NCERT Solutions for Class 8 Maths Chapter 9 Algebraic Expressions and Identities Ex 9.5

Ex 9.5 Class 8 Maths Question 1.

Use a suitable identity to get each of the following products:

(i) (x + 3) (x + 3)

(ii) (2y + 5) (2y + 5)

(iii) (2a − 7) (2a − 7)

(iv) $(3a - \frac{1}{2})$ $(3a - \frac{1}{2})$

(v) (1.1m − 0.4) (1.1m + 0.4)

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

(vii) (6x − 7) (6x + 7)

(viii) (-a + c) (-a + c)

(ix) $(\frac{x}{2} + \frac{3y}{4})$ $(\frac{x}{2} + \frac{3y}{4})$

(x) (7a − 9b) (7a − 9b)

Solution:

$(i)\ (x + 3)\ (x + 3)$

$= (x + 3)^2$

$= (x)^2 \times 2 \times x \times 3 + (3)^2$

$= x^2 + 6x + 9 \qquad [(a + b)^2 = a^2 + 2ab + b^2]$

$(ii)\ (2y + 5)\ (2y + 5)$

$= (2y + 5)^2$

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

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

$= 4y^2 + 20y + 25$

$(iii)\ (2a - 7)\ (2a - 7)$

$= (2a - 7)^2$

$= (2a)^2 - 2(2a)\ (7) + (7)^2$

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

$= 4a^2 - 28a + 49$

(*iv*) $\left(3a - \frac{1}{2}\right)\left(3a - \frac{1}{2}\right)$

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

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

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

$= 9a^2 - 3a + \frac{1}{4}$

(*v*) $(1.1m - 0.4)(1.1m + 0.4)$

$= (1.1\,m)^2 - (0.4)^2$

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

$= 1.21m^2 - 0.16$

(*vi*) $(a^2 + b^2)(-a^2 + b^2)$

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

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

$= b^4 - a^4$

$= -a^4 + b^4$

(*vii*) $(6x - 7)(6x + 7)$

$= (6x)^2 - (7)^2$ $[(a + b)(a - b) = a^2 - b^2]$

$= 36x^2 - 49$

(*viii*) $(-a + c)(-a + c)$

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

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

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

$$(ix)\ \left(\frac{x}{2}+\frac{3y}{4}\right)\left(\frac{x}{2}+\frac{3y}{4}\right)$$

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

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

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

$$=\frac{x^2}{4}+\frac{3}{4}xy+\frac{9y^2}{16}$$

$$(x)\ (7a-9b)\,(7a-9b)$$

$$=(7a)^2-2(7a)(9b)+(9b)^2$$

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

$$=49a^2-126ab+81b^2$$

Ex 9.5 Class 8 Maths Question 2.

Use the identity (x + a)(x + b) = x^2 + (a + b)x + ab to find the following products.

(i) (x + 3) (x + 7)

(ii) (4x + 5)(4x + 1)

(iii) (4x – 5) (4x – 1)

(iv) (4x + 5) (4x – 1)

(v) (2x + 5y) (2x + 3y)

(vi) ($2a^2$ + 9) ($2a^2$ + 5)

(vii) (xyz – 4) (xyz – 2)

Solution:

$(i)\ (x+3)(x+7)$

$= x^2 + (3+7)x + 3 \times 7$

$= x^2 + 10x + 21$

$(ii)\ (4x+5)(4x+1)$

$= (4x)^2 + (5+1)(4x) + 5 \times 1$

$= 16x^2 + 6(4x) + 5$

$= 16x^2 + 24x + 5$

$(iii)\ (4x-5)(4x-1)$

$= (4x)^2 - (5+1)(4x) + (-5) \times (+1)$

$= 16x^2 - 6(4x) + 5$

$= 16x^2 - 24x + 5$

$(iv)\ (4x+5)(4x-1)^2$

$= (4x)^2 + (5-1)(4x) + 5 \times (-1)$

$= 16x^2 + 4(4x) - 5$

$= 16x^2 + 16x - 5$

$(v)\ (2x+5y)(2x+3y)$

$= (2x)^2 + (5y+3y)(2x) + (5y)(3y)$

$= 4x^2 + (8y)(2x) + 15y^2$

$= 4x^2 + 16xy + 15y^2$

$(vi)\ (2a^2+9)(2a^2+5)$

$= (2a^2)^2 + (9+5)(2a)^2 + 5 \times 9$

$= 4a^4 + (14)(2a^2) + 45$

$= 4a^4 + 28a^2 + 45$

$(vii)\ (xyz-4)(xyz-2)$

$= (xyz)^2 - (4+2)(xyz) + (-4)(-2)$

$= x^2y^2z^2 - (6)(xyz) + 8$

$= x^2y^2z^2 - 6xyz + 8$

Ex 9.5 Class 8 Maths Question 3.

