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RD Sharma Class 9 Solutions Maths Chapter 4 Algebraic Identities PDF

Here we have provided RD Sharma Class 9 Solutions Maths Chapter 4 solutions for the students to help them ace their examinations. Students can refer to these solutions and practice these questions to score better in the exams.

RD Sharma Class 9 Solutions Maths Chapter 4 Algebraic Identities PDF

RD Sharma Class 9 Solutions Maths Chapter 4 Algebraic Identities

RD Sharma Class 9 Solutions Maths Chapter 4 Algebraic Identities Exercise 4.1 Page No: 4.6

Question 1: Evaluate each of the following using identities:

(i) $(2x – 1/x)^2$

(ii) $(2x + y) (2x – y)$

(iii) $(a^2b – b^2a)^2$

(iv) $(a – 0.1) (a + 0.1)$

(v) $(1.5.x^2 – 0.3y^2) (1.5x^2 + 0.3y^2)$

Solution:

(i) $(2x - 1/x)^2$

[Use identity: $(a - b)^2 = a^2 + b^2 - 2ab$]

$(2x - 1/x)^2 = (2x)^2 + (1/x)^2 - 2\,(2x)(1/x)$

$= 4x^2 + 1/x^2 - 4$

(ii) $(2x + y)\,(2x - y)$

[Use identity: $(a - b)(a + b) = a^2 - b^2$]

$(2x + y)\,(2x - y) = (2x\,)^2 - (y)^2$

$= 4x^2 - y^2$

(iii) $(a^2b - b^2a)^2$

[Use identity: $(a - b)^2 = a^2 + b^2 - 2ab$]

$(a^2b - b^2a)^2 = (a^2b)^2 + (b^2a)^2 - 2\,(a^2b)(\,b^2a)$

$= a^4b^2 + b^4a^2 - 2\,a^3b^3$

(iv) $(a - 0.1)\,(a + 0.1)$

[Use identity: $(a - b)(a + b) = a^2 - b^2$]

$(a - 0.1)\,(a + 0.1) = (a)^2 - (0.1)^2$

$= (a)^2 - 0.01$

(v) $(1.5\,x^2 - 0.3y^2)\,(1.5\,x^2 + 0.3y^2)$

[Use identity: $(a - b)(a + b) = a^2 - b^2$]

$(1.5\,x^2 - 0.3y^2)\,(1.5x^2 + 0.3y^2) = (1.5\,x^2\,)^2 - (0.3y^2)^2$

$= 2.25\,x^4 - 0.09y^4$

Question 2: Evaluate each of the following using identities:

(i) $(399)^2$

(ii) $(0.98)^2$

(iii) 991 x 1009

(iv) 117 x 83

Solution:

(i)

$399^2 = (400-1)^2$

$= (400)^2+(1)^2 - 2x400x1$

[Use identity: $(a - b)^2 = a^2 + b^2 - 2ab$]

Here, a = 400 and b = 1

= 160000 + 1 – 800

= 159201

So, $(399)^2 = 159201$

(ii)

$(0.98)^2 = (1-0.02)^2$

[Use identity: $(a - b)^2 = a^2 + b^2 - 2ab$]

$= (1)^2 + (0.02)^2 - 2x1x0.02$

= 1 + 0.0004 – 0.04

= 1.0004 – 0.04

= 0.9604

So, $(0.98)^2 = 0.9604$

(iii)

991×1009

$= (1000-9)(1000+9)$

[Use identity: $(a - b)(a + b) = a^2 - b^2$]

$= (1000)^2 - (9)^2$

$= 1000000 - 81$

$= 999919$

$991 \times 1009 = 999919$

(iv)

117×83

$= (100+17)(100-17)$

[Use identity: $(a - b)(a + b) = a^2 - b^2$]

$= (100)^2 - (17)^2$

$= 10000 - 289$

$= 9711$

$117 \times 83 = 9711$

Question 3: Simplify each of the following:

(i) 175 x 175 +2 x 175 x 25 + 25 x 25

(ii) 322 x 322 – 2 x 322 x 22 + 22 x 22

(iii) 0.76 x 0.76 + 2 x 0.76 x 0.24 + 0.24 x 0.24

(iv)

$$\frac{7.83 \times 7.83 - 1.17 \times 1.17}{6.66}$$

Solution:

(i) $175 \times 175 + 2 \times 175 \times 25 + 25 \times 25 = (175)^2 + 2\,(175)\,(25) + (25)^2$

$= (175 + 25)^2$

[Because $a^2 + b^2 + 2ab = (a+b)^2$]

$= (200)^2$

= 40000

So, 175 x 175 +2 x 175 x 25 + 25 x 25 = 40000.

(ii) 322 x 322 – 2 x 322 x 22 + 22 x 22

$= (322)^2 - 2 \times 322 \times 22 + (22)^2$

$= (322 - 22)^2$

[Because $a^2 + b^2 - 2ab = (a-b)^2$]

$= (300)^2$

= 90000

So, 322 x 322 – 2 x 322 x 22 + 22 x 22= 90000.

(iii) 0.76 x 0.76 + 2 x 0.76 x 0.24 + 0.24 x 0.24

$= (0.76)^2 + 2 \times 0.76 \times 0.24 + (0.24)^2$

$= (0.76+0.24)^2$

[Because $a^2 + b^2 + 2ab = (a+b)^2$]

$= (1.00)^2$

= 1

So, 0.76 x 0.76 + 2 x 0.76 x 0.24 + 0.24 x 0.24 = 1.

