

# EDUCATION SOLUTION

## MATHEMATICS OF CLASS IX

### CHAPTER-2 POLYNOMIALS

**Q.1. Which of the following expressions are polynomials in one variable and which are not? State reason for your answer.**

(i)  $4x^2 - 3x + 7$                       (ii)  $y^2 + \sqrt{2}$

(iii)  $3\sqrt{t} + t\sqrt{2}$                       (iv)  $y + \frac{2}{y}$

(v)  $x^{10} + y^3 + t^{50}$

**Q.2. Write the coefficient of  $x^2$  in each of the following polynomials.**

(i)  $2 + x^2 + x$

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

(iii)  $\frac{\pi}{2}x^2 + x$

(iv)  $\sqrt{2}x - 1$

**Q.3. Give one example each of a binomial of degree 35 and monomial of degree 100.**

**Q.4. Write the degree of each of the following polynomials.**

(i)  $5x^3 + 4x^2 + 7x$                       (ii)  $4 - y^2$

(iii)  $5t - \sqrt{7}$                               (iv)  $3$

**Q.5. Classify the following as linear, quadratic and cubic polynomials.**

(i)  $x^2 + x$                                   (ii)  $x - x^3$

(iii)  $y + y^2 + 4$                           (iv)  $1 + x$

(v)  $3t$     (vi)  $r^2$

(vii)  $7x^3$

**Q.6. For the polynomial**

$$\frac{7x^5 - 5x + 6}{11} - \frac{3}{4}x^4 - x^{11}. \text{ Write}$$

- (i) The degree of the polynomial.
- (ii) The coefficient of  $x^5$ .
- (iii) The coefficient of  $x^{11}$ .
- (iv) The constant term.

Q.7. Find the coefficient of  $x^2$  in  $(3x + x^3) \left(x + \frac{1}{x}\right)$ .

Q.8. If  $p = 10$ , then find the degree of the polynomial  $f(x) = (x - p)^2 + 5$ .

Q.9. Verify that  $x = 1$  is a zero of the polynomial  $2x^2 - x - 1$ .

Q.10. Find a zero of the polynomial  $p(x) = 2x + 4$ .

Q.11. Verify whether 3 and 0 are zeroes of the polynomial  $x^2 - 3x$ .

Q.12. If the polynomials  $ax^3 + 3x^2 + 5x - 4$  and  $x^3 - 4x + a$  leave the same remainder, when divided by  $(x-2)$  then find the value of  $a$ .

Q.13. Find the value of the polynomial  $5x - 4x^2 + 3$  at

(i)  $x = 0$     (ii)  $x = -1$     (iii)  $x = 2$

Q.14. Find  $p(0)$ ,  $p(1)$  and  $p(2)$  for each of the following polynomials.

(i)  $p(y) = y^2 - y + 1$

(ii)  $p(t) = 2 + t + 2t^2 - t^3$

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

Q.15. Verify whether the following are zeroes of the polynomial indicated against them.

(i)  $p(x) = 3x + 1$ ,  $x = -\frac{1}{3}$

(ii)  $p(x) = 5x - \pi$ ,  $x = \frac{4}{5}$

(iii)  $p(x) = x^2 - 1$ ,  $x = 1, -1$

Q.16. Find the zero of the polynomial in each of the following cases.

(i)  $p(x) = x + 5$     (ii)  $p(x) = x - 5$

(iii)  $p(x) = 2x + 5$     (iv)  $p(x) = 3x - 2$

Q.17. Find the remainder when  $x^3 + 3x^2 + 3x + 1$  is divided by

(i)  $x + 1$     (ii)  $x - \frac{1}{2}$

(iii)  $x$     (iv)  $x + \pi$

Q.18. Find the remainder when  $x^3 - ax^2 + 6x - a$  is divided by  $(x - a)$ .

Q.19. Check, whether  $(7 + 3x)$  is a factor of  $3x^3 + 7x$ .

