# Pure mathematics

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## Contents

# 1 Number theory

The number theory is primarily devoted to the study of the integers and integer-valued functions.

## 1.1 Arithmetic

### 1.1.1 Operations

- Addition: $1 + 2 = 3$
- Subtraction: $3 - 2 = 1$
- Multiplication: $3 \times 2 = 6$
- Division: $6 \div 3 = 2$

### 1.1.2 Fundamental theorem of arithmetic<br>Prime factorization theorem

Every integer greater than 1 can be represented **uniquely** as a **product of prime numbers**, up to the order of the factors.

$$n = p_1^{n_1} p_2^{n_2} \dots p_k^{n_k} = \prod_{i=1}^{k} p_i^{n_i}$$

## 1.2 Sum of natural numbers

To get to this formula just right down a few examples and find out the pattern.

$$1 = 1 = \frac{1 * 2}{2}$$

$$3 = 1 + 2 = \frac{2 * 3}{2}$$

$$6 = 1 + 2 + 3 = \frac{3 * 4}{2}$$

$$S = \sum_{a=1}^{n} a = 1 + 2 + \ldots + n = \frac{n(n+1)}{2}$$