WORKBOOK

Subject: **Mathematics**

Student: ....

School year: ..../...........

Topic: **Numbers**

Names of numbers

English has special names for the some of the numbers in the decimal number system that are 'powers of ten'.

- 1 - One
- 10 - Ten
- 100 - One Hundred
- 1000 - One Thousand
- 1 000 000 - One Million

When dealing with larger numbers than this there are two different ways of naming the numbers in English. Under the 'long scale' a new name is given every time the number is a million times larger than the last named number. It is also called the 'British Standard'. This scale used to be common in Britain but is not often used in English speaking countries today. It is still used in some other European nations. Another scale is the 'short scale' under which a new name is given every time a number is a thousand times larger than the last named number. This scale is a lot more common in most English speaking nations today.

evropský sociální fond v ČR EVROPSKÁ UNIE MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY OP Vzdělávání pro konkurenceschopnost Jihomoravský kraj

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

- 1 000 000 000 - One Billion (Short Scale), One Milliard (Long Scale).
- 1 000 000 000 000 - One Trillion (Short Scale), One Billion (Long Scale)
- 1 000 000 000 000 000 - One Quadrillion (Short Scale), One Billiard (Long Scale)

Types of numbers

Natural numbers

The most familiar numbers are the **natural numbers** or counting numbers: one, two, three, ... In the base ten number system, in almost universal use today for arithmetic operations, the symbols for natural numbers are written using ten digits: 1, 2, 3, 4, 5, 6, 7, 8, and 9.

The symbol for the set of all natural numbers is **N**, also written $\mathbb{N}$.

	addition	multiplication
closure:	$a + b$ is a natural number	$a \times b$ is a natural number
associativity:	$a + (b + c) = (a + b) + c$	$a \times (b \times c) = (a \times b) \times c$
commutativity:	$a + b = b + a$	$a \times b = b \times a$
existence of an identity element:		$a \times 1 = a$
distributivity:	$a \times (b + c) = (a \times b) + (a \times c)$	
No zero divisors:		if $ab = 0$, then either $a = 0$ or $b = 0$ (or both)

Integers

Negative numbers are numbers that are less than zero. They are the opposite of positive numbers. For example, if a positive number indicates a bank deposit, then a negative number indicates a withdrawal of the same amount. Negative numbers are usually written by writing a negative sign (also called a minus sign) in front of the number they are the opposite of. Thus the opposite of 7 is written −7. When the set of negative numbers is combined with the natural numbers and zero, the result is the set of integer numbers, also called **integers**, **Z** (German *Zahl*, plural *Zahlen*), also written $\mathbb{Z}$.

The following lists some of the basic properties of addition and multiplication for any integers *a*, *b* and *c*.

	addition	multiplication
closure	$a + b$ is an integer	$a \times b$ is an integer
associativity:	$a + (b + c) = (a + b) + c$	$a \times (b \times c) = (a \times b) \times c$
commutativity:	$a + b = b + a$	$a \times b = b \times a$
existence of an identity element:	$a + 0 = a$	$a \times 1 = a$
existence of inverse elements:	$a + (-a) = 0$	
distributivity:	$a \times (b + c) = (a \times b) + (a \times c)$	

Rational number

A **rational number** is a number which can be expressed as a ratio of two integers:

$\frac{a}{b}$, where b is not zero.

Each rational number can be written in infinitely many forms, such as

$\frac{3}{6} = \frac{2}{4} = \frac{1}{2}$,

- in simplest form when a and b have no common divisors except

The decimal expansion of a rational number is eventually periodic

The set of all rational numbers, which constitutes a field, is denoted $\mathbb{Q}$. is defined as

$$\mathbb{Q} = \{\frac{a}{b} : a \in \mathbb{Z}, b \in \mathbb{N}^{+}\}$$

where $\mathbb{Z}$ denotes the set of integers.