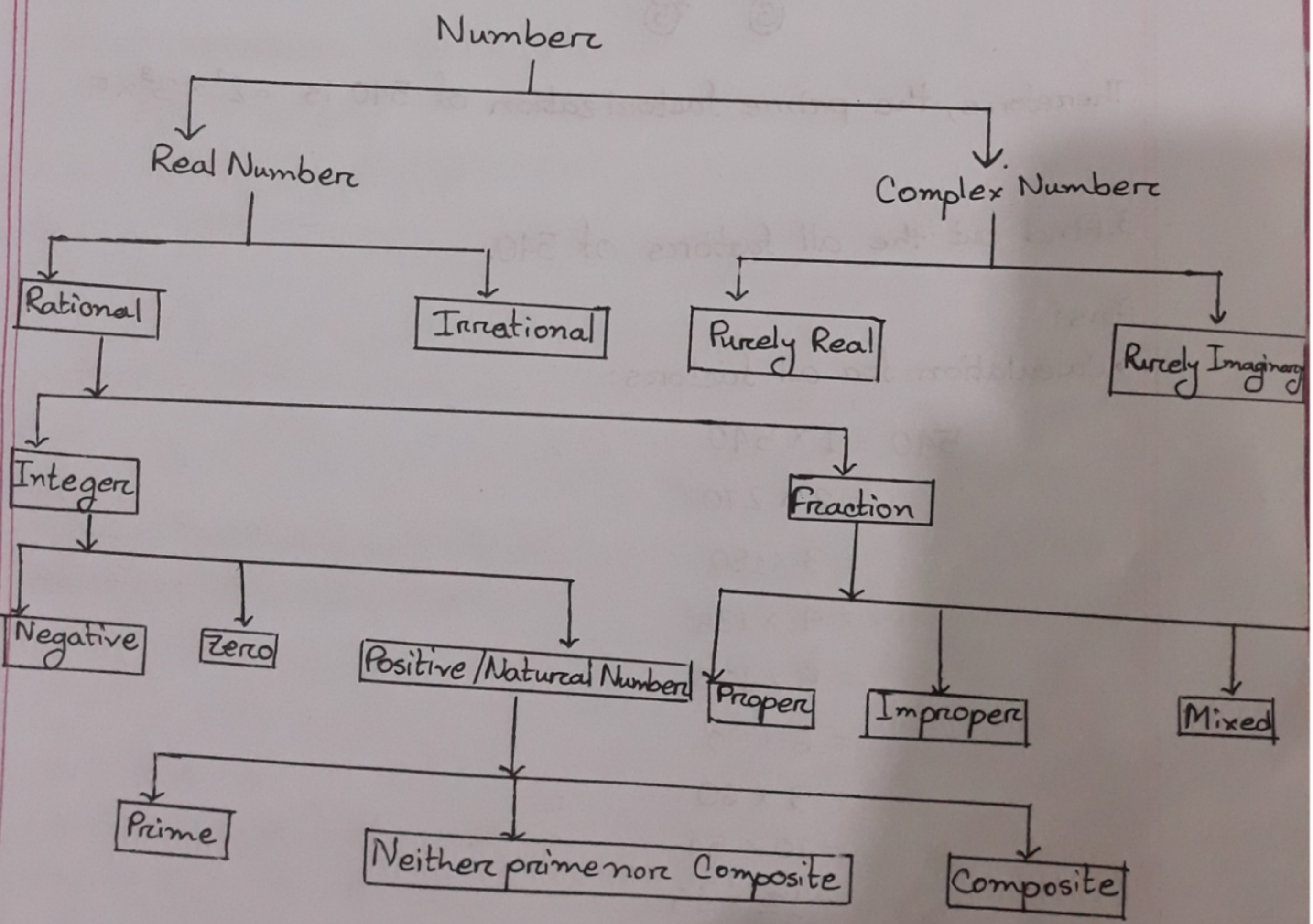
1. Write down the classification of number system.

Ans:

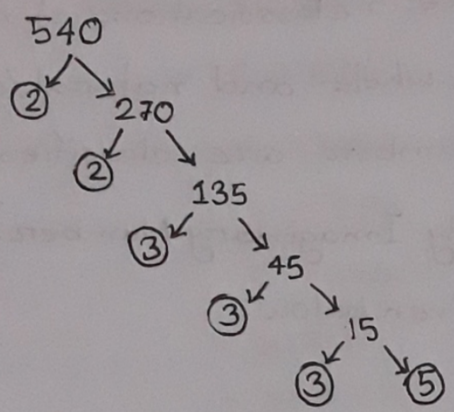
- Number system is mainly classified into 2 types: Real Number & Complex Number. There are 5 classifications of real numbers: rational, irrational, integer, whole and natural/counting. On the other hand, Complex Number are classified into Purely Real Number & Purely Imaginary Number. The classification chart of Number system is given below:



2. Find the prime factorization of 540 using tree.

Ans:

- The prime factorization of 540 using the tree method:



Therefore, the prime factorization of 540 is $= 2^2 \times 3^3 \times 5$

3. Find out the all factors of 540.

Ans:

- Calculation for all factors:

$$
\begin{aligned}
540 &= 1 \times 540 \\
&= 2 \times 270 \\
&= 3 \times 180 \\
&= 4 \times 135 \\
&= 5 \times 108 \\
&= 6 \times 90 \\
&= 9 \times 60 \\
&= 10 \times 54 \\
&= 12 \times 45 \\
&= 15 \times 36 \\
&= 18 \times 30 \\
&= 20 \times 27
\end{aligned}
$$

The factors of 540 are : 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 27, 30, 36, 45, 54, 60, 90, 108, 135, 180, 270.

