

# Mathematics

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(Chapter – 2) (Polynomials)(Exemplar Problems)

(Class – IX)

## Exercise 2.4

### Question 9:

Prove that  $(a + b + c)^3 - a^3 - b^3 - c^3 = 3(a + b)(b + c)(c + a)$ .

### Answer 9:

$$\begin{aligned} \text{LHS} &= (a + b + c)^3 - a^3 - b^3 - c^3 \\ &= [(a + b + c)^3 - a^3] - [b^3 + c^3] \\ &= \{[(a + b + c) - a]\{(a + b + c)^2 + (a + b + c)a + a^2\}\} - [(b + c)(b^2 - bc + c^2)] \\ &\quad [\because a^3 - b^3 = (a - b)(a^2 + ab + b^2) \text{ and } a^3 + b^3 = (a + b)(a^2 - ab + b^2)] \\ &= (b + c)\{(a^2 + b^2 + c^2 + 2ab + 2bc + 2ca) + (a^2 + ab + ac) + a^2\} - [(b + c)(b^2 - bc + c^2)] \\ &= (b + c)(3a^2 + b^2 + c^2 + 3ab + 2bc + 3ca) - [(b + c)(b^2 - bc + c^2)] \\ &= (b + c)[(3a^2 + b^2 + c^2 + 3ab + 2bc + 3ca) - (b^2 - bc + c^2)] \\ &= (b + c)[3a^2 + 3ab + 3bc + 3ca] \\ &= 3(b + c)[a^2 + ab + bc + ca] \\ &= 3(b + c)[a(a + b) + c(b + a)] \\ &= 3(a + b)(b + c)(a + c) \\ &= 3(a + b)(b + c)(c + a) \\ &= \text{RHS} \end{aligned}$$

