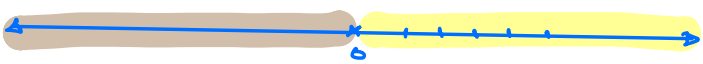
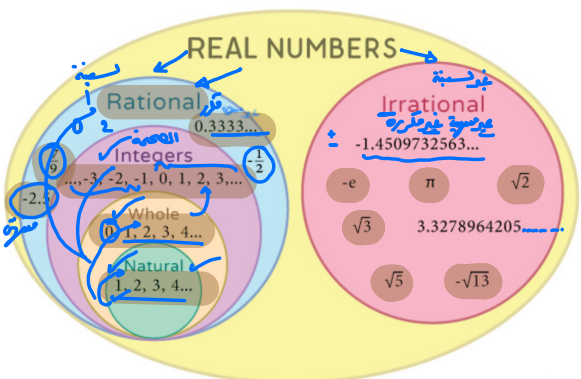
beIN Class
ONLINE CLASSES

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





Real Numbers Venn Diagram

Rational → مكررة غير مكررة

Irrational → غير مكررة غير مكررة

NATURAL NUMBERS

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

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

Natural Numbers greater than one

2,3,4,5,6,7,8,9……..

Prime

Divisible evenly only by 1 and itself

for example:

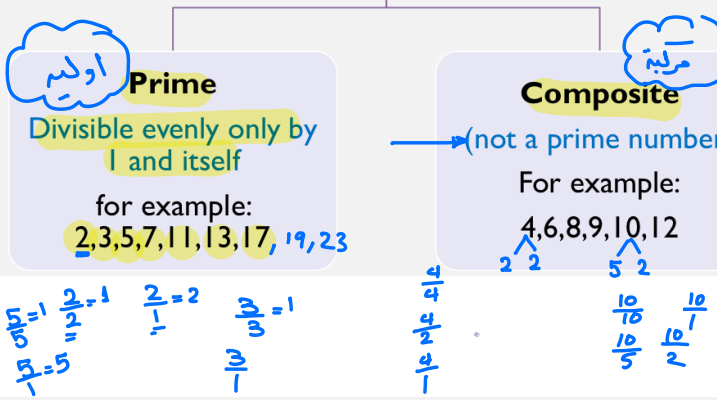
2,3,5,7,11,13,17, 19,23

Composite

(not a prime number)

For example:

4,6,8,9,10,12



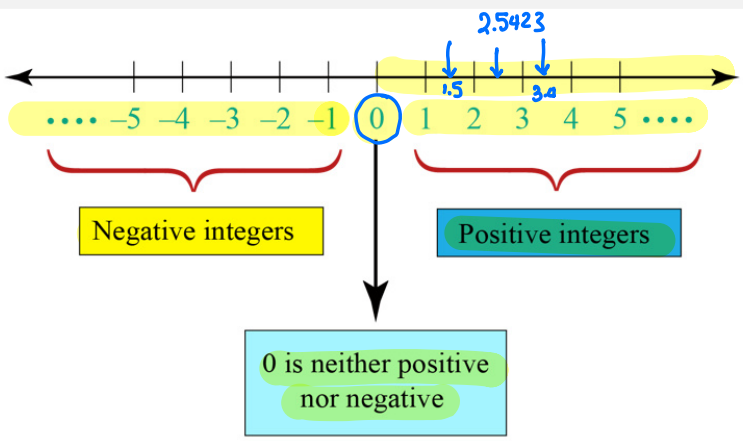
WHOLE NUMBERS

The Whole numbers include zero and the natural numbers.

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

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).

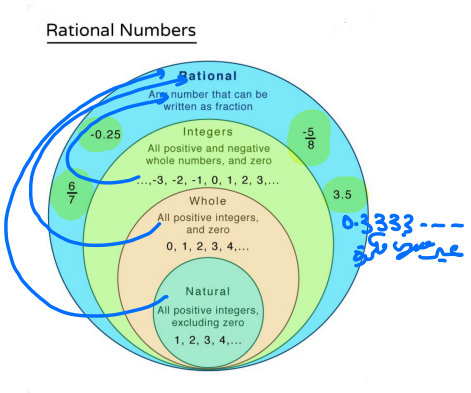


$$Integers = Z = \{\dots\dots\dots, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, \dots\dots\dots\}$$

Why we call it Z ?

