportionnalité.
Cross product method : Méthode du produit en croix.

IV - Solving a Proportionality Problem

Method 2:

1. Identify the two quantities ;
2. create and fill a table of proportionality using the quantities identified ;
3. check that the situation is proportional ;
4. find the constant of proportionality and/or use cross-multiplication ;
5. interpret the result with a well written english sentence.

Final Example :

Instructions: Read the problem. Complete the table. Find the constant of proportionality and the missing values. Then write a full sentence to interpret the result.

Problem: In a specialized shop 3 notebooks cost 6€. How much do 5 notebooks cost?

Table of proportionality (to complete):

Quantity (notebooks)	3	5
Price (€)	6	?

Resolution:

- We identify the two quantities: quantity of notebooks and price.
- We check proportionality: the situation is proportional.
- We find the coefficient of proportionality:

  $$6 \div 3 = 2$$

  So the coefficient is 2 euros per notebook.
- We calculate the missing value:

  $$5 \times 2 = 10$$

Completed table:

Quantity (notebooks)	3	5
Price (€)	6	10

Conclusion (full English sentence):
Five notebooks cost 10 euros.