Q. 1 Solve the given quadratic equation

$(x-1)3+8=0$,   given that cube roots of unity are $1,\omega,\omega2$.

Solution:

Step 1:

$(x-1)3+8=0$

$(x-1)3=-8$

Step 2:

$-8=8\cdot(-1)$.

Now, -1 can be written in exponential form as: $-1=ei\pi$.

So,

$(x-1)3=8ei\pi$

Step 3:

The cube roots of $8ei\pi$ are:

$x-1=83\cdot ei\pi/3,83\cdot ei(\pi/3+2\pi/3),83\cdot ei(\pi/3+4\pi/3)$

Since $83=2$, we get:

x−1=2ei(π/3),2ei(π),2ei(5π/3)

Step 4: Simplify:

1. x−1=2eiπ/3=2(cosπ3+isinπ3)=2(12+i32)=1+i3 ⇒ x=2+i3
2. x−1=2eiπ=2(−1)=−2 ⇒ x=−1
3. x−1=2ei5π/3=2(cos5π3+isin5π3)=2(12−i32)=1−i3 ⇒ x=2−i3

Answer: x = −1, x = 2 + i√3, x = 2 − i√3

Here formula used:

Euler's formula: eiθ=cosθ+isinθ

Trigonometric Values

cosπ3=12,sinπ3=32

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