Find the following squares by using the identities.

(i) $(b - 7)^2$

(ii) $(xy + 3z)^2$

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

(iv) $(\frac{2}{3} m + \frac{3}{2} n)^2$

(v) $(0.4p - 0.5q)^2$

(vi) $(2xy + 5y)^2$

Solution:

$(i)\ (b-7)^2 = (b)^2 - 2(b)(7) + (7)^2$

$= b^2 - 14b + 49$

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

$(ii)\ (xy + 3z)^2$

$= (xy)^2 + 2(xy)(3z) + (3z)^2$

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

$= x^2y^2 + 6xyz + 9y^2$

$(iii)\ (6x^2 - 5y)^2$

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

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

$= 36x^4 - 60x^2y + 25y^2$

$(iv)\ \left(\frac{2}{3}m + \frac{3}{2}n\right)^2$

$= \left(\frac{2}{3}m\right)^2 + 2\left(\frac{2}{3}m\right)\left(\frac{3}{2}n\right) + \left(\frac{3}{2}n\right)^2$

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

$= \frac{4}{9}m^2 + 2mn + \frac{9}{4}n^2$

$(v)\ (0.4p - 0.5q)^2$

$= (0.4p)^2 - 2(0.4p)(0.5q) + (0.5q)^2$

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

$= 0.16p^2 - 0.4pq + 0.25q^2$

$(vi)\ (2xy + 5y)^2$

$= (2xy)^2 + 2(2xy)(5y) + (5y)^2$

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

$= 4x^2y^2 + 20xy^2 + 25y^2$

Ex 9.5 Class 8 Maths Question 4.

Simplify:

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

(ii) $(2x + 5)^2 - (2x - 5)^2$

(iii) $(7m - 8n)^2 + (7m + 8n)^2$

(iv) $(4m + 5n)^2 + (5m + 4n)^2$

(v) $(2.5p - 1.5q)^2 - (1.5p - 2.5q)^2$

(vi) $(ab + bc)^2 - 2ab^2c$

(vii) $(m^2 - n^2m)^2 + 2m^3n^2$

Solution:

(*i*) $(a^2 - b^2)^2$

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

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

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

(*ii*) $(2x + 5)^2 - (2x - 5)^2$

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

$= (4x^2 + 20x + 25) - (4x^2 - 20x + 25)$

$= \cancel{4x^2} + 20x + \cancel{25} - \cancel{4x^2} + 20x - \cancel{25}$

$= 20x + 20x = 40x$

Alternately:

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

$= [(2x + 5) + (2x - 5)]\,(2x + 5) - (2x - 5)]$

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

$= (2x + \cancel{5} + 2x - \cancel{5})\,(\cancel{2x} + 5 - \cancel{2x} + 5)$

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

$= 4x \times 10 = 40x$

(*iii*) $(7m - 8n)^2 + (7m + 8n)^2$

$= (7m)^2 - 2(7m)(8n) + (8n)^2 + (7m)^2 + 2(7m)(8n) + (8n)^2$

$= 49m^2 - \cancel{112mn} + 64n^2 + 49m^2 + \cancel{112mn} + 64n^2$

$= 98m^2 + 128n^2$

(iv) $(4m + 5n)^2 + (5m + 4n)^2$

$= (4m)^2 + 2(4m)(5n) + (5n)^2$

$+ (5m)^2 + 2(5m)(4n) + (4n)^2$

$= 16m^2 + 40mn + 25n^2 + 25m^2$

$+ 40mn + 16n^2$

$= 41m^2 + 80mn + 41n^2$

(v) $(2.5p - 1.5q)^2 - (1.5p - 2.5q)^2$

$= [(2.5p)^2 - 2(2.5p)(1.5q) + (1.5q)^2]$

$- [(1.5p)^2 - 2(1.5p)(2.5q) + (2.5q)^2]$

$= (6.25p^2 - 7.5pq + 2.25q^2)$

$- (2.25p^2 - 7.5pq + 6.25q^2)$

$= 6.25p^2 - \cancel{7.5pq} + 2.25q^2$

$- 2.25p^2 + \cancel{7.5pq} - 6.25q^2$

$= 6.25p^2 - 2.25p^2 + 2.25q^2 - 6.25q^2$

$= 4p^2 - 4q^2$

(vi) $(ab + bc)^2 - 2ab^2c$

$= (ab)^2 + 2(ab)(bc) + (bc)^2 - 2ab^2c$

$= a^2b^2 + \cancel{2ab^2}c + b^2c^2 - \cancel{2ab^2c}$

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

(vii) $(m^2 - n^2m)^2 + 2m^3n^2$

$= (m^2)^2 - 2m^2(n^2m) + (n^2\, m)^2 + 2m^3n^2$

$= m^4 - \cancel{2m^3n^2} + n^4m^2 + \cancel{2m^3n^2}$

$= m^4 + n^4m^2$

Ex 9.5 Class 8 Maths Question 5.

Show that:

(i) $(3x + 7)^2 - 84x = (3x - 7)^2$

(ii) $(9p - 5q)^2 + 180pq = (9p + 5q)^2$

(iii) $(\frac{4}{3}\, m - \frac{3}{4}\, n)^2 + 2mn = \frac{16}{9}\, m^2 + \frac{9}{16}\, n^2$

(iv) $(4pq + 3q)^2 - (4pq - 3q)^2 = 48pq^2$

(v) $(a - b)(a + b) + (b - c)(b + c) + (c - a)(c + a) = 0$

Solution:

(*i*) To Show that:

$(3x + 7)^2 - 84x = (3x - 7)^2$

LHS $= (3x + 7)^2 - 84x$

$= (3x)^2 + 2(3x)(7) + (7)^2 - 84x$

$= 9x^2 + 42x + 49 - 84x$

$= 9x^2 - 42x + 49$

$= (3x)^2 - 2(3x)\,(7) + (7)^2$

$= (3x - 7)^2 =$ RHS

LHS = RHS

Hence, proved.

(*ii*) To show that:

$(9p - 5q)^2 + 180pq = (9p + 5q)^2$

LHS $= (9p - 5q)^2 + 180pq$

$= (9p)^2 - 2(9p)(5q) + (5q^2) + 180pq$

$= 81p^2 - 90pq + 25q^2 + 180pq$

$= 81p^2 + 90pq + 25q^2$

$= (9p)^2 + 2(9p)\,(5q) + (5q)^2$

$= (9p + 5q)^2 =$ RHS

LHS = RHS

Hence, proved.

(*iii*) To show that:

$$\left(\frac{4}{3}m - \frac{3}{4}n\right)^2 + 2mn = \frac{16}{9}m^2 + \frac{9}{16}n^2$$

$$\text{LHS} = \left(\frac{4}{3}m - \frac{3}{4}n\right)^2 + 2mn$$

$$= \left(\frac{4}{3}m\right)^2 - 2\left(\frac{4}{3}m\right)\left(\frac{3}{4}n\right) + \left(\frac{3}{4}n\right)^2 + 2mn$$

$$= \frac{16}{9}m^2 - \cancel{2mn} + \frac{9}{16}n^2 + \cancel{2mn}$$

$$= \frac{16}{9}m^2 + \frac{9}{16}n^2 = \text{RHS}$$

LHS = RHS

Hence, proved.

(*iv*) To show that:

$(4pq + 3q)^2 - (4p - 3q)^2 = 48pq^2$

$\text{LHS} = (4pq + 3q)^2 - (4pq - 3q)^2$

$= [(4pq + 3q) + (4pq - 3q)]$

$[(4pq + 3q) - (4pq - 3q)]$

$= (4pq + \cancel{3q} + 4pq - \cancel{3q})$

$(\cancel{4pq} + 3q - \cancel{4pq} + 3q)$

$= (8pq)(6q)$

$= 48pq^2 = \text{RHS}$

LHS = RHS

Hence, proved.

(*v*) To show that:

$(a - b)(a + b) + (b - c)(b + c)(c - a)(c + a)$

$= 0$

$\text{LHS} = (a^2 - b^2) + (b^2 - c^2) + (c^2 - a^2)$

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

$= \cancel{a^2} - \cancel{b^2} + \cancel{b^2} - \cancel{c^2} + \cancel{c^2} - \cancel{a^2}$

$= 0 = \text{RHS}$

LHS = RHS

Hence, proved.

Ex 9.5 Class 8 Maths Question 6.

