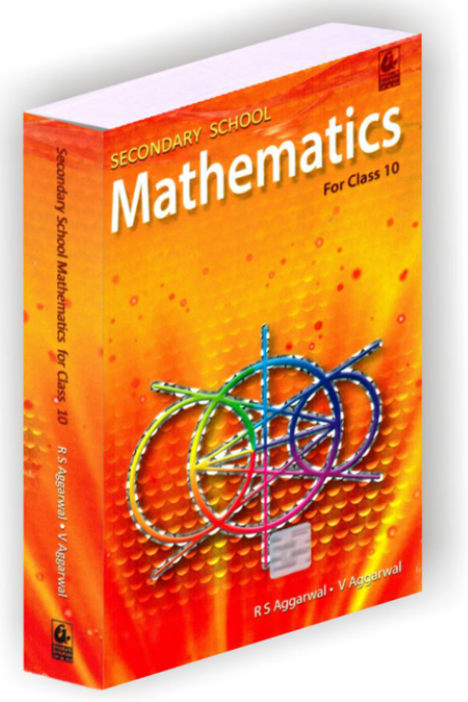
RS Aggarwal Solutions for Class 10 Maths Chapter 2–Polynomials

Class 10 - Chapter 2 Polynomials



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RS Aggarwal Solutions for Class 10 Maths Chapter 2–Polynomials

Class 10: Maths Chapter 2 solutions. Complete Class 10 Maths Chapter 2 Notes.

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Exercise 2A

Question 1:

We have

$$f(x) = (x^2 + 3x - 10)$$

$$= x^2 + 5x - 2x - 10$$

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

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

$$\therefore f(x) = 0 \Rightarrow (x+5)(x-2) = 0$$

$$\Rightarrow x + 5 = 0 \text{ or } x - 2 = 0$$

$$\Rightarrow x = -5 \text{ or } x = 2$$

$$\text{Sum of zeroes} = (-5) + 2 = -3 = \frac{-3}{1} = \frac{-(\text{coefficient of } x)}{(\text{coefficient of } x^2)}$$

Product of zeroes

$$= (-5) \times (2) = -10 = \frac{-10}{1} = \frac{\text{Constant term}}{\text{coefficient of } x^2}$$

Question 2:

We have

$$f(x) = (6x^2 - 7x - 3)$$

$$= 6x^2 - 9x + 2x - 3$$

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

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

$$\therefore f(x) = 0 \Rightarrow (2x - 3)(3x + 1) = 0$$

$$\Rightarrow 2x - 3 = 0 \text{ or } 3x + 1 = 0$$

$$x = \frac{3}{2} \text{ or } x = \frac{-1}{3}$$

So, the zeroes of f(x) are $\frac{3}{2}$ and $\frac{-1}{3}$

$$\text{Sum of zeroes} = \frac{3}{2} + \left(\frac{-1}{3}\right) = \frac{7}{6} = \frac{-(\text{coefficient of } x)}{(\text{coefficient of } x^2)}$$

$$\text{Product of zeroes} = = \left(\frac{3}{2}\right) \times \left(\frac{-1}{3}\right) = \frac{-3}{6} = \frac{\text{constant term}}{(\text{coefficient of } x^2)}$$

Question 3:

$$f(x) = 4x^2 - 4x - 3 = 4x^2 - 6x + 2x - 3$$

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

$$\text{Now, } f(x) = 0 \Rightarrow (2x - 3)(2x + 1) = 0$$

$$\therefore 2x - 3 = 0 \text{ or } 2x + 1 = 0$$

$$\text{or } x = \frac{3}{2}, x = -\frac{1}{2}$$

$$\text{Sum of zeroes} = \frac{3}{2} + \left(-\frac{1}{2}\right) = \frac{3 - 1}{2} = \frac{2}{2} = 1$$

$$= \frac{-(-4)}{4} = -\frac{\text{coeff. of } x}{\text{coeff. of } x^2}$$

$$\text{Product of zeroes} = \left(\frac{3}{2}\right) \times \left(-\frac{1}{2}\right) = -\frac{3}{4}$$

$$= \frac{\text{constant term}}{\text{coeff. of } x^2}$$

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Question 4:

We have

$$f(x) = 5x^2 - 4 - 8x = 5x^2 - 8x - 4$$

$$= 5x^2 - 10x + 2x - 4$$

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

$$f(x) = 0 \Rightarrow (x-2)(5x+2) = 0$$

$$\Rightarrow x - 2 = 0 \quad \text{or} \quad 5x + 2 = 0$$

$$\therefore x = 2, \frac{-2}{5}$$

So, the zeroes of f(x) are 2 and $\frac{-2}{5}$

$$\text{Sum of zeroes} = 2 + \left(\frac{-2}{5}\right) = \frac{10-2}{5} = \frac{8}{5} = -\frac{\text{Coeff. of } x}{\text{Coeff. of } x^2}$$

$$\text{Product of zeroes} = 2 \times \left(\frac{-2}{5}\right) = \frac{-4}{5} = \frac{\text{Constant term}}{\text{coeff. of } x^2}$$

