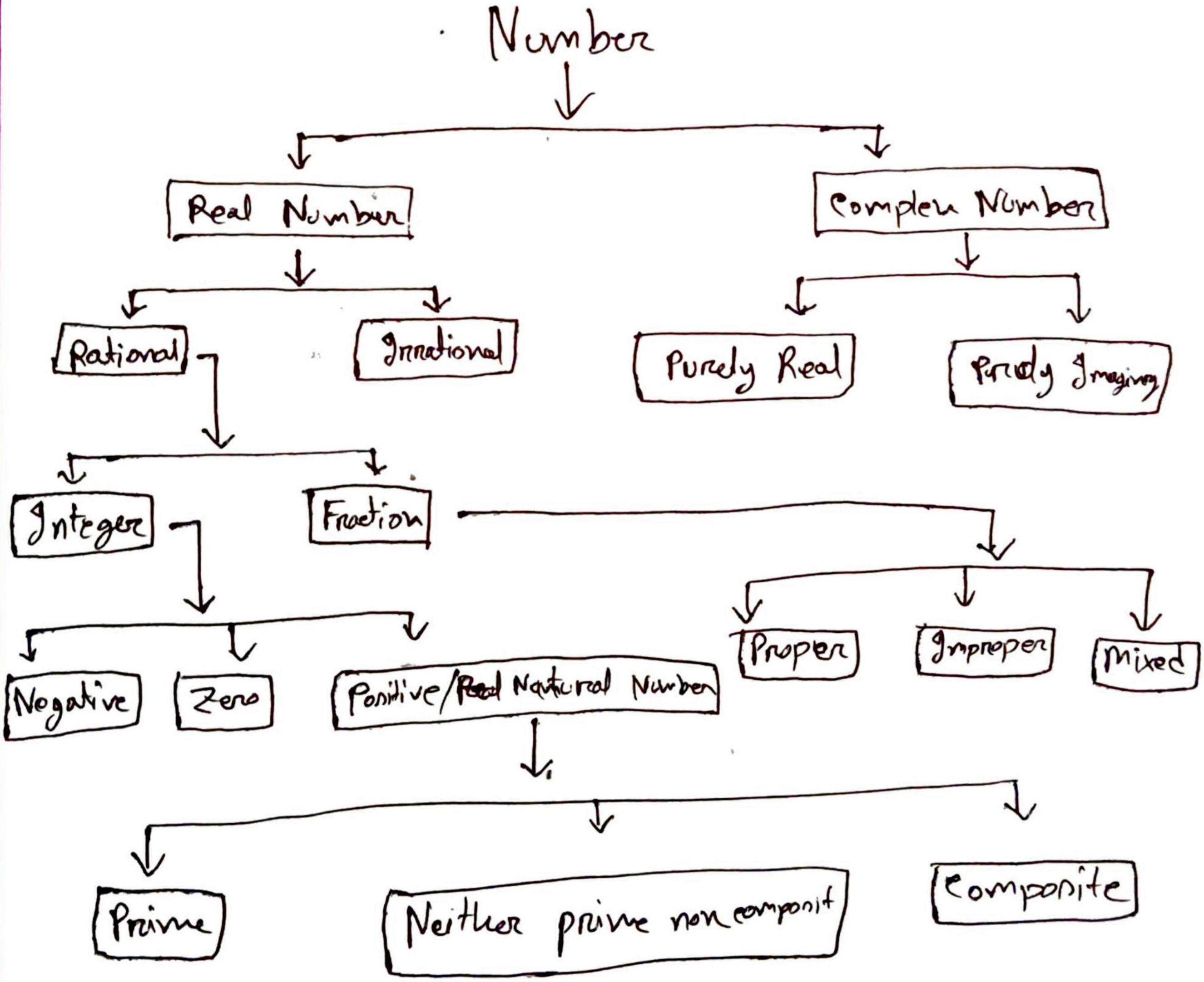
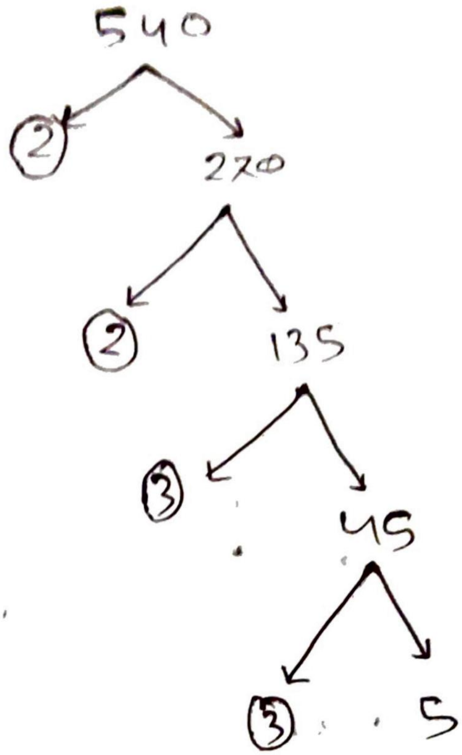
Number System

1. Write down the classification of number system.



Find the prime factorization of 540 using tree.