Zahlen

RATIONAL NUMBERS



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

Examples:

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

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

IRRATIONAL NUMBERS

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

Examples:

$\pi = 3.145926 \ldots \ldots$

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

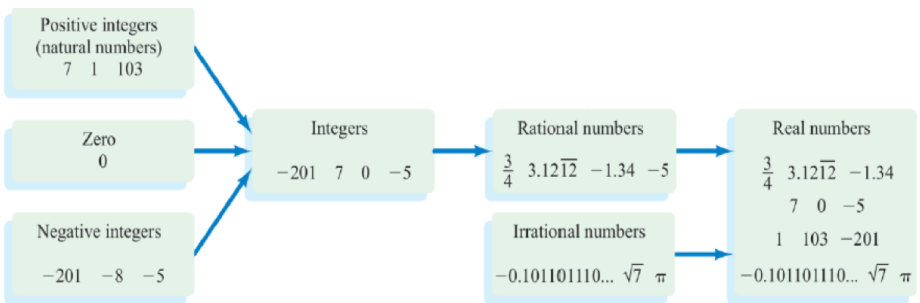
$2.13113111311113 \ldots \ldots$

There are several famous irrational numbers. These include,

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

عدد غير نسبي وغير مكرر

Irrational number


Positive integers
(natural numbers)
7 1 103
Zero
0
Negative integers
−201 −8 −5
Integers
−201 7 0 −5
Rational numbers
$\frac{3}{4}$ $3.12\overline{12}$ −1.34 −5
Irrational numbers
−0.101101110... $\sqrt{7}$ π
Real numbers
$\frac{3}{4}$ $3.12\overline{12}$ −1.34
7 0 −5
1 103 −201
−0.101101110... $\sqrt{7}$ π

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

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

مقدر عشري
3.14444 ...

9. $\{-1.5, 0, \frac{5}{2}, \sqrt{7}, 2.71, -\pi, 3.1\overline{4}, 100, -8\}$

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

9] Natural → 100

Integers → $\{-8, 0, 100\}$

Rational Numbers → $\{-1.5, 0, \frac{5}{2}, 2.71, 3.1\overline{4}, 100, -8\}$

IRRational = $\{\sqrt{7}, -\pi\}$
لانهاية

$\{\pi \quad e \quad \phi \quad \sqrt{\ } \quad \sqrt{\ } \quad \sqrt{\ }$ عشري غير مقدر $\}$ Irrational

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

(a) natural numbers $\sqrt{16}$

(b) integers $\sqrt{16}$ ، $-\frac{20}{5}$ ، -500

(c) rational numbers 1.3 ، $1.333\ldots$ ، 5.34 ، -500 ، $1\frac{2}{3}$ ، $\frac{246}{579}$ ، $-\frac{20}{5}$

(d) irrational numbers $\sqrt{5}$

Which of the following numbers are prime numbers?

