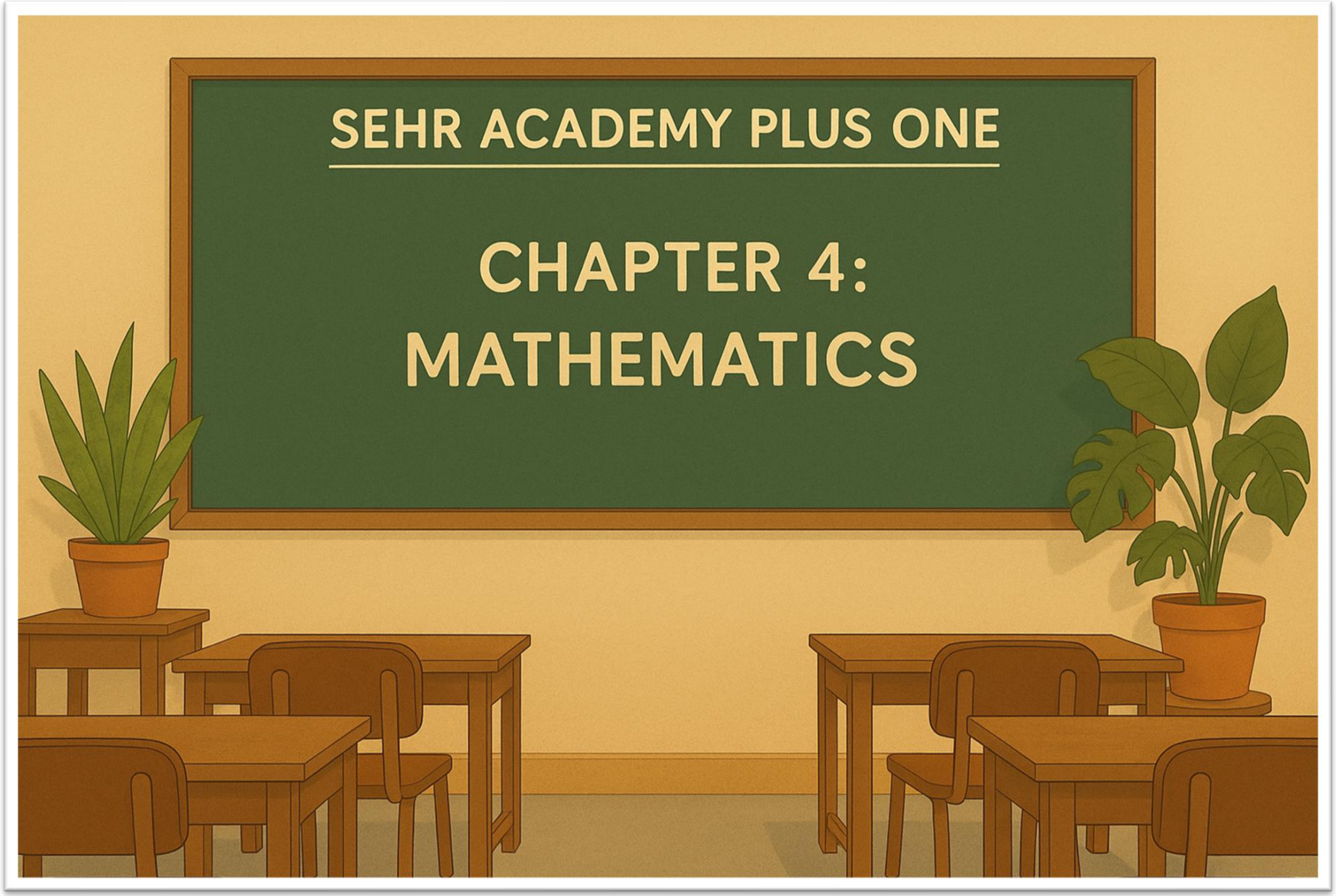
Plus One Science 25/26

Sehr Academy

22 August 2025
Friday

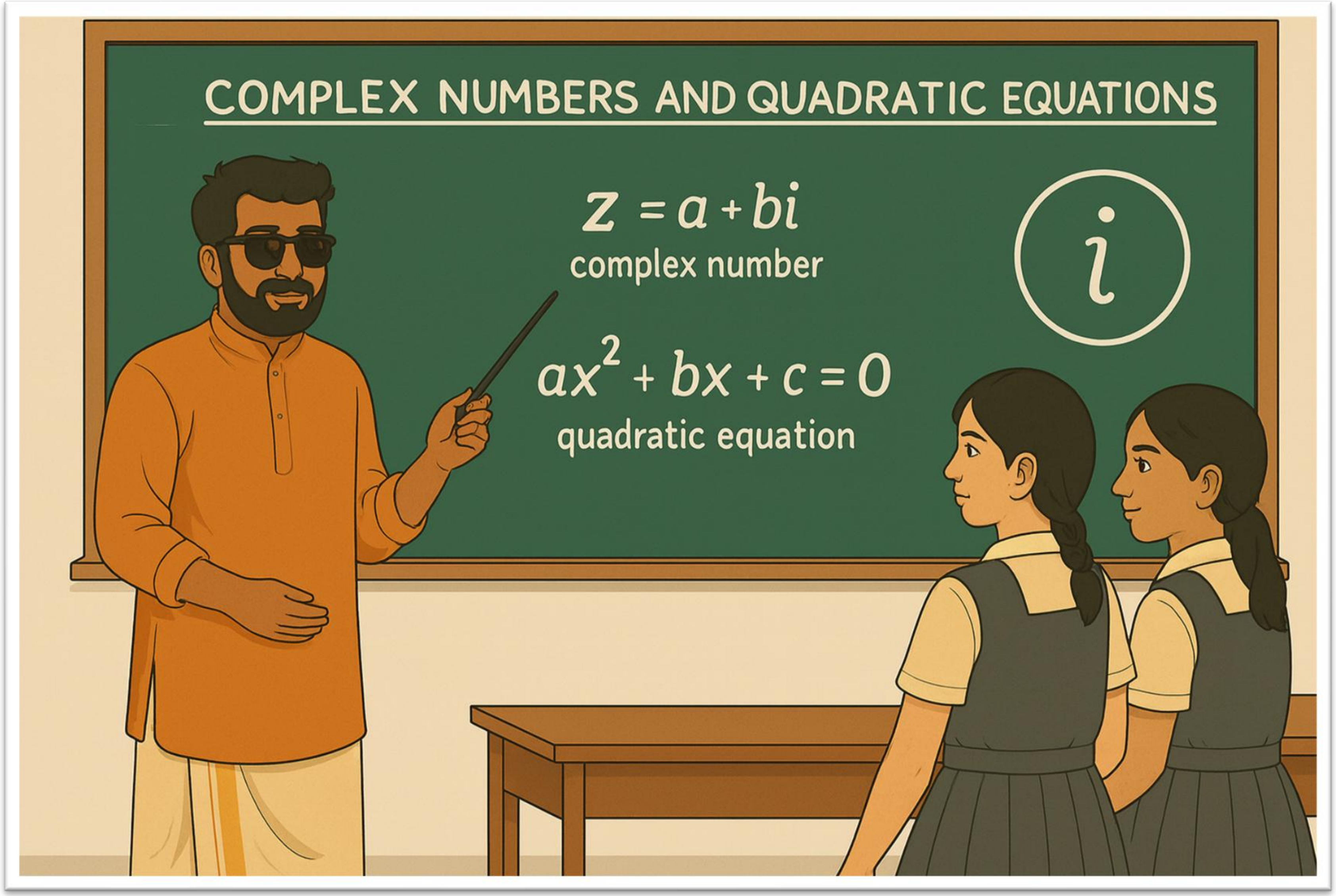
SEHR ACADEMY
GANESHAMANGALAM, VATANAPALLY



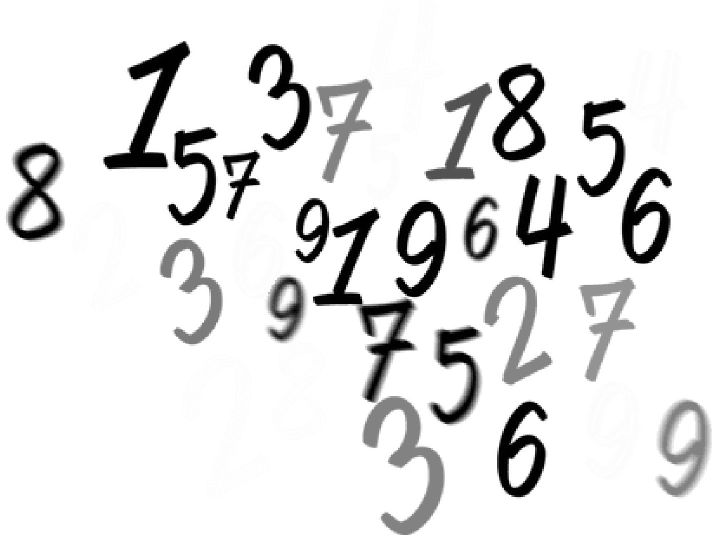
First Term Exam (School)

1. ~~Sets~~
2. ~~Relations & Functions~~
