অনলাIBন ক্লাসে

১ম পর্বের সকল

শিক্ষার্থীদের কে

“ শিক্ষা নিয়ে গড়ব দেশ
শেখ হাসিনার বাংলাদেশ ”

স্বাগতম

উপস্থাপনায় :

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আজকের ক্লাস

১ম পর্ব

বিষয় : ম্যাথমেটিক্স-১

বিষয় কোড : ৬৫৯১১

b¤^i e›Ub t

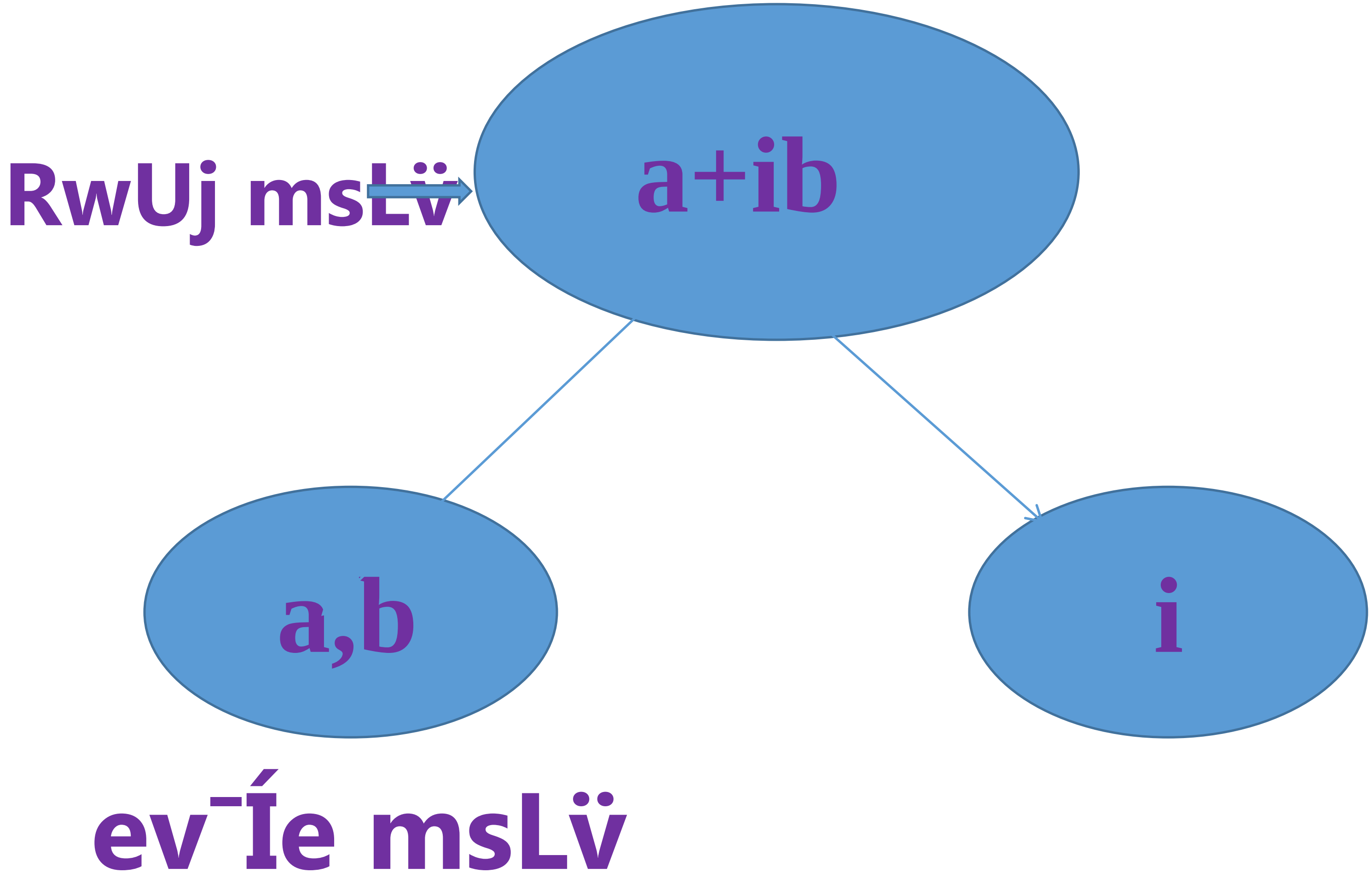
ZvwË¡K b¤^i		eënvwiK b¤^i	me©‡gvU b¤^i
ZvwË¡K avivevwnK (TC)	ZvwË¡K mgvcbx (dvBbvj) (TF)	eënvwiK avivevwnK (PF)	
60	**90**	**50**	**200**

Aav̈q-4

RwUj ivwkgvjv

wcÖq wkÿv_x©e„›` জটিল রাশিমালা Aa¨v‡qi wkLb dj

১. জটিল রাশিমালা কি জানতে পারবে।
২.জটিল সংখ্যা কি জানতে পারবে।
৩. কাল্পনিক সংখ্যা কি জানতে পারবে।
৪. জটিল রাশিমালার এর সূত্রাবলী সম্পর্কে জানতে পারবে।
৫. জটিল রাশিমালার এর সমস্যা সম্পর্কে জানতে পারবে।
৬. জটিল রাশিমালার এর অংকগুলো সমাধান করতে পারবে।



KvíwbK msL¨v

RwUj ivwkgvjv Kv‡K e‡j ?

DËi- hw` a Ges b ev¯Íe msL¨v nq Z‡e a+ib AvKv‡ii ivwk‡K RwUj ivwk e‡j| msL¨vwUi a †K ev¯Íe Ask Ges ib †K KvíwbK Ask ejv nq|

RwUj msL¨v(Complex Number)t

‡h mKj msL¨v ev¯Íe Ges Aev¯Íe Ask aviY K‡i †mB msL¨v‡K RwUj msL¨v e‡j| RwUj msL¨v‡K mvavibZ z Øviv cÖKvk Kiv nq|

MvwbwZKfv‡e, $z = x + iy$ ‡hLv‡b x,y ev¯Íe msL¨v Ges $i=$ KvíwbK msL¨v|

RwUj msL¨vi AbyeÜx (Congugate of Complex Number)t $x - iy$ AvKv‡ii msL¨v‡K $x + iy$ AvKv‡ii msL¨vi AbyeÜx RwUj msL¨v e‡j|Bnv‡K z Øviv cÖKvk Kiv nq| hw` $z = x + iy$ GKwU RwUj msL¨v nq Z‡e Gi AbyeÜx n‡e

$z = x - iy$ | GKB fv‡e hw` $z = x - iy$ GKwU RwUj msL¨v nq Z‡e Gi AbyeÜx n‡e $z = x + iy$

KvíwbK msLÿv (Imaginary Number)t GKwU RwUj msLÿvi Aev¯Íe Ask‡K KvíwbK msLÿv e‡j| hw` $z = x + iy$ GKwU RwUj msLÿv nq Z‡e iy Ask‡K KvíwbK msLÿv e‡j|KvíwbK msLÿv‡K i Øviv cÖKvk Kiv nq| ‡hLv‡b $i = \sqrt{-1}$

RwUj msLÿvi cig gvb/gWzjvm I Av¸©‡g›U|

hw` GKwU RwUj $z = x + iy$ msLÿv nq, Z‡e Bnvi ciggvb $|z|$ Øviv cÖKvk Kiv nq|

A_v©r $r = |z| = |x + iy| = \sqrt{x^2 + y^2}$

Ges Av¸©‡g›U $\tan\theta = \frac{y}{x} \quad \therefore \theta = \tan^{-1}\frac{y}{x}$

Ges ‡cvjvi AvKv‡i cÖKvk Ki‡j $x = r\mathrm{Cos}\theta$ Ges $y = r\mathrm{Sin}\theta$

GK‡Ki Nbg~j wZbwU $1, \omega, \omega^2$

GK‡Ki KvíwbK g~jØ‡qi ¸bdj $=1$

A_©vr $\omega.\omega^2=1$ ev, $\omega^3 = 1$,

$\omega^4=\omega^3.\omega=1.\omega=\omega$

$\omega^5 = \omega^3.\omega^2 = 1.\omega^2 = \omega^2$

$\omega^6 = \omega^3.\omega^3 = 1.1 = 1$

$\omega^7 = \omega^6.\omega = 1.\omega = \omega$

$\omega^8 = \omega^6.\omega^2 = 1.\omega^2 = \omega^2$

$\omega^9 = \omega^3.\omega^3.\omega^3 = 1.1.1 = 1$

$\omega^{10} = \omega^9.\omega = 1.\omega = \omega$

$\omega^{11} = \omega^9.\omega^2 = 1.\omega^2 = \omega^2$

GK‡Ki KvíwbK g~jÎ‡qi ‡hvMdj $= 0$

A_©vr $1 + \omega + \omega^2 = 0$

cÖ‡qvRbxq m~Î: $\omega^3=1$ $i^2 = -1$, $1 + \omega + \omega^2 =0$

AwZ mswÿß cÖkœ

1. 1Gi Nbg~j¸‡jv wjL|

- DËi-GK‡Ki Nbg~j wZbwU 1, $\frac{1}{2}$ (-1+ $\sqrt{-3}$) , $\frac{1}{2}$ (-1- $\sqrt{-3}$) G‡`i GKwU ev¯Íe Ges Ab¨ ˆ`ywU KvíwbK g~j|

- 2.GK‡Ki KvíwbK Nbg~j `ywU wjL|
- DËi-GK‡Ki KvíwbK Nbg~j `ywU $\frac{1}{2}$ (-1+ $\sqrt{-3}$) ,$\frac{1}{2}$ (-1- $\sqrt{-3}$)

3. hw` $x = \frac{1}{2}(-1+\sqrt{-3})$,$y = \frac{1}{2}(-1-\sqrt{-3})$ nq Z‡e $x^3 + y^3$Gi gvb wbY©q Ki|

- DËi: awi,

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

$y = \omega^2 = \frac{1}{2}(-1-\sqrt{-3})$

$\therefore x^3 + y^3$

$= \omega^3 + \omega^6$

$= 1 + (\omega^3)^2$

$= 1 + 1^2$

$= 1+1$

$= 2$ (Ans.)

4 (i) $(-i)^{15}$ Gigvb KZ ?

- mgvavb: $(-i)^{15}$

$= (i^2 . i)^{15}$

$= (i^3)^{15}$

$= i^{45}$

$= (i^2)^{22} . i$

$= (-1)^{22} . i$

$= 1.i$

$= i$ (Ans.)

❑ 4(ii) ω^{17} Gigvb KZ ?

mgvavb: ω^{17}

$= (\omega^3)^5.\omega^2$

$=(1)^5.\omega^2$

$= \omega^2$

❑ 4(iii) i^{15} Gi gvb KZ ?

mgvavb: i^{15}

$=(i^2)^7.i$

$=(-1)^7.i$

$= -1.i$

$= -i$

❑ 4(iv) $(i^{51} + i^5)$ Gi gvb KZ ?

mgvavb: $(i^{51} + i^5)$

$=(i^2)^{25}.i + (i^2)^2.i$

$=(-1)^{25}.i + (-1)^2.i$

$= -1.i + 1.i$

$= -i + I$

$= 0$

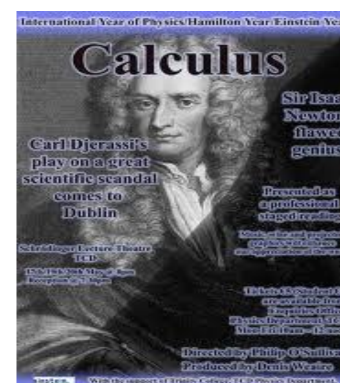
❑ 4(v) i^{302} Gi gvb KZ ?

mgvavb : i^{302}

$= (i^2)^{151}$

$=(-1)^{151}$

$= -1$



5.GK‡Ki KvíwbK Nbg~j ω n‡j
(i)cÖgvb Ki ‡h, $(1+\omega)^3 - (1+\omega^2)^3 = 0$

mgvavb: L.S

$(1+\omega)^3 - (1+\omega^2)^3$

$= (-\omega^2)^3 - (-\omega)^3$ [$1+\omega+\omega^2=0$

$= -\omega^6 + \omega^3$ $1+\omega = -\omega^2$

$= -(\omega^3)^2 + \omega^3$ $1+\omega^2 = -\omega$]

$= -(1)^2 + 1$

$= -1+1$

$= 0 =$ R.S

6. a + ib = 0 n‡j a Ges b Gi gvb KZ ?

mgvavb:

†h‡nZz a + ib = 0

a = -ib

$a^2 = -b^2$

$a^2 + b^2 = 0$

∴ a^2 Ges b^2 cÖ‡Z¨‡K †hvM‡evaK | myZivscÖ‡Z¨‡K k~b¨ bvn‡jZv‡`i †hvMdjk~b¨ n‡Zcv‡ibv|

A_©vra = 0, b = 0

same : a + ib = 0 n‡j $a^2 + b^2$ Gi gvb KZ ?

7. ω^{17} Gi gvb KZ ?

mgvavbt $\omega^{17} = (\omega^3)^5 \omega^2$

$= 1.\ \omega^2$

$= \omega^2$ **(Ans)**

8. **5-6i RwUj msLÿvi cig gvb/gWzjvm KZ?**

mgvavbt awi, $z = 5 - 6i$

gWzjvm $|z| = |5 - 6i\,|$

$= \sqrt{5^2 + (-6)^2}$

$= \sqrt{61}$

$\therefore$ wb‡Y©q gWzjvm $= \sqrt{61}$

9. 4-5i RwUj msLÿvi cig gvb/gWzjvm KZ?

mgvavbt awi, $z = 4 - 5i$

gWzjvm $|z| = |4 - 5i|$

$$= \sqrt{4^2 + (-5)^2}$$

$$= \sqrt{41} \ \textbf{(Ans)}$$

$\therefore$ wb‡Y©q gWzjvm $= \sqrt{41}$

10. $\mathbf{i^{15}}$ Gi gvb KZ ?

mgvavbt $i^{15} = (i^2)^7 . i$

$$= (-1)^7 . i$$

$$= -i \ \textbf{(Ans)}$$

11. $\mathbf{(-i)^{15}}$ Gi gvb KZ ?

mgvavbt $(-i)^{15} = -i^{15}$

$$= -(i^2)^7 . i$$

$$= -(-1)^7 . i$$

$$= -i \ \ \textbf{(Ans)}$$

12. $\mathbf{i^{302}}$ Gi gvb KZ ?

mgvavbt $i^{302} = (i^2)^{151}$

$$= (-1)^{151}$$

$$= -1 \ \ \textbf{(Ans)}$$

GB Aa¨¨‡qi cwVZ AwZ msw¶ß cÖkœvejx

❑1Gi Nbg~j¸‡jv wjL|

❖GK‡Ki KvíwbK Nbg~j `ywU wjL|

❑hw` $x = \frac{1}{2}(-1+\sqrt{-3})$,$y = \frac{1}{2}(-1-\sqrt{-3})$ nq Z‡e $x^3 + y^3$Gi gvb wbY©q Ki|

❖$(-i)^{15}$ Gigvb KZ ?

❑ ω^{17}Gi gvb KZ ?

❖11(iii) i^{15}Gi gvb KZ ?

❑ $(i^{51} + i^5)$ Gi gvb KZ ?

❖i^{302}Gi gvb KZ ?

❑GK‡Ki KvíwbK Nbg~j ωn‡j cÖgvb Ki †h, $(1 + \omega)^3$ - $(1 + \omega^2)^3 = 0$

GB Aav̈‡qi cwVZ AwZ mswÿß cÖkœvejx

GK‡Ki KvíwbKNbg~j w n‡j

- $(1+\omega+2\omega^2)^6$Gigvb KZ?
- $1+\omega+2\omega^2$Gi gvb KZ?
- $(1+\omega^4)(1+\omega^8)$ Gi gvb KZ?
- $(1+w+2w^2)^2$Gi gvb KZ?
- $\omega^8 - \omega^{-4}$Gi gvb KZ?
- ω^{3n+2} Gigvb KZ?
- $a+ib=0$ n‡j a Ges b Gi gvb K
- $a+ib=0$ n‡ja^2+b^2 Gi gvb KZ

mswÿß cÖkœ

1. -1 Gi Nbg~j wbY©q t

mgvavbt awi, $\sqrt[3]{-1} = x$

ev, $x^3 = -1$ (Dfq cÿ‡K Nb K‡i cvB)

ev, $x^3 + 1 = 0$

ev, $(x+1)(x^2 - x + 1)$

ev, $x+1=0$

ev, $x = -1$

A_ev, $x^2 - x + 1$

ev, $x = \frac{-(-1)\pm\sqrt{(-1)^2-4.1.1}}{2.1} = \frac{1\pm\sqrt{-3}}{2}$

$ax^2 + bx + c = 0$ n‡Z Rvwb, $x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

GK‡Ki Nbg~j wZbwU $-1, \frac{1+i\sqrt{3}}{2}, \frac{1-i\sqrt{3}}{2}$

2. i Gi Nbg~j wbY©qt

mgvavbt awi, $\sqrt[3]{i} = x$

ev, $x^3 = i$ (Dfq cÿ‡K Nb K‡i cvB)

ev, $x^3 - i = 0$

ev, $x^3 + i^3 = 0$

ev, $(x + i)(x^2 - xi + i^2) = 0$

ev, $(x + i)(x^2 - xi - 1)$

ev, $x+i = 0$ ev, $x = -i$

A_ev, $x^2 - ix - 1 = 0$

ev, $x = \frac{-(-i)\pm\sqrt{(-1)^2-4.1.(-1)}}{2.1} = \frac{i\pm\sqrt{3}}{2}$

$ax^2 + bx + c = 0$ n‡Z Rvwb, $x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$\therefore$ i Gi Nbg~j wZbwU $-i, \frac{i+\sqrt{3}}{2}, \frac{i-\sqrt{3}}{2}$ **(Ans)**

3. -i Gi Nbg~j wbY©qt

mgvavbt awi, $\sqrt[3]{-i} = x$

ev, $x^3 = -i$ (Dfq cÿ‡K Nb K‡i cvB)

ev, $x^3 + i = 0$

ev, $x^3 - i^3 = 0$

ev, $(x - i)(x^2 + ix + i^2) = 0$

ev, $(x - i)(x^2 + ix - 1) = 0$

ev, $x - i = 0$ ev, $x = i$

A_ev, $x^2 + ix - 1 = 0$

ev, $x = \frac{-i \pm \sqrt{1^2 - 4.1.(-1)}}{2.1} = \frac{-i \pm \sqrt{3}}{2}$

$ax^2 + bx + c = 0$ n‡Z Rvwb, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

∴ -i Nbg~j wZbwU $i, \frac{-i + \sqrt{3}}{2}, \frac{-i - \sqrt{3}}{2}$ **(Ans)**

mswÿß cÖkœ

❖4 . mij Ki : $\frac{(1+i)^2+(1-i)^2}{(1+i)^2-(1-i)^2}$

mgvavb: $\frac{(1+i)^2+(1-i)^2}{(1+i)^2-(1-i)^2}$

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

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

$= \frac{2-1-1}{4i}$

$= 0$ (Ans)

5. cÖgvb Ki †h, $(1-i)^{-2}$- $(1+i)^{-2}$=i

mgvavb: L.H.S

$(1-i)^{-2}$- $(1+i)^{-2}$

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

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

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

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

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

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

6. 2i Gi eM©g~j wbb©qt

mgvavbt

awi, $2i = 1 + 2i - 1$

ev, $2i = 1^2 + 2.1.i + i^2$

ev, $2i = (1+i)^2$

ev, $\sqrt{2i} = \sqrt{(1+i)^2}$

ev, $\sqrt{2i} = \pm(1+i)$

$\therefore \sqrt{2i} = \pm(1+i)$

$\therefore$ 2i Gi eM©g~j $\sqrt{2i} = \pm(1+i)$

•7 .GK‡Ki KvíwbK Nbg~j ωn‡j cÖgvb Ki †h,

$(viii)\ (1-\omega+\omega^2)(1-\omega^2+\omega^4)(1-\omega^4+\omega^8)(1-\omega^8+\omega^{16})=16$

mgvavb: L.S

$(1-\omega+\omega^2)(1-\omega^2+\omega)(1-\omega^4+\omega^8)(1-\omega^8+\omega^{16})$

$=(1-\omega+\omega^2)(1-\omega^2+\omega)(1-\omega+\omega^2)(1-\omega^2+\omega)$

$=(1+\omega^2-\omega)(1+\omega-\omega^2)(1+\omega^2-\omega)(1+\omega-\omega^2)$

$=(-\omega-\omega)(-\omega^2-\omega^2)(-\omega-\omega)(-\omega^2-\omega^2)$

$=(-2\omega)(-2\omega^2)(-2\omega)(-2\omega^2)$

$=16\omega^6$

$=16(\omega^3)^2$

$=16(1)^2$

=16=R.S (proved)

8. cÖgvb Ki †h, $(x+y)^2+(xw+yw^2)^2+(xw^2+yw)^2 = 16xy$

mgvavb: LS

$(x+y)^2+(x\omega+y\omega^2)^2+(x\omega^2+y\omega)^2$

$=x^2+2xy+y^2+x^2\omega^2+2xy\omega^3+y^2\omega^4+x^2\omega^4+2xy\omega^3+y^2\omega^2$

$=x^2+2xy+y^2+x^2\omega^2+2xy+y^2\omega+x^2\omega+2xy+y^2\omega^2$

$=6xy+x^2+x^2\omega+x^2\omega^2+y^2+y^2\omega+y^2\omega^2$

$=6xy+x^2(1+\omega+\omega^2)+y^2(1+\omega+\omega^2)$

$=6xy+x^2(0)+y^2(0)$ $[\therefore 1+\omega+\omega^2=0]$

$=6xy$(proved)

- Same-8.GK‡Ki KvíwbK Nbg~j w n‡j $x = p+q$, $y = p\omega+q\omega^2$,

$z = p\omega^2 + q\omega$ nq Z‡e cÖgvb Ki †h, $x^2 + y^2 + z^2 =$

GB Aavü‡qi cwVZ mswýß cÖkœvejx

❑mij Ki : $\frac{(1+i)^2+(1-i)^2}{(1+i)^2-(1-i)^2}$

❖cÖgvb Ki †h, $(1-i)^{-2}$- $(1+i)^{-2}$= i

❑GK‡Ki KvíwbK Nbg~jω n‡jcÖgvb Ki †h,

$(1-\omega+\omega^2)(1-\omega^2+\omega^4)(1-\omega^4+\omega^8)(1-\omega^8+\omega^{16})=16$

❖cÖgvbKi †h,$(x+y)^2+(x\omega+y\omega^2)^2+(x\omega^2+y\omega)^2=16xy$

iPbvg~jK cÖkœ

❖.1.**hw` $\sqrt[3]{x+iy}=p+iq$ nq Z‡e †`LvI †h,4(p^2-q^2) = $\frac{x}{p}+\frac{y}{q}$**

mgvavb: †`Iqv Av‡Q,

$$\sqrt[3]{x+iy}=p+iq$$

ev, $(\sqrt[3]{x+iy})^3$ =(p + iq$)^3$ [**Dfqcÿ ‡K Nb K‡i**]

ev, x+iy = $p^3 + 3p^2iq + 3pi^2q^2 + i^3q^3$

ev, x+iy = $p^3 + 3p^2iq - 3pq^2 - iq^3$ [$i^2 = -1$]

Dfqcÿ n‡Z ev¯Íe I Kvíwbk gvb mgxK…Z K‡I cvB

$x = p^3 - 3pq^2$

$x = p(p^2 - 3q^2)$

$\frac{x}{p} = (p^2 - 3q^2)$

$iy = 3p^2iq - iq^3$

$iy = iq(3p^2 - q^2)$

$\frac{y}{q} = (3p^2 - q^2)$

R.S= $\frac{x}{p} + \frac{y}{q}$

$= p^2 - 3q^2 + 3p^2 - q^2$

$= 4p^2 - 4q^2$

$= 4(p^2 - q^2)$ (proved)

2. hw` $\sqrt[3]{a+ib} = x + iy$ nq Z‡e,

cÖgvb Ki †h, $\sqrt[3]{a-ib} = x - iy$

mgvavbt

‡`Iqv Av‡Q, $\sqrt[3]{a+ib} = x + iy$

ev, $\left(\sqrt[3]{a+ib}\right)^3 = (x+iy)^3$

ev, $a + ib = x^3 + 3x^2iy + 3x(iy)^2 + (iy)^3$

ev, $a + ib = x^3 + i3x^2y - 3xy^2 - iy^3$

(‡hLv‡b, $i^2 = -1, i^3 = i^2.i = -i$)

ev, $a + ib = x^3 - 3xy^2 + i(3x^2y - y^3)$

Dfq cÿ †_‡K ev¯Íe I KvíwbK Ask‡K mgxK…Z K‡i cvB

$a = x^3 - 3xy^2$ Ges $b = (3x^2y - y^3)$

GLb, $a - ib = (x^3 - 3xy^2) - i(3x^2y - y^3)$

ev, $a - ib = x^3 - 3xy^2 - i3x^2y + iy^3$

ev, $a - ib = x^3 - 3x^2iy - 3xy^2 - (-i)y^3$

ev, $a - ib = x^3 - 3x^2iy + 3x(iy)^2 - (iy)^3 \quad (\therefore\ i^3 = -i)$

ev, $a - ib = (x - iy)^3$

$\therefore \quad \sqrt[3]{a - ib} = x - iy$ **(Proved)**

3. $\sqrt[6]{-64}$ Gi gvb KZ ?

mgvavb: g‡bKwi,

$\sqrt[6]{-64} = x$

ev, $\sqrt[6]{(2i)^6} = x$ $[(2i)^6 = 2^6.i^6 = 64.(i^2)^3 = 64(-1)^3$

ev, $(2i)^6 = x^6$ $= -64]$

ev, $x^6 - (2i)^6 = 0$

ev, $(x^3)^2 - \{(2i)^3\}^2 = 0$

ev, $\{x^3 + (2i)^3\}\{x^3 - (2i)^3\} = 0$

$\therefore x^3 + (2i)^3 = 0$

ev, $(x + 2i)(x^2 - 2ix + 4i^2) = 0$

ev, $(x + 2i)(x^2 - 2ix - 4) = 0$

ev, $(x + 2i) = 0$

ev, $x = -2i$

A_ev, $x^2 - 2ix - 4 = 0$

$$\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{2i \pm \sqrt{(-2i)^2 - 4.1.(-4)}}{2.1}$$ **[a = 1,b = -2i,c =-4]**

$$= \frac{2i \pm \sqrt{4i^2 + 16}}{2}$$

$$= \frac{2i \pm \sqrt{-4 + 16}}{2}$$

$$= \frac{2i \pm \sqrt{12}}{2}$$

$$= \frac{2i \pm \sqrt{4*3}}{2}$$

$$= \frac{2i \pm 2\sqrt{3}}{2}$$

$$= \frac{2(i \pm \sqrt{3})}{2}$$

$$= i \pm \sqrt{3}$$

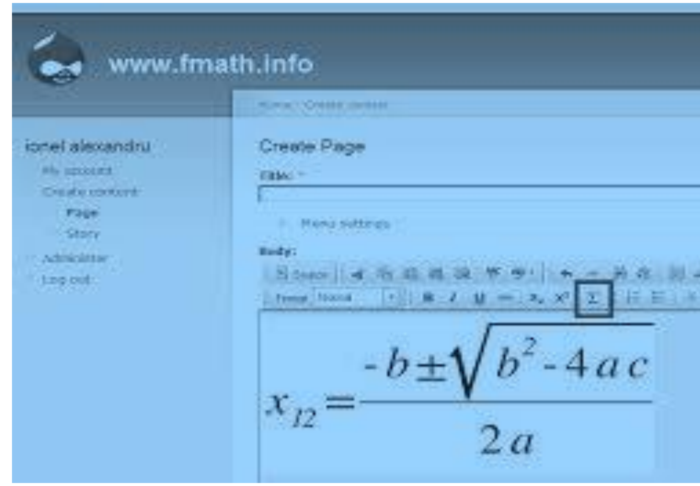
Avevi, $x^3 - (2i)^3 = 0$

ev, $(x - 2i)(x^2 + 2ix + 4i^2) = 0$

ev, $(x - 2i)(x^2 + 2ix - 4) = 0$

ev, $(x - 2i) = 0$

ev, $x = 2i$



A_ev, $x^2 + 2ix - 4 = 0$

$$\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-2i \pm \sqrt{(2i)^2 - 4.1.(-4)}}{2.1}$$ **[a = 1,b = 2i,c =-4]**

$$= \frac{-2i \pm \sqrt{4i^2 + 16}}{2}$$

$$= \frac{-2i \pm \sqrt{-4 + 16}}{2}$$

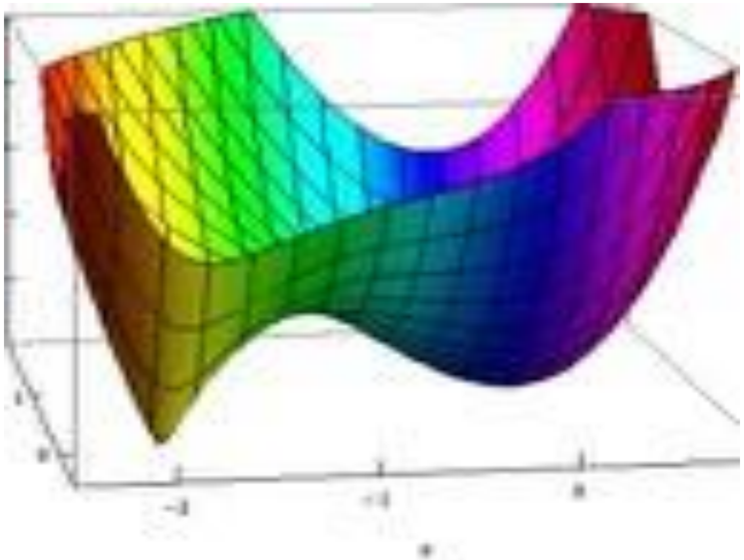
$$= \frac{-2i \pm \sqrt{12}}{2}$$

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

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

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

$= -\ i \pm \sqrt{3}$



wb‡Y©q gvb mg~n $x = \pm 2i,\ i \pm \sqrt{3},\ -i \pm \sqrt{3}$

4. $\sqrt[4]{-144}$ Gi gvb wbb©q Ki|

mgvavbt $\sqrt[4]{-144} = \sqrt[4]{(12i)^2}$

$= \sqrt{\pm 12i} = \sqrt{12}.\sqrt{\pm i}$

$= \pm 2\sqrt{3}.\sqrt{\pm i}$

GLb, $i = \frac{1}{2}(2i) = \frac{1}{2}(1 + 2i + i^2)$

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

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

$\therefore \sqrt{\pm i} = \sqrt{\frac{1}{2}(1 \pm i)^2} = \frac{1}{\sqrt{2}}(1 \pm i)$

$\therefore \sqrt[4]{-144} = \pm 2\sqrt{3}.\frac{1}{\sqrt{2}}(1 \pm i) = \pm\sqrt{6}(1 \pm i)$ **(Ans)**

5. **hw`** $x=\frac{1}{2}(-1+\sqrt{-3})$ **Ges** $y=\frac{1}{2}(-1-\sqrt{-3})$

nq Z‡e †`LvI †h,

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

(ii) $x^2+xy+y^2=0$

(iii) $x^3+y^3=2$

(iv) $x^4+x^2y^2+y^4=0$

mgvavbt

‡`Iqv Av‡Q, $x=\frac{1}{2}(-1+\sqrt{-3}),\ y=\frac{1}{2}(-1-\sqrt{-3})$

awi, $x=\frac{1}{2}(-1+\sqrt{-3})=\omega$

Ges $y=\frac{1}{2}(-1-\sqrt{-3})=\omega^2$

(i)L.H.S $= x^3 + \frac{1}{x^3}$

$= \omega^3 + \frac{1}{\omega^3}$

$= 1 + \frac{1}{1}$

$= 2$ **(R.H.S) (Proved)**

(ii)L.H.S $= x^2 + xy + y^2$

$= \omega^2 + \omega.\omega^2 + (\omega^2)^2$

$= \omega^2 + \omega^3 + \omega^4$

$= \omega^2 + 1 + \omega = 0$ **R.H.S(Proved)**

(iii)L.H.S $= x^3 + y^3$

$= \omega^3 + (\omega^2)^3$

$= 1 + \omega^3$

$= 1 + 1$

$= 2$ **R.H.S (Proved)**

(iv)L.H.S $= x^4 + x^2y^2 + y^4$

$= \omega^4 + \omega^2(\omega^2)^2 + (\omega^2)^4$

$= \omega^4 + \omega^2 . \omega^4 + \omega^8$

$= \omega^4 + \omega^6 + \omega^8$

$= \omega + 1 + \omega^2$

$= 0$ **R.H.S (Proved)**

GB Aav¨‡qi cwVZ iPbvg~jK cÖkœvejx

- ❑hw` $\sqrt[3]{x+iy} = p + iq$nqZ‡e †`LvI †h,4$(p^2-q^2) = \frac{x}{p} + \frac{y}{q}$
- ❖ $\sqrt[6]{-64}$ Gi gvb KZ ?
- ❑-1 Ges iGiNbg~jevwni Ki
- ❖ - iGiNbg~jevwni Ki|
- ❑2i , 1+i eM©g~j wbb©q

- ❑GK‡Ki KvíwbK Nbg~j ωn‡j$x = p+q$, $y = p\omega+q\omega^2$,

  $z = p\omega^2 + q\omega$nq Z‡e cÖgvbKi †h, $x^2 + y^2 + z^2 = 6pq$

Thank You