

Maharashtra Board Solutions Class 9-Maths

(Part 1): Chapter 3.5- Polynomials

BOOK SOLUTIONS
CLASS 9
MATHS

CHAPTER 3.5
Polynomials



Maharashtra Board Solutions→

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Maharashtra Board Solutions Class 9-Maths

(Part 1): Chapter 3.5- Polynomials

Class 9: Maths Chapter 3.5 solutions. Complete Class 9 Maths Chapter 3.5 Notes.

Maharashtra Board Solutions Class 9-Maths (Part 1): Chapter 3.5- Polynomials

Maharashtra Board 9th Maths Chapter 3.5, Class 9 Maths Chapter 3.5 solutions

Question 1.

Find the value of the polynomial $2x - 2x^3 + 7$ using given values for x .

i. $x = 3$

ii. $x = -1$

iii. $x = 0$

Solution:

i. $p(x) = 2x - 2x^3 + 7$

Put $x = 3$ in the given polynomial.

$$\therefore p(3) = 2(3) - 2(3)^3 + 7$$

$$= 6 - 2 \times 27 + 7$$

$$= 6 - 54 + 7$$

$$\therefore P(3) = -41$$

ii. $p(x) = 2x - 2x^3 + 7$

Put $x = -1$ in the given polynomial.

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$$\therefore p(-1) = 2(-1) - 2(-1)^3 + 7$$

$$= -2 - 2(-1) + 7$$

$$= -2 + 2 + 7$$

$$\therefore p(-1) = 7$$

$$\text{iii. } p(x) = 2x - 2x^3 + 7$$

Put $x = 0$ in the given polynomial.

$$\therefore p(0) = 2(0) - 2(0)^3 + 7$$

$$= 0 - 0 + 7$$

$$\therefore P(0) = 7$$

Question 2.

For each of the following polynomial, find $p(1)$, $p(0)$ and $p(-2)$.

$$\text{i. } p(x) = x^3$$

$$\text{ii. } p(y) = y^2 - 2y + 5$$

$$\text{ii. } p(y) = x^4 - 2x^2 + x$$

Solution:

$$\text{i. } p(x) = x^3$$

$$\therefore p(1) = 1^3 = 1$$

$$p(x) = x^3$$

$$\therefore p(0) = 0^3 = 0$$

$$p(x) = x^3$$

$$\therefore p(-2) = (-2)^3 = -8$$

$$\text{ii. } p(y) = y^2 - 2y + 5$$

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$$\therefore p(1) = 1^2 - 2(1) + 5$$

$$= 1 - 2 + 5$$

$$\therefore P(1) = 4$$

$$p(y) = y^2 - 2y + 5$$

$$\therefore p(0) = 0^2 - 2(0) + 5$$

$$= 0 - 0 + 5$$

$$\therefore p(0) = 5$$

$$p(y) = y^2 - 2y + 5$$

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

$$= 4 + 4 + 5$$

$$\therefore p(-2) = 13$$

$$\text{iii. } p(x) = x^4 - 2x^2 - x$$

$$\therefore p(1) = (1)^4 - 2(1)^2 - 1$$

$$= 1 - 2 - 1$$

$$\therefore p(1) = -2$$

$$\therefore p(x) = x^4 - 2x^2 - x$$

$$\therefore p(0) = (0)^4 - 2(0)^2 - 0$$

$$= 0 - 0 - 0$$

$$\therefore p(0) = 0$$

$$p(x) = x^4 - 2x^2 - x$$

$$\therefore p(-2) = (-2)^4 - 2(-2)^2 - (-2)$$

$$= 16 - 2(4) + 2$$

$$= 16 - 8 + 2$$

$$\therefore p(-2) = 10$$

Question 3.

If the value of the polynomial $m^3 + 2m + a$ is 12 for $m = 2$, then find the value of a .

Solution:

$$p(m) = m^3 + 2m + a$$

$$\therefore p(2) = (2)^3 + 2(2) + a$$

$$\therefore 12 = 8 + 4 + a \dots [\because p(2) = 12]$$

$$\therefore 12 = 12 + a$$

$$\therefore a = 12 - 12$$

$$\therefore a = 0$$

Question 4.

For the polynomial $mx^2 - 2x + 3$ if $p(-1) = 7$, then find m .

Solution:

$$p(x) = mx^2 - 2x + 3$$

$$\therefore p(-1) = m(-1)^2 - 2(-1) + 3$$

$$\therefore 7 = m(1) + 2 + 3 \dots [\because p(-1) = 7]$$

$$\therefore 7 = m + 5$$

$$\therefore m = 7 - 5$$

$$\therefore m = 2$$

Question 5.

Divide the first polynomial by the second polynomial and find the remainder using remainder theorem.

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i. $(x^2 - 1x + 9); (x + 1)$

ii. $(2x^3 - 2x^2 + ax - a); (x - a)$

iii. $(54m^3 + 18m^2 - 27m + 5); (m - 3)$

Solution:

i. $p(x) = x^2 - 7x + 9$

Divisor = $x + 1$

$\therefore$ take $x = -1$

$\therefore$ By remainder theorem,

$\therefore$ Remainder = $p(-1)$

$p(x) = x^2 - 7x + 9$

$\therefore p(-1) = (-1)^2 - 7(-1) + 9$

$= 1 + 7 + 9$

$\therefore$ Remainder = 17

ii. $p(x) = 2x^3 - 2x^2 + ax - a$

Divisor = $x - a$

$\therefore$ take $x = a$

By remainder theorem,

Remainder = $p(a)$

$p(x) = 2x^3 - 2x^2 + ax - a$

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

$= 2a^3 - 2a^2 + a^2 - a$

$\therefore$ Remainder = $2a^3 - a^2 - a$

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iii. $p(m) = 54m^3 + 18m^2 - 27m + 5$

Divisor = $m - 3$

$\therefore$ take $m = 3$

$\therefore$ By remainder theorem,

Remainder = $p(3)$

$$p(m) = 54m^3 + 18m^2 - 27m + 5$$

$$\therefore p(3) = 54(3)^3 + 18(3)^2 - 27(3) + 5$$

$$= 54(27) + 18(9) - 81 + 5$$

$$= 1458 + 162 - 81 + 5$$

$$\therefore \text{Remainder} = 1544$$

Question 6.

If the polynomial $y^3 - 5y^2 + 7y + m$ is divided by $y + 2$ and the remainder is 50, then find the value of m .

Solution:

$$p(y) = y^3 - 5y^2 + 7y + m$$

Divisor = $y + 2$

$$\therefore \text{take } y = -2$$

$\therefore$ By remainder theorem,

$$\text{Remainder} = p(-2) = 50$$

$$P(y) = y^3 - 5y^2 + 7y + m$$

$$\therefore P(-2) = (-2)^3 - 5(-2)^2 + 7(-2) + m$$

$$\therefore 50 = -8 - 5(4) - 14 + m$$

$$\therefore 50 = -8 - 20 - 14 + m$$

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$$\therefore 50 = -42 + m$$

$$\therefore m = 50 + 42$$

$$\therefore m = 92$$

Question 7.

Use factor theorem to determine whether $x + 3$ is a factor of $x^2 + 2x - 3$ or not.

Solution:

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

$$\text{Divisor} = x + 3$$

$$\therefore \text{take } x = -3$$

$$\therefore \text{Remainder} = p(-3)$$

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

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

$$= 9 - 6 - 3$$

$$\therefore p(-3) = 0$$

$$\therefore \text{By factor theorem, } x + 3 \text{ is a factor of } x^2 + 2x - 3.$$

Question 8.

If $(x - 2)$ is a factor of $x^3 - mx^2 + 10x - 20$, then find the value of m .

Solution:

$$p(x) = x^3 - mx^2 + 10x - 20 \quad x - 2 \text{ is a factor of } x^3 - mx^2 + 10x - 20.$$

$$\therefore \text{By factor theorem,}$$

$$\text{Remainder} = p(2) = 0$$

$$p(x) = x^3 - mx^2 + 10x - 20$$

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$$\therefore p(2) = (2)^3 - m(2)^2 + 10(2) - 20$$

$$\therefore 0 = 8 - 4m + 20 - 20$$

$$\therefore 0 = 8 - 4m$$

$$\therefore 4m = 8$$

$$\therefore m = 2$$

Question 9.

By using factor theorem in the following examples, determine whether $q(x)$ is a factor of $p(x)$ or not.

i. $p(x) = x^3 - x^2 - x - 1$; $q(x) = x - 1$

ii. $p(x) = 2x^3 - x^2 - 45$; $q(x) = x - 3$

Solution:

i. $p(x) = x^3 - x^2 - x - 1$

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

$\therefore$ take $x = 1$

Remainder = $p(1)$

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

$$\therefore P(1) = (1)^3 - (1)^2 - 1 - 1$$

$$= 1 - 1 - 1 - 1$$

$$= -2 \neq 0$$

$\therefore$ By factor theorem, $x - 1$ is not a factor of $x^3 - x^2 - x - 1$.

ii. $p(x) = 2x^3 - x - 45$

Divisor = $q(x) = x - 3$

take $x = 3$

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$$\text{Remainder} = p(3)$$

$$p(x) = 2x^3 - x^2 - 45$$

$$P(3) = 2(3)^3 - (3)^2 - 45$$

$$= 2(27) - 9 - 45$$

$$= 54 - 9 - 45$$

$$= 0$$

$\therefore$ By factor theorem, $x - 3$ is a factor of $2x^3 - x^2 - 45$.

Question 10.

If $(x^{31} + 31)$ is divided by $(x + 1)$, then find the remainder.

Solution:

$$p(x) = x^{31} + 31$$

$$\text{Divisor} = x + 1$$

$$\therefore \text{ take } x = -1$$

$\therefore$ By remainder theorem,

$$\text{Remainder} = p(-1)$$

$$p(x) = x^{31} + 31 \dots$$

$$\therefore p(-1) = (-1)^{31} + 31$$

$$= -1 + 31 = 30$$

$$\therefore \text{Remainder} = 30$$

Question 11.

Show that $m - 1$ is a factor of $m^{21} - 1$ and $m^{22} - 1$. [3 Marks]

Solution:

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i. $p(m) = m^{21} - 1$

Divisor = $m - 1$

$\therefore$ take $m = 1$

Remainder = $p(1)$

$p(m) = m^{21} - 1$

$\therefore P(1) = 1^{21} - 1 = 1 - 1 = 0$

$\therefore$ By factor theorem, $m - 1$ is a factor of $m^{21} - 1$.

ii. $p(m) = m^{22} - 1$

Divisor = $m - 1$

$\therefore$ take $m = 1$

Remainder = $p(1)$

$p(m) = m^{22} - 1$

$\therefore P(1) = 1^{22} - 1 = 1 - 1 = 0$

$\therefore$ By factor theorem, $m - 1$ is a factor of $m^{22} - 1$.

Question 12.

If $x - 2$ and $x - 12$ both are the factors of the polynomial $nx^2 - 5x + m$, then show that $m = n = 2$.

Solution:

$p(x) = nx^2 - 5x + m$

$(x - 2)$ is a factor of $nx^2 - 5x + m$.

$\therefore$ By factor theorem,

$P(2) = 0$

$\therefore p(x) = nx^2 - 5x + m$

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$$\therefore p(2) = n(2)^2 - 5(2) + m$$

$$\therefore 0 = n(4) - 10 + m$$

$$\therefore 4n - 10 + m = 0 \dots(i)$$

Also, ($x = 12$) is a factor of $nx^2 - 5x + m$.

$\therefore$ By factor theorem,

$$p(12) = 0$$

$$p(x) = nx^2 - 5x + m$$

$$\therefore p(12) = n(12)^2 - 5(12) + m$$

$$0 = n(4) - 52 + m$$

$$\therefore 0 = n - 10 + 4m \dots \text{[Multiplying both sides by 4]}$$

$$\therefore n = 10 - 4m \dots\dots(ii)$$

Substituting $n = 10 - 4m$ in equation (i),

$$4(10 - 4m) - 10 + m = 0$$

$$\therefore 40 - 16m - 10 + m = 0$$

$$\therefore -15m + 30 = 0$$

$$\therefore -15m = -30$$

$$\therefore m = 2$$

Substituting $m = 2$ in equation (ii),

$$n = 10 - 4(2)$$

$$= 10 - 8$$

$$\therefore n = 2$$

$$\therefore m = n = 2$$

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Question 13.

i. If $p(x) = 2 + 5x$, then find the value of $p(2) + p(-2) - p(1)$.

