

Counting Principles

Mathematics

When to multiply and when to add, and the two questions that decide.

Multiply for choices made one after another. Add for choices that are mutually exclusive alternatives.

Product: $n_1 \times n_2 \times \dots \times n_k$ · Sum: $n_1 + n_2$

3 shirts, 4 ties

The product rule.

12 outfits

A 4-digit PIN

Repetition allowed.

$10^4 = 10000$

Ordering 5 books

No repetition.

$5! = 120$

THE COMMON MISTAKE

✗ **Adding when the choices are made in sequence**

✓ **Multiplying for choices made in sequence**

Add only when the options are alternatives you choose between. Multiply when you make one choice and then a further one.

Ask two questions before anything else: does the order matter, and may items repeat? Those two answers pick the formula.