

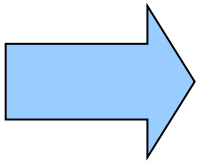
Mathematics and Associated
Teaching Methods I

INTEGER NUMBERS (INTEGERS)

Degree in Primary Education Teaching

Introduction

- Integers do not appear to deal with daily necessities as the natural numbers. To count?
- They have no real existence. What do they measure?



Why do integers appear?

Contexts in which they appear

1. **States** in which negative values have sense: temperatures, floors, years, bank accounts, football, golf,...
2. **Variations** of those states: positive (increase) or negative (decrease) variation of a state with respect a previous one.
3. **Mathematical extension**: to make possible the subtraction between each pair of numbers.

Graphical representation of the integers

1. Stairway.

- Both the states and the variations can be represented.
- It is useful to work with the order: the greatest number is the topmost one.

2. Number line.

- The states are represented with spots.
- The variations are represented with arrows (vectors) in a certain (positive or negative) direction and with a certain associated magnitude (variation units).

Operations with integers

- **Addition:**
 - First state + variation = final state.
 - Variation 1 + variation 2 = total variation.
- **Subtraction:**
 - The idea of “taking away” used with natural numbers is not entirely valid.
 - Mathematical definition from the addition.
 - It arises (in any of the two previous approaches) whenever any of the addends is unknown.

- From an operative point of view:

- To **sum** two numbers having the same sign, the two numbers are added and the sign is kept. If they have different sign, the numbers are subtracted (the greatest minus the smaller) and the sign of the greatest one is kept.
- The **difference** is transformed in a sum in which the sign of the subtrahend is changed, and later the same rules considered for the addition are applied.

Multiplication and division

- The ideas of “repeated addition” or “distribution” applied in the case of natural numbers are not valid in this case.
- **From an operative point of view:**
 - To multiply (or divide) two numbers with the same sign, they are multiplied (or divided) and the sign + is placed before. If they have different signs, they are multiplied (or divided) and the sign – is placed before.
 - **Signs rule:**

$+ \times + = +$	$+ \times - = -$	$- \times + = -$	$- \times - = +$
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Operations with integers

- **Powers:**

- For natural numbers:

$$a^n = a \times a \times a \dots \times a$$

- For negative numbers:

$$(-a)^n = \begin{cases} a^n, & \text{if } n \text{ is even} \\ -a^n, & \text{if } n \text{ is odd} \end{cases}$$