3. ~~Trigonometric Functions~~
4. Complex Numbers & Quadratic Equations

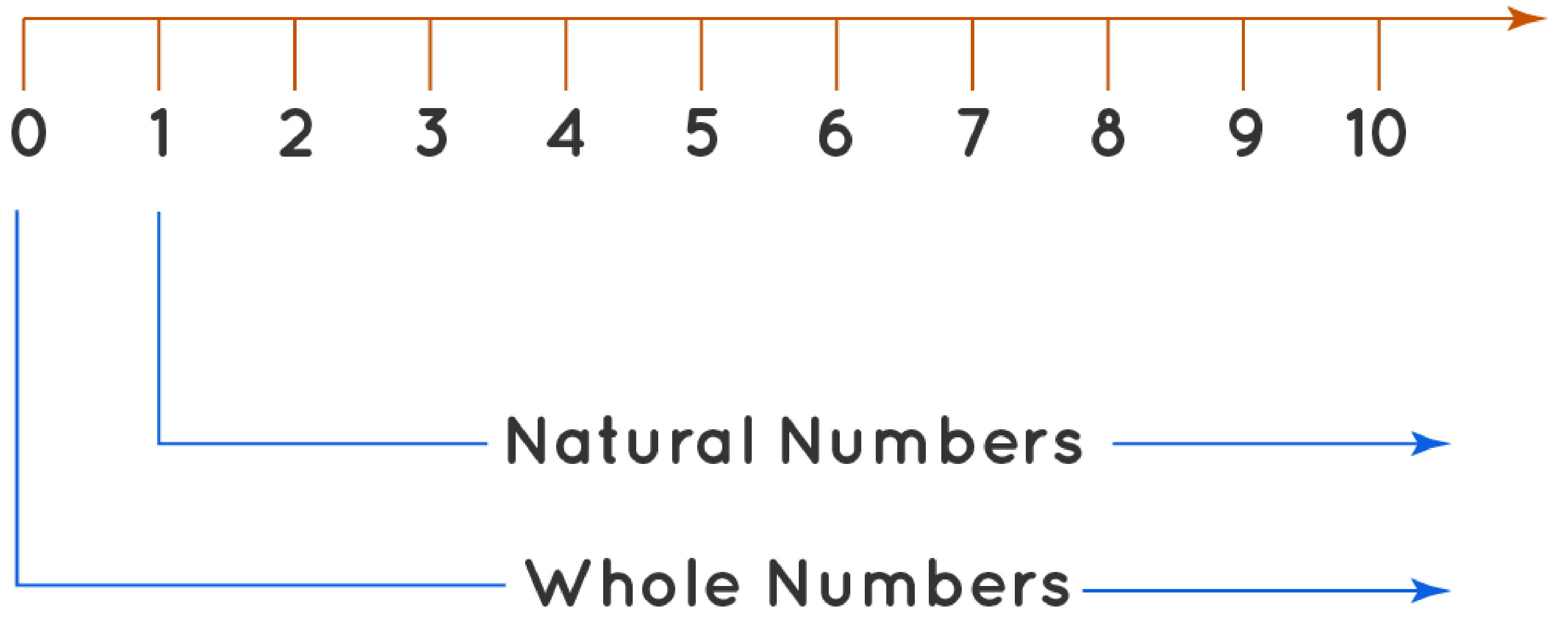
Complex Numbers & Quadratic Equations


COMPLEX NUMBERS AND QUADRATIC EQUATIONS
z = a + bi
complex number
i
ax² + bx + c = 0
quadratic equation


COMPLEX
NUMBERS



What are numbers?


