

Chapter - 9

Algebraic Expressions

- Terms** \Rightarrow Terms are the individual building blocks of expressions. They add up to form expressions. A p term is a product of its factors.
Ex $\rightarrow 5xy - 3$.
- Factors** \rightarrow Factors are those variables or constants, whose product form a term of an expression.
Ex $\rightarrow 8, p$ and q are the factors of the term $8pq$.
- Coefficients** \Rightarrow The numerical factor of a term is called the coefficient of that term.
Ex $-2xy$, coefficient of $2xy$ is 2 .
- Like Terms** \Rightarrow Like terms are those terms which have same variables raised to the same power.
Ex $\rightarrow 3x^2y$ and $5x^2y$ are like terms.
- Monomial** \Rightarrow An expression with only one term is called a monomial. Ex $\rightarrow 6x, 7pq$ etc.
- Binomial** \Rightarrow An expression which contains two unlike terms is called a binomial.
Ex $4y - 3z, pq + 1$

7. Polynomial \rightarrow Expressions that have more than two terms with non zero coefficients and variables having non-negative integral exponents are called polynomials.

$$\text{Ex} \rightarrow a + b + c + 2.$$

Algebraic Identities

$$\text{I. } (a+b)^2 = a^2 + 2ab + b^2$$

$$\text{II. } (a-b)^2 = a^2 - 2ab + b^2$$

$$\text{III. } (a+b)(a-b) = a^2 - b^2$$

$$\text{IV. } (x+a)(x+b) = x^2 + (a+b)x + ab$$

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

$$\text{VI. } (a+b)^3 = a^3 + b^3 + 3ab(a+b)$$

$$\text{VII. } (a-b)^3 = a^3 - b^3 - 3ab(a-b)$$

$$\text{VIII. } a^3 + b^3 + c^3 - 3abc = (a+b+c) \times (a^2 + b^2 + c^2 - ab - bc - ca)$$

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Ex - 9.1

1. Identify the terms, their coefficients for each of the following expressions.

Expression	Terms	Coefficient
(i) $5xyz^2 - 3zy$	Term: $5xyz^2$ Term: $-3zy$	5 -3
(ii) $1 + x + x^2$	Term: 1 Term: x Term: x^2	1 1 1
(iii) $4x^2y^2 - 4x^2y^2z^2 + z^2$	Term: $4x^2y^2$ Term: $-4x^2y^2z^2$ Term: z^2	4 -4 1
(iv) $3 - pq + qr - p$	Term: 3 Term: $-pq$ Term: qr Term: $-p$	3 -1 1 -1
(v) $\frac{2x}{2} + \frac{y}{2} - xy$	Term: $\frac{2x}{2}$ Term: $\frac{y}{2}$ Term: $-xy$	$\frac{1}{2}$ $\frac{1}{2}$ -1
(vi) $0.3a - 0.6ab + 0.5b$	Term: $0.3a$ Term: $-0.6ab$ Term: $0.5b$	0.3 -0.6 0.5

Q2. Classify the following Polynomials as monomials, binomials, trinomials! Which polynomials do not fit in any of these three categories:

Ans	Monomials (1 term)	Binomials (2 terms)	Trinomials (3 terms)	Polynomials that not fit in these categories:-
	1000	$x + y$	$7 + y + 5x$	$x + x^2 + x^3 + x^4$
	pqx	$2y - 3y^2$	$2y - 3y^2 + 4y^3$	$ab + bc + cd + da$
		$4z - 15z^2$	$5x - 4y + 3zy$	
		$p^2q + pq^2$		
		$2p + 2q$		

Q3. Add the following

(i) $ab - bc, bc - ca, ca - ab$

Ans $(ab - bc) + (bc - ca) + (ca - ab)$

$$\cancel{ab} - \cancel{bc} + \cancel{bc} - \cancel{ca} + \cancel{ca} - \cancel{ab}$$

$\Rightarrow 0$

(ii) $a - b + ab, b - c + bc, c - a + ac$

As $(a - b + ab) + (b - c + bc) + (c - a + ac)$

$$\cancel{a} - \cancel{b} + ab + \cancel{b} - \cancel{c} + bc + \cancel{c} - \cancel{a} + ac$$

$$ab + bc + ac$$

$$(iii) \quad 2p^2q^2 - 3pq + 4, 5 + 7pq - 3p^2q^2$$

$$\Rightarrow -p^2q^2 + 4pq + 9$$

$$(iv) \quad l^2 + m^2, m^2 + n^2, n^2 + l^2, + 2lm + 2mn + 2nl$$

$$\Rightarrow 2l^2 + 2m^2 + 2n^2 + 2lm + 2mn + 2nl, \\ 2(l^2 + m^2 + n^2 + lm + mn + nl),$$

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Q4. Subtract $4a - 7ab + 3b + 12$ from $12a - 9ab + 5b - 3$

Sol. $(12a - 9ab + 5b - 3) - (4a - 7ab + 3b + 12)$

$$12a - 9ab + 5b - 3 - 4a + 7ab - 3b - 12$$

$$8a - 2ab + 2b - 15 \text{ Ans}$$

(b) Subtract $3xy + 5yz - 7zx$ from $5xy - 2yz - 2zx + 10xyz$

Sol. $(5xy - 2yz - 2zx + 10xyz) - (3xy + 5yz - 7zx)$

$$5xy - 2yz - 2zx + 10xyz - 3xy - 5yz + 7zx$$

$$2xy - 7yz + 5zx + 10xyz \text{ Ans}$$

(c) Subtract $4P^2Q - 3PQ + 5PQ^2 - 8P + 7Q - 10$ from $18 - 3P - 11Q + 5PQ - 2PQ^2 + 5P^2Q$

Sol. $(18 - 3P - 11Q + 5PQ