Q.20. If  $x = 3$  and  $x = 0$  are zeroes of the polynomial  $2x^3 - 8x^2 + abx + b$ , then find the values of  $a$  and  $b$ .

Q.21. The polynomial  $bx^3 + 3x^2 - 3$  and  $2x^3 - 5x + b$ , when divided by  $(x - 4)$  leaves the remainder  $r_1$  and  $r_2$ , respectively. Find the value of  $b$ , if  $2r_1 - r_2 = 0$ .

Q.22. The polynomial

$$P(x) = x^4 - 2x^3 + 3x^2 - ax + 3a - 7,$$

When divided by  $(x + 1)$ , leaves the remainder 19. Find the value of  $a$ . Also, find the remainder, when  $p(x)$  is divided by  $x + 2$ .

Q.23. If the polynomials  $p(x) = 2x^3 + bx^2 + 3x - 5$  and  $q(x) = x^3 + x^2 - 4x - b$  leaves the same remainder, when divided by  $x - 2$ , then prove that  $b = \frac{-13}{5}$ .

Q.34. If the polynomials  $(2x^3 + kx^2 + 3x - 5)$  and  $(x^3 + x^2 - 2x + k)$  leave the same remainder when divided by  $(x - 3)$ , find the value of  $k$ . Also, find the remainder in first case.

Q.35. Using factor theorem, show that  $(x + 1)$  is a factor of  $x^{19} + 1$ .

Q.36. Factorise  $2x^2 + 7x + 3$  by splitting the middle terms.

Q.37. Factorise  $x^2 - 5x + 6$  by using factor theorem.

Q.38. Factorise  $2x^3 - 5x^2 - 19x + 42$ .

Q.39. Write  $(2x + 3y - 5z)^2$  in expanded form.

Q.40. Evaluate  $(999)^3$  by using suitable identities.

Q.41. Evaluate  $105 \times 106$  without multiplying directly.

Q.42. Determine which of the following polynomial has  $(x + 1)$  as a factor ?

(i)  $x^3 + x^2 + x + 1$

(ii)  $x^4 + x^3 + x^2 + x + 1$

(iii)  $x^4 + 3x^3 + 3x^2 + x + 1$

Q.43. Find the value of  $k$ , if  $(x-1)$  is a factor of  $p(x)$  in each of the following cases.

(i)  $p(x) = x^2 + x + k$

(ii)  $p(x) = 2x^2 + kx + \sqrt{2}$

(iii)  $p(x) = kx^2 - \sqrt{2}x + 1$

Q.44. Factorise

(i)  $12x^2 - 7x + 1$

(ii)  $2x^2 + 7x + 3$

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

(iv)  $3x^2 - x - 4$

Q.45. Factorise the following polynomial by remainder theorem.

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

(ii)  $x^3 - 3x^2 - 9x - 5$

(iii)  $x^3 + 13x^2 + 32x + 20$

Q.46. Use suitable identities to find the following products.

(i)  $(x + 4)(x + 10)$

(ii)  $(x + 8)(x - 10)$

$$(iii) (3x + 4)(3x - 5) \quad (iv) \left(y^2 + \frac{3}{2}\right)\left(y^2 - \frac{3}{2}\right)$$

Q.47. Evaluate the following products without multiplying directly.

$$(i) 103 \times 107 \quad (ii) 95 \times 96 \quad (iii) 104 \times 96$$

Q.48. Factorise the following using appropriate identities.

$$(i) 9x^2 + 6xy + y^2 \quad (ii) 4y^2 - 4y + 1$$

$$(iii) x^2 - \frac{y^2}{100}$$

Q.49. Expand each of the following using suitable identities.

$$(i) (x + 2y + 4z)^2 \quad (ii) (2x - y + z)^2$$

$$(iii) (-2x + 3y + 2z)^2 \quad (iv) (3a - 7b - c)^2$$

Q.50. Factorise

$$(i) 4x^2 + 9y^2 + 16z^2 + 12xy - 24yz - 16xz$$

$$(ii) 2x^2 + y^2 + 8z^2 - 2\sqrt{2}xy + 4\sqrt{2}yz - 8xz$$

Q.51. Write the following cubes in expanded form.