0
1
2
3
4
5
6
7
8
9
10
Natural Numbers
Whole Numbers

Natural Numbers

Whole Numbers

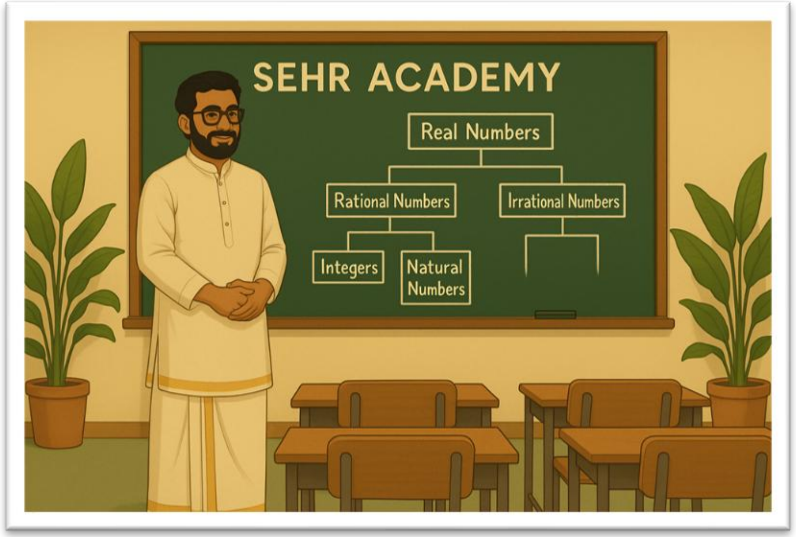
Integers

Rational Numbers

Irrational Numbers

Real Numbers

Rational Numbers

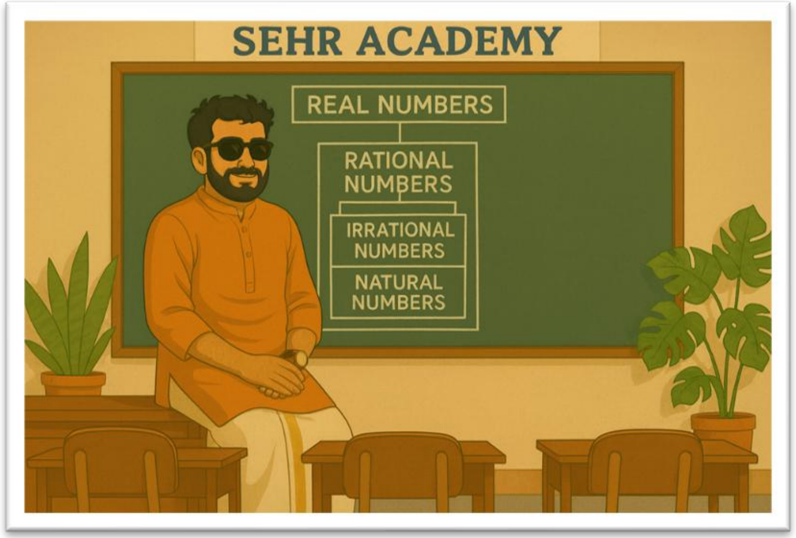


Rational numbers are in the form of p/q, where p and q can be any integer and q ≠ 0.

$p/q \to q \neq 0$

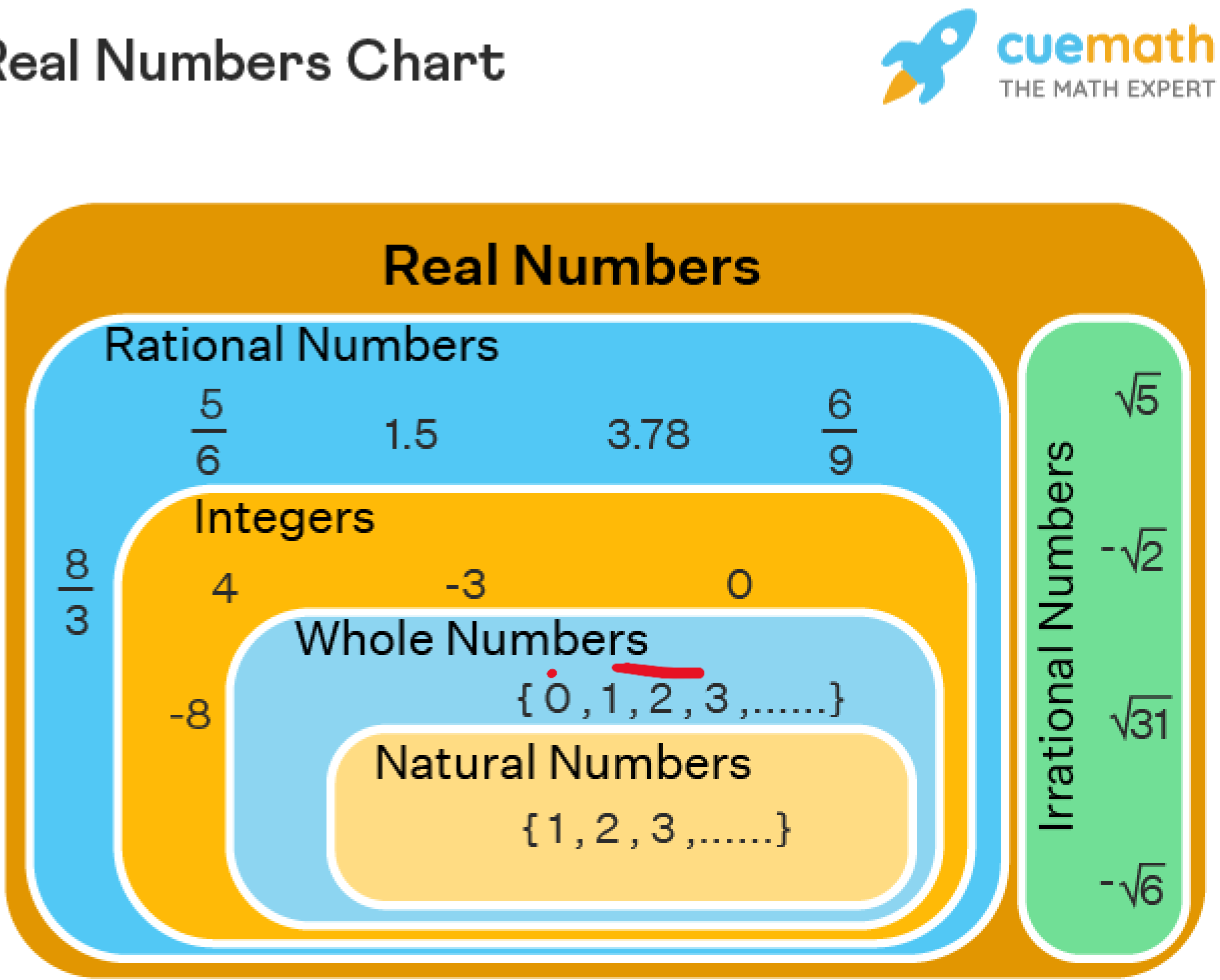
Rational numbers include natural numbers, whole numbers, integers, fractions of integers, and decimals (terminating decimals and recurring decimals).