(iv)

$$\frac{7.83 \times 7.83 - 1.17 \times 1.17}{6.66}$$

$$= \frac{(7.83 + 1.17)(7.83 - 1.17)}{6.66}$$

$$= \frac{(9.00)(6.66)}{(6.66)} = 9$$

Question 4: If x + 1/x = 11, find the value of x^2 +1/x^2.

Solution:

$x + \frac{1}{x} = 11$ (Given)

So, $(x + \frac{1}{x})^2 = x^2 + (\frac{1}{x})^2 + 2$ x x x $\frac{1}{x}$

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

$\Rightarrow (11)^2 = x^2 + \frac{1}{x^2} + 2$

$\Rightarrow 121 = x^2 + \frac{1}{x^2} + 2$

$\Rightarrow x^2 + \frac{1}{x^2} = 119$

Question 5: If x – 1/x = -1, find the value of x^2 +1/x^2.

Solution:

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

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

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

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

$\Rightarrow 2 + 1 = x^2 + \frac{1}{x^2}$

$\Rightarrow x^2 + \frac{1}{x^2} = 3$

RD Sharma Class 9 Solutions Maths Chapter 4 Algebraic Identities Exercise 4.2 Page No: 4.11

Question 1: Write the following in the expanded form:

(i) $(a + 2b + c)^2$

(ii) $(2a - 3b - c)^2$

(iii) $(-3x+y+z)^2$

(iv) $(m+2n-5p)^2$

(v) $(2+x-2y)^2$

(vi) $(a^2+b^2+c^2)^2$

(vii) $(ab+bc+ca)^2$

(viii) (x/y+y/z+z/x)2

(ix) $(a/bc + b/ac + c/ab)^2$

(x) $(x+2y+4z)^2$

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

(xii) $(-2x+3y+2z)^2$

Solution:

Using identities:

$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$

(i) $(a + 2b + c)^2$

$= a^2 + (2b)^2 + c^2 + 2a(2b) + 2ac + 2(2b)c$

$= a^2 + 4b^2 + c^2 + 4ab + 2ac + 4bc$

(ii) $(2a - 3b - c)^2$

$= [(2a) + (-3b) + (-c)]^2$

$= (2a)^2 + (-3b)^2 + (-c)^2 + 2(2a)(-3b) + 2(-3b)(-c) + 2(2a)(-c)$

$= 4a^2 + 9b^2 + c^2 - 12ab + 6bc - 4ca$

(iii) $(-3x+y+z)^2$

$= [(-3x)^2 + y^2 + z^2 + 2(-3x)y + 2yz + 2(-3x)z$

$= 9x^2 + y^2 + z^2 - 6xy + 2yz - 6xz$

(iv) $(m+2n-5p)^2$

$= m^2 + (2n)^2 + (-5p)^2 + 2m \times 2n + (2\times2n\times-5p) + 2m \times -5p$

$= m^2 + 4n^2 + 25p^2 + 4mn - 20np - 10pm$

(v) $(2+x-2y)^2$

$= 2^2 + x^2 + (-2y)^2 + 2(2)(x) + 2(x)(-2y) + 2(2)(-2y)$

$= 4 + x^2 + 4y^2 + 4x - 4xy - 8y$

(vi) $(a^2+b^2+c^2)^2$

$= (a^2)^2 + (b^2)^2 + (c^2)^2 + 2a^2b^2 + 2b^2c^2 + 2a^2c^2$

$= a^4 + b^4 + c^4 + 2a^2b^2 + 2b^2c^2 + 2c^2a^2$

(vii) $(ab+bc+ca)^2$

$= (ab)^2 + (bc)^2 + (ca)^2 + 2(ab)(bc) + 2(bc)(ca) + 2(ab)(ca)$

$= a^2b^2 + b^2c^2 + c^2a^2 + 2(ac)b^2 + 2(ab)(c)^2 + 2(bc)(a)^2$

(viii) $(x/y+y/z+z/x)^2$

$$= (\frac{x}{y})^2 + (\frac{y}{z})^2 + (\frac{z}{x})^2 + 2\frac{x}{y}\frac{y}{z} + 2\frac{y}{z}\frac{z}{x} + 2\frac{z}{x}\frac{x}{y}$$

$$= (\frac{x^2}{y^2}) + (\frac{y^2}{z^2}) + (\frac{z^2}{x^2}) + 2\frac{x}{z} + 2\frac{y}{x} + 2\frac{z}{y}$$

(ix) (a/bc + b/ac + c/ab)^2

$$= (\frac{a}{bc})^2 + (\frac{b}{ca})^2 + (\frac{c}{ab})^2 + 2(\frac{a}{bc})(\frac{b}{ca}) + 2(\frac{b}{ca})(\frac{c}{ab}) + 2(\frac{a}{bc})(\frac{c}{ab})$$

$$= (\frac{a^2}{b^2c^2}) + (\frac{b^2}{c^2a^2}) + (\frac{c^2}{a^2b^2}) + \frac{2}{a^2} + \frac{2}{b^2} + \frac{2}{c^2}$$

