Polynomials

CHAPTER

SOLUTIONS



1. (i) The given graph is parallel to *x*-axis, it does not intersect the *x*-axis.

 \therefore It has no zero.

NCERT FOCUS

- (ii) The given graph intersects the *x*-axis at one point only.
- \therefore It has one zero.
- (iii) The given graph intersects the *x*-axis at three points.
- \therefore It has three zeroes.
- (iv) The given graph intersects the *x*-axis at two points.∴ It has two zeroes.
- (v) The given graph intersects the *x*-axis at four points.
- : It has four zeroes.
- (vi) The given graph meets the *x*-axis at three points.
- \therefore It has three zeroes.

EXERCISE - 2.2

1. (i) We have,
$$p(x) = x^2 - 2x - 8$$

= $x^2 + 2x - 4x - 8 = x(x + 2) - 4(x + 2) = (x - 4)(x + 2)$
For $p(x) = 0$, we must have $(x - 4)(x + 2) = 0$
Either $x - 4 = 0 \Rightarrow x = 4$ or $x + 2 = 0 \Rightarrow x = -2$
 \therefore The zeroes of $x^2 - 2x - 8$ are 4 and -2
Now, sum of the zeroes = $4 + (-2) = 2 = \frac{-(-2)}{1}$

$$=\frac{-(\text{Coefficient of } x)}{x}$$

Coefficient of x^2

Product of zeroes =
$$4 \times (-2) = \frac{-8}{-8} = \frac{\text{Constant term}}{-8}$$

Thus, the relationship between the zeroes and the coefficients in the polynomial $x^2 - 2x - 8$ is verified. (ii) We have, $p(s) = 4s^2 - 4s + 1$ $= 4s^2 - 2s - 2s + 1 = 2s(2s - 1) - 1(2s - 1)$ = (2s - 1)(2s - 1)For p(s) = 0, we have, $(2s - 1) = 0 \Rightarrow s = \frac{1}{2}$ \therefore The zeroes of $4s^2 - 4s + 1$ are $\frac{1}{2}$ and $\frac{1}{2}$ Sum of the zeroes $= \frac{1}{2} + \frac{1}{2} = 1 = \frac{-(-4)}{4} = \frac{-(\text{Coefficient of } s)}{\text{Coefficient of } s^2}$ and product of zeroes $= \left(\frac{1}{2}\right) \times \left(\frac{1}{2}\right) = \frac{1}{4} = \frac{\text{Constant term}}{\text{Coefficient of } s^2}$

Thus, the relationship between the zeroes and coefficient of s^2 in the polynomial $4s^2 - 4s + 1$ is verified. (iii) We have, $p(x) = 6x^2 - 3 - 7x$ $= 6x^{2} - 7x - 3 = 6x^{2} - 9x + 2x - 3 = 3x(2x - 3) + 1(2x - 3)$ = (3x + 1)(2x - 3)For p(x) = 0, we have, Either $(3x + 1) = 0 \Rightarrow x = -\frac{1}{3}$ or $(2x - 3) = 0 \Rightarrow x = \frac{3}{2}$ Thus, the zeroes of $6x^{2} - 3 - 7x$ are $-\frac{1}{3}$ and $\frac{3}{2}$. Now, sum of the zeroes $= -\frac{1}{3} + \frac{3}{2} = \frac{7}{6} = \frac{-(-7)}{6}$ $= \frac{-(\text{Coefficient of } x)}{\text{Coefficient of } x^{2}}$ and product of zeroes $= (-\frac{1}{3}) \times \frac{3}{2} = \frac{-3}{6}$ Constant term

$$=$$
 Coefficient of x^2

Thus, the relationship between the zeroes and coefficients in the polynomial $6x^2 - 3 - 7x$ is verified. (iv) We have, $p(u) = 4u^2 + 8u = 4u(u + 2)$ For p(u) = 0, we have Either $4u = 0 \Rightarrow u = 0$ or $u + 2 = 0 \Rightarrow u = -2$ The zeroes of $4u^2 + 8u$ are 0 and – 2. Now, $4u^2 + 8u$ can be written as $4u^2 + 8u + 0$. Sum of the zeroes = $0 + (-2) = -2 = \frac{-(8)}{4}$ -(Coefficient of *u*) $= \frac{1}{Coefficient of u^2}$ and the product of zeroes = $0 \times (-2) = 0 = \frac{0}{4}$ Constant term Coefficient of u^2 Thus, the relationship between the zeroes and the coefficients in the polynomial $4u^2 + 8u$ is verified. (v) We have, $p(t) = t^2 - 15 = (t^2) - (\sqrt{15})^2$ $=(t+\sqrt{15})(t-\sqrt{15})$ $[:: a^2 - b^2 = (a + b) (a - b)]$ For p(t) = 0, we have Either $(t + \sqrt{15}) = 0 \Rightarrow t = -\sqrt{15}$ or $t - \sqrt{15} = 0 \implies t = \sqrt{15}$ The zeroes of t^2 – 15 are – $\sqrt{15}$ and $\sqrt{15}$ ÷ Now, we can write $t^2 - 15$ as $t^2 + 0t - 15$. (0)

$$\therefore \text{ Sum of the zeroes} = -\sqrt{15} + \sqrt{15} = 0 = \frac{-(0)}{1}$$
$$= \frac{-(\text{Coefficient of } t)}{\text{Coefficient of } t^2}$$

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Product of zeroes = $(-\sqrt{15}) \times (\sqrt{15}) = \frac{-(15)}{1}$ = $\frac{\text{Constant term}}{\text{Coefficient of } t^2}$

Thus, the relationship between zeroes and the coefficients in the polynomial $t^2 - 15$ is verified. (vi) We have, $p(x) = 3x^2 - x - 4$

 $= 3x^{2} + 3x - 4x - 4 = 3x(x + 1) - 4(x + 1) = (x + 1)(3x - 4)$ For p(x) = 0, we have Either $(x + 1) = 0 \Rightarrow x = -1$

- or $3x 4 = 0 \Rightarrow x = 4/3$
- \therefore The zeroes of $3x^2 x 4$ are -1 and 4/3

Now, sum of the zeroes =
$$(-1) + \frac{4}{3} = \frac{1}{3} = \frac{-(-1)}{3}$$

_ -(Coefficient of *x*)

and product of zeroes = $(-1) \times \frac{4}{3} = \frac{(-4)}{3}$

$$=\frac{\text{Constant term}}{\text{Coefficient of }x^2}$$

Coefficient of x^2

Thus, the relationship between the zeroes and coefficients in the polynomial $3x^2 - x - 4$ is verified.

2. (i) Since, sum of the zeroes,
$$(\alpha + \beta) = \frac{1}{4}$$

Product of the zeroes, $\alpha\beta = -1$

∴ The required quadratic polynomial is $x^2 - (\alpha + \beta)x + \alpha\beta$

$$=x^{2} - \left(\frac{1}{4}\right)x + (-1) = x^{2} - \frac{1}{4}x - 1 = \frac{1}{4}(4x^{2} - x - 4)$$

Since, $\frac{1}{4}(4x^2 - x - 4)$ and $(4x^2 - x - 4)$ have same

zeroes, therefore $(4x^2 - x - 4)$ is the required quadratic polynomial.

(ii) Since, sum of the zeroes, $(\alpha + \beta) = \sqrt{2}$

Product of zeroes, $\alpha\beta = \frac{1}{2}$

 $\therefore \text{ The required quadratic polynomial is} x^2 - (\alpha + \beta)x + \alpha\beta$

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

Since, $\frac{1}{3}(3x^2 - 3\sqrt{2}x + 1)$ and $(3x^2 - 3\sqrt{2}x + 1)$ have same zeroes, therefore

 $(3x^2 - 3\sqrt{2}x + 1)$ is the required quadratic polynomial. (iii) Since, sum of zeroes, $(\alpha + \beta) = 0$ Product of zeroes, $\alpha\beta = \sqrt{5}$

 $\therefore \text{ The required quadratic polynomial is}$ $x^2 - (\alpha + \beta)x + \alpha\beta$ $= x^2 - (0)x + \sqrt{5} = x^2 + \sqrt{5}$

(iv) Since, sum of zeroes, $(\alpha + \beta) = 1$ Product of zeroes, $\alpha\beta = 1$ $\therefore \text{ The required quadratic polynomial is}$ $x^2 - (\alpha + \beta)x + \alpha\beta = x^2 - (1)x + 1 = x^2 - x + 1$

(v) Since, sum of the zeroes, $(\alpha + \beta) = -\frac{1}{4}$

Product of zeroes, $\alpha\beta = 1/4$

 \therefore The required quadratic polynomial is $x^2 - (\alpha + \beta)x + \alpha\beta$

$$= x^{2} - \left(-\frac{1}{4}\right)x + \frac{1}{4} = x^{2} + \frac{x}{4} + \frac{1}{4} = \frac{1}{4}(4x^{2} + x + 1)$$

Since, $\frac{1}{4}(4x^2 + x + 1)$ and $(4x^2 + x + 1)$ have same zeroes, therefore, the required quadratic polynomial is $(4x^2 + x + 1)$.

(vi) Since, sum of zeroes, $(\alpha + \beta) = 4$ and product of zeroes, $\alpha\beta = 1$

... The required quadratic polynomial is $x^2 - (\alpha + \beta)x + \alpha\beta = x^2 - 4x + 1.$

EXERCISE - 2.3

1. (i) Here, dividend $p(x) = x^3 - 3x^2 + 5x - 3$, and divisor $g(x) = x^2 - 2$

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We have

$$\frac{x-3}{-2)x^{3}-3x^{2}+5x-3} \\
\frac{x^{3}-2x}{(-)(+)} \\
\frac{-3x^{2}+7x-3}{-3x^{2}+6} \\
\frac{(+)(-)}{7x-9}$$

Thus, the quotient = (x - 3) and remainder = (7x - 9).

(ii) Here, dividend $p(x) = x^4 - 3x^2 + 4x + 5$ and divisor $g(x) = x^2 + 1 - x = x^2 - x + 1$

∴ We have

$$x^{2} - x + 1 \overline{\smash{\big)}} x^{4} + 0x^{3} - 3x^{2} + 4x + 5}$$

$$x^{4} - x^{3} + x^{2}$$

$$(-) (+) (-)$$

$$x^{3} - 4x^{2} + 4x + 5$$

$$x^{3} - x^{2} + x$$

$$(-) (+) (-)$$

$$- 3x^{2} + 3x + 5$$

$$- 3x^{2} + 3x - 3$$

$$(+) (-) (+)$$

$$8$$

Thus, the quotient = $(x^2 + x - 3)$ and remainder = 8.

Polynomials

(iii) Here, dividend, $p(x) = x^4 - 5x + 6$ and divisor, $g(x) = 2 - x^2 = -x^2 + 2$

∴ We have

$$\begin{array}{r} -x^{2} - 2 \\ -x^{2} + 2 \overline{\smash{\big)}} x^{4} - 5x + 6 \\ x^{4} - 2x^{2} \\ (-) (+) \\ 2x^{2} - 5x + 6 \\ 2x^{2} - 4 \\ (-) (+) \\ \hline -5x + 10 \end{array}$$

Thus, the quotient $= -x^2 - 2$ and remainder = -5x + 10. **2.** (i) Dividing $2t^4 + 3t^3 - 2t^2 - 9t - 12$ by $t^2 - 3$, we have

$$2t^{2} + 3t + 4$$

$$t^{2} - 3 \int 2t^{4} + 3t^{3} - 2t^{2} - 9t - 12$$

$$2t^{4} - 6t^{2}$$

$$(-) (+)$$

$$3t^{3} + 4t^{2} - 9t - 12$$

$$3t^{3} - 9t$$

$$(-) (+)$$

$$4t^{2} - 12$$

$$4t^{2} - 12$$

$$(-) (+)$$

$$0$$

 \therefore Remainder = 0

:. $(t^2 - 3)$ is a factor of $2t^4 + 3t^3 - 2t^2 - 9t - 12$.

(ii) Dividing $3x^4 + 5x^3 - 7x^2 + 2x + 2$ by $x^2 + 3x + 1$, we have

 \therefore Remainder = 0

:. $x^2 + 3x + 1$ is a factor of $3x^4 + 5x^3 - 7x^2 + 2x + 2$.

(iii) Dividing $x^5 - 4x^3 + x^2 + 3x + 1$ by $x^3 - 3x + 1$, we get

$$\begin{array}{r} x^{2} - 1 \\ x^{3} - 3x + 1 \hline x^{5} - 4x^{3} + x^{2} + 3x + 1 \\ x^{5} - 3x^{3} + x^{2} \\ (-) (+) (-) \\ -x^{3} + 3x + 1 \\ -x^{3} + 3x - 1 \\ (+) (-) (+) \\ \hline 2 \end{array}$$

: Remainder = 2, *i.e.*, remainder $\neq 0$

:
$$x^3 - 3x + 1$$
 is not a factor of $x^5 - 4x^3 + x^2 + 3x + 1$.

3. We have $p(x) = 3x^4 + 6x^3 - 2x^2 - 10x - 5$. Given $\sqrt{\frac{5}{3}}$ and $-\sqrt{\frac{5}{3}}$ are zeroes of p(x). $\therefore \qquad \left(x - \sqrt{\frac{5}{3}}\right) \left(x + \sqrt{\frac{5}{3}}\right)$ is a factor of p(x).

Now, let us divide $3x^4 + 6x^3 - 2x^2 - 10x - 5$ by

x-

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

$$x^2 - \frac{5}{3} \int \frac{3x^2 + 6x + 3}{3x^4 + 6x^3 - 2x^2 - 10x - 5}$$

$$(-) \qquad (+)$$

$$\frac{-(-) \qquad (+)}{3x^2 - 5}$$

$$\frac{-(-) \qquad (+)}{3x^2 - 5}$$

$$\frac{-(-) \qquad (+)}{0}$$

$$\therefore \quad 3x^4 + 6x^3 - 2x^2 - 10x - 5 = (3x^2 + 6x + 3)(x^2 - 5/3)$$
$$= 3(x^2 + 2x + 1)\left(x^2 - \frac{5}{3}\right) = 3(x + 1)^2(x^2 - 5/3)$$

Thus, the other zeroes of the given polynomial are -1 and -1.

4. Here, dividend, $p(x) = x^3 - 3x^2 + x + 2$, divisor = g(x), quotient = (x - 2) and remainder = (-2x + 4) \therefore (Divisor × Quotient) + Remainder = Dividend \therefore [g(x) × (x - 2)] + [(-2x + 4)] = $x^3 - 3x^2 + x + 2$

$$\Rightarrow g(x) \times (x-2) = x^3 - 3x^2 + x + 2 - (-2x + 4)$$

= $x^3 - 3x^2 + x + 2 + 2x - 4 = x^3 - 3x^2 + 3x - 2$
$$\therefore g(x) = \frac{x^3 - 3x^2 + 3x - 2}{x - 2}$$

Now, dividing $x^3 - 2x^2 + 2x - 2$ have $x - 2$ are have

Now, dividing $x^3 - 3x^2 + 3x - 2$ by x - 2, we have

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

$$\therefore \quad g(x) = \frac{x^3 - 3x^2 + 3x - 2}{x - 2} = x^2 - x + 1.$$

Thus, the required divisor, $g(x) = x^2 - x + 1$. 5. (i) Let $p(x) = 3x^2 - 6x + 27$, g(x) = 3and $q(x) = x^2 - 2x + 9$. Then, deg p(x) = deg q(x) and r(x) = 0Also, $p(x) = g(x) \times q(x) + r(x)$ (ii) Let $p(x) = 2x^3 - 2x^2 + 2x + 3$, $g(x) = 2x^2 - 1$, q(x) = x - 1 and r(x) = 3x + 2. Then, deg q(x) = deg r(x)Also, $p(x) = g(x) \times q(x) + r(x)$ (iii) Let $p(x) = 2x^3 - 4x^2 + x + 4$, $g(x) = 2x^2 + 1$, q(x) = x - 2 and r(x) = 6, Then, deg r(x) = 0Also, $p(x) = g(x) \times q(x) + r(x)$

EXERCISE - 2.4

1. (i)
$$\because p(x) = 2x^3 + x^2 - 5x + 2$$

 $\therefore p\left(\frac{1}{2}\right) = 2\left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^2 - 5\left(\frac{1}{2}\right) + 2$
 $= \frac{1}{4} + \frac{1}{4} - \frac{5}{2} + \frac{2}{1} = \frac{1+1-10+8}{4} = 0$
 $\Rightarrow \frac{1}{2}$ is a zero of $p(x)$.
Again, $p(1) = 2(1)^3 + (1)^2 - 5(1) + 2 = 2 + 1 - 5 + 2 = 0$
 $\Rightarrow 1$ is a zero of $p(x)$.
Also, $p(-2) = 2(-2)^3 + (-2)^2 - 5(-2) + 2$
 $= -16 + 4 + 10 + 2 = -16 + 16 = 0$
 $\Rightarrow -2$ is a zero of $p(x)$.
Now, $p(x) = 2x^3 + x^2 - 5x + 2$
 \therefore Comparing it with $ax^3 + bx^2 + cx + d$, we have $a = 2$,
 $b = 1, c = -5$ and $d = 2$
Also, $\frac{1}{2}, 1$ and -2 are the zeroes of $p(x)$.
Let $\alpha = \frac{1}{2}, \beta = 1$ and $\gamma = -2$
 $\therefore \alpha + \beta + \gamma = \frac{1}{2} + 1 + (-2) = -\frac{1}{2} = \frac{-b}{a}$

Again,
$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{1}{2}(1) + 1(-2) + (-2)\left(\frac{1}{2}\right)$$

$$= \frac{1}{2} - 2 - 1 = \frac{-5}{2} = \frac{c}{a}$$
and product of zeroes = $\alpha\beta\gamma$

$$= \frac{1}{2} \times 1 \times (-2) = -\frac{2}{2} = \frac{-d}{a}$$
Thus, the relationship between the coefficients and the zeroes of $p(x)$ is verified.
(ii) Here, $p(x) = x^3 - 4x^2 + 5x - 2$
 $\therefore p(2) = (2)^3 - 4(2)^2 + 5(2) - 2$
 $= 8 - 16 + 10 - 2 = 18 - 18 = 0$
 $\Rightarrow 2$ is a zero of $p(x)$.
Again, $p(1) = (1)^3 - 4(1)^2 + 5(1) - 2$
 $= 1 - 4 + 5 - 2 = 6 - 6 = 0$
 $\Rightarrow 1$ is a zero of $p(x)$.
Now, comparing $p(x) = x^3 - 4x^2 + 5x - 2$ with $ax^3 + bx^2 + cx + d = 0$, we have
 $a = 1, b = -4, c = 5$ and $d = -2$
Also, 2, 1 and 1 are the zeroes of $p(x)$.
Let $\alpha = 2, \beta = 1, \gamma = 1$
Now, sum of zeroes = $\alpha + \beta + \gamma = 2 + 1 + 1 = 4 = -b/a$
Again, $\alpha\beta + \beta\gamma + \gamma\alpha = 2(1) + 1(1) + 1(2)$

and product of zeroes = $\alpha\beta\gamma$ = (2)(1)(1) = 2 = -d/aThus, the relationship between the zeroes and the coefficients of p(x) is verified.

2. Let the required cubic polynomial be $ax^3 + bx^2 + cx + d = 0$ and its zeroes be α , β and γ .

$$\therefore \quad \alpha + \beta + \gamma = 2 = \frac{-(\text{Coefficient of } x^2)}{\text{Coefficient of } x^3} = \frac{-b}{a}$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = -7 = \frac{\text{Coefficient of } x}{\text{Coefficient of } x^3} = \frac{c}{a}$$

$$\alpha\beta\gamma = -14 = \frac{-(\text{Constant term})}{\text{Coefficient of } x^3} = \frac{-d}{a}$$
If $a = 1$, then $\frac{-b}{a} = \frac{-b}{1} = 2 \Rightarrow b = -2$,
 $\frac{c}{a} = \frac{c}{1} = -7 \Rightarrow c = -7$
and $\frac{-d}{a} = -\frac{d}{1} = -14 \Rightarrow d = 14$
 \therefore The required cubic polynomial is
 $1x^3 + (-2)x^2 + (-7)x + 14 = 0$
 $= x^3 - 2x^2 - 7x + 14 = 0$
3. We have, $p(x) = x^3 - 3x^2 + x + 1$.
Comparing it with $Ax^3 + Bx^2 + Cx + D$,

We have A = 1, B = -3, C = 1 and D = 1 \therefore It is given that (a - b), *a* and (a + b) are the zeroes of

the polynomial.

$$\therefore \text{ Let } \alpha = (a - b), \beta = a \text{ and } \gamma = (a + b)$$

$$\therefore \alpha + \beta + \gamma = -\frac{B}{A} = -\frac{(-3)}{1} = 3$$

$$\Rightarrow (a - b) + a + (a + b) = 3 \Rightarrow 3a = 3 \Rightarrow a = 1$$

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Again,
$$\alpha\beta\gamma = \frac{-D}{A} = -1$$

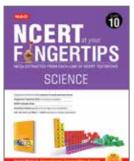
 $\Rightarrow (a-b) \times a \times (a+b) = -1$
 $\Rightarrow (1-b) \times 1 \times (1+b) = -1 \Rightarrow 1-b^2 = -1$
 $\Rightarrow b^2 = 1+1=2 \Rightarrow b=\pm\sqrt{2}$
Thus, $a = 1$ and $b=\pm\sqrt{2}$
4. Here, $p(x) = x^4 - 6x^3 - 26x^2 + 138x - 35$
 \therefore Two of the zeroes of $p(x)$ are : $2\pm\sqrt{3}$
 $\therefore [x - (2+\sqrt{3})][x - (2-\sqrt{3})]$
 $= [(x-2) - \sqrt{3}][(x-2) + \sqrt{3}]$
 $= (x-2)^2 - (\sqrt{3})^2$
 $= (x^2 + 4 - 4x) - 3 = x^2 - 4x + 1$
So, $x^2 - 4x + 1$ is a factor of $p(x)$.
Now, dividing $p(x)$ by $x^2 - 4x + 1$, we have
 $\frac{x^2 - 2x - 35}{x^4 - 4x^3 + x^2}$
 $\frac{(-) (+) (-)}{-2x^3 - 27x^2 + 138x - 35}$
 $-2x^3 + 8x^2 - 2x$
 $\frac{(+) (-) (+)}{-35x^2 + 140x - 35}$
 $-35x^2 + 140x - 35$
 $\frac{(+) (-) (+)}{-35x^2 + 140x - 35}$
 $\frac{(+) (-) (+)}{-35x^2 + 140x - 35}$

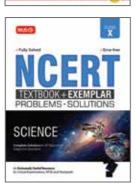
$$\therefore (x^2 - 4x + 1)(x^2 - 2x - 35) = p(x) \Rightarrow (x^2 - 4x + 1)(x^2 - 7x + 5x - 35) = p(x) \Rightarrow (x^2 - 4x + 1)[x(x - 7) + 5(x - 7)] = p(x) \Rightarrow (x^2 - 4x + 1)(x - 7)(x + 5) = p(x) i.e., (x - 7) and (x + 5) are other factors of $p(x)$.
 \therefore 7 and - 5 are other zeroes of the given polynomial.
5. Applying the division algorithm to the polynomials $x^4 - 6x^3 + 16x^2 - 25x + 10$ and $x^2 - 2x + k$, we have$$

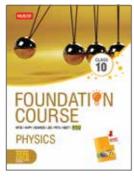
$$x^{2} - 2x + k \overline{\smash{\big)}} x^{4} - 6x^{3} + 16x^{2} - 25x + 10} \\ x^{4} - 2x^{3} + kx^{2} \\ (-) (+) (-) \\ -4x^{3} + (16 - k)x^{2} - 25x + 10 \\ -4x^{3} + 8x^{2} - 4kx \\ (+) (-) (+) \\ \hline (8 - k)x^{2} + (4k - 25)x + 10 \\ (8 - k)x^{2} - 2(8 - k)x + k(8 - k) \\ (-) (+) (-) \\ \hline (-9 + 2k)x - k(8 - k) + 10 \\ \hline \end{array}$$

 $\therefore \text{ Remainder} = (2k - 9)x - k(8 - k) + 10$ But the remainder = x + a (Given) Therefore, comparing them, we have $2k - 9 = 1 \Rightarrow 2k = 1 + 9 = 10 \Rightarrow k = 5$ and a = -k(8 - k) + 10= -5(8 - 5) + 10= -5(3) + 10 = -15 + 10 = -5Thus, k = 5 and a = -5

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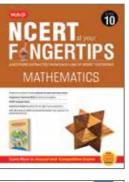


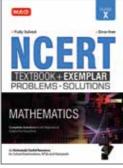


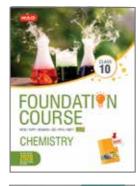




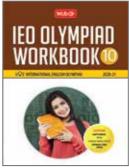






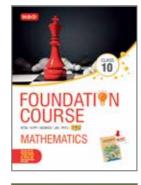


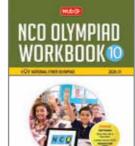


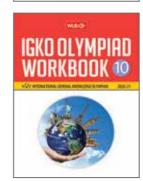




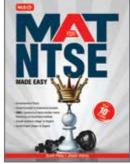


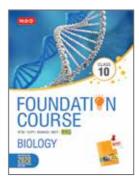


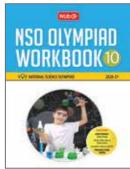


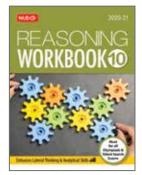












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