Real Numbers



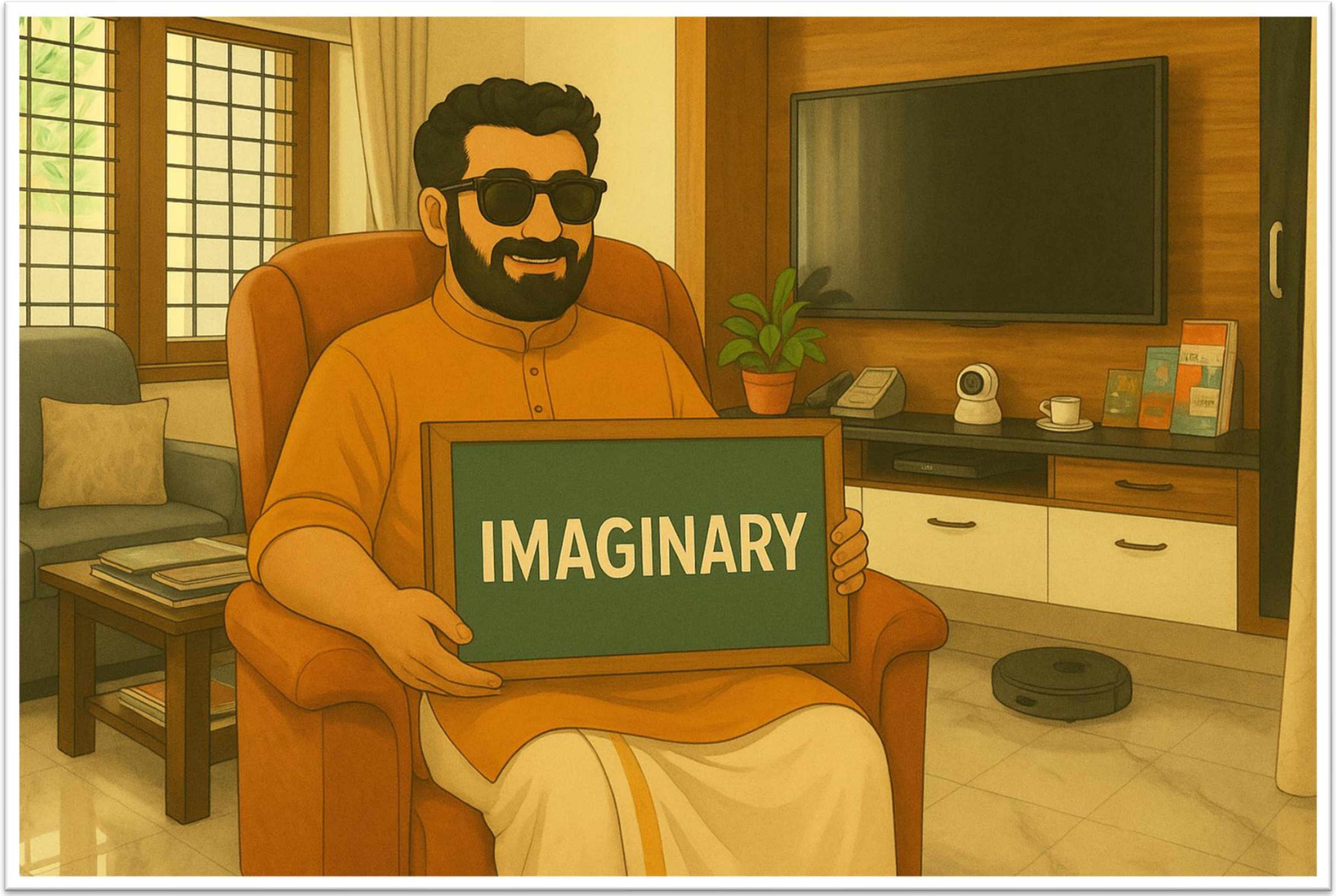
A real number is any number that can be found on the number line, including rational and irrational numbers. This encompasses whole numbers, integers, fractions, and decimals. Essentially, if a number can be represented on a number line, it's a real number

Real Numbers Chart



p/q

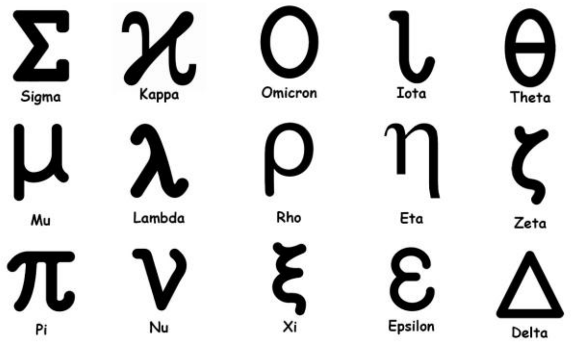

WHAT IS
THE OPPOSITE
OF REAL?