(x) (x+2y+4z)^2

= x^2 + $(2y)^2$ + $(4z)^2$ + (2x)(2y) + 2(2y)(4z) + 2x(4z)

= *$x^2 + 4y^2 + 16z^2 + 4xy + 16yz + 8xz$*

(xi) (2x−y+z)^2

= $(2x)^2$ + $(-y)^2$ + $(z)^2$ + 2(2x)(−y) + 2(−y)(z) + 2(2x)(z)

= *$4x^2 + y^2 + z^2 - 4xy - 2yz + 4xz$*

(xii) (−2x+3y+2z)^2

= $(-2x)^2$ + $(3y)^2$ + $(2z)^2$ + 2(−2x)(3y)+2(3y)(2z)+2(−2x)(2z)

= *$4x^2 + 9y^2 + 4z^2 - 12xy + 12yz - 8xz$*

Question 2: Simplify

(i) $(a + b + c)^2 + (a - b + c)^2$

(ii) $(a + b + c)^2 - (a - b + c)^2$

(iii) $(a + b + c)^2 + (a - b + c)^2 + (a + b - c)^2$

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

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

Solution:

(i) $(a + b + c)^2 + (a - b + c)^2$

$= (a^2 + b^2 + c^2 + 2ab+2bc+2ca) + (a^2 + (-b)^2 + c^2 -2ab-2bc+2ca)$

$= 2a^2 + 2b^2 + 2c^2 + 4ca$

(ii) $(a + b + c)^2 - (a - b + c)^2$

$= (a^2 + b^2 + c^2 + 2ab+2bc+2ca) - (a^2 + (-b)^2 + c^2 -2ab-2bc+2ca)$

$= a^2 + b^2 + c^2 + 2ab + 2bc + 2ca - a^2 - b^2 - c^2 + 2ab + 2bc - 2ca$

$= 4ab + 4bc$

(iii) $(a + b + c)^2 + (a - b + c)^2 + (a + b - c)^2$

$= a^2 + b^2 + c^2 + 2ab + 2bc + 2ca + (a^2 + b^2 + (c)^2 - 2ab - 2cb + 2ca) + (a^2 + b^2 + c^2 + 2ab - 2bc - 2ca)$

$= 3a^2 + 3b^2 + 3c^2 + 2ab - 2bc + 2ca$

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

$= [4x^2 + p^2 + c^2 + 4xp - 2pc - 4xc] - [4x^2 + p^2 + c^2 - 4xp - 2pc + 4xc]$

$= 4x^2 + p^2 + c^2 + 4xp - 2pc - 4cx - 4x^2 - p^2 - c^2 + 4xp + 2pc - 4cx$

$= 8xp - 8xc$

$= 8(xp - xc)$

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

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

$= [x^4 + y^4 + z^4 + 2x^2y^2 - 2y^2z^2 - 2x^2z^2 - [x^4 + y^4 + z^4 - 2x^2y^2 - 2y^2z^2 + 2x^2z^2]$

$= 4x^2y^2 - 4z^2x^2$

Question 3: If $a + b + c = 0$ and $a^2 + b^2 + c^2 = 16$, find the value of $ab + bc + ca$.

Solution:

$a + b + c = 0$ and $a^2 + b^2 + c^2 = 16$ (given)

Choose $a + b + c = 0$

Squaring both sides,

$(a + b + c)^2 = 0$

$a^2 + b^2 + c^2 + 2(ab + bc + ca) = 0$

16 + 2(ab + bc + c) = 0

2(ab + bc + ca) = -16

ab + bc + ca = -16/2 = -8

or *ab + bc + ca = -8*

RD Sharma Class 9 Solutions Maths Chapter 4 Algebraic Identities Exercise 4.3 Page No: 4.19

Question 1: Find the cube of each of the following binomial expressions:

(i) (1/x + y/3)

(ii) $(3/x – 2/x^2)$

(iii) (2x + 3/x)

(iv) (4 – 1/3x)

Solution:

[Using identities: $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$ and $(a – b)^3 = a^3 – b^3 – 3ab(a – b)$]

(i)

$$(\frac{1}{x} + \frac{y}{3}))^3 = (\frac{1}{x})^3 + (\frac{y}{3})^3 + 3(\frac{1}{x})(\frac{y}{3})(\frac{1}{x} + \frac{y}{3})$$

$$= \frac{1}{x^3} + \frac{y^3}{27} + 3 \times \frac{1}{x} \times \frac{y}{3}(\frac{1}{x} + \frac{y}{3})$$

$$= \frac{1}{x^3} + \frac{y^3}{27} + \frac{y}{x}(\frac{1}{x} + \frac{y}{3})$$

$$= \frac{1}{x^3} + \frac{y^3}{27} + (\frac{y}{x} \times \frac{1}{x}) + (\frac{y}{x} \times \frac{y}{3})$$

$$= \frac{1}{x^3} + \frac{y^3}{27} + \frac{y}{x^2} + \frac{y^2}{3x}$$

(ii)

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

$$= \frac{27}{x^3} - \frac{8}{x^6} - 3 \times \frac{3}{x} \times \frac{2}{x^2}\left(\frac{3}{x} - \frac{2}{x^2}\right)$$

$$= \frac{27}{x^3} - \frac{8}{x^6} - \frac{18}{x^3}\left(\frac{3}{x} - \frac{2}{x^2}\right)$$

$$= \frac{27}{x^3} - \frac{8}{x^6} - \frac{54}{x^4} + \frac{36}{x^5}$$

(iii)

