CBSE Class –VIII Mathematics
NCERT Solutions
CHAPTER - 9
Algebraic Expressions and Identities (Ex. 9.5)

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

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

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

Ans. (i) $(x+3)(x+3)=(x+3)^2$

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

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

= x^2+6x+9

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

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

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

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

(iii) $(2a-7)(2a-7)=(2a-7)^2$

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

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

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

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

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

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

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

(v) $(1.1m-0.4)(1.1m+0.4)=(1.1m)^2-(0.4)^2$

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

= $1.21m^2-0.16$

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

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

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

$=b^4-a^4$

(vii) $\left(6x-7\right)\left(6x+7\right)=\left(6x\right)^2-\left(7\right)^2$

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

$=36x^2-49$

(viii) $\left(-a+c\right)\left(-a+c\right)$

$\left(c-a\right)\left(c-a\right)=\left(c-a\right)^2$

$=\left(c\right)^2-2\times c\times a+\left(a\right)^2$

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

$=c^2-2ca+a^2$

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

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

[Using identity $\left(a+b\right)^2=a^2+2ab+b^2$]

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

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

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

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

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

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) $(xyz-4)(xyz-2)$

Ans. (i) $(x+3)(x+7)$

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

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

$=x^2+10x+21$

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

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

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

$= 16x^2+6\times 4x+5=16x^2+24x+5$

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

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

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

$= 16x^2+(-6)\times 4x+5=16x^2-24x+5$

(iv) $(4x+5)(4x-1)$

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

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

$= 16x^2+(5-1)\times 4x-5$

$= 16x^2+4\times 4x-5$

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

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

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

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

$= 4x^2+8y\times 2x+15y^2$

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

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

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

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

$=4a^4+14\times 2a^2+45$

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

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

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

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

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

3. Find the following squares by using identities:

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

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

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

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

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

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

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

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

$= b^2 - 14b + 49$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$= 0.16p^2 - 0.40pq + 0.25q^2$

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

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

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

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

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

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

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

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

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

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

={(2x+5)+(2x-5)}{(2x+5)-(2x-5)}

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

={4x}{2x+5-2x+5}

=(4x)(10)

=40x

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

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

$+\left[(7m)^2+2\times 7m\times 8n+(8n)^2\right]$

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

$=49m^2-112mn+64n^2+\left[49m^2+112mn+64n^2\right]$

$=49m^2-112mn+64n^2+49m^2+112mn+64n^2$

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

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

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

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

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

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

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

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

$=(2.5p)^2-2\times 2.5p\times 1.5q+(1.5q)^2-\left[(1.5p)^2-2\times 1.5p\times 2.5q+(2.5q)^2\right]$ [Using identity $(a-b)^2=a^2-2ab+b^2$]

$=6.25p^2-7.50pq+2.25q^2-\left[2.25p^2-7.50pq+6.25q^2\right]$

$=6.25p^2-7.50pq+2.25q^2-2.25p^2+7.50pq-6.25q^2$

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

(vi) $(ab+bc)^2-2ab^2c=(ab)^2+2\times ab\times bc+(bc)^2-2ab^2c$

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

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

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

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

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

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

$=m^4-2m^3n^2+n^4m^2+2m^3n^2$

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

5. Show that:

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

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

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

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

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

Ans. (i) L.H.S. = $(3x+7)^2-84x$

$=(3x)^2+2\times3x\times7+(7)^2-84x$

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

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

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

= $(3x-7)^2$ [$\because (a-b)^2=a^2-2ab+b^2$]

= R.H.S.

(ii) L.H.S. = $(9p-5q)^2+180pq$

$=(9p)^2-2\times9p\times5q+(5q)^2+180pq$

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

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

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

= $(9p+5q)^2$ [$\because (a+b)^2=a^2+2ab+b^2$]

(iii) L.H.S. = $\left(\frac{4}{3}m-\frac{3}{4}n\right)^2+2mn$

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

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

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

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

= R.H.S.

