

# Mathematics

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

(Class – IX)

## Exercise 2.3

### Question 24:

Factorise:

(i)  $2x^3 - 3x^2 - 17x + 30$

(ii)  $x^3 - 6x^2 + 11x - 6$

(iii)  $x^3 + x^2 - 4x - 4$

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

### Answer 24:

(i). Given that:  $p(x) = 2x^3 - 3x^2 - 17x + 30$

$$\Rightarrow p(1) = 2(1)^3 - 3(1)^2 - 17(1) + 30$$

$$= 2 - 3 - 17 + 30$$

$$= 32 - 20 = 12 \neq 0$$

$$p(2) = 2(2)^3 - 3(2)^2 - 17(2) + 30$$

$$= 16 - 12 - 34 + 30$$

$$= 46 - 46 = 0$$

$$\Rightarrow (x - 2) \text{ is a factor of } p(x).$$

	$2x^2 + x - 15$
$x - 2$	$\begin{array}{r} 2x^3 - 3x^2 - 17x + 30 \\ 2x^3 - 4x^2 \\ \hline - \quad + \\ \hline \quad x^2 - 17x + 30 \\ \quad x^2 - 2x \\ \hline \quad \quad - \quad + \\ \quad \quad \quad - 15x + 30 \\ \quad \quad \quad - 15x + 30 \\ \hline \quad \quad \quad \quad + \quad - \\ \quad \quad \quad \quad \quad 0 \end{array}$

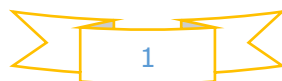
$$\text{Now, } p(x) = (x - 2)(2x^2 + x - 15)$$

$$= (x - 2)(2x^2 + 6x - 5x - 15)$$

$$= (x - 2)[2x(x + 3) - 5(x + 3)]$$

$$= (x - 2)[(x + 3)(2x - 5)]$$

$$= (x - 2)(x + 3)(2x - 5)$$



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(ii). Given that:  $p(x) = x^3 - 6x^2 + 11x - 6$

$$\Rightarrow p(1) = (1)^3 - 6(1)^2 + 11(1) - 6$$

$$= 1 - 6 + 11 - 6$$

$$= 12 - 12$$

$$= 0$$

$\Rightarrow (x - 1)$  is a factor of  $p(x)$ .

$$\begin{array}{r} x^2 - 5x + 6 \\ x - 1 \overline{) x^3 - 6x^2 + 11x - 6} \\ \underline{x^3 - x^2} \phantom{+ 11x - 6} \\ -5x^2 + 11x - 6 \\ \underline{-5x^2 + 5x} \phantom{- 6} \\ +6x - 6 \\ \underline{+6x - 6} \\ - \phantom{+} 0 \end{array}$$

$$\text{Now, } p(x) = (x - 1)(x^2 - 5x + 6)$$

$$= (x - 1)(x^2 - 3x - 2x + 6)$$

$$= (x - 1)[x(x - 3) - 2(x - 3)]$$

$$= (x - 1)[(x - 3)(x - 2)]$$

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

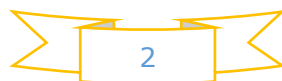
(iii). Given that:  $p(x) = x^3 + x^2 - 4x - 4$

$$\Rightarrow p(1) = (1)^3 + (1)^2 - 4(1) - 4$$

$$= 1 + 1 - 4 - 4$$

$$= 2 - 8$$

$$= -6 \neq 0$$



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$$\begin{aligned}p(-1) &= (-1)^3 + (-1)^2 - 4(-1) - 4 \\&= -1 + 1 + 4 - 4 \\&= 5 - 5 = 0 \\&\Rightarrow (x + 1) \text{ is a factor of } p(x).\end{aligned}$$

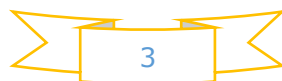
$$\begin{array}{r}x^2 - 4 \\x + 1 \overline{) \begin{array}{r} x^3 + x^2 - 4x - 4 \\ x^3 + x^2 \\ \hline -4x - 4 \\ -4x - 4 \\ \hline 0 \end{array}}\end{array}$$

$$\begin{aligned}\text{Now, } p(x) &= (x + 1)(x^2 - 4) \\&= (x + 1)(x^2 - 2^2) \\&= (x + 1)[(x - 2)(x + 2)] \\&= (x + 1)(x - 2)(x + 2)\end{aligned}$$

(iv). Given that:  $p(x) = 3x^3 - x^2 - 3x + 1$

$$\begin{aligned}\Rightarrow p(1) &= 3(1)^3 - (1)^2 - 3(1) + 1 \\&= 3 - 1 - 3 + 1 \\&= 4 - 4 = 0 \\&\Rightarrow (x - 1) \text{ is a factor of } p(x).\end{aligned}$$

$$\begin{array}{r}3x^2 + 2x - 1 \\x - 1 \overline{) \begin{array}{r} 3x^3 - x^2 - 3x + 1 \\ 3x^3 - 3x^2 \\ \hline 2x^2 - 3x + 1 \\ 2x^2 - 2x \\ \hline -x + 1 \\ -x + 1 \\ \hline 0 \end{array}}\end{array}$$



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$$\begin{aligned}\text{Now, } p(x) &= (x - 1)(3x^2 + 2x - 1) \\ &= (x - 1)(3x^2 + 3x - x - 1) \\ &= (x - 1)[3x(x + 1) - 1(x + 1)] \\ &= (x - 1)[(x + 1)(3x - 1)] \\ &= (x - 1)(x + 1)(3x - 1)\end{aligned}$$