$$(i) (2x + 1)^3 \quad (ii) (2a - 3b)^3$$

$$(iii) \left(\frac{3}{2}x + 1\right)^3 \quad (iv) \left(x - \frac{2}{3}y\right)^3$$

Q.52. Evaluate the following using suitable identities.

$$(i) (99)^3 \quad (ii) (102)^3 \quad (iii) (998)^3$$

Q.53. Factorise each of the following.

$$(i) 8a^3 + b^3 + 12a^2b + 6ab^2$$

$$(ii) 8a^3 - b^3 - 12a^2b + 6ab^2$$

$$(iii) 27 - 125a^3 - 135a + 225a^2$$

Q.54. Verify that

$$(i) x^3 + y^3 = (x + y)(x^2 - xy + y^2)$$

$$(ii) x^3 - y^3 = (x - y)(x^2 + xy + y^2)$$

Q.55. Factorise each of the following.

$$(i) 27y^3 + 125z^3 \quad (ii) 64m^3 - 343n^3$$

$$Q.56. \text{Factorise } 27x^3 + y^3 + z^3 - 9xyz$$

$$Q.57. \text{Verify that } x^3 + y^3 + z^3 - 3xyz$$

$$Q.58. \text{If } (x + y + z) = 0, \text{ then show that } x^3 + y^3 + z^3 = 3xyz.$$

Q.59. Without actually calculating the cubes, find the value of each of the following:

(i)  $(-12)^3 + (7)^3 + (5)^3$

(ii)  $(28)^3 + (-15)^3 + (-13)^3$

Q.60. Give possible expressions for the length and the breadth of each of the following rectangles, in which their areas are given.

(i) Area  $25a^2 - 35a + 12$

(ii) Area  $35y^2 + 13y - 12$

Q.61. What are the possible expressions for the dimensions of the cuboids whose volumes are given below ?

(i) Volume  $3x^2 - 12x$

(ii) Volume  $12ky^2 + 8ky - 20k$

Q.62. If  $(x - a)$  is a factor of  $4x^2 - mx - na$ , then prove that  $a = \frac{m+n}{4}$ .

Q.63. Factorise  $7x^2 + 2\sqrt{14}x + 2$ .

Q.64. If  $a + b + c = 9$  and  $ab + bc + ca = 40$ , then find the value of  $a^2 + b^2 + c^2$ .

Q.65. Find the value of  $27x^3 + 8y^3$ , if  $3x + 2y = 20$  and  $xy = \frac{11}{9}$ .

Q.66. What is the degree of the polynomial  $\sqrt{5}$  ?

Q.67. Find the coefficient of  $x^2$  in the expansion of  $(x - 4)^2$ .

Q.68. What is the degree of zero polynomial ?

Q.69. What type of the polynomial  $-2$  is ?

Q.70. How many zeroes has a cubic polynomial ?

Q.71. What is the best way to evaluate  $(998)^2$  ?

Q.72. If  $x + y + z = 0$ , then find the value of  $x^3 + y^3 + z^3$ .

Q.73. What is the zero of the polynomial

$$p(x) = a^2x, a \neq 0 ?$$

Q.74. A zero polynomial has how many zeroes ?

Q.75. What is the zeroes of the polynomial  $p(x) = x^2 + x - 6$  ?

Q.76. Find the remainder, when  $p(x) = x^3 - ax^2 + x$  is divided by  $(x - a)$ .

Q.77. Find the factors of  $3x^2 - x - 4$ .

Q.78. Which identity do we use to factorise  $x^2 - \frac{y^2}{100}$  ?

Q.79. If  $x^{11} + 101$  is divided by  $x + 1$ , then find the remainder.