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

$$= 8x^3 + \frac{27}{x^3} + \frac{18x}{x}\left(2x + \frac{3}{x}\right)$$

$$= 8x^3 + \frac{27}{x^3} + \frac{18x}{x}\left(2x + \frac{3}{x}\right)$$

$$= 8x^3 + \frac{27}{x^3} + (18 \times 2x) + \left(18 \times \frac{3}{x}\right)$$

$$= 8x^3 + \frac{27}{x^3} + 36x + \frac{54}{x}$$

(iv)

$$\left(4-\frac{1}{3x}\right)^3 = 4^3 - \left(\frac{1}{3x}\right)^3 - 3(4)\left(\frac{1}{3x}\right)\left(4 - \frac{1}{3x}\right)$$

$$= 64 - \frac{1}{27x^3} - \frac{4}{x}\left(4 - \frac{1}{3x}\right)$$

$$= 64 - \frac{1}{27x^3} - \frac{16}{x} + \frac{4}{3x^2}$$

Question 2: Simplify each of the following:

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

(ii) $(x/2 + y/3)^3 – (x/2 – y/3)^3$

(iii) $(x + 2/x)^3 + (x – 2/x)^3$

(iv) $(2x – 5y)^3 – (2x + 5y)^3$

Solution:

[Using identities:

$a^3 + b^3 = (a + b)(a^2 + b^2 – ab)$

$a^3 – b^3 = (a – b)(a^2 + b^2 + ab)$

$(a + b)(a-b) = a^2 – b^2$

$(a + b)^2 = a^2 + b^2 + 2ab$ and

$(a – b)^2 = a^2 + b^2 – 2ab$]

(i) $(x + 3)^3 + (x – 3)^3$

Here a = (x + 3), b = (x – 3)

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

$= 2x[(x^2 + 9 + 6x) + (x^2 + 9 - 6x) - x^2 + 9]$

$= 2x[(x^2 + 9 + 6x + x^2 + 9 - 6x - x^2 + 9)]$

$= 2x (x^2 + 27)$

$= 2x^3 + 54x$

(ii) $(x/2 + y/3)^3 – (x/2 – y/3)^3$

Here a = (x/2 + y/3) and b = (x/2 – y/3)

$$= [(\frac{x}{2} + \frac{y}{3}) - (\frac{x}{2} - \frac{y}{3})][(\frac{x}{2} + \frac{y}{3})^2 + (\frac{x}{2} - \frac{y}{3})^2 + (\frac{x}{2} + \frac{y}{3})(\frac{x}{2} - \frac{y}{3})]$$

$$= \frac{2y}{3}[(\frac{x^2}{4} + \frac{y^2}{9} + \frac{2xy}{6}) + (\frac{x^2}{4} + \frac{y^2}{9} - \frac{2xy}{6}) + \frac{x^2}{4} - \frac{y^2}{9}]$$

$$= \frac{2y}{3}[\frac{x^2}{4} + \frac{y^2}{9} + \frac{x^2}{4} + \frac{x^2}{4}]$$

$$= \frac{2y}{3}[\frac{3x^2}{4} + \frac{y^2}{9}]$$

$$= \frac{x^2 y}{2} + \frac{2y^3}{27}$$

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

Here $a = (x + 2/x)$ and $b = (x - 2/x)$

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

$$= (2x)[(x^2 + \frac{4}{x^2} + \frac{4x}{x}) + (x^2 + \frac{4}{x^2} - \frac{4x}{x}) - (x^2 - \frac{4}{x^2})$$

$$= (2x)[(x^2 + \frac{4}{x^2} + \frac{4}{x^2} + \frac{4}{x^2})$$

$$= (2x)[(x^2 + \frac{12}{x^2})$$

$$= 2x^3 + \frac{24}{x}$$

(iv) $(2x - 5y)^3 - (2x + 5y)^3$

Here $a = (2x - 5y)$ and $b = 2x + 5y$

$= (2x - 5y - 2x - 5y)[(2x - 5y)^2 + (2x + 5y)^2 + ((2x - 5y)(2x + 5y))]$

$= (-10y)[(4x^2 + 25y^2 - 20xy) + (4x^2 + 25y^2 + 20xy) + 4x^2 - 25y^2]$

$= (-10y)[4x^2 + 4x^2 + 4x^2 + 25y^2]$

$= (-10y)[12x^2 + 25y^2\}$

$= -120x^2y - 250y^3$

Question 3: If a + b = 10 and ab = 21, find the value of $a^3 + b^3$.

Solution:

a + b = 10, ab = 21 (given)

Choose a + b = 10

Cubing both sides,

$(a + b)^3 = (10)^3$

$a^3 + b^3 + 3ab(a + b) = 1000$

$a^3 + b^3 + 3 \times 21 \times 10 = 1000$ (using given values)

$a^3 + b^3 + 630 = 1000$

$a^3 + b^3 = 1000 – 630 = 370$

or $a^3 + b^3 = 370$

Question 4: If a – b = 4 and ab = 21, find the value of $a^3 – b^3$.