Using identities, evaluate:

(i) 71^2

(ii) 99^2

(iii) 102^2

(iv) 998^2

(v) 5.2^2

(vi) 297×303

(vii) 78×82

(viii) 8.9^2

(ix) 1.05×9.5

Solution:

$(i)\ 71^2 = (70 + 1)^2$

$= (70)^2 + 2(70)(1)^2 + (1)^2$

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

$= 4900 + 140 + 1$

$= 5041$

Hence, $71^2 = 5041$

$(ii)\ 99^2 = (100 - 1)^2$

$= (100)^2 - 2(100)\,(1) + (1)^2$

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

$= 10000 - 200 + 1$

$= 10001 - 200$

$= 9801$

Hence, $99^2 = 9801$

$(iii)\ 102^2 = (100 + 2)^2$

$= (100)^2 + 2(100)(2) + (2)^2$

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

$= 10000 + 400 + 4$

$= 10404$

Hence, $102^2 = 10404$

$(iv)\ 998^2 = (1000 - 2)^2$

$= (1000)^2 - 2(1000)\,(2) + (2)^2$

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

$= 1000000 - 4000 + 4$

$= 1000004 - 4000$

$= 996004$

Hence, $998^2 = 996004$

(v) $5.2^2 = (5 + 0.2)^2$

$= (5)^2 + 2(5)(0.2) + (0.2)^2$

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

$= 25 + 2 + 0.04$

$= 27 + 0.04$

$= 27.04$

Hence, $(5.2)^2 = 27.04$

(vi) $297 \times 303 = (300 - 3)(300 + 3)$

$= (300)^2 - (3)^2$ $[(a + b)(a - b) = a^2 - b^2]$

$= 90000 - 9$

$= 89991$

Hence, $297 \times 303 = 89991$

(vii) $78 \times 82 = (80 - 2)(80 + 2)$

$= (80)^2 - (2)^2$ $[(a + b)(a - b) = a^2 - b^2]$

$= 6400 - 4$

$= 6396$

Hence, $78 \times 82 = 6396$

(viii) $8.9^2 = (9 - 0.1)^2$

$= (9)^2 - 2(9)(0.1) + (0.1)^2$

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

$= 81 - 1.8 + 0.01$

$= 81.01 - 1.8$

$= 79.21$

Hence, $8.9^2 = 79.21$

(ix) $1.05 \times 9.5 = (1 + 0.5)(10 - 0.5)$

$= 1(10 - 0.5) + 0.05(10 - 0.5)$

$= 10 - 0.5 + 0.05 \times 10 - 0.05 \times 0.5$

$= 10 - 0.5 + 0.5 - 0.025$

$= 10.5 - 0.525$

$= 9.975$

Hence, $1.05 \times 9.5 = 9.975$

Ex 9.5 Class 8 Maths Question 7.

Using $a^2 - b^2 = (a + b)(a - b)$, find

(i) $51^2 - 49^2$

(ii) $(1.02)^2 - (0.98)^2$

(iii) $153^2 - 147^2$

(iv) $12.1^2 - 7.9^2$

Solution:

(i) $51^2 - 49^2 = (51 + 49)(51 - 49) = 100 \times 2 = 200$

(ii) $(1.02)^2 - (0.98)^2 = (1.02 + 0.98)(1.02 - 0.98) = 2.00 \times 0.04 = 0.08$

(iii) $153^2 - 147^2 = (153 + 147)(153 - 147) = 300 \times 6 = 1800$

(iv) $12.1^2 - 7.9^2 = (12.1 + 7.9)(12.1 - 7.9) = 20.0 \times 4.2 = 84$

Ex 9.5 Class 8 Maths Question 8.

Using $(x + a)(x + b) = x^2 + (a + b)x + ab$, find

(i) 103×104

(ii) 5.1×5.2

(iii) 103×98

(iv) 9.7×9.8

Solution:

(i) $103 \times 104 = (100 + 3)(100 + 4) = (100)^2 + (3 + 4)(100) + 3 \times 4 = 10000 + 700 + 12 = 10712$

(ii) $5.1 \times 5.2 = (5 + 0.1)(5 + 0.2) = (5)^2 + (0.1 + 0.2)(5) + 0.1 \times 0.2 = 25 + 1.5 + 0.02 = 26.5 + 0.02 = 26.52$

(iii) $103 \times 98 = (100 + 3)(100 - 2) = (100)^2 + (3 - 2)(100) + 3 \times (-2) = 10000 + 100 - 6 = 10100 - 6 = 10094$

(iv) $9.7 \times 9.8 = (10 - 0.3)(10 - 0.2) = (10)^2 - (0.3 + 0.2)(10) + (-0.3)(-0.2) = 100 - 5 + 0.06 = 95 + 0.06 = 95.06$