

Que 3:- find $\phi(12)$ using PIE.

where $\phi(n) =$ set containing x such that $x < n$ and $\gcd(x, n) = 1$.

Solution:-

we know $12 = 2 \times 2 \times 3$

so say $P_1 = 2$ and $P_2 = 3$

so say

$$A_1 = \{m \in [12] \mid 2 \mid m\}$$

$$A_1 = \{2, 4, 6, 8, 10, 12\}$$

$$A_2 = \{3, 6, 9, 12\}$$

so A_1 is the set give all numbers divide by 2.

A_2 is set give all numbers divide by 3.

so $A_1 \cup A_2$ will get set of all numbers less than 12 such that they are not coprime.

$$\underline{\underline{\text{so}}} \quad |A_1 \cup A_2| = |A_1| + |A_2| - |A_1 \cap A_2|$$

$$= 6 + 4 - 2$$

$$= 8$$

so 8 numbers are not coprime to 12

so total number of coprime number less than 12 is $12 - 8 = 4$.