Solution:

a – b = 4, ab= 21 (given)

Choose a – b = 4

Cubing both sides,

$(a – b)^3 = (4)^3$

$a^3 – b^3 – 3ab (a – b) = 64$

$a^3 - b^3 - 3 \times 21 \times 4 = 64$ (using given values)

$a^3 - b^3 - 252 = 64$

$a^3 - b^3 = 64 + 252$

$= 316$

Or $a^3 - b^3 = 316$

Question 5: If x + 1/x = 5, find the value of $x^3 + 1/x^3$.

Solution:

Given: x + 1/x = 5

Apply Cube on x + 1/x

$$(x + \frac{1}{x})^3 = x^3 + \frac{1}{x^3} + 3(x \times \frac{1}{x})(x + \frac{1}{x})$$

$$5^3 = x^3 + \frac{1}{x^3} + 3(x + \frac{1}{x})$$

$$125 = x^3 + \frac{1}{x^3} + 3(5)$$

$$125 = x^3 + \frac{1}{x^3} + 15$$

$$125 - 15 = x^3 + \frac{1}{x^3}$$

$$x^3 + \frac{1}{x^3} = 110$$

Question 6: If x – 1/x = 7, find the value of $x^3 - 1/x^3$.

Solution:

Given: x – 1/x = 7

Apply Cube on x – 1/x

$$(x - \frac{1}{x})^3 = x^3 - \frac{1}{x^3} - 3(x \times \frac{1}{x})(x - \frac{1}{x})$$

$$7^3 = x^3 - \frac{1}{x^3} - 3(x - \frac{1}{x})$$

$$343 = x^3 - \frac{1}{x^3} - (3 \times 7)$$

$$343 + 21 = x^3 - \frac{1}{x^3}$$

$$x^3 - \frac{1}{x^3} = 364$$

Question 7: If x – 1/x = 5, find the value of x^3 – 1/x^3 .

Solution:

Given: x – 1/x = 5

Apply Cube on x – 1/x

$$(x - \frac{1}{x})^3 = x^3 - \frac{1}{x^3} - 3(x \times \frac{1}{x})(x - \frac{1}{x})$$

$$5^3 = x^3 - \frac{1}{x^3} - 3(x - \frac{1}{x})$$

$$125 = x^3 - \frac{1}{x^3} - (3 \times 5)$$

$$125 = x^3 - \frac{1}{x^3} - 15$$

$$125 + 15 = x^3 - \frac{1}{x^3}$$

$$x^3 - \frac{1}{x^3} = 140$$

Question 8: If (x^2 + 1/x^2) = 51, find the value of x^3 – 1/x^3.

Solution:

We know that: $(x – y)^2 = x^2 + y^2 – 2xy$

Replace y with 1/x, we get

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

Since $(x^2 + 1/x^2) = 51$ (given)

$(x - 1/x)^2 = 51 - 2 = 49$

or $(x - 1/x) = \pm 7$

Now, Find $x^3 - 1/x^3$

We know that, $x^3 - y^3 = (x - y)(x^2 + y^2 + xy)$

Replace y with 1/x, we get

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

Use $(x - 1/x) = 7$ and $(x^2 + 1/x^2) = 51$

$x^3 - 1/x^3 = 7 \times 52 = 364$

$x^3 - 1/x^3 = 364$

Question 9: If $(x^2 + 1/x^2) = 98$, find the value of $x^3 + 1/x^3$.

Solution:

We know that: $(x + y)^2 = x^2 + y^2 + 2xy$

Replace y with 1/x, we get

$(x + 1/x)^2 = x^2 + 1/x^2 + 2$

Since $(x^2 + 1/x^2) = 98$ (given)

$(x + 1/x)^2 = 98 + 2 = 100$

or $(x + 1/x) = \pm 10$

Now, Find $x^3 + 1/x^3$

We know that, $x^3 + y^3 = (x + y)(x^2 + y^2 - xy)$

Replace y with 1/x, we get

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

Use $(x + 1/x) = 10$ and $(x^2 + 1/x^2) = 98$

$x^3 + 1/x^3 = 10 \times 97 = 970$

$x^3 + 1/x^3 = 970$

Question 10: If $2x + 3y = 13$ and $xy = 6$, find the value of $8x^3 + 27y^3$.

Solution:

Given: $2x + 3y = 13$, $xy = 6$

Cubing $2x + 3y = 13$ both sides, we get

$(2x + 3y)^3 = (13)^3$

$(2x)^3 + (3y)^3 + 3(2x)(3y)(2x + 3y) = 2197$

$8x^3 + 27y^3 + 18xy(2x + 3y) = 2197$

$8x^3 + 27y^3 + 18 \times 6 \times 13 = 2197$

$8x^3 + 27y^3 + 1404 = 2197$

$8x^3 + 27y^3 = 2197 – 1404 = 793$

$8x^3 + 27y^3 = 793$

Question 11: If $3x – 2y= 11$ and $xy = 12$, find the value of $27x^3 – 8y^3$.

