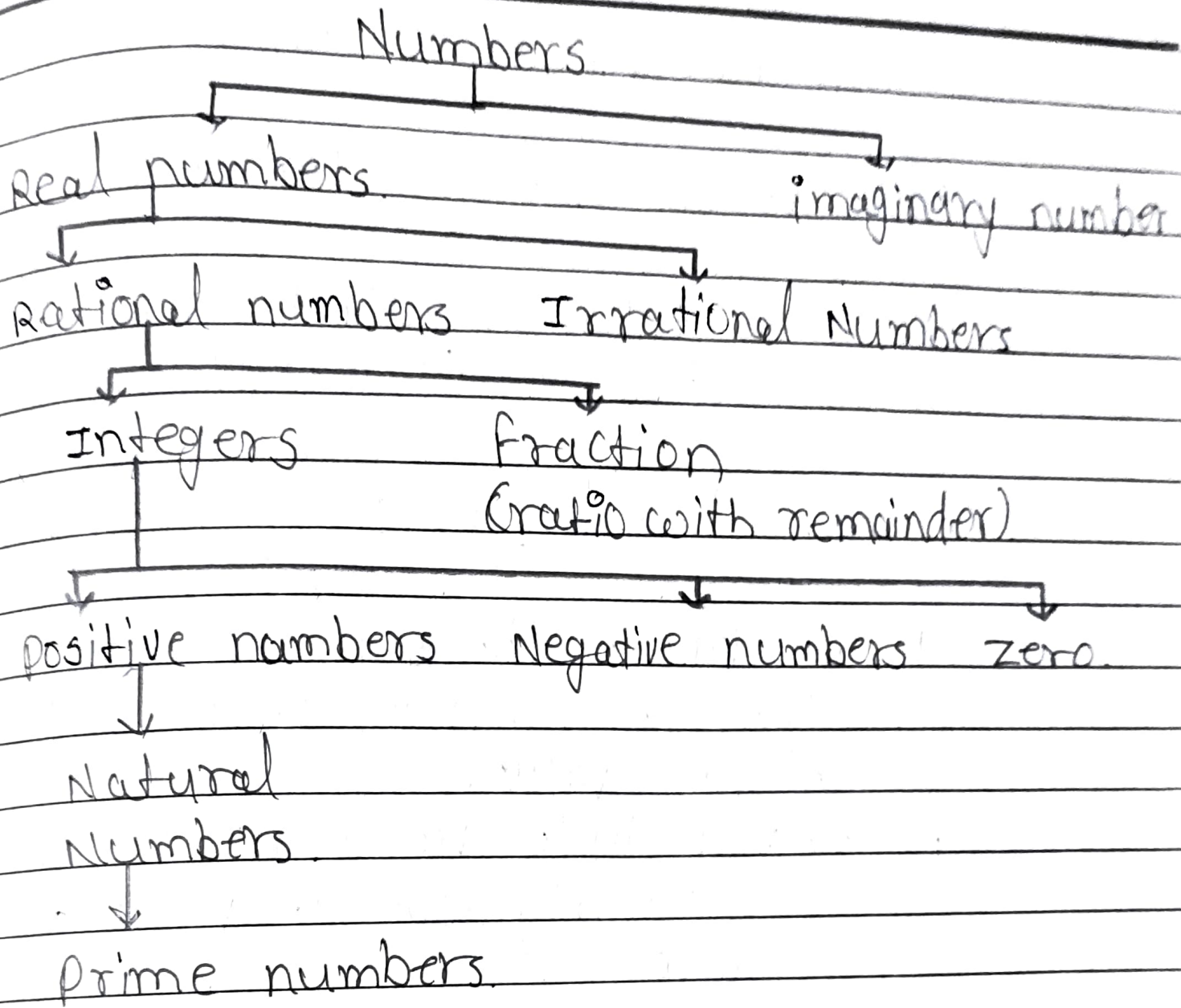


Number systems



Page No. _____
Date _____

Natural numbers & whole numbers (Integers)

- All positive numbers are called as natural number. for ex: 1, 2, 3, 4, ...
- The integers are whole numbers, may be positive, negative or zero. ex. -1, -2, -3, -4, 0, 1, 2, 3, 4, ...
- Zero (0) is neither positive (+) nor negative (-)
- Zero (0) is also not a natural no.
- Positive no. are written with (+) sign.
- Negative no. are written with (-) sign.
- The sign tells us whether the no. is greater than '0' or less than '0'.
- A no. which has no sign is positive
- If we ignore the sign of signed no. then the remaining no. is called as its Absolute value.
for ex: absolute value of +5 is 5.
similarly absolute value of -5 is also 5.

Introduction ($i = \text{iota}$ अक्षर)

$$i = \sqrt{-1} \text{ and } i^2 = -1$$

Symbol i is called as an imaginary unit

$$\begin{array}{l} i = \sqrt{-1} \\ i^2 = -1 \end{array}$$

Imaginary no.

A no. of the form ki , where $k \in \mathbb{R}$, $k \neq 0$ and $i = \sqrt{-1}$ is called an imaginary number.

ex:

$$\sqrt{-25} = 5i, 2i, \frac{2}{7}i, -11i, \sqrt{-4} \text{ etc.}$$

Let's Note.

The no. i satisfies following properties

- i) $i \times 0 = 0$
- ii) IF $a \in \mathbb{R}$, then $\sqrt{-a^2} = \sqrt{i^2 a^2} = \pm ia$
- iii) IF $a, b \in \mathbb{R}$, and $ai = bi$ then $a = b$

Complex number

Definition: A no. of the form $a+ib$, where $a, b \in \mathbb{R}$ and $i = \sqrt{-1}$ is called a complex number and it is denoted by z .

$$\therefore z = a + ib = a + bi$$

• Here, 'a' is called the real part of z and is denoted by $\text{Re}(z)$ or $R(z)$

• 'b' is called the ~~real part~~ ^{imaginary} part of z and is denoted by $\text{Im}(z)$ or $I(z)$

~~The~~
ex:

z	$a + ib$	$\text{Re}(z)$	$\text{Im}(z)$
$2 + 4i$	$2 + 4i$	2	4
$5i$	$0 + 5i$	0	5
$3 - 4i$	$3 - 4i$	3	-4
$5 + \sqrt{-4}$	$5 + 4i$	5	4
$2 + \sqrt{-5}$	$2 + \sqrt{5}i$	2	$\sqrt{5}$
$7 + \sqrt{3}$	$(7 + \sqrt{3}) + 0i$	$(7 + \sqrt{3})$	0

• Let's Note.

- ① A complex no. whose real part is zero is called as imaginary number.
- ② A complex no. whose imaginary part is zero is a real number.
- ③ A complex no. whose both real and imaginary parts are zero is the zero complex no.

The set \mathbb{R} of real number is a subset of the set \mathbb{C} of complex no.

Conjugate of a Complex Number

Definition: The conjugate of a complex number $z = a + ib$ is defined as $a - ib$ and is denoted by \bar{z}

ex :

z	\bar{z}
$3 + 4i$	$3 - 4i$
$7i - 2$	$-7i - 2$
3	3
$5i$	$-5i$
$2 + \sqrt{3}$	$2 + \sqrt{3}$
$7 + \sqrt{-5}$	$7 - \sqrt{5}i$

Properties of \bar{z}

- ① $(\bar{\bar{z}}) = z$
- ② If $z = \bar{z}$, then z is real
- ③ If $z = -\bar{z}$, then z is imaginary.

① Ex = 3.1 @.1.

write the conjugate of the following complex numbers.

→

- i) $3+i = 3-i$
- ii) $3-i = 3+i$
- iii) $-\sqrt{3}-\sqrt{7}i = \sqrt{3}+\sqrt{7}i$
- iv) $-\sqrt{5} = +\sqrt{5}i$
- v) $5i = -5i$
- vi) $\sqrt{5}-i = \sqrt{5}i$
- vii) $\sqrt{2}+\sqrt{3}i = \sqrt{2}-\sqrt{3}i$