IMAGINARY

Imaginary Numbers

An imaginary number is a number that, when squared, results in a negative number. It is typically expressed as a real number multiplied by the imaginary unit i

$(3i)^2 \rightarrow -3$



$$i = \sqrt{-1}$$

Ι ι

Iota

$$i = \sqrt{-1}$$

$$i^2 = \left(\sqrt{-1}\right)^2 = -1$$

$$i^3 = i^2 \times i = -1 \times i = -i$$

$$i^4 = i^2 \times i^2 = -1 \times -1 = 1$$

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$3^0 \rightarrow 1$

$3^1 \rightarrow 3$

$3^2 \rightarrow 9$

$3^2 \cdot 3^7 \rightarrow 3^9$

$(3^2)^7 \rightarrow 3^{14}$

$3^{-1} \rightarrow 1/3$

$3^{-2} \rightarrow 1/9$

$3^{1/2} \rightarrow \sqrt{3}$

$3^{-1/2} \rightarrow 1/\sqrt{3}$

$3^{-1/2} \rightarrow (3^{1/2})^{-1} \rightarrow (\sqrt{3})^{-1} \rightarrow \frac{1}{\sqrt{3}}$

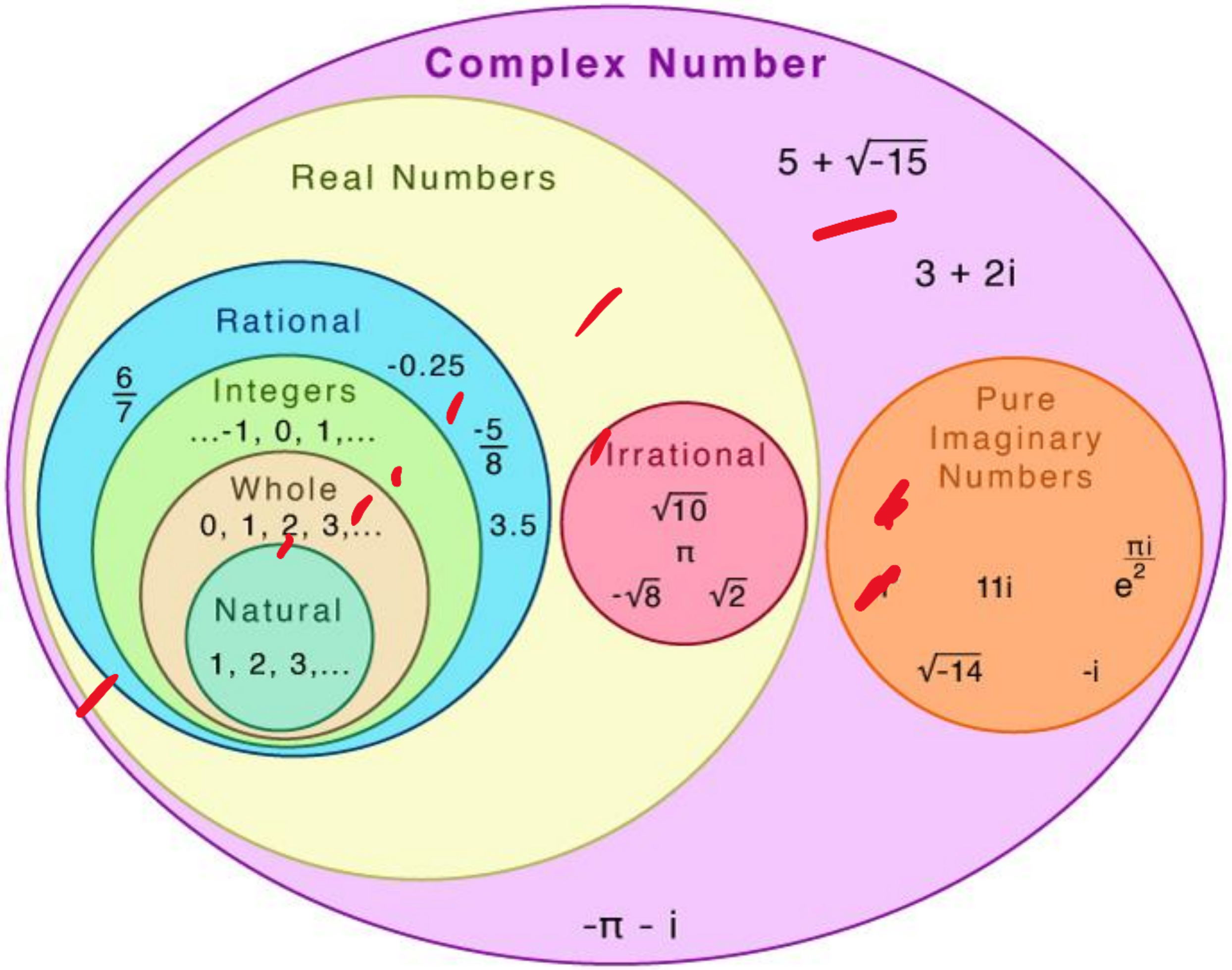
$3^{-3/2}$

$\left(\left((3)^{1/2}\right)^3\right)^{-1}$

Complex Number

Venn Diagram

MATH MONKS



$5 + \sqrt{-15} +$

Complex Numbers

Complex numbers are numbers that can be expressed in the form $a + bi$, where 'a' and 'b' are real numbers, and i is the imaginary unit $i = \sqrt{-1}$. The a part is the real part, and b is the imaginary part of the complex number.