Solution:

Given: $3x – 2y = 11$ and $xy = 12$

Cubing $3x – 2y = 11$ both sides, we get

$(3x – 2y)^3 = (11)^3$

$(3x)^3 – (2y)^3 – 3(3x)(2y)(3x – 2y) =1331$

$27x^3 – 8y^3 – 18xy(3x -2y) =1331$

$27x^3 – 8y^3 – 18 \times 12 \times 11 = 1331$

$27x^3 – 8y^3 – 2376 = 1331$

$27x^3 – 8y^3 = 1331 + 2376 = 3707$

$27x^3 - 8y^3 = 3707$

RD Sharma Class 9 Solutions Maths Chapter 4 Algebraic Identities Exercise 4.4 Page No: 4.23

Question 1: Find the following products:

(i) $(3x + 2y)(9x^2 - 6xy + 4y^2)$

(ii) $(4x - 5y)(16x^2 + 20xy + 25y^2)$

(iii) $(7p^4 + q)(49p^8 - 7p^4q + q^2)$

(iv) $(x/2 + 2y)(x^2/4 - xy + 4y^2)$

(v) $(3/x - 5/y)(9/x^2 + 25/y^2 + 15/xy)$

(vi) $(3 + 5/x)(9 - 15/x + 25/x^2)$

(vii) $(2/x + 3x)(4/x^2 + 9x^2 - 6)$

(viii) $(3/x - 2x^2)(9/x^2 + 4x^4 - 6x)$

(ix) $(1 - x)(1 + x + x^2)$

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

(xi) $(x^2 - 1)(x^4 + x^2 + 1)$

(xii) $(x^3 + 1)(x^6 - x^3 + 1)$

Solution:

(i) $(3x + 2y)(9x^2 - 6xy + 4y^2)$

$= (3x + 2y)[(3x)^2 - (3x)(2y) + (2y)^2)]$

We know, $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$

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

$= 27x^3 + 8y^3$

(ii) $(4x - 5y)(16x^2 + 20xy + 25y^2)$

$= (4x - 5y)[(4x)^2 + (4x)(5y) + (5y)^2)]$

We know, $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$

$= (4x)^3 – (5y)^3$

$= 64x^3 – 125y^3$

(iii) $(7p^4 + q)(49p^8 – 7p^4q + q^2)$

$= (7p^4 + q)[(7p^4)^2 – (7p^4)(q) + (q)^2)]$

We know, $a^3 + b^3 = (a + b)(a^2 + b^2 – ab)$

$= (7p^4)^3 + (q)^3$

$= 343\,p^{12} + q^3$

(iv) $(x/2 + 2y)(x^2/4 – xy + 4y^2)$

We know, $a^3 – b^3 = (a – b)(a^2 + b^2 + ab)$

$(x/2 + 2y)(x^2/4 – xy + 4y^2)$

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

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

$$= \frac{x^3}{8} + 8y^3$$

(v) $(3/x – 5/y)(9/x^2 + 25/y^2 + 15/xy)$

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

$$=\left(\frac{3}{x}\right)^3 - \left(\frac{5}{y}\right)^3$$

$$= \left(\frac{27}{x^3}\right) - \left(\frac{125}{y^3}\right)$$

[Using $a^3 – b^3 = (a – b)(a^2 + b^2 + ab)$]

(vi) $(3 + 5/x)(9 – 15/x + 25/x^2)$

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

$= (3)^3 + (\frac{5}{x})^3$

$= 27 + \frac{125}{x^3}$

[Using: $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$]

(vii) $(2/x + 3x)(4/x^2 + 9x^2 - 6)$

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

$= (\frac{2}{x})^3 + (3x)^3$

$= \frac{8}{x^3} + 27x^3$

[Using: $a^3 + b^3 = (a + b)(a^2 + b^2 - ab)$]

(viii) $(3/x - 2x^2)(9/x^2 + 4x^4 - 6x)$

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

$= (\frac{3}{x} - 2x^2)[(\frac{9}{x^2}) + 4x^4 - (\frac{3}{x})(2x^2)]$

$= (\frac{3}{x})^3 - (2x^2)^3$

$= \frac{27}{x^3} - 8x^6$

[Using : $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$]

(ix) $(1 - x)(1 + x + x^2)$

And we know, $a^3 - b^3 = (a - b)(a^2 + b^2 + ab)$

$(1 - x)(1 + x + x^2)$ can be written as

$(1 - x)[(1^2 + (1)(x) + x^2)]$

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

$= 1 – x^3$

(x) $(1 + x)(1 – x + x^2)$

And we know, $a^3 + b^3 = (a + b)(a^2 + b^2 – ab)]$

$(1 + x)(1 – x + x^2)$ can be written as,

$(1 + x)[(1^2 – (1)(x) + x^2)]$

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

$= 1 + x^3$

(xi) $(x^2 – 1)(x^4 + x^2 +1)$ can be written as,

$(x^2 – 1)[(x^2)^2 – 1^2 + (x^2)(1)]$

$= (x^2)^3 – 1^3$

$= x^6 – 1$

[using $a^3 – b^3 = (a – b)(a^2 + b^2 + ab)$]

(xii) $(x^3 + 1)(x^6 – x^3 + 1)$ can be written as,

$(x^3 + 1)[(x^3)^2 – (x^3)(1) + 1^2]$

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

$= x^9 + 1$

[using $a^3 + b^3 = (a + b)(a^2 + b^2 – ab)$]

Question 2: If x = 3 and y = -1, find the values of each of the following using in identity:

(i) $(9y^2 – 4x^2)(81y^4 + 36x^2y^2 + 16x^4)$

(ii) $(3/x – x/3)(x^2 /9 + 9/x^2 + 1)$

(iii) $(x/7 + y/3)(x^2/49 + y^2/9 – xy/21)$

(iv) $(x/4 – y/3)(x^2/16 + xy/12 + y^2/9)$
(v) $(5/x + 5x)(25/x^2 – 25 + 25x^2)$

Solution:

(i) $(9y^2 – 4x^2)(81y^4 + 36x^2y^2 + 16x^4)$

$= (9y^2 – 4x^2) [(9y^2)^2 + 9y^2 x 4x^2 + (4x^2)^2]$

$= (9y^2)^3 – (4x^2)^3$

$= 729 y^6 – 64 x^6$

Put x = 3 and y = -1

= 729 – 46656

= *– 45927*

(ii) Put x = 3 and y = -1

$(3/x – x/3)(x^2 /9 + 9/x^2 + 1)$

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

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

$$= \left(\frac{3}{3}\right)^3-\left(\frac{3}{3}\right)^3$$

$$= 1^3 - 1^3 = 0$$

(iii) Put x = 3 and y = -1

$(x/7 + y/3)(x^2/49 + y^2/9 – xy/21)$

$$= \left(\frac{x}{7}+\frac{y}{3}\right)\left[\left(\frac{x}{7}\right)^2 - \frac{x}{7}\times\frac{y}{3} - \left(\frac{y}{3}\right)^2\right]$$

$$= \left(\frac{x}{7}\right)^3 + \left(\frac{y}{3}\right)^3$$

$$= \frac{x^3}{343} + \frac{y^3}{27}$$

$$= \frac{(3)^3}{343} + \frac{(-1)^3}{27}$$

$$= \frac{27}{343} - \frac{1}{27} = \frac{729-343}{9261} = \frac{386}{9261}$$

(iv) Put x = 3 and y = -1

$(x/4 – y/3)(x^2/16 + xy/12 + y^2/9)$

$$= \left(\frac{x}{4}-\frac{y}{3}\right)\left[\left(\frac{x}{4}\right)^2 + \frac{x}{4}\times\frac{y}{3} + \left(\frac{y}{3}\right)^2\right]$$

$$= \left(\frac{x}{4}\right)^3 - \left(\frac{y}{3}\right)^3 = \frac{x^3}{64} - \frac{y^3}{27}$$

$$= \frac{(3)^3}{64} - \frac{(-1)^3}{27} = \frac{27}{64} + \frac{1}{27}$$

$$= \frac{793}{1728}$$

(v) Put x = 3 and y = -1

$(5/x + 5x)(25/x^2 – 25 + 25x^2)$

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

$$= \left(\frac{5}{x}\right)^3 + (5x)^3 = \frac{125}{x^3} + 125x^3$$

$$= \frac{125}{(3)^3} + 125 \times (3)^3 = \frac{125}{27} + 125 \times 27$$

$$= \frac{125}{27} + 3375$$

$$= \frac{91250}{27}$$

Question 3: If a + b = 10 and ab = 16, find the value of $a^2 - ab + b^2$ and $a^2 + ab + b^2$.

Solution:

a + b = 10, ab = 16

Squaring, a + b = 10, both sides

$(a + b)^2 = (10)^2$

$a^2 + b^2 + 2ab = 100$

$a^2 + b^2 + 2 \times 16 = 100$

$a^2 + b^2 + 32 = 100$

$a^2 + b^2 = 100 - 32 = 68$

$a^2 + b^2 = 68$

Again, $a^2 - ab + b^2 = a^2 + b^2 - ab = 68 - 16 = 52$ and

$a^2 + ab + b^2 = a^2 + b^2 + ab = 68 + 16 = 84$

Question 4: If a + b = 8 and ab = 6, find the value of $a^3 + b^3$.

Solution:

a + b = 8, ab = 6

Cubing, a + b = 8, both sides, we get

$(a + b)^3 = (8)^3$

$a^3 + b^3 + 3ab(a + b) = 512$

$a^3 + b^3 + 3 \times 6 \times 8 = 512$

$a^3 + b^3 + 144 = 512$

$a^3 + b^3 = 512 – 144 = 368$

$a^3 + b^3 = 368$

RD Sharma Class 9 Solutions Maths Chapter 4 Algebraic Identities Exercise 4.5 Page No: 4.28

Question 1: Find the following products:

(i) $(3x + 2y + 2z) (9x^2 + 4y^2 + 4z^2 – 6xy – 4yz – 6zx)$

(ii) $(4x – 3y + 2z) (16x^2 + 9y^2 + 4z^2 + 12xy + 6yz – 8zx)$

(iii) $(2a – 3b – 2c) (4a^2 + 9b^2 + 4c^2 + 6ab – 6bc + 4ca)$

(iv) $(3x -4y + 5z) (9x^2 + 16y^2 + 25z^2 + 12xy- 15zx + 20yz)$

Solution:

(i) $(3x + 2y + 2z) (9x^2 + 4y^2 + 4z^2 – 6xy – 4yz – 6zx)$

$= (3x + 2y + 2z) [(3x)^2 + (2y)^2 + (2z)^2 – 3x \times 2y – 2y \times 2z – 2z \times 3x]$