$540 = 2 \times 2 \times 3 \times 3 \times 3 \times 5$

$= 2^3 3^3 5$ Ans.

2

3. Find out the factors of ~~450~~ 540.

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

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

OR

$$\begin{array}{r|l} 2 & 540 \\ \hline 2 & 270 \\ \hline 3 & 135 \\ \hline 3 & 45 \\ \hline 3 & 15 \\ \hline & 5 \end{array}$$

$$540 = 2 \times 2 \times 3 \times 3 \times 3 \times 5$$

$$= (2^2)(3^3)(5)$$

So, the total number of factors of 540 is $(2+1)(3+1)(1+1) = 3 \cdot 4 \cdot 2$

$$= 24$$ A.

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

$240 = 2\cdot120 = 2\cdot2\cdot60 = 2^2\cdot2\cdot30 = 2^2\,2\cdot15 = 2^4\,3\,5$

$540 = 2\cdot270 = 2\cdot2\cdot135 = 2^2\cdot3\,45 = 2^2\,3\cdot3\,15 = 2^2\,3\,3\,3\,5$

$= 2^2\,3^3\cdot5$

$\because$ LCM $\cdot$ (240 and 540) $= 2^4\cdot3^3\cdot5 = 2160$

$\therefore$ GCD : (240 and 540) $= 2^2\cdot3\cdot5 = 60$

A.

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

$42 = 2\times21 = 2\times3\times7 = 2^1\times3^1\times7^1$

$63 = 3\times21 = 3\times3\times7 = 3^2\times7^1$

$140 = 2\times70 = 2\times2\times35 = 2^2\times5^1\times7^1$

$\therefore$ LCM = (42, 63, 140) $= 2^2\cdot3^2\cdot5\cdot7 = 1260$

$\therefore$ HCF = (42, 63, 140) $= 7$

$\therefore$ Therefore, HCF of 42, 63, 140 = 7 and

LCM of 42, 63, 140 = 1260.

A.

5

6. Find the H.C.F and L.C.M of $\frac{2}{3}, \frac{8}{9}, \frac{16}{81}, \frac{10}{27}$.

calculation for numerators

$2 = 2^1$

$8 = 2^3$

$16 = 2^4$

$10 = 2^1 \times 5^1$

calculation for denominators

$3 = 3^1$

$9 = 3^2$

$81 = 3^4$

$27 = 3^3$

L.C.M $(2, 8, 16, 10) = 2^4 \times 5 = 80$

L.C.M $(3, 9, 81, 27) = 3^4 = 81$

H.C.F $(2, 8, 16, 10) = 2$

H.C.F $(3, 9, 81, 27) = 3$

H.CF of $\frac{2}{3}, \frac{8}{9}, \frac{16}{81}$ and $\frac{10}{27} = \frac{\text{H.C.F }(2, 8, 16, 10)}{\text{L.C.M }(3, 9, 81, 27)}$

$= \frac{2}{81}$

L.C.M of $\frac{2}{3}, \frac{8}{9}, \frac{16}{81}$ and $\frac{10}{27} = \frac{\text{L.C.M }(2, 8, 16, 10)}{\text{H.C.F }(3, 9, 81, 27)}$

$= \frac{80}{3}$

R.

7. Finding the modulus argument and polar:

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

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

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

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

$$= \frac{1+2\sqrt{3}i\cancel{+1}-3}{4} = \frac{-2+2\sqrt{3}i}{4} = -\frac{1}{2}+\frac{\sqrt{3}}{2}i \quad [x+iy]$$

So, $x = -\frac{1}{2}$ and $y = \frac{\sqrt{3}}{2}$

$\therefore$ Modulus, $|z| = \sqrt{x^2+y^2}$

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

$$= \sqrt{\frac{1}{4}+\frac{3}{4}}$$

$$= 1$$

Argument

$$\theta = \tan^{-1}\left(\frac{y}{x}\right)$$

$$= \pi - \tan^{-1}\left(\frac{\frac{\sqrt{3}}{2}}{\frac{-1}{2}}\right)$$

$$= \pi - \tan^{-1}(-\sqrt{3})$$

$$= \pi - \tan^{-1}(\sqrt{3})$$

$$= \pi - 60^\circ$$

$$= \pi - \frac{\pi}{3}$$

$$= \frac{2\pi}{3}$$

Polar Form

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

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

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

7

10. Express :- r (cos θ + i sin θ) from , $1+i\sqrt{3}$

So, $x = 1$ and $y = \sqrt{3}$

We know, $\theta = \tan^{-1}\left(\frac{y}{x}\right)$

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

$= \tan^{-1}(\sqrt{3})$

$= 60^\circ$

$= \frac{\pi}{3}$

So, $z = r \cdot (\cos\theta + i\sin\theta)$

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

Therefore, from form of $1+i3 = \left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$

Ans: