এস এস সি গণিত (আবশ্যিক)

অধ্যায়-৩: বীজগাণিতিক রাশি

১ ▸ $A = x + y + z$, $B = x^2 - \sqrt{3} + 1$ এবং $C = x^3 + \dfrac{1}{x^3}$

ক. প্রমাণ কর যে, $x^3 + y^3 + z^3 = 3xyz$ যখন $A = 0$।

খ. $B = 0$ হলে $\left(x^3 + \dfrac{1}{x^3}\right) + \left(x^2 + \dfrac{1}{x^2}\right)$ এর মান নির্ণয় কর।

গ. প্রমাণ কর যে, $x = \dfrac{3 + \sqrt{5}}{2}$, যখন $C = 18$।

১ নং প্রশ্নের সমাধান

ক দেওয়া আছে, $A = x + y + z$ এবং $A = 0$
$\therefore x + y + z = 0$

বা, $x + y = -z$

বা, $(x + y)^3 = (-z)^3$

বা, $x^3 + y^3 + 3xy(x + y) = -z^3$

বা, $x^3 + y^3 + z^3 + 3xy(-z) = 0$

বা, $x^3 + y^3 + z^3 - 3xyz = 0$

$\therefore x^3 + y^3 + z^3 = 3xyz$ (প্রমাণিত)

খ এখানে, $B = x^2 - \sqrt{3} + 1$ এবং $B = 0$

$\therefore x^2 - \sqrt{3} + 1 = 0$

বা, $x^2 + 1 = \sqrt{3}x$

বা, $x + \dfrac{1}{x} = \sqrt{3}$

প্রদত্ত রাশি $= \left(x^3 + \dfrac{1}{x^3}\right) + \left(x^2 + \dfrac{1}{x^2}\right)$

$= \left\{\left(x + \dfrac{1}{x}\right)^3 - 3x\cdot\dfrac{1}{x}\left(x + \dfrac{1}{x}\right)\right\} + \left\{\left(x + \dfrac{1}{x}\right)^2 - 2x\cdot\dfrac{1}{x}\right\}$

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

$= (3\sqrt{3} - 3\sqrt{3}) + (3 - 2) = 0 + 1 = 1$। (Ans.)

গ এখানে, $C = x^3 + \dfrac{1}{x^3}$ এবং $C = 18$

$\therefore x^3 + \dfrac{1}{x^3} = 18$

বা, $x^6 + 1 = 18x^3$

বা, $x^6 - 18x^3 + 1 = 0$

বা, $x^6 - 18x^3 + 81 - 80 = 0$

বা, $(x^3)^2 - 2\cdot x^3\cdot 9 + 9^2 = 80$

বা, $(x^3 - 9)^2 = (4\sqrt{5})^2$

বা, $x^3 - 9 = 4\sqrt{5}$

বা, $x^3 = 9 + 4\sqrt{5}$

বা, $x^3 = \dfrac{72}{8} + \dfrac{32\sqrt{5}}{8} = \dfrac{72 + 32\sqrt{5}}{8} = \dfrac{27 + 27\sqrt{5} + 45 + 5\sqrt{5}}{8}$

বা, $x^3 = \dfrac{3^3 + 3\cdot 3^2\sqrt{5} + 3\cdot 3\cdot\sqrt{5}^2 + \sqrt{5}^3}{8}$

বা, $x^3 = \dfrac{(3 + \sqrt{5})^3}{8}$

বা, $x^3 = \left(\dfrac{3 + \sqrt{5}}{2}\right)^3$

$\therefore x = \dfrac{3 + \sqrt{5}}{2}$ (প্রমাণিত)

২ ▸ x এবং x এর গুণাত্মক বিপরীত রাশির সমষ্টি 3

ক. $x - \dfrac{1}{x}$ এর মান নির্ণয় কর।

খ. দেখাও যে, $\dfrac{x^4 + 1}{x^2} = 18$

গ. $x^4 - 7x^2 + 1 = 0$ এর সত্যতা যাচাই কর।

২ নং প্রশ্নের সমাধান

ক x এর গুণাত্মক বিপরীত রাশি $\dfrac{1}{x}$

প্রশ্নানুসারে, $x + \dfrac{1}{x} = 3$

বা, $\left(x + \dfrac{1}{x}\right)^2 = 9$ [বর্গ করে]

বা, $\left(x - \dfrac{1}{x}\right)^2 + 4\cdot x\cdot\dfrac{1}{x} = 9$

বা, $\left(x - \dfrac{1}{x}\right)^2 + 4 = 9$

বা, $\left(x - \dfrac{1}{x}\right)^2 = 5$

$\therefore x - \dfrac{1}{x} = \pm\sqrt{5}$ (Ans.)

খ 'ক' হতে পাই, $x + \dfrac{1}{x} = 3$

বামপক্ষ $= \dfrac{x^4 + 1}{x^2} = \dfrac{x^4}{x^2} + \dfrac{1}{x^2} = x^2 + \dfrac{1}{x^2}$

$= \left(x + \dfrac{1}{x}\right)^2 - 3x\cdot\dfrac{1}{x}\left(x + \dfrac{1}{x}\right)$

$= 3^2 - 3\cdot 1\cdot 3$ [মান বসিয়ে]

$= 27 - 9$

$= 18 =$ ডানপক্ষ

$\therefore \dfrac{x^4 + 1}{x^2} = 18$ (দেখানো হলো)

গ $x^4 - 7x^2 + 1 = 0$

বা, $x^4 + 1 = 7x^2$

বা, $\dfrac{x^4 + 1}{x^2} = 7$

বা, $\dfrac{x^4}{x^2} + \dfrac{1}{x^2} = 7$

বা, $x^2 + \dfrac{1}{x^2} = 7$

বা, $\left(x + \dfrac{1}{x}\right)^2 - 2x\cdot\dfrac{1}{x} = 7$

বা, $\left(x + \dfrac{1}{x}\right)^2 = 7 + 2$

বা, $\left(x + \dfrac{1}{x}\right)^2 = 9$

বা, $x + \dfrac{1}{x} = 3$

$\therefore x + \dfrac{1}{x} = 3$ এর জন্য $x^4 - 7x^2 + 1 = 0$ সমীকরণটি সত্য।

৩ ▸ $a^3 + b^3 = 3ab$ দেখালে $a > b$

ক. $\dfrac{a}{b} + \dfrac{b}{a} = $ কত?

খ. $\dfrac{a^2}{b^2} + \dfrac{b^2}{a^2}$ এর মান নির্ণয় কর।

গ. প্রমাণ কর যে, $\dfrac{a^3}{b^3} - \dfrac{b^3}{a^3} = 2\sqrt{5}$

৩ নং প্রশ্নের সমাধান

ক দেওয়া আছে, $a^3 + b^3 = 3ab$ দেখানে, $a > b$

বা, $\dfrac{a^2 + b^2}{ab} = \dfrac{3ab}{ab}$ [উভয়পক্ষে ab দ্বারা ভাগ করে]

বা, $\dfrac{a^2}{ab} + \dfrac{b^2}{ab} = 3$

বা, $\dfrac{a}{b} + \dfrac{b}{a} = 3$

$\therefore \dfrac{a}{b} + \dfrac{b}{a} = 3$ (Ans.)

খ 'ক' হতে পাই, $\dfrac{a}{b} + \dfrac{b}{a} = 3$

$\dfrac{a^2 + b^2}{b^2} = \dfrac{a^2}{b^2} + \dfrac{b^2}{a^2}$

$= \left(\dfrac{a}{b}\right)^2 + \left(\dfrac{b}{a}\right)^2 = \left(\dfrac{a}{b} + \dfrac{b}{a}\right)^2 - 2\cdot\dfrac{a}{b}\cdot\dfrac{b}{a}$

$= (3)^2 - 2 = 9 - 2 = 7$ (Ans.)

খ দেওয়া আছে, $2a + \dfrac{2}{a} = 5$

$\therefore 8a^3 + \dfrac{8}{a^3} = (2a)^3 + \left(\dfrac{2}{a}\right)^3 = \left(2a + \dfrac{2}{a}\right)^3 - 3\cdot 2a\cdot\dfrac{2}{a}\left(2a + \dfrac{2}{a}\right)$

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