2 3 5 7

composite

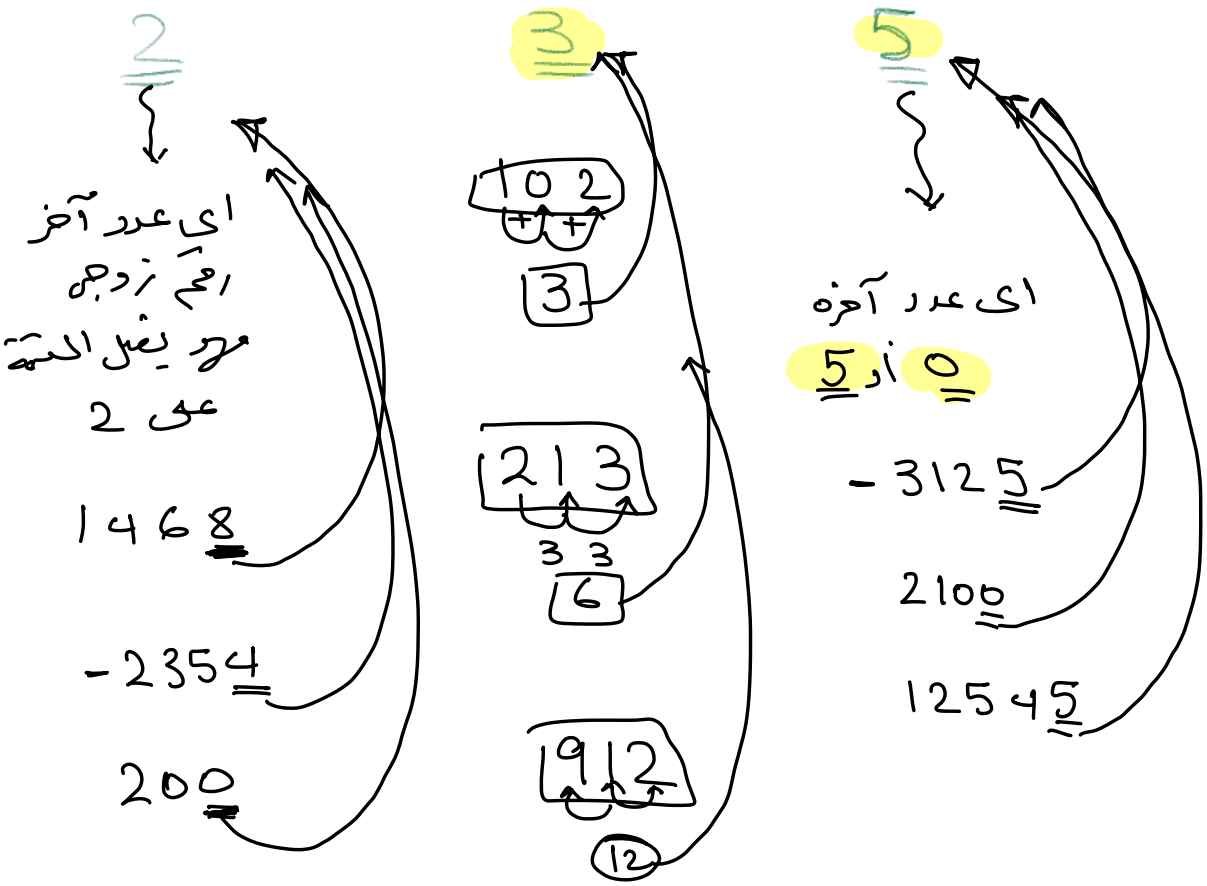
i. $\frac{39}{3}$ = 13 composite

ii. 53 → prime

iii. $\frac{102}{2}$ = 51 → composite

iv. 97 → prime

prime ← لا تعمل العمة



EXERCISE

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

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

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

Integer → 31, 51

Rational → $\frac{5}{7}$, $-2\frac{1}{2}$, 31, 4.235653907493, 51, 0.888----

Irrational $\frac{5}{\sqrt{7}}$, π

Prime → 31

EXERCISE

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

H.W

$\frac{-1}{5}$	0	44	π
3.14	5.05005000500005 … …	$\sqrt{81}$	$\sqrt{3}$
$\sqrt{-3}$	52	$\frac{-27}{6}$	e
$2.\overline{76}$	-1	97	-0.88888 ……
3.9745618 … ……	-44	2	$\frac{3}{4}$

Real Numbers → all numbers are real except $\sqrt{-3}$ → Imaginary

Integer → $0, 44, \sqrt{81}, 52, -1, 97, -44, 2$

Rational → $-\frac{1}{5}, 0, 44, 3.14, \sqrt{81}, 52, -\frac{27}{6}, 2.\overline{76}, -1$

$97, -0.8888\ldots, -44, 2, \frac{3}{4}$

Irrational → $\pi, 5.0500500050000\ldots, \sqrt{3}, e, 3.9745618\ldots$

Prime → $97, 2$

The rational numbers of the set

$\left\{-3,-\frac{7}{\sqrt{4}},-1,\frac{0}{3},\frac{\pi}{3},\sqrt{81},\frac{22}{7},1.7272272227\ldots,3.126126126\ldots,\sqrt{16},\sqrt{27}\right\}$ are given by:

a. $\left\{\frac{0}{3},\frac{22}{7}\right\}$

b. $\{-3,-1\}$

c. $\left\{-3,-\frac{7}{\sqrt{4}},-1,\frac{0}{3},\sqrt{81},\frac{22}{7},3.126126126\ldots,\sqrt{16}\right\}$

d. $\left\{\frac{\pi}{3},1.7272272227\ldots,3.126126126\ldots,\sqrt{27}\right\}$

How would 0.333333 be classified?

A. rational number

B. whole number

C. integer

D. irrational number

Which of the following is TRUE about the set $\{1,2,3,0,-1,-2,\frac{1}{3},\sqrt{16}\}$?

All elements are rational numbers.

Some elements are not real numbers.

All elements are integers.

Some elements are irrational numbers.

P.2