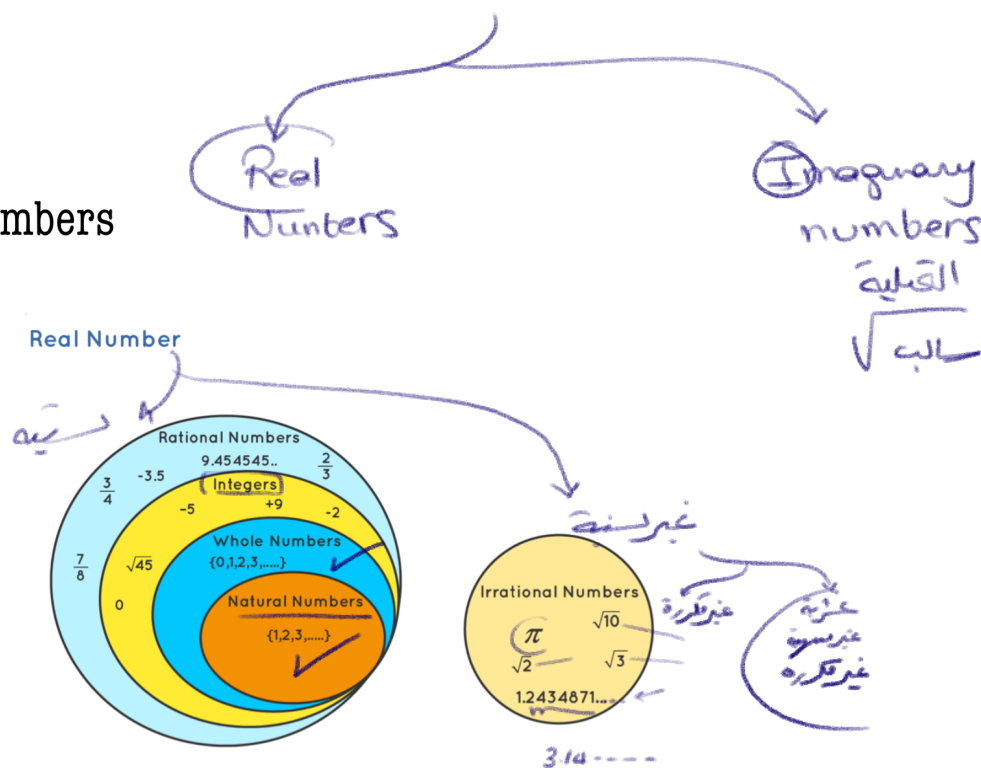


P.2 REAL NUMBERS

- ✓ Real numbers
- ✓ Properties of real numbers
 - Addition and Subtraction
 - Multiplication and division
 - The real line
 - Sets and Interval
 - Absolute value and distance

- Real numbers



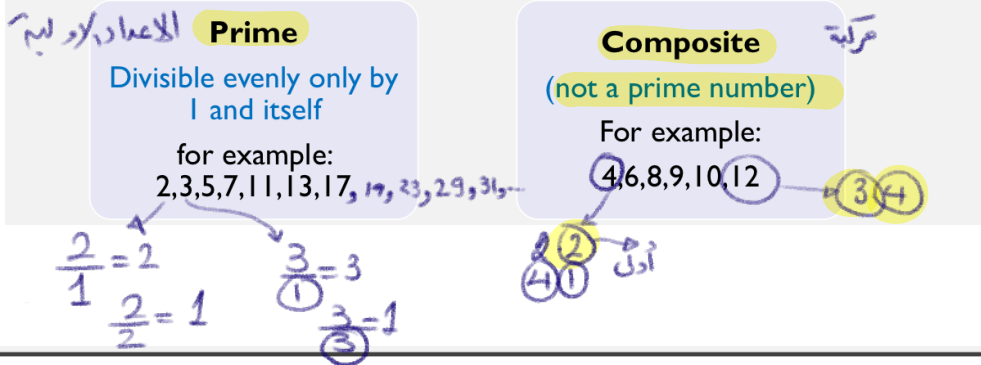
NATURAL NUMBERS

The numbers that we use to count things, such as the number of books in a library .

Natural Numbers $N = \{1, 2, 3, 4, 5, 6, 7, \dots \dots \dots\}$

Natural Numbers greater than one

2,3,4,5,6,7,8,9.....