Solution:

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

$$\therefore P(2) = 2 + 5(2)$$

$$= 2 + 10$$

$$= 12$$

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

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

$$= 2 - 10 = -8$$

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

$$P(1) = 2 + 5(1)$$

$$= 2 + 5 = 7$$

$$\therefore P(2) + P(-2) - p(1) = 12 + (-8) - 7$$

$$\therefore P(2) + p(-2) - p(1) = -3$$

ii. If $p(x) = 2x^2 - 5\sqrt{3}x + 5$, then find the value of $p(5\sqrt{3})$.

Solution:

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

$$\therefore p(5\sqrt{3}) = 2(5\sqrt{3})^2 - 5\sqrt{3}(5\sqrt{3}) + 5$$

$$= 2(25 \times 3) - 25 \times 3 + 5$$

$$= 150 - 75 + 5$$

$$\therefore p(5\sqrt{3}) = 80$$

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Question 1.

1. Divide $p(x) = 3x^2 + x + 7$ by $x + 2$. Find the remainder.
2. Find the value of $p(x) = 3x^2 + x + 7$ when $x = -2$.
3. See whether remainder obtained by division is same as the value of $p(-2)$. Take one more example and verify. (Textbook pg. no. 50)

Solution:

$$\begin{array}{r} 1. \quad \begin{array}{r} 3x-5 \\ x+2 \overline{) 3x^2+x+7} \\ \underline{3x^2+6x} \\ -5x+7 \\ \underline{-5x-10} \\ 17 \end{array} \end{array}$$

$\therefore$ Remainder = 17

2. $p(x) = 3x^2 + x + 7$

Substituting $x = -2$, we get

$$p(-2) = 3(-2)^2 + (-2) + 7$$

$$= 12 - 2 + 7$$

$$\therefore p(-2) = 17$$

3. Yes, remainder = $p(-2)$

Another Example:

If the polynomial $t^3 - 3t^2 + kt + 50$ is divided by $(t - 3)$, the remainder is 62. Find the value of k .

Solution:

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When given polynomial is divided by $(t - 3)$ the remainder is 62. It means the value of the polynomial when $t = 3$ is 62.

$$p(t) = t^3 - 3t^3 + kt + 50$$

By remainder theorem,

$$\text{Remainder} = p(3) = 3^3 - 3 \times 3^2 + k \times 3 + 50$$

$$= 27 - 3 \times 9 + 3k + 50$$

$$= 27 - 27 + 3k + 50$$

$$= 3k + 50$$

But remainder is 62.

$$\therefore 3k + 50 = 62$$

$$\therefore 3k = 62 - 50$$

$$\therefore 3k = 12$$

$$\therefore k = 4$$

Question 2.

Verify that $(x - 1)$ is a factor of the polynomial $x^3 + 4x - 5$. (Textbook pg. no. 51)

Solution:

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

Substituting $x = 1$ in $p(x)$, we get

$$p(1) = (1)^3 + 4(1) - 5$$

$$= 1 + 4 - 5$$

$$P(1) = 0$$

$\therefore$ By remainder theorem,

$$\text{Remainder} = 0$$

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$\therefore (x - 1)$ is the factor of $x^3 + 4x - 5$.



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- Chapter 7.5- Statistics

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concepts with simple language with simple illustrations. Every year around 10 lakh students are enrolled in schools that are affiliated with the Maharashtra State Board.

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As of now, the MSCERT and Balbharti are responsible for the syllabus and textbooks of Classes 1 to 8, while Classes 9 and 10 are under the Maharashtra State Board of Secondary and Higher Secondary Education (MSBSHSE).

How many state boards are there in Maharashtra?

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