Question 5:

We have

$$f(x) = 6x^2 - 3 - 7x$$

$$= 6x^2 - 9x + 2x - 3$$

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

$$f(x) = 0 \Rightarrow (2x - 3)(3x + 1) = 0$$

$$\Rightarrow 2x - 3 = 0 \text{ or } 3x + 1 = 0$$

$$\therefore x = \frac{3}{2}, -\frac{1}{3}$$

$$\text{Sum of zeros} = \frac{3}{2} + \left(-\frac{1}{3}\right) = \frac{9-2}{6} = \frac{7}{6}$$

$$= -\frac{\text{Coeff. of } x}{\text{Coeff. of } x^2}$$

$$\text{Product of zeros} = \frac{3}{2} \times \left(-\frac{1}{3}\right) = -\frac{1}{2} = \frac{-3}{6}$$

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

Question 6:

We have

$$f(x) = 2x^2 - 11x + 15$$
$$= 2x^2 - 6x - 5x + 15$$
$$= 2x(x-3) - 5(x-3) = (x-3)(2x-5)$$

Now, $f(x) = (x-3)(2x-5) = 0$

$\therefore x - 3 = 0$ or $2x - 5 = 0$

$\Rightarrow x = 3$ or $x = \frac{5}{2}$

So zeros of f(x) are 3 and $\frac{5}{2}$

$$\text{Sum of zeros} = 3 + \frac{5}{2} = \frac{11}{2} = -\frac{(-11)}{2}$$
$$= -\frac{\text{Coeff. of } x}{\text{Coeff. of } x^2}$$

$$\text{product of zeros} = 3 \times \frac{5}{2} = \frac{15}{2} = \frac{\text{Constant term}}{\text{Coeff. of } x^2}$$

Question 7:

We have

$$f(x) = x^2 - 5 = (x)^2 - \left(\sqrt{5}\right)^2$$
$$= \left(x - \sqrt{5}\right)\left(x + \sqrt{5}\right)$$
$$\left[\because a^2 - b^2 = (a-b)(a+b)\right]$$

$f(x) = 0 \Rightarrow \left(x - \sqrt{5}\right)\left(x + \sqrt{5}\right) = 0$

$\therefore x - \sqrt{5} = 0$ or $x + \sqrt{5} = 0$

$\Rightarrow x = \sqrt{5}$ or $x = -\sqrt{5}$

So the zeros of f(x) are $\sqrt{5}$ and $-\sqrt{5}$

$$\text{Sum of zeros} = \sqrt{5} + \left(-\sqrt{5}\right) = 0 = -\frac{\text{Coeff. of } x}{\text{Coeff. of } x^2}$$

$$\text{Product of zeros} = \left(\sqrt{5}\right)\left(-\sqrt{5}\right) = -5 = \frac{-5}{1} = \frac{\text{Constant term}}{\text{Coeff. of } x^2}$$

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Question 8:

Let

$$f(x) = 8x^2 - 4 = 4(2x^2 - 1) = 4\left[(\sqrt{2}x)^2 - 1^2\right]$$

$$\left[a^2 - b^2 = (a-b)(a+b)\right]$$

$$= 4(\sqrt{2}x - 1)(\sqrt{2}x + 1)$$

$$f(x) = 0 \Rightarrow (\sqrt{2}x - 1)(\sqrt{2}x + 1) = 0$$

$$\therefore \sqrt{2}x - 1 = 0 \text{ or } \sqrt{2}x + 1 = 0$$

$$\therefore x = \frac{1}{\sqrt{2}} \text{ or } x = -\frac{1}{\sqrt{2}}$$

So, the zeros of f(x) are $\frac{1}{\sqrt{2}}$ and $-\frac{1}{\sqrt{2}}$

$$\text{Sum of zeros} = \left(\frac{1}{\sqrt{2}}\right) + \left(-\frac{1}{\sqrt{2}}\right) = 0 = \frac{0}{8} = \frac{\text{Coeff. of } x}{\text{Coeff. of } x^2}$$

$$\text{Product of zeros} = \left(\frac{1}{\sqrt{2}}\right) \times \left(-\frac{1}{\sqrt{2}}\right) = -\frac{1}{2} = \frac{-4}{8}$$

$$= \frac{\text{constant term}}{\text{Coeff. of } x^2}$$

Question 9:

Let, $f(x) = 5u^2 + 10u = 5u(u+2)$

$f(x) = 0 \Rightarrow 5u(u+2) = 0$

$\therefore u = 0$ or $u + 2 = 0$

$\Rightarrow u = 0$ or $u = -2$

$$\text{Sum of zeros} = 0 + (-2) = -2 = -\frac{10}{5}$$

$$= -\frac{\text{Coeff. of } x}{\text{Coeff. of } x^2}$$

$$\text{Product of zero} = 0 \times (-2) = 0 = \frac{0}{5} = \frac{\text{Constant term}}{\text{Coeff. of } x^2}$$

Question 10:

If zeros are denoted by α and β then

$\alpha + \beta = 2 + (-6) = -4$ or $\alpha\beta = 2 \times (-6) = -12$

$\therefore$ Quadratic polynomial is

$x^2 - (\alpha + \beta)x + \alpha\beta = x^2 - (-4x) + (-12) = x^2 + 4x - 12$

$$\text{Sum of zeros} = -\frac{\text{Coeff. of } x}{\text{Coeff. of } x^2} = \frac{-4}{1} = -4$$

Also, $\alpha + \beta = 2 + (-6) = -4$

$$\text{Product of zeros} = \frac{\text{Constant term}}{\text{Coeff. of } x^2} = \frac{-12}{1} = -12$$

Also, $\alpha\beta = 2 \times (-6) = -12$

Question 11:

Let α and β are the zeros then

$$\alpha+\beta=\frac{2}{3}+\left(-\frac{1}{4}\right)=\frac{8-3}{12}=\frac{5}{12}$$

$$\alpha\beta=\frac{2}{3}\times\left(-\frac{1}{4}\right)=-\frac{2}{12}=-\frac{1}{6}$$

$\therefore$ quadratic polynomial whose zeros are α,β is

$$x^2-(\alpha+\beta)x+\alpha\beta=x^2-\left(\frac{5}{12}\right)x+\left(-\frac{1}{6}\right)$$

$$=\frac{1}{12}\left(12x^2-5x-2\right)$$

$$\text{Sum of zeros}=-\frac{\text{Coeff. of } x}{\text{Coeff. of } x^2}=-\frac{-5}{12}=\frac{5}{12}$$

$$\text{Also sum of zeros}=\frac{2}{3}+\left(-\frac{1}{4}\right)=\frac{5}{12}$$

$$\text{Product of zeros}=\frac{\text{Constant term}}{\text{Coeff. of } x^2}=\frac{-2}{12}=\frac{-1}{6}$$

$$\text{Also Product of zeros}=\frac{2}{3}\times\left(-\frac{1}{4}\right)=\frac{-2}{12}=\frac{-1}{6}$$

Question 12:

Question 13:

Let α, β be the zeros of required quadratic polynomial f(x)
We have,
$\alpha + \beta = -5$ and $\alpha\beta = 6$
$\therefore f(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

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

So, the required polynomial is $x^2 + 5x + 6$

Now $f(x) = x^2 + 5x + 6 = x^2 + 3x + 2x + 6$

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

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

$f(x) = 0 \Rightarrow$ either $x + 3 = 0$ or $x + 2 = 0$

$\Rightarrow$ either $x = -3$ or $x = -2$

$\therefore$ Zeros of the polynomials are -3 and -2

Question 14:

Let α, β be the zeros of required quadratic polynomial f(x)
We have,

$\alpha+\beta=\frac{5}{2}, \alpha\beta=1$

Now, $f(x)=x^2-(\alpha+\beta)x+\alpha\beta$

$$=x^2-\frac{5}{2}x+1=\frac{1}{2}(2x^2-5+2)$$

The polynomial whose zeros are α,β is $2x^2-5x+2$

Further, $f(x)=\frac{1}{2}(2x^2-5x+2)=\frac{1}{2}(2x^2-4x-x+2)$

$$=\frac{1}{2}[2x(x-2)-(x-2)]$$

$$=\frac{1}{2}(x-2)(2x-1)$$

$$f(x)=0 \Rightarrow \frac{1}{2}(x-2)(2x-1)=0$$

$\therefore$ for that $x-2=0$ or $2x-1=0$

i.e., Either $x=2$ or $x=\frac{1}{2}$

$\therefore$ Zeros of polynomial are 2 and $\frac{1}{2}$

Question 15:

Let α, β be the zeros of required quadratic polynomial f(x)
We have,
$\alpha+\beta=0,\ \alpha\beta=-1$
$\therefore$ Polynomial whose zeros are α, β is

$$f(x)=x^2-(\alpha+\beta)x+\alpha\beta$$
$$=x^2-0.x+(-1)=x^2-1$$

$\therefore$ Required polynomial is x^2-1
Now $f(x)=x^2-1=(x-1)(x+1)$

$$f(x)=0 \quad \Rightarrow (x-1)(x+1)=0$$

$\therefore$ Either $x-1=0$ or $x+1=0$
i.e Either $x=1$ or $x=-1$
$\therefore$ Zeros of the polynomial are 1 and -1

Question 16:

Let α, β be the zeros of required quadratic polynomial f(x)
We have,
$\alpha+\beta=\sqrt{2}$ and $\alpha\beta=-12$
$\therefore$ Polynomial whose zeros are α, β is

$$f(x)=x^2-(\alpha+\beta)x+\alpha\beta=x^2-\sqrt{2}x-12$$

$\therefore$ Polynomial required is $x^2-\sqrt{2}x-12$
For that, $f(x)=x^2-\sqrt{2}x-12$

$$=x^2-3\sqrt{2}x+2\sqrt{2}x-12$$
$$=x\left(x-3\sqrt{2}\right)x+2\sqrt{2}\left(x-3\sqrt{2}\right)$$
$$=\left(x-3\sqrt{2}\right)\left(x+2\sqrt{2}\right)$$

$$f(x)=0 \quad \Rightarrow \left(x-3\sqrt{2}\right)\left(x+2\sqrt{2}\right)$$

$\Rightarrow$Either $x-3\sqrt{2}=0$ or $x+2\sqrt{2}=0$
$\therefore$Either $x=3\sqrt{2}$ or $x=-2\sqrt{2}$

Question 17:

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α and β are the zeros of polynomial f(x) such that
$\alpha + \beta = 6$ and $\alpha\beta = 4$
The polynomial f(x) whose zeros are α, β is
$x^2 - (\alpha + \beta)x + \alpha\beta = x^2 - 6x + 4$

Exercise 2B

Question 1:

$p(x) = x^3 - 2x^2 - 5x + 6$

$\therefore p(3) = (3)^3 - 2(3)^2 - 5(3) + 6$

$= 27 - 18 - 15 + 6 = 0$

$p(-2) = (-2)^3 - 2(-2)^2 - 5(-2) + 6$

$= -8 - 8 + 10 + 6 = 0$

$p(1) = (1)^3 - 2(1)^2 - 5(1) + 6$

$= 1 - 2 - 5 + 6 = 0$

Thus, 3, -2, 1 are the zeros of $p(x) = x^3 - 2x^2 - 5x + 6$

$\therefore \alpha = 3$, $\beta = -2$ and $\gamma = 1$

Comparing the given polynomial with
$p(x) = ax^3 + bx^2 + cx + d$,

We get, a = 1, b = -2, c = -5 and d = 6

Now, $(\alpha + \beta + \gamma) = (3 - 2 + 1) = 2 = -\frac{b}{a}$

$(\alpha\beta + \beta\gamma + \gamma\alpha) = [3 \times (-2) + (-2) \times 1 + (1) \times 3]$

$= (-6 - 2 + 3) = -5 = \frac{c}{a}$

and $\alpha\beta\gamma = [3 \times (-2) \times 1] = -6 = \frac{-d}{a}$

Question 2:

$p(x) = 3x^3 - 10x^2 - 27x + 10$

$\therefore \quad p(5) = 3(5)^3 - 10(5)^2 - 27(5) + 10$

$= 375 - 250 - 135 + 10 = 0$

$p(-2) = 3(-2)^3 - 10(-2)^2 - 27(-2) + 10$

$= -24 - 40 + 54 + 10 = 0$

$p\left(\frac{1}{3}\right) = 3\left(\frac{1}{3}\right)^3 - 10\left(\frac{1}{3}\right)^2 - 27\left(\frac{1}{3}\right) + 10$

$= \frac{1}{9} - \frac{10}{9} - 9 + 10 = 0$

$\therefore$ Then, $5, -2, \frac{1}{3}$ zeros of

$p(x) = 3x^3 - 10x^2 - 27x + 10$

$\therefore \alpha = 5, \beta = -2, \gamma = \frac{1}{3}$

Comparing the given polynomial with

$p(x) = ax^3 + bx^2 + cx + d$

We get $a = 3, b = -10, c = -27$ and $d = 10$

Now, $(\alpha + \beta + \gamma) = \left(5 - 2 + \frac{1}{3}\right) = \frac{10}{3} = \frac{-b}{a}$

$(\alpha\beta + \beta\gamma + \gamma\alpha) = \left[5 \times (-2) + (-2) \times \frac{1}{3} + \left(\frac{1}{3}\right) \times 5\right]$

$= \left(-10 - \frac{2}{3} + \frac{5}{3}\right) = \frac{-27}{3} = \frac{c}{a}$

and $\alpha\beta\gamma = \left[5 \times (-2) \times \frac{1}{3}\right] = \frac{-10}{3} = \frac{-d}{a}$

Question 3:

Required polynomial = [x – (-2)] [x – (-3)] [x – (-1)]

= (x + 2) (x + 3)(x + 1)

$= (x^2 + 5x + 6)(x + 1)$

$= x^3 + x^2 + 5x^2 + 5x + 6x + 6$

$= x^3 + 6x^2 + 11x + 6$

Question 4:

Required Polynomial

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

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

$$= \frac{2x^3-4x^2-6x-x^2+2x+3}{2} = p(x)$$

$$p(x) = \frac{2x^3-4x^2-6x-x^2+2x+3}{2}$$

$$p(x) = \frac{1}{2}(2x^3-5x^2-4x+3)$$

Hence, required polynomial is $(2x^3-5x^2-4x+3)$

Question 5:

$f(x) = 4x^3 - 8x^2 + 8x + 1$

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

$r(x) = (x + 3)$

By division algorithm, we have

$$\text{Dividend} = (\text{Quotient} \times \text{Divisor}) + \text{Remainder}$$

$$f(x) = q(x) \times g(x) + r(x)$$

$$(4x^3 - 8x^2 + 8x + 1) = (2x - 1) \times g(x) + (x + 3)$$

$$g(x) = \frac{(4x^3 - 8x^2 + 8x + 1) - (x + 3)}{(2x - 1)}$$

$$= \frac{4x^3 - 8x^2 + 7x - 2}{2x - 1} = 2x^2 - 3x + 2$$

$$\begin{array}{r|l} & 2x^2 - 3x + 2 \\ \hline 2x - 1 & 4x^3 - 8x^2 + 7x - 2 \\ & 4x^3 - 2x^2 \\ & (-) \quad (+) \\ \hline & -6x^2 + 7x \\ & -6x^2 + 3x \\ & (+) \quad (-) \\ \hline & 4x - 2 \\ & 4x - 2 \\ & (-) \quad (+) \\ \hline & 0 \end{array}$$

Question 6:

The terms of dividend and divisor are in decreasing order

$$
\begin{array}{r|l}
 & 2x - 5 \\
\hline
x+3 & 2x^2 + x - 15 \\
 & +2x^2 + 6x \\
\hline
 & \quad - 5x - 15 \\
 & \quad - 5x - 15 \\
 & \quad + \quad + \\
\hline
 & \qquad 0 \\
\hline
\end{array}
$$

Clearly degree (of remainder) = 0 < degree (x + 3)
$\therefore$ Quotient = 2x – 5 and remainder = 0

$$\Rightarrow (\text{Quotient} \times \text{divisor}) + \text{remainder}$$

$$= (2x - 5)(x + 3) + 0$$

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

$$= 2x^2 + x - 15 = \text{dividend}$$

Thus, (Quotient × divisor) + remainder = dividend

Question 7:

First we write the terms of dividend and divisor in decreasing order of their degree and then perform the division as shown below.

$$
\begin{array}{r|l}
 & x + 4 \\
\hline
-5x + 3 & -5x^2 - 17x + 12 \\
 & -5x^2 + 3x \\
 & + \quad - \\
\hline
 & -20x + 12 \\
 & -20x + 12 \\
 & + \quad - \\
\hline
 & 0 \\
\hline
\end{array}
$$

Clearly degree (of remainder) = 0 < degree (- 5x + 3)

$\therefore$ Quotient = x + 4 and remainder = 0

$\Rightarrow$ (Quotient $\times$ divisor) + remainder

$$= (x+4)(-5x+3)+0$$

$$= -5x^2 + 3x - 20x + 12 = 0$$

$$= -5x^2 - 17x + 12 = \text{dividend}$$

Thus, (Quotient × divisor) + remainder = dividend

Hence, the division algorithm is verified.

Question 8:

First we write the given polynomials in standard form in decreasing order of degree and then perform the division as shown below.

$$
\begin{array}{r|l}
 & 3x - 1 \\
\hline
x^2 - x + 2 & 3x^3 - 4x^2 + 7x - 2 \\
 & +3x^3 - 3x^2 + 6x \\
 & \quad - \quad + \quad - \\
\hline
 & \quad -x^2 + x - 2 \\
 & \quad -x^2 + x - 2 \\
\hline
 & \quad\quad 0
\end{array}
$$

Clearly degree(of remainder) = 0 < degree $(x^2 - x + 2)$

$\therefore$ Quotient = $(3x - 1)$, Remainder = 0

$\Rightarrow$ (Quotient $\times$ divisor) + remainder

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

$$= 3x^3 - 3x^2 + 6x - x^2 + x - 2 = 0$$

$$= 3x^3 - 4x^2 + 7x - 2 = \text{dividend}$$

Thus, (Quotient × divisor) + remainder = dividend

Hence, the division algorithm is verified.

Question 9:

First we write the given polynomials in standard form in decreasing order of degree and then perform the division as shown below.

$$
\begin{array}{r|l}
 & 2x+3 \\
\hline
-3x^2+5x+2 & -6x^3+x^2+19x+6 \\
 & -6x^3+10x^2+4x \\
 & \quad + \quad - \quad - \\
\hline
 & \quad -9x^2+15x+6 \\
 & \quad -9x^2+15x+6 \\
 & \quad + \quad - \quad - \\
\hline
 & \quad 0
\end{array}
$$

Clearly degree of remainder $= 0 <$ degree $\left(-3x^2+5x+2\right)$

$\therefore$ Quotient $= (2x+3)$, remainder $= 0$

$\Rightarrow$ (Quotient $\times$ divisor) + remainder

$= (2x+3)\left(-3x^2+5x+2\right)+0$

$= -6x^3+10x^2+4x-9x^2+15x+6$

$\therefore -6x^3+x^2+19x+6 =$ dividend

= (Quotient $\times$ divisor) + remainder = Dividend

Hence the division algorithm is verified.

Question 10:

2 is the zero of the polynomial $x^3 - 4x^2 + x + 6$
$\therefore$ x -2 is a factor of it
Dividing the given polynomial by x – 2

$$
\begin{array}{r|l}
 & x^2 - 2x - 3 \\
\hline
x - 2 & x^3 - 4x^2 + x + 6 \\
 & -x^3 - 2x^2 \\
 & + \quad + \\
\hline
 & -2x^2 + x \\
 & -2x^2 + 4x \\
 & + \quad - \\
\hline
 & -3x + 6 \\
 & -3x + 6 \\
\hline
 & 0
\end{array}
$$

Remainder = 0, Quotient of $q(x) = x^2 - 2x - 3$
Now, $q(x) = x^2 - 2x - 3$

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

Other zeros of given cubic polynomial are zeros of q(x)
$\therefore q(x) = 0 \Rightarrow (x-3)(x+1) = 0$
$\Rightarrow$ Either $x - 3 = 0$ or $x + 1 = 0$
$\therefore$ Either $x = 3$ or $x = -1$
$\therefore$ Other zeros of the given cubic polynomial are 3 and -1

Question 11:

One zero of the polynomial $x^3 + 2x^2 - 11x - 12$ is -1
$\therefore$ x + 1 is a factor of $x^3 + 2x^2 - 11x - 12$
Dividing $x^3 + 2x^2 - 11x - 12$ by x + 1

$$
\begin{array}{r|l}
x+1 & x^2+x-12 \\
\cline{2-2}
 & x^3+2x^2-11x-12 \\
 & x^3+x^2 \\
 & \text{– –} \\
\cline{2-2}
 & x^2-11x \\
 & x^2+x \\
 & \text{– –} \\
\cline{2-2}
 & -12x-12 \\
 & -12x-12 \\
\cline{2-2}
 & 0
\end{array}
$$

Quotient $q(x) = x^2 + x - 12$

$= x^2 + 4x - 3x - 12$

$= (x+4)(x-3)$

Other zeros of given polynomial are the zeros of q(x)

$\therefore q(x) = 0$

$\Rightarrow (x+4)(x-3) = 0$

$\Rightarrow$ Either $x+4=0$ or $x-3=0$

$\Rightarrow$ Either $x=-4$ or $x=3$

$\therefore$ -4, 3 are the zeros of q(x)

$\therefore$ The zeros of given polynomial are -4, -1 and 3

Question 12:

1 and -2 are the two zeros of the polynomial
$x^3 - 4x^2 - 7x + 10$
Dividing the polynomial by $x - 1$

$$
\begin{array}{r|l}
 & x^2 - 3x - 10 \\
\hline
x - 1 & x^3 - 4x^2 - 7x + 10 \\
 & x^3 - x^2 \\
 & \quad - \quad + \\
\hline
 & \quad -3x^2 - 7x \\
 & \quad -3x^2 + 3x \\
 & \quad + \quad - \\
\hline
 & \qquad -10x + 10 \\
 & \qquad -10x + 10 \\
 & \qquad + \quad - \\
\hline
 & \qquad\quad 0
\end{array}
$$

Quotient $q(x) = x^2 - 3x - 10$
2 is a zero of given polynomial so it is a zero of
$x^2 - 3x - 10$

Dividing $x^2 - 3x - 10$ by $x + 2$

$$
\begin{array}{r|l}
 & x - 5 \\
\hline
x + 2 & x^2 - 3x - 10 \\
 & x^2 + 2x \\
 & \quad - \quad - \\
\hline
 & \quad -5x - 10 \\
 & \quad -5x - 10 \\
 & \quad + \quad + \\
\hline
 & \qquad 0
\end{array}
$$

Third zero of the given polynomial is given by $x - 5 = 0$ or
$x = 5$

Question 13:

https://www.indcareer.com/schools/rs-aggarwal-solutions-for-class-10-maths-chapter-2-polynomials/

3 and -3 are the two zeros of the polynomial
$x^4 + x^3 - 11x^2 - 9x + 18$

$\therefore (x-3)(x+3) = x^2 - 9$ is a factor of given polynomial

$\therefore$ Dividing the given polynomial by $x^2 - 9$

$$
\begin{array}{r|l}
x^2 - 9 & \mathbf{x^2 + x - 2} \\
\cline{2-2}
 & x^4 + x^3 - 11x^2 - 9x + 18 \\
 & x^4 \quad\quad - 9x^2 \\
 & - \quad\quad + \\
\cline{2-2}
 & \mathbf{x^3 - 2x^2 - 9x} \\
 & \mathbf{x^3 \quad\quad - 9x} \\
 & - \quad\quad + \\
\cline{2-2}
 & -2x^2 \quad +18 \\
 & -2x^2 \quad +18 \\
 & + \quad\quad - \\
\cline{2-2}
 & 0 \\
\cline{2-2}
\end{array}
$$

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

Other zeros of given polynomial are -2 and 1
So zeros of given polynomial are 1, -2, 3 and -3

Question 14:

2 and -2 are two polynomials

$x^4 + x^3 - 34x^2 - 4x + 120$

$\therefore (x-2)(x+2) = x^2 - 4$ will divide the given polynomial completely.

Dividing $x^4 + x^3 - 34x^2 - 4x + 120$ by $x^2 - 4$

$$
\begin{array}{l}
\quad\quad x^2 + x - 30 \\
x^2 - 4 \overline{)\, x^4 + x^3 - 34x^2 - 4x + 120} \\
\quad\quad x^4 \quad\quad - 4x^2 \\
\quad\quad - \quad\quad + \\
\hline
\quad\quad\quad x^3 - 30x^2 - 4x + 120 \\
\quad\quad\quad x^3 \quad\quad - 4x \\
\quad\quad\quad - \quad\quad + \\
\hline
\quad\quad\quad\quad -30x^2 \quad + 120 \\
\quad\quad\quad\quad -30x^2 \quad + 120 \\
\quad\quad\quad\quad + \quad\quad - \\
\hline
\quad\quad\quad\quad\quad\quad 0 \\
\hline
\end{array}
$$

$\therefore$ Quotient $q(x) = x^2 + x - 30$

$= x^2 + 6x - 5x - 30$

$= x(x+6) - 5(x+6)$

$= (x+6)(x-5)$

For finding zeros of q(x), q(x) = 0

(x + 6)(x – 5) = 0, x = -6 or 5

Other zeros of given polynomial are -6 and 5

So zeros of given polynomial are 2, -2, -6 and 5

Question 15:

$\sqrt{3}$ and $-\sqrt{3}$ are the zeros of polynomial

$x^4 + x^3 - 23x^2 - 3x + 60$

$\therefore (x - \sqrt{3})(x + \sqrt{3}) = x^2 - 3$ will divide the given polynomial completely

Dividing $x^4 + x^3 - 23x^2 - 3x + 60$ by $x^2 - 3$

$$
\begin{array}{r|l}
x^2 - 3 & x^2 + x - 20 \\
\hline
 & x^4 + x^3 - 23x^2 - 3x + 60 \\
 & x^4 \quad\quad - 3x^2 \\
 & - \quad\quad + \\
\hline
 & x^3 - 20x^2 - 3x + 60 \\
 & x^3 \quad\quad - 3x \\
 & - \quad\quad + \\
\hline
 & -20x^2 \quad\quad + 60 \\
 & -20x^2 \quad\quad + 60 \\
 & + \quad\quad - \\
\hline
 & 0
\end{array}
$$

Quotient $q(x) = x^2 + x - 20 = x^2 + 5x - 4x - 20$

$= x(x + 5) - 4(x + 5)$

$= (x + 5)(x - 4)$

Other zeros of the given polynomial are the zeros of $q(x)$

$\therefore q(x) = 0 \Rightarrow (x + 5)(x - 4) = 0$

Or $x = -5$ or 4

Hence the zeros of given polynomial are $\sqrt{3}, -\sqrt{3}, -5, 4$

Question 16:

$\sqrt{3}$ and $-\sqrt{3}$ are the zeros of polynomial $2x^4 - 3x^3 - 5x^2 + 9x - 3$

$\therefore (x-\sqrt{3})(x+\sqrt{3}) = x^2 - 3$ will divide the given polynomial completely

Dividing $2x^4 - 3x^3 - 5x^2 + 9x - 3$ by $x^2 - 3$, we get

$$
\begin{array}{r|l}
x^2 - 3 & 2x^2 - 3x + 1 \\
\hline
 & 2x^4 - 3x^3 - 5x^2 + 9x - 3 \\
 & 2x^4 \quad\quad - 6x^2 \\
 & - \quad\quad + \\
\hline
 & -3x^3 + x^2 + 9x \\
 & -3x^3 \quad\quad + 9x \\
 & + \quad\quad - \\
\hline
 & x^2 \quad - 3 \\
 & x^2 \quad - 3 \\
 & - \quad\quad + \\
\hline
 & 0 \\
\hline
\end{array}
$$

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

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

Other zeros of given polynomial are given by

$q(x) = 0 \Rightarrow (x-1)(2x-1) = 0 \quad \therefore x = 1, \frac{1}{2}$

Hence, zeros of given polynomial are $\sqrt{3}, -\sqrt{3}, 1, \frac{1}{2}$

Question 17:

Sum of $3+\sqrt{2}$ and $3-\sqrt{2} = (3+\sqrt{2})+(3-\sqrt{2}) = 6$

Product of $(3+\sqrt{2})$ and $(3-\sqrt{2})$

$$= (3+\sqrt{2})(3-\sqrt{2}) = 9-2 = 7$$

Polynomial whose zeros are $3+\sqrt{2}$ and $3-\sqrt{2}$ is

$x^2 - (\text{sum of zeros})x + (\text{product of zeros}) = x^2 - 6x + 7$

Dividing $p(x)$ by $x^2 - 6x + 7$

$$\begin{array}{r|l} & 2x^2 + x - 1 \\ \hline x^2 - 6x + 7 & 2x^4 - 11x^3 + 7x^2 + 13x - 7 \\ & 2x^4 - 12x^3 + 14x^2 \\ & \quad - \quad + \quad - \\ \hline & \quad x^3 - 7x^2 + 13x \\ & \quad x^3 - 6x^2 + 7x \\ & \quad - \quad + \quad - \\ \hline & \quad -x^2 + 6x - 7 \\ & \quad -x^2 + 6x - 7 \\ & \quad + \quad - \quad + \\ \hline & \quad 0 \end{array}$$

Quotient $= 2x^2 + x - 1$

$\therefore$ Other zeros of polynomial $p(x)$ are also the zeros of $q(x)$

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

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

$q(x) = 0$

$\Rightarrow (x+1)(2x-1) = 0$

$\Rightarrow$ Either $x+1=0$ or $2x-1=0$

$\Rightarrow$ Either $x = -1$ or $x = \frac{1}{2}$

$\therefore$ The zeros of given polynomial $p(x)$ are

$\frac{1}{2}, -1, (3+\sqrt{2})$ and $(3-\sqrt{2})$

Question 18:

$\sqrt{5}$ and $-\sqrt{5}$ are the zeros of the polynomial $x^4 + 4x^3 - 2x^2 - 20x - 15$

$\therefore (x - \sqrt{5})(x + \sqrt{5}) = x^2 - 5$ will divide the given polynomial completely.

Dividing $x^4 + 4x^3 - 2x^2 - 20x - 15$ by $x^2 - 5$, we get

$$
\begin{array}{r|l}
x^2 - 5 & x^2 + 4x + 3 \\
\hline
 & x^4 + 4x^3 - 2x^2 - 20x - 15 \\
 & x^4 \quad\quad - 5x^2 \\
 & - \quad\quad + \\
\hline
 & 4x^3 + 3x^2 - 20x \\
 & 4x^3 \quad\quad - 20x \\
 & - \quad\quad + \\
\hline
 & 3x^2 \quad\quad - 15 \\
 & 3x^2 \quad\quad - 15 \\
 & - \quad\quad + \\
\hline
 & 0
\end{array}
$$

$$\text{Quotient} = x^2 + 4x + 3 = x^2 + 3x + x + 3$$
$$= x(x + 3) + (x + 3) = (x + 3)(x + 1)$$

Other zeros of the given polynomial are the zeros of $q(x)$

$\therefore \quad q(x) = 0$ or $(x + 3)(x + 1) = 0$

$\Rightarrow \quad x = -3, -1$

Thus, the zeros of the given polynomial are

$\sqrt{5}, -\sqrt{5}, -3, -1$

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