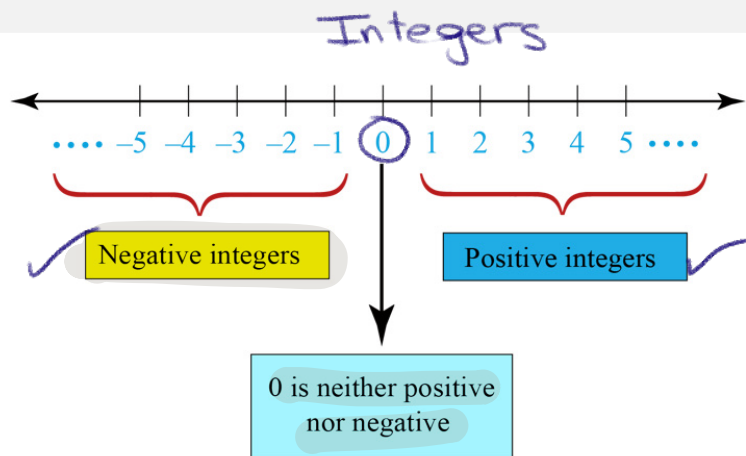
WHOLE NUMBERS

The Whole numbers include zero and the natural numbers.

W = {0, 1, 2, 3, 4, 5, 6,}

We also need numbers to measure temperature below zero or, in accounting, when a company incurs a loss.

Integers included negative integers, zero and positive integers (natural numbers).



$$\text{Integers} = Z = \{ \dots \dots \dots, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, \dots \dots \dots \}$$

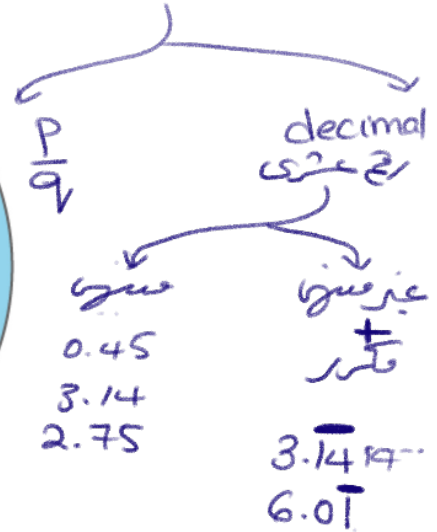
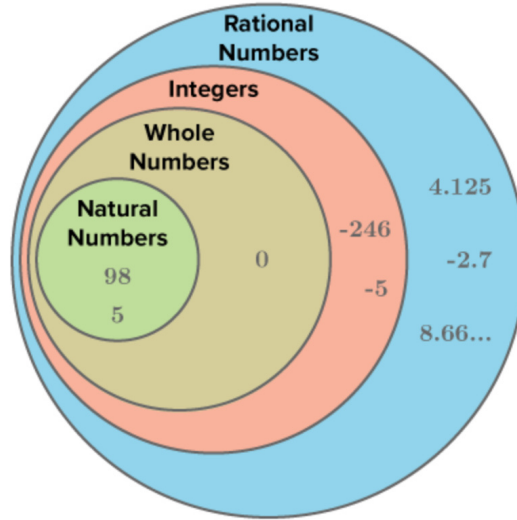
Why we call it Z?

Zahlen

Z
W
Z

RATIONAL NUMBERS

الأعداد النسبية



Rational Numbers = $\left\{ \frac{p}{q}, \text{ where } p \text{ and } q \text{ are integers and } q \neq 0 \right\}$

Examples:

$$\frac{3}{4}, -\frac{5}{9}, \frac{8}{1} \text{ and } \frac{2}{7}$$

A rational number written as a fraction can be written as a decimal by dividing the numerator by the denominator. The result is either a

terminating decimal such as $0.45 = \frac{9}{20}$ or a repeating decimal such

as $\frac{12}{55} = 0.218181818... = 0.2\overline{18}$

مكرر + غير منتهى

IRRATIONAL NUMBERS

Numbers that are not rational numbers are called irrational numbers. In decimal form, an irrational number has a decimal representation that never terminates nor repeats.