$a+bi$

img unit

Representation of a Complex Number

Complex Numbers

$$Z = a + \underbrace{ib}_{\text{Imaginary number}}$$

$a \rightarrow$ Real part

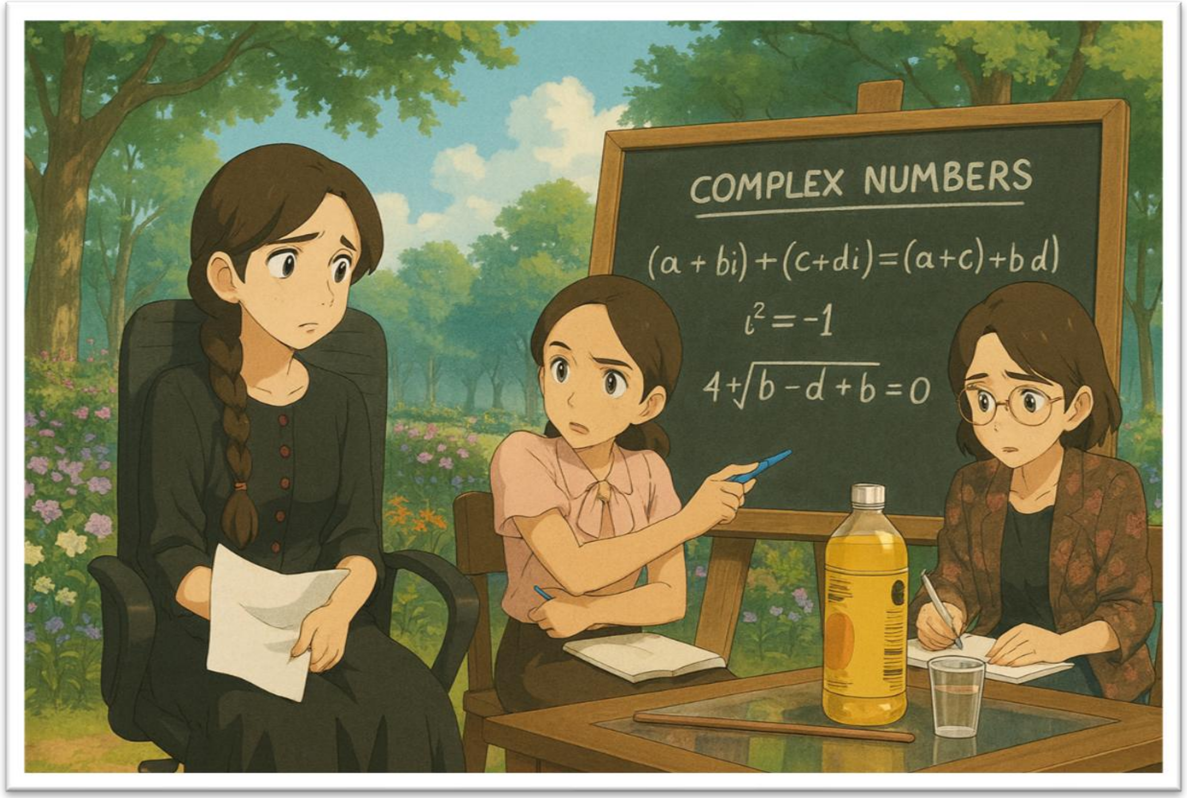
$b \rightarrow$ Imaginary part

$3i \rightarrow 3$ img part

$\rightarrow$ Coefficient

$a \longrightarrow$ Real part

$b \longrightarrow$ Imaginary part



$$z = a + ib$$ Standard form

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i Find real & imaginary parts $\longrightarrow$

$$z = \underbrace{2}_{a} + \underbrace{3}_{b}i$$

$z = 0 + 3i$ — Purely img.

$z = 3 + 0i \rightarrow$ Purely real

$10 \rightarrow \quad z = 10 + 0i$

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$$\sqrt{a \times b} = \sqrt{a} \cdot \sqrt{b}$$

$$z = 21 + \sqrt{-25}$$

$$\sqrt{-25}$$

$$= \sqrt{-1 \times 25}$$

$$= \sqrt{25} \times \sqrt{-1}$$

$$= 5 \times \sqrt{-1}$$

$$= 5i$$

$$\boxed{= 21 + 5i}$$

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$$z = \frac{2\pi}{3} - 5i$$

$$z = a + ib$$

Imaginary part $\Rightarrow$ $\frac{2\pi}{3} + (-5)i$

-5.

