

Mathematics

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

(Class – X)

Exercise 2.4

Question 5:

If $x - \sqrt{5}$ is a factor of the cubic polynomial $x^3 - 3\sqrt{5}x^2 + 13x - 3\sqrt{5}$, then find all the zeroes of the polynomial.

Answer 5:

Let $f(x) = x^3 - 3\sqrt{5}x^2 + 13x - 3\sqrt{5}$ and given that, $(x - \sqrt{5})$ is a one of the factor of $f(x)$.

Now, using division algorithm.

$$\begin{array}{r} x^2 - 2\sqrt{5}x + 3 \\ x - \sqrt{5} \overline{) x^3 - 3\sqrt{5}x^2 + 13x - 3\sqrt{5}} \\ \underline{-x^3 + \sqrt{5}x^2} \phantom{+ 13x - 3\sqrt{5}} \\ -2\sqrt{5}x^2 + 13x - 3\sqrt{5} \\ \underline{+ 2\sqrt{5}x^2 - 10x} \phantom{- 3\sqrt{5}} \\ 13x - 3\sqrt{5} \\ \underline{- 13x + 3\sqrt{5}} \\ 0 \end{array}$$

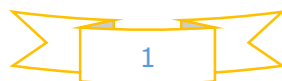
$$\therefore x^3 - 3\sqrt{5}x^2 + 13x - 3\sqrt{5} = (x^2 - 2\sqrt{5}x + 3) \times (x - \sqrt{5}) + 0$$

[\because Dividend = divisor \times quotient + remainder]

$$= (x - \sqrt{5})[x^2 - \{(\sqrt{5} + \sqrt{2}) + (\sqrt{5} - \sqrt{2})\}x + 3]$$

$$= (x - \sqrt{5})[x^2 - (\sqrt{5} - \sqrt{2})x - (\sqrt{5} - \sqrt{2})x + (\sqrt{5} + \sqrt{2})(\sqrt{5} - \sqrt{2})]$$

[$\because 3 = (\sqrt{5} + \sqrt{2})(\sqrt{5} - \sqrt{2})$]



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$$= (x - \sqrt{5})[x\{x - (\sqrt{5} + \sqrt{2})\} - (\sqrt{5} - \sqrt{2})\{x - (\sqrt{5} + \sqrt{2})\}]$$

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

Hence, all the zeroes of polynomial are $\sqrt{5}$, $(\sqrt{5} + \sqrt{2})$ and $(\sqrt{5} - \sqrt{2})$.