Q.80. If  $\frac{x}{y} + \frac{y}{x} = -1$ ,  $x \neq 0$ ,  $y \neq 0$ , then find the value of  $x^3 - y^3$ .

- Q.81. If  $f(x) = x - 9$ , then find the value of  $f(x) - f(-x)$ .
- Q.82. Find the value of  $(1015)^2 - (1014)^2$ .
- Q.83. If  $(x + 2)$  and  $(x - 1)$  are factors of  $(x^3 + 10x^2 + mx + n)$ , then find the values of  $m$  and  $n$ .
- Q.84. What is the value of the expression  $4a^2 + b^2 + 4ab + 8a + 4b + 4$  ?
- Q.85. What is the must condition for the indices of  $x$  in a polynomial of  $x$  ?
- Q.86. If  $(x^{100} + 2x^{99} + k)$  is divisible by  $(x + 1)$ , then find the value of  $k$ .
- Q.87. Find the remainder, when  $p(x) = 4x^3 - 12x^2 + 11x - 5$  is divided by  $(2x - 1)$ .
- Q.88. If  $p(y) = 2y^3 - y^2 - 13y - 6$ , then find the value of  $p\left(-\frac{2}{3}\right)$ .
- Q.89. If  $x^2 + kx + 12 = (x - 6)(x - 2)$  for all  $x$ , then find the value of  $k$ .
- Q.90. Find the factor of the expression  $ab + bc + ax + cx$ .
- Q.91. What is the value of  $305 \times 308$  ?
- Q.92. The volume of a cuboid is  $2x^2 - 16$ , then find its possible dimensions.
- Q.93. Find the value of  $58^3 - 24^3 - 34^3$  .
- Q.94. What is the degree of the polynomial  
 $4x^4 + 0x^3 + 0x^5 + 5x + 7$  ?
- Q.95. Find the remainder, when  $x^{51} + 51$  is divided by  $x + 1$ .
- Q.96. If  $p(x) = x^2 - 2\sqrt{2}x + 1$ , then find the value of  $p(2\sqrt{2})$ .
- Q.97. What is the factor of  $(x + y)^3 - (x^3 + y^3)$  ?
- Q.98. Find the factors of  $(25x^2 - 1) + (1 + 5x)^2$ .
- Q.99. If  $f(t) = 4t^2 - 3t + 6$ , then find  
(i)  $f(4)$   
(ii)  $f(-5)$
- Q.100. Verify that, 0 and 3 are the zeroes of the polynomial  $p(x) = x^2 - 3x$ .
- Q.101. Find the remainder when the polynomial  $f(x) = 4x^3 - 12x^2 + 14x - 3$  is divided by  $2x - 1$ .
- Q.102. Find the remainder, when  
 $f(x) = x^3 - 6x^2 + 13x + 60$  is divided by  $(x + 2)$ .
- Q.103. Find the remainder, when  
 $f(x) = x^3 - ax^2 + 2x - a$  is divided by  $(x - a)$ .
- Q.104. Find the value of  $a$  for which  $(x - a)$  is a factor of the polynomial  $f(x) = x^5 - a^2x^3 + 2x + a - 3$ .
- Q.105. Show that  $(x + 5)$  is a factor of the polynomial  $f(x) = x^3 + x^2 + 3x + 115$ .
- Q.106. Factorise

(i)  $5a(b + c) - 7b(b + c)$

(ii)  $6(2a + 3b)^2 - 8(2a + 3b)$ .

Q.107. Simplify  $\sqrt{2a^2 + 2\sqrt{6}ab + 3b^2}$ .

Q.108. Expand  $\left(\frac{1}{2}a - \frac{1}{4}b + 2\right)^2$ .

Q.109. Factorise the following expressions

(i)  $25x^2 + 4y^2 + 9z^2 - 20xy - 12yz + 30xz$

(ii)  $9x^2 + 16y^2 + 4z^2 - 24xy + 16yz - 12xz$

Q.110. If  $a^2 + \frac{9}{a^2} = 31$ , then what is the value of  $a - \frac{3}{a}$ ?

