

# Mathematics

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

(Class – X)

## Exercise 2.4

### Question 6:

For which value of  $a$  and  $b$ , are zeroes of  $q(x) = x^3 + 2x^2 + a$  the zeroes of polynomial  $p(x) = x^5 - x^4 - 4x^3 + 3x^2 + 3x + b$ ? which zeroes of  $p(x)$  are not the zeroes of  $q(x)$ ?

### Answer 6:

Given that the zeroes of  $q(x) = x^3 + 2x^2 + a$  are also the zeroes of the polynomial  $p(x) = x^5 - x^4 - 4x^3 + 3x^2 + 3x + b$  i.e.,  $q(x)$  is a factor of  $p(x)$ . Using division algorithm.

$$\begin{array}{r} x^2 - 3x + 2 \\ x^3 + 2x^2 + a \overline{) x^5 - x^4 - 4x^3 + 3x^2 + 3x + b} \\ \underline{-x^5 + 2x^4} \phantom{+ 3x^2 + 3x + b} \\ -3x^4 - 4x^3 - (a-3)x^2 + 3x + b \\ \underline{+3x^4 + 6x^3} \phantom{+ 3x + b} \\ 2x^3 - (a-3)x^2 + (3+3a)x + b \\ \underline{-2x^3 + 4x^2 + 2a} \\ -(a+1)x^2 + (3+3a)x + b - 2a \end{array}$$

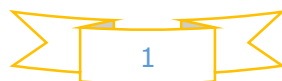
If  $(x^3 + 2x^2 + a)$  is a factor of  $x^5 - x^4 - 4x^3 + 3x^2 + 3x + b$ , then remainder should be zero.

$$\text{i.e., } -(1+a)x^2 + (3+3a)x + (b-2a) = 0 \cdot x^2 + 0 \cdot x + 0$$

On comparing the coefficient of  $x^2$  and constant term, we get

$$a + 1 = 0$$

$$\Rightarrow a = -1$$



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$$\text{and } b - 2a = 0$$

$$\Rightarrow b = 2a$$

$$\Rightarrow b = 2(-1) = -2 \quad [ \because a = -1 ]$$

For  $a = -1$  and  $b = -2$ , the zeroes of  $q(x)$  are also the zeroes of the polynomial  $p(x)$ .

$$\therefore q(x) = x^3 + 2x^2 - 1$$

$$\text{And } p(x) = x^5 - x^4 - 4x^3 + 3x^2 + 3x - 2$$

Now, Dividend = divisor  $\times$  quotient + remainder

$$p(x) = (x^3 + 2x^2 - 1)(x^2 - 3x + 2) + 0$$

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

$$= (x^3 + 2x^2 - 1)(x - 2)(x - 1)$$

Hence, the zeroes of  $p(x)$  are 1 and 2 which are not the zeroes of  $q(x)$ .