$= (3x)^3 + (2y)^3 + (2z)^3 – 3 \times 3x \times 2y \times 2z$

$= 27x^3 + 8y^3 + 8Z^3 – 36xyz$

(ii) $(4x – 3y + 2z) (16x^2 + 9y^2 + 4z^2 + 12xy + 6yz – 8zx)$

$= (4x -3y + 2z) [(4x)^2 + (-3y)^2 + (2z)^2 – 4x \times (-3y) – (-3y) \times (2z) – (2z \times 4x)]$

$= (4x)^3 + (-3y)^3 + (2z)^3 – 3 \times 4x \times (-3y) \times (2z)$

$= 64x^3 – 27y^3 + 8z^3 + 72xyz$

(iii) $(2a -3b- 2c) (4a^2 + 9b^2 + 4c^2 + 6ab – 6bc + 4ca)$

$= (2a -3b- 2c) [(2a)^2 + (-3b)^2 + (-2c)^2 – 2a \times (-3b) – (-3b) \times (-2c) – (-2c) \times 2a]$

$= (2a)^3 + (-3b)^3 + (-2c)^3 - 3 \times 2a \times (-3b)(-2c)$

$= 8a^3 - 21b^3 - 8c^3 - 36abc$

(iv) $(3x - 4y + 5z)(9x^2 + 16y^2 + 25z^2 + 12xy - 15zx + 20yz)$

$= [3x + (-4y) + 5z][(3x)^2 + (-4y)^2 + (5z)^2 - 3x \times (-4y) - (-4y)(5z) - 5z \times 3x]$

$= (3x)^3 + (-4y)^3 + (5z)^3 - 3 \times 3x \times (-4y)(5z)$

$= 27x^3 - 64y^3 + 125z^3 + 180xyz$

Question 2: If x + y + z = 8 and xy + yz+ zx = 20, find the value of $x^3 + y^3 + z^3 - 3xyz$.

Solution:

We know, $x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$

Squaring, x + y + z = 8 both sides, we get

$(x + y + z)^2 = (8)^2$

$x^2 + y^2 + z^2 + 2(xy + yz + zx) = 64$

$x^2 + y^2 + z^2 + 2 \times 20 = 64$

$x^2 + y^2 + z^2 + 40 = 64$

$x^2 + y^2 + z^2 = 24$

Now,

$x^3 + y^3 + z^3 - 3xyz = (x + y + z)[x^2 + y^2 + z^2 - (xy + yz + zx)]$

$= 8(24 - 20)$

$= 8 \times 4$

$= 32$

$\Rightarrow x^3 + y^3 + z^3 - 3xyz = 32$

Question 3: If a +b + c = 9 and ab + bc + ca = 26, find the value of $a^3 + b^3 + c^3 - 3abc$.

Solution:

a + b + c = 9, ab + bc + ca = 26

Squaring, a + b + c = 9 both sides, we get

$(a + b + c)^2 = (9)^2$

$a^2 + b^2 + c^2 + 2 (ab + bc + ca) = 81$

$a^2 + b^2 + c^2 + 2 \times 26 = 81$

$a^2 + b^2 + c^2 + 52 = 81$

$a^2 + b^2 + c^2 = 29$

Now, $a^3 + b^3 + c^3 – 3abc = (a + b + c) [(a^2 + b^2 + c^2 – (ab + bc + ca)]$

= 9[29 – 26]

= 9 x 3

= 27

⇒ *$a^3 + b^3 + c^3 – 3abc = 27$*

RD Sharma Class 9 Solutions Maths Chapter 4 Algebraic Identities Exercise VSAQs Page No: 4.28

Question 1: If x + 1/x = 3, then find the value of $x^2 + 1/x^2$.

Solution:

x + 1/x = 3

Squaring both sides, we have

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

$x^2 + 1/x^2 + 2 = 9$

$x^2 + 1/x^2 = 9 – 2 = 7$

Question 2: If x + 1/x = 3, then find the value of x^6 + 1/x^6.

Solution:

x + 1/x = 3

Squaring both sides, we have

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

$x^2 + 1/x^2 + 2 = 9$

$x^2 + 1/x^2 = 9 – 2 = 7$

$x^2 + 1/x^2 = 7$ …(1)

Cubing equation (1) both sides,

$$= \left(x^2 + \frac{1}{x^2}\right)^3 = (7)^3$$

$$= x^6 + \frac{1}{x^6} + 3\left(x^2 + \frac{1}{x^2}\right) = 343$$

$$= x^6 + \frac{1}{x^6} + 3 \times 7 = 343$$

$$= x^6 + \frac{1}{x^6} = 322$$

Question 3: If a + b = 7 and ab = 12, find the value of $a^2 + b^2$.

Solution:

a + b = 7, ab = 12

Squaring, a + b = 7, both sides,

$(a + b)^2 = (7)^2$

$a^2 + b^2 + 2ab = 49$

$a^2 + b^2 + 2 \times 12 = 49$

$a^2 + b^2 + 24 = 49$

$a^2 + b^2 = 25$

Question 4: If a – b = 5 and ab = 12, find the value of $a^2 + b^2$.

Solution:

a – b = 5, ab = 12

Squaring, a – b = 5, both sides,

$(a - b)^2 = (5)^2$

$a^2 + b^2 - 2ab = 25$

$a^2 + b^2 - 2 \times 12 = 25$

$a^2 + b^2 - 24 = 25$

$a^2 + b^2 = 49$