(iv) L.H.S. = $(4pq+3q)^2-(4pq-3q)^2$

$=(4pq)^2+2\times4pq\times3q+(3q)^2-\left[(4pq)^2-2\times4pq\times3q+(3q)^2\right]$ [Using identities $(a+b)^2=a^2+2ab+b^2$ and $(a-b)^2=a^2-2ab+b^2$]

$=16p^2q^2+24pq^2+9q^2-\left[16p^2q^2-24pq^2+9q^2\right]=$
$16p^2q^2+24pq^2+9q^2-16p^2q^2+24pq^2-9q^2=48pq^2$

= R.H.S.

(v)L.H.S.= $(a-b)(a+b)+(b-c)(b+c)+(c-a)(c+a)=a^2-b^2+b^2-c^2+c^2-a^2$

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

= 0

= R.H.S.

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

Ans. (i) $71^2 = (70+1)^2$

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

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

= 4900 + 140 + 1 = 5041

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

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

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

= 10000 – 200 + 1 = 9801

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

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

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

= 10000 + 400 + 4 = 10404

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

$= (1000)^2 - 2\times1000\times2 + (2)^2$

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

= 1000000 – 4000 + 4 = 996004

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

$= (5)^2 + 2\times5\times0.2 + (0.2)^2$

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

= 25 + 2.0 + 0.04 = 27.04

(vi) 297×303

$= (300 - 3)\times(300 + 3)$

$= (300)^2 - (3)^2$

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

= 90000 – 9 = 89991

(vii) $78\times82 = (80 - 2)\times(80 + 2)$

$= (80)^2 - (2)^2$

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

= 6400 – 4 = 6396

(viii) $8.9^2 = (8+0.9)^2$

$=(8)^2+2\times8\times0.9+(0.9)^2$

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

= 64 + 14.4 + 0.81 = 79.21

(ix) 10.05x9.5= $(10\ +\ 0.5)\times(10\ -\ 0.5)$

= $(10)^2-(0.5)^2$

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

= 100 – 0.25 = 99.75

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) $12.1^2-7.9^2$

Ans. (i) $51^2-49^2=(51+49)(51-49)$

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

= 100×2 = 200

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

$=(1.02+0.98)(1.02-0.98)$

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

= 2.00×0.04 = 0.08

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

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

= 300×6 = 1800

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

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

= 20.0×4.2 = 84.0 = 84

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

(i) $\mathbf{103 \times 104}$

(ii) $\mathbf{5.1 \times 5.2}$

(iii) $\mathbf{103 \times 98}$

(iv) $\mathbf{9.7 \times 9.8}$

Ans. (i) $103 \times 104 = (100 + 3) \times (100 + 4)$

= $(100)^2 + (3+4) \times 100 + 3 \times 4$

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

= $10000 + 7 \times 100 + 12$

= 10000 + 700 + 12 = 10712

(ii) $5.1 \times 5.2 = (5+0.1) \times (5+0.2)$

= $(5)^2 + (0.1+0.2) \times 5 + 0.1 \times 0.2$

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

= $25+0.3\times5+0.02$

= 25 + 1.5 + 0.02 = 26.52

(iii) $103\times98=(100+3)\times(100-2)$

= $(100)^2+(3-2)\times100+3\times(-2)$

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

= $10000+(3-2)\times100-6$

= 10000 + 100 – 6 = 10094

(iv) $9.7\times9.8=(10-0.3)\times(10-0.2)$

= $(10)^2+\{(-0.3)+(-0.2)\}\times10+(-0.3)\times(-0.2)$ [Using identity $(x+a)(x+b)=x^2+(a+b)x+ab$]

= $100+\{-0.3-0.2\}\times10+0.06$

= $100-0.5\times10+0.06$

= 100 – 5 + 0.06 = 95.06