Examples:

$$\pi = 3.145926 \dots\dots$$

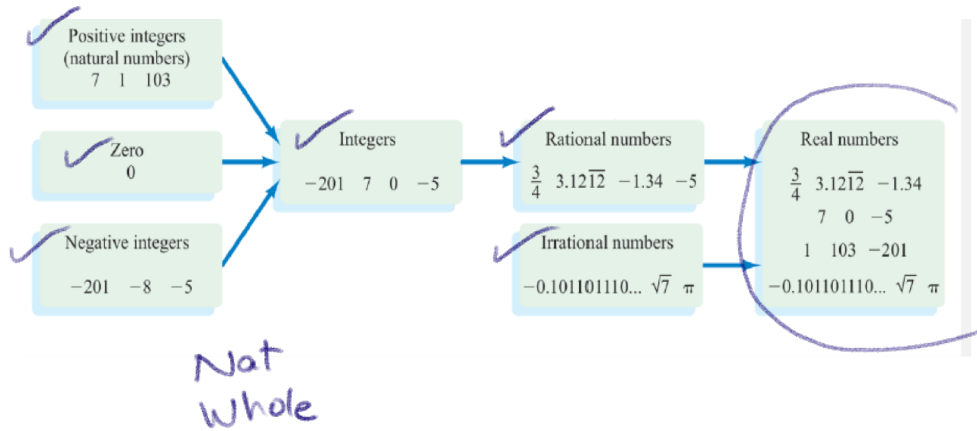
$$\sqrt{11} = 3.316 \dots\dots$$

$$2.13113111311113 \dots\dots$$

غير متكررة + غير منتهية

There are several famous irrational numbers. These include,

π	Greek letter pi	3.141...	The ratio between the circumference and the diameter of a circle
ϕ	Greek letter phi	1.618...	The Golden Ratio
e	The number e	2.718...	Euler's Number e
$\sqrt{2}$	The square root of 2	1.414...	A surd



EXERCISE

Determine whether each number is an integer, a rational number, an irrational number, a prime number, or a real number. ✓

$\frac{5}{\sqrt{7}}$ $\frac{5}{7}$ $-2\frac{1}{2}$ 31 4.235653907493 51 π 0.888.....

عروضه
قله

Real Number $\frac{5}{\sqrt{7}}$ $\frac{5}{7}$ $-2\frac{1}{2}$ 31 4.235653907493 51 π 0.888.....

Rational Number $\frac{5}{7}$ و $-2\frac{1}{2}$ و 31 و 4.235653907493 و 51 و 0.888...

Irrational number $\frac{5}{\sqrt{7}}$ و π
 لیس اسیف ← $\sqrt{7}$

Integers: 31 و 51

Prime: 31

$$3.17 = 51$$

EXERCISE

Determine whether each number is an integer, a rational number, an irrational number, a prime number, or a real number.

$\frac{-1}{5}$	0 ✓	44 ✓	π
3.14	5.05005000500005	$\sqrt{81} = 9$	$\sqrt{3}$
$\sqrt{-3}$ Not real	52 ✓	$\frac{-27}{6}$	e
$2.\overline{76}$	-1	97	$-0.88888 \dots$
3.9745618	-44 ✓	2 ✓	$\frac{3}{4}$

Real: All sets excepts $\sqrt{-3}$

Rational: $-\frac{1}{5}$, 0, 44, 3.14, $\sqrt{81}$, $-\frac{27}{6}$, $2.\overline{76}$, -1, 97, $-0.888\dots$, -44, 2, $\frac{3}{4}$

Irrational: π , $5.05005000500005 \dots$ (غير نسبي), $\sqrt{3}$, e , $3.9745618 \dots$

Integers: 0, 44, 52, -44, 2

Prime: 2
 أكبر عدد ←

Which of the following numbers are prime numbers?

i. $39 \rightarrow 13 \times 3$ Not prime

ii. $53 \rightarrow$ Prime

iii. 102 \rightarrow Not prime

iv. 97 \rightarrow Prime.

9-10 ■ Real Numbers List the elements of the given set that are

- (a) natural numbers
- (b) integers
- (c) rational numbers
- (d) irrational numbers

✓ 9. $\{-1.5, 0, \frac{5}{2}, \sqrt{7}, 2.71, -\pi, 3.\overline{14}, 100, -8\}$

✓ 10. $\{1.3, 1.3333\dots, \sqrt{5}, 5.34, -500, 1\frac{2}{3}, \sqrt{16}, \frac{246}{579}, -\frac{20}{5}\}$

9//

a] Natural Numbers 100

b] Integers 0, 100, -8

c] Rational numbers $-1.5, 0, \frac{5}{2}, 2.71, 3.\overline{14}, \frac{100}{-8}$

d] Irrational $\sqrt{7}, -\pi$

10// a] Natural $\sqrt{16}$

b] Integers $\sqrt{16}, -\frac{20}{5}, -500$

c] Rational $1.3, 1.333\dots, 5.34, 1\frac{2}{3}, \frac{246}{579}, \frac{2}{5}$

d] Irrational $\sqrt{5}$