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$i^0 \longrightarrow 1$

$i^1 \longrightarrow i$

$i^2 \longrightarrow -1$

$i^3 \longrightarrow -i$

$i^4 \longrightarrow (\sqrt{-1})^2 \cdot (\sqrt{-1})^2$

$= 1$

$i^5 \longrightarrow i$

$i^{25} \longrightarrow$

$i^{37} \longrightarrow$

$i^{13} \longrightarrow$

$i^{25} \longrightarrow i^{24} \cdot i$

$i^{8} = i^4 \cdot i^4 \cdot i$

$= 1 \cdot 1 = 1$

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$$\boxed{4k+y}$$

$$i^2 = -1 \Rightarrow i^x = 1$$

$$x \rightarrow ?$$

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$K \rightarrow$ integer

$2^x = y$

$2^{x+1} = 2y$

$2^{x} \times 2 = 2y$

$i^{4k+0} = 1$

$i^{4k+1} = i$

$i^{4k+2} = -1$

$i^{4k+3} = -i$

$i^{4k+4} = 1$

$i^{25} \rightarrow i^{24+1} \rightarrow i^{\boxed{4 \times 6} + \boxed{1}}$

$i^{\cancel{4 \times 6} + 1} \rightarrow i^{1}$

$$\boxed{\Rightarrow i^{25} = i^{1}}$$

$4k+y$

$k \to$ integer

$i^{25} \to i^{1} \to i$

$i^{37} \to i$

$i^{13} \to i$

$i^{-23} \to$

$i^{24} \to i^{6\times4+0}$

$\to i^{\cancel{6\times4}+0}$

$\to i^{0} \to 1$

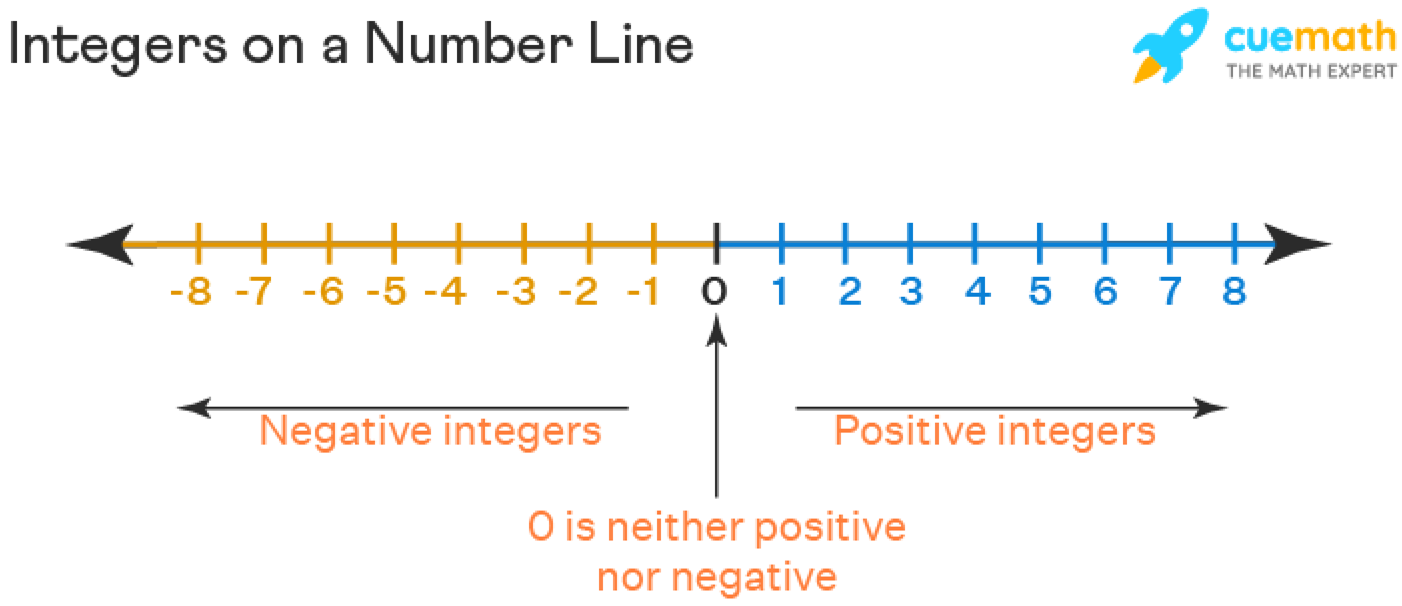
$\boxed{4k+y}$

$i^{-23} \rightarrow i^{1}$

$$-23$$
$$\downarrow$$
$$-24+1$$
$$\downarrow$$
$$\cancel{4}(-6)+1$$
$$\downarrow$$
$$\underline{1}$$

3 4

-24 -23


Integers on a Number Line
cuemath
THE MATH EXPERT
-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8
Negative integers
Positive integers
0 is neither positive
nor negative

Standard form $\rightarrow$ $a+ib$

$$Z = \frac{1}{2+3i}$$

$(2+3i)^{-1}$ ✗

Reverse

$z = a + ib$

$\hookrightarrow$ conjugate

$\bar{z} = a - ib$

$\cancel{a+ib}$

$\cancel{a+ib}$

$\cancel{ib-a}$

$$z = 2+5i$$

$$\Rightarrow \bar{z} = 2-5i$$

middle sign changes

$$z = -25 - 12i$$

$$\hookrightarrow \bar{z} = -25 + 12i$$

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

$$x \times \frac{4}{4} = \frac{1}{2} \times \frac{\cancel{4}}{\cancel{4}} = \frac{1}{2}.$$

Fraction → To get standard form

$$z = \frac{1}{(1+i)} \times \frac{(1-i)}{(1-i)}$$

$$z = a+ib$$

$$\bar{z} = a-ib$$

$$i^2 = -1$$

$$z \cdot \bar{z} = (a+ib)(a-ib)$$

$$= a^2 - (ib)^2 = a^2 - i^2b^2$$

$$\Rightarrow \quad z \cdot \bar{z} = a^2 + b^2$$

$$z = \frac{1}{(1+i)} \times \frac{(1-i)}{(1-i)}$$

$$(a+b)(a-b) = a^2 - b^2$$

$$z = \frac{(1-i)}{1^2 - (i)^2} = \frac{1-i}{1-(-1)} = \frac{1-i}{2}$$

$$z = \frac{1-i}{2}$$

$$= \frac{1}{2} - \frac{1}{2} \cdot i$$

Standard form

Qn. Express

$$\frac{2+i}{2-i}$$ in form $a+ib$.

$(a+b)^2$

$$\frac{2+i}{2-i} \cdot \frac{2+i}{2+i} = \frac{4+i^2+2\cdot 2\cdot i}{2^2-i^2}$$

$$= \frac{4-1+4i}{4+1} = \frac{3+4i}{5}$$

$$= \frac{3}{5} + \frac{4}{5}i.$$

$$(2+i)^2 \rightarrow 2^2 + i^2 + 2.2.i$$

$$= 4 - 1 + 4i$$

$$= \underline{3 + 4i}$$

Qu. Write the complex no.

$z = \frac{i+1}{1-i}$ in $a+ib$ form.

$$\frac{1+i}{1-i} \rightarrow \frac{(1+i)^2}{2} = \frac{\cancel{1}+2i\cancel{-1}}{\cancel{2}}$$

$$= \underline{i}.$$

$$= \underline{0+i}.$$

$$\frac{2i}{0} \rightarrow$$

$$\boxed{\tan 90 = \frac{\sin 90}{\cos 90} = \frac{1}{0} \rightarrow ND}$$

$$\underline{\cot 90 = 0}$$

Additive Inverse

$$x + (-x) = 0$$

Number

Additive Inverse

Additive Identity

$$-x + x = 0$$

Number

Additive Inverse

Additive Identity

$$21 + (-21) = 0$$

$$-319 + (319) = 0$$

$z = 2 + 5i \longrightarrow -ve$

Additive inverse $\longrightarrow -z$

$-z = -(2 + 5i)$

$= -2 - 5i$

Multiplicative Inverse Property

$$\text{Number} \longleftarrow n \times \frac{1}{n} = 1 \longrightarrow \text{Product}$$

$\frac{1}{n}$ ↓ Multiplicative Inverse of Number

$x \to x^{-1} = \frac{1}{x}$

$$5 \times \frac{1}{5} = 1$$

Number Multiplicative Inverse

$$\frac{1}{5} \times 5 = 1$$

Number Multiplicative Inverse

$z \rightarrow$ Multiplicate inverse

$z^{-1} = \frac{1}{z}$ $\rightarrow$ then change to std. form.

$1+2i$

$\frac{1}{1+2i}$

$z^{-1} = \frac{1}{z}$

$$z^{-1} = \frac{\bar{z}}{|z|^2}$$

$$z = a + ib$$

$$\rightarrow \quad |z| = \sqrt{a^2 + b^2}$$

Multiplicative inverse of $3+4i$

$Z = 3+4i$

$$\bar{z} = \frac{1}{3+4i}$$

Convert to std form

$$Z = \frac{1}{3+4i} \times \frac{(3-4i)}{(3-4i)}$$

$$= \frac{3-4i}{9+16} = \frac{3}{25} - \frac{4}{25}i$$

Formula Method

$$z^{-1} = \frac{\bar{z}}{|z|^2}$$

$a - ib$

$\downarrow$

conjugate

$$z = 3+4i \qquad |z| = \sqrt{3^2+4^2}$$

$$z^{-1} = \frac{3-4i}{\left(\sqrt{3^2+4^2}\right)^2} = \frac{3-4i}{25}$$

$$= \frac{3}{25} - \frac{4}{25} \cdot i$$

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Practice Questions

SEHR

Practice Questions

IMPROVEMENT 2023

3. i) The value of $i + i^2 + i^3 = \dots\dots\dots$ (1)

$Ans = i + (-1) + (-i) = i - 1 - i = -1$

4. ii) If $z_1 = 2 + i$ and $z_2 = 1 + i$, then express $\frac{z_1 . z_2}{\bar{z}_2}$ in $a + ib$ form. (3)

$z_1 z_2 = (2 + i)(1 + i) = 2 + 2i + i + i^2 = 2 + 3i - 1 = 1 + 3i$

$$Now, \frac{z_1 z_2}{\bar{z}_2} = \frac{1 + 3i}{1 - i} = \frac{1 + 3i}{1 - i} \times \frac{1 + i}{1 + i}$$

$$= \frac{(1 + 3i)(1 + i)}{(1 - i)(1 + i)} = \frac{1 + i + 3i + 3i^2}{1 - i^2} = \frac{1 + 4i + 3(-1)}{1 + 1} = \frac{-2 + 4i}{2} = -1 + i2$$

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Practice **Questions**

The value of $i + i^2 + i^3 =$ $\cancel{i} - 1 + (\cancel{-i})$

$= -1$

Practice Questions

b) Express the complex number $3(7 + i7) + i(7 + i7)$ in $a + ib$ form.

$21 + 21i$

Practice Questions

IMPROVEMENT 2020

10. a) Write the complex number $z = \frac{1+i}{1-i}$ in $a + ib$ form. (1)

$0 + i$

$$z = \frac{1+i}{1-i} = \frac{1+i}{1-i} \times \frac{1+i}{1+i} = \frac{(1+i)^2}{1-i^2} = \frac{1+2i+i^2}{1-(-1)} = \frac{1+2i-1}{2} = \frac{2i}{2} = \cancel{2 = 2 + i0}$$

$$z = 3(7+i7) + i(7+i7)$$

$$= 21 + 21i + 7i + 7i^2$$

$$= 21 + 28i - 7$$

$$= \underline{14 + 28i}.$$

Practice Questions

The value of $i^{35}=$ i^3 $=$ $-i$

Practice Questions

MARCH 2024

1. Express $(1-i)^6$ in $x+iy$ form. (2)

$$(1-i)^6 = 1 - {}^6C_1(i) + {}^6C_2(i^2) - {}^6C_3(i^3) + {}^6C_4(i^4) - {}^6C_5(i^5) + {}^6C_6(i^6)$$
$$= 1 - 6i + 15(-1) - 20(-i) + 15(1) - 6(i) + (-1)$$
$$= 1 - 6i - 15 + 20i + 15 - 6i - 1$$
$$= 8i = 0 + i8$$

2. Find the coordinates that represent the complex number $\frac{1-i}{1+i}$ in the argand plane. (2)

$a+ib \rightarrow$

$$z = \frac{1-i}{1+i}$$
$$= \frac{(1-i)}{(1+i)} \times \frac{(1-i)}{(1-i)}$$
$$= \frac{(1-i)^2}{1-i^2} = \frac{1-2i+i^2}{1-(-1)} = \frac{-2i}{2} = -i$$

Coordinates that represent the complex number $-i = 0 + i(-1)$ is $(0, -1)$

Practice Questions

7. a) Value of i^4 is .... (1)

Ans: 1

b) Express the complex number i^{39} in the form $a + ib$ form. (2)

$i^{39} = i.i^{38} = i.(i^2)^{19} = i(-1)^{19} = i(-1) = -i = 0 + i(-1)$

c) Write the conjugate number $3 + 4i$ (1)

Conjugate of $3 + 4i = 3 - 4i$

$i^{39} \rightarrow i^3$

$= -i$

Practice Questions

MARCH 2012

20. Consider the complex number, $z = \frac{5-\sqrt{3}i}{4+2\sqrt{3}i}$

a) Express Z in the form $a + ib$. (2)

$$z = \frac{5-\sqrt{3}i}{4+2\sqrt{3}i} = \frac{5-\sqrt{3}i}{4+2\sqrt{3}i} \times \frac{4-2\sqrt{3}i}{4-2\sqrt{3}i}$$

$$= \frac{5-\sqrt{3}i}{4+2\sqrt{3}i} \times \frac{4-2\sqrt{3}i}{4-2\sqrt{3}i} = \frac{20-10\sqrt{3}i-4\sqrt{3}i+2\times 3i^2}{16-4\times 3i^2}$$

$$= \frac{20-14\sqrt{3}i+6(-1)}{16-12(-1)} = \frac{14-14\sqrt{3}i}{28} = \frac{14(1-\sqrt{3}i)}{28} = \frac{1-\sqrt{3}i}{2} = \frac{1}{2} + i\left(\frac{\sqrt{3}}{2}\right)$$

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$|a+ib| = \sqrt{a^2+b^2}$

Practice **Questions**

b) $If\ (a+ib)(c+id)(e+if) = A+iB$, then

Show that $(a^2+b^2)(c^2+d^2)(e^2+f^2) = A^2+B^2$.

We have, $|(a+ib)(c+id)(e+if)| = |A+iB|$

$$\left(\sqrt{a^2+b^2}\right)^2\left(\sqrt{c^2+d^2}\right)^2\left(\sqrt{e^2+f^2}\right)^2 = \left(\sqrt{A^2+B^2}\right)^2$$

squaring we have,

$\therefore\ (a^2+b^2)(c^2+d^2)(e^2+f^2) = A^2+B^2$, proved.

Practice Questions

AUGUST 2009

24. i) Express the complex number $\frac{3-\sqrt{-16}}{1-\sqrt{-9}}$ in the form $a+ib$. (2)

$$\frac{3-\sqrt{-16}}{1-\sqrt{-9}}=\frac{3-4i}{1-3i}=\frac{3-4i}{1-3i}\times\frac{1+3i}{1+3i}=\frac{3+9i-4i-12i^2}{1-9i^2}$$

$$=\frac{3+5i-12(-1)}{1-9(-1)}=\frac{3+5i+12}{10}=\frac{15+5i}{10}=\frac{3+i}{2}=\frac{3}{2}+i\frac{1}{2}$$

ii) Deleted.

Practice Questions

SEPTEMBER 2012

17. i) Deleted.

ii) Express $\frac{2+i}{2-i}$ in the form $a+ib$. (3)

$$z=\frac{2+i}{2-i}=\frac{2+i}{2-i}\times\frac{2+i}{2+i}=\frac{(2+i)^2}{4-i^2}=\frac{4+4i+i^2}{4-(-1)}=\frac{4+4i-1}{5}$$

$$=\frac{3+i4}{5}=\frac{3}{5}+i\frac{4}{5}$$