Q.111. By actual division, find the quotient and the remainder when the first polynomial  $x^4 + 1$  is divided by the second polynomial  $x - 1$ .

Q.112. What must be subtracted from  $\frac{x}{y}$  to make it  $\frac{y}{x}$ ?

Q.113. If  $x^2 + \frac{1}{x^2} = 14$ , then find  $x^3 + \frac{1}{x^3}$ .

Q.114. Simplify the following expressions

(i)  $(x + y + z)^2 + (x + y - z)^2$

(ii)  $(2x + p - c)^2 - (2x - p + c)^2$

Q.115. Using remainder theorem, find the remainder when  $q(x) = x^4 - 2x^2 + 6x + 3$  is divided by  $(x - 2)$ .

Q.116. If the polynomials  $(2x^3 + ax^2 + 3x - 5)$  and  $(x^3 + x^2 - 2x + a)$  leave the same remainder when divided by  $(x - 2)$ , find the value of  $a$ . Also, find the remainder in each case.

Q.117. The remainder of the polynomial  $5 + bx - 2x^2 + ax^3$ , when divided by  $x - 2$  is twice the remainder when it is divided by  $(x + 1)$ . Show that  $10a + 4b = 9$ .

Q.118. For what value of  $k$  is the polynomial  $(2x^4 + 3x^2 + 2kx^2 + 3x + 6)$  exactly divisible by  $(x + 2)$ ?

Q.119. Expand

(i)  $(0.1x - 0.2y)^3$       (ii)  $\left(\frac{y}{3} - \frac{x}{2}\right)^2$

Q.120. If  $\sqrt{u} + \sqrt{v} - \sqrt{w} = 0$ , then find the value of  $(u + v - w)$ .

Q.121. If  $f(x) = x^2 - 5x + 1$ , then evaluate  $f(2) - f(-1) + f\left(\frac{1}{3}\right)$ .

Q.122. Find  $y^2 + \frac{1}{y^2}$  and  $y^4 + \frac{1}{y^4}$ , if  $y - \frac{1}{y} = 9$ .

Q.123. Factorise  $(p - q)^3 + (q - r)^3 + (r - p)^3$

Q.124. Find the product

$$(3x - 5y - 4)(9x^2 + 25y^2 + 15xy + 12x - 20y + 16).$$

Q.125. Factorise

$$a^3(b - c)^3 + b^3(c - a)^3 + c^3(a - b)^3.$$

Q.126. Factorise

$$(5a - 7b)^3 + (9c - 5a)^3 + (7b - 9c)^3.$$

Q.127. If  $x + y + 4 = 0$ , then find the value of  $x^3 + y^3 - 12xy + 64$ .

Q.128. Find the value of  $k$ , if  $(x - 1)$  is a factor of  $p(x) = kx^2 - \sqrt{2}x + 1$ .

Q.129. Evaluate

$$(i) (104)^3 \quad (ii) (999)^3$$

Q.130. If  $x - y = 5$  and  $xy = 84$ , then find the value of  $x^3 - y^3$ .

Q.131. Give an example of a polynomial which is

(i) monomial of degree 1.

(ii) binomial of degree 22.

(iii) trinomial of degree 5.

Q.132. Without actual division, prove that  $(2x^4 - 6x^3 + 3x^2 + 3x - 2)$  is exactly division by  $(x^2 - 3x + 2)$ .

Q.133. If  $(x^3 + ax^2 + bx + 6)$  has  $(x - 2)$  as a factor and leaves a remainder 3 when divided by  $(x - 3)$ , then find the values of  $a$  and  $b$ .

Q.134. If  $x = 2y + 6$ , then find the value of  $x^3 - 8y^3 - 36xy - 216$ .

Q.135. Prove that  $x^3 + y^3 + z^3 - 3xyz$

Q.136. If  $a, b$  and  $c$  are all non-zero and  $a + b + c = 0$ , then prove that  $\frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab} = 3$ .