4. What is the GCD & LCM of 240 & 540.

Ans:

- Given numbers are 240 & 540.

$240 = 2\cdot 120 = 2\cdot 2\cdot 60 = 2\cdot 2\cdot 2\cdot 30 = 2\cdot 2\cdot 2\cdot 2\cdot 15 = 2\cdot 2\cdot 2\cdot 2\cdot 3\cdot 5 = 2^4\cdot 3\cdot 5$

$540 = 2\cdot 270 = 2\cdot 2\cdot 135 = 2\cdot 2\cdot 3\cdot 45 = 2\cdot 2\cdot 3\cdot 3\cdot 15 = 2\cdot 2\cdot 3\cdot 3\cdot 3\cdot 5 = 2^2\cdot 3^3\cdot 5$

$\therefore$ LCM $(240 \,\&\, 540) = 2^4\cdot 3^3\cdot 5 = 2160$

& G.C.D $(240 \,\&\, 540) = 2^2\cdot 3\cdot 5 = 60$

5. Find the H.C.F & L.C.M of 42, 63 & 140.

Ans:

- Given numbers are 42, 63 & 140.

$42 = 2\cdot 21 = 2\cdot 3\cdot 7$

$63 = 3\cdot 21 = 3\cdot 3\cdot 7 = 3^2\cdot 7$

$140 = 2\cdot 70 = 2\cdot 2\cdot 35 = 2\cdot 2\cdot 5\cdot 7 = 2^2\cdot 5\cdot 7$

$\therefore$ LCM $(42, 63, 140) = 2^2\cdot 3^2\cdot 5\cdot 7 = 1260$

& H.C.F $(42, 63, 140) = 7$

6. Find the HCF & L.CM of $\frac{2}{3}, \frac{8}{9}, \frac{16}{81}$ & $\frac{10}{27}$.

Ans:

- Given fractions are $2/3, 8/9, 16/81$ & $10/27$.

Calculation for Numerator

$2 = 2^1$

$8 = 2^3$

$16 = 2^4$

$10 = 2\cdot 5$

LCM $(2, 8, 16, 10) = 2^4\cdot 5 = 80$

HCF $(2, 8, 16, 10) = 2^1 = 2$

Calculation for Denominator

$3 = 3^1$

$9 = 3^2$

$81 = 3^4$

$27 = 3^3$

LCM $(3, 9, 81, 27) = 3^4 = 81$

HCF $(3, 9, 81, 27) = 3^1 = 3$

$\therefore$ LCM $(2/3, 8/9, 16/81 \,\&\, 10/27) = \dfrac{\text{LCM of } 2,8,16,10}{\text{HCF of } 3,9,81,27} = \dfrac{80}{3}$

$\therefore$ HCF $(2/3, 8/9, 16/81 \,\&\, 10/27) = \dfrac{\text{HCF of } 2,8,16,10}{\text{LCM of } 3,9,81,27} = \dfrac{2}{81}$

7. Find the modulus and Argument of $z = \frac{1+\sqrt{3}i}{1-\sqrt{3}i}$ and also its polar, exponential form.

- Given, $z = \frac{1+\sqrt{3}i}{1-\sqrt{3}i}$

$$= \frac{(1+\sqrt{3}i)(1+\sqrt{3}i)}{(1-\sqrt{3}i)(1+\sqrt{3}i)}$$

$$= \frac{1^2+\sqrt{3}i+\sqrt{3}i+3i^2}{1-3i^2}$$

$$= \frac{1+2\sqrt{3}i+3(-1)}{1-3(-1)}$$

$$= \frac{1+2\sqrt{3}i-3}{1+3}$$

$$= \frac{2\sqrt{3}i-2}{4}$$

$$= \frac{\sqrt{3}}{2}i - \frac{1}{2}$$

$$= -\frac{1}{2} + \frac{\sqrt{3}}{2}i$$

$\therefore r = |z| = \sqrt{(-\frac{1}{2})^2 + (\frac{\sqrt{3}}{2})^2} = \sqrt{\frac{1}{4}+\frac{3}{4}} = \sqrt{\frac{4}{4}} = 1$ (Ans)

$Arg(z), \theta = \pi - \tan^{-1}\left|\frac{\frac{\sqrt{3}}{2}}{-\frac{1}{2}}\right| = \pi - \tan^{-1}|-\sqrt{3}| = \pi - \frac{\pi}{3}$

$= \frac{2\pi}{3}$ (Ans)

polar form of $z = r(\cos\theta + i\sin\theta)$

$= 1\left(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}\right)$

$= \cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}$ (Ans)

Exponential form of $z = re^{i\theta}$

$= 1e^{i2\pi/3}$

$= e^{2\pi/3 i}$ (Ans)

10. Express $1+i\sqrt{3}$ in the form of $r(\cos\theta + i\sin\theta)$.

Ans: Given $z = 1 + i\sqrt{3}$

Here,
$$r = \sqrt{1^2 + \sqrt{3}^2} = \sqrt{1+3} = \sqrt{4} = 2$$

and $\theta = \tan^{-1}\left(\frac{\sqrt{3}}{1}\right) = \tan^{-1}(\sqrt{3}) = \frac{\pi}{3}$

$\therefore$ Polar form,
$$r(\cos\theta + i\sin\theta) = 2\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$$