Q.137. Factorise  $x^3 + 13x^2 + 32x + 20$ .

Q.138. If  $(x + a)$  is a factor of the polynomials  $x^2 + px + q$  and  $x^2 + mx + n$ , then prove that  $a = \frac{n - q}{m - p}$ .

Q.139. Find the value of  $\frac{1}{27}r^3 - s^3 + 125t^3 + 5rst$ , when  $s = \frac{r}{3} + 5t$ .

Q.140. If  $x + y + z = 1$ ,  $xy + yz + zx = -1$  and  $xyz = -1$ , then find the value of  $x^3 + y^3 + z^3$ .

Q.141. Let  $A$  and  $B$  be the remainder, when the polynomials  $y^3 + ay^2 - 12y + 6$  are divided by  $(y + 1)$  and  $(y - 2)$ , respectively. If  $2A + B = 6$ , then find the value of  $a$ .

Q.142. Factorise  $a^7 - ab^6$ .

Q.143. Factorise  $(x + y)^3 - (x - y)^3$ .

Q.144. Find the square root of



$$(x^2 - 5x + 6)^2 - (x^2 - 6x + 8)^2.$$

Q.145. Find the zeroes of the polynomial

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

Q.146. Factorise  $2y^4 + y^3 - 14y^2 - 19y - 6$ .

Q.147. If a teacher Divides a material of volume  $(x^3 + 6x^3 + 12x + 8)$  cubic units among three students of his class equally. Is it possible, to find the quantity of material each get and which moral value is depicted ?

Q.148. Two friends start business together. They decided to share their capitals depending upon a variable expenditure. The capital polynomial of the two partners together is given by polynomial  $6x^2 + 11x - 35$ . Which is the product of their individual share factors. (i) Find their factors. (ii) Are their capital shares same ? (iii) Write the value depicted by this question.

Q.149. Factorise  $9x^2 + y^2 + z^2 - 6xy + 2yz - 6xz$ . Hence, find its value when  $x = 1$ ,  $y = 2$  and  $z = -1$ .

Q.150. Factorise  $a^{12}y^4 - a^4y^{12}$ .

Q.151. Write the coefficient of  $x$  in the expansion of  $(x + 5)^3$ .

Q.152. Find the zeroes of the polynomial  $p(x) = (x - 2)^2 - (x + 2)^2$ .

Q.153. Find the value of  $p\left(\frac{1}{2}\right)$  for  $p(x) = x^4 - x^2 + x$ .

Q.154. Find the value of the polynomial at the indicated value of variable  $p(x) = 3x^2 - 4x + \sqrt{11}$  at  $x = 2$ .

Q.155. Find the zeroes of  $x^2 - 7$ .

Q.156. Verify that 1 is not a zero of the polynomial  $4y^4 - 3y^3 + 2y^2 - 5y + 1$ .

Q.157. Find the zero of the polynomial  $p(x)$ , where  $p(x) = ax + 3$ ,  $a \neq 0$ .

Q.158. Find the value of  $p$  for which  $x + p$  is a factor of  $x^2 + px + 3 - p$ .

Q.159. Find the value of  $94 \times 96$ , by using identity.

Q.160. If  $p + \frac{1}{p} = 3$ , then find the value of  $p^2 + \frac{1}{p^2}$ .

Q.161. What are the possible expression for the dimensions of a cuboid, whose volume is given below ?

$$\text{Volume} = 12ky^2 + 8ky - 20k$$

Q.162. Find the value of  $x^3 - 8y^3 - 36xy - 216$ , when  $x = 2y + 6$ .

Q.163. Find the value of  $64x^3 + 125z^3$ , if  $4x + 5z = 19$  and  $xz = 5$ .

Q.164. If  $a + b = 10$  and  $a^2 + b^2 = 58$ , then find the value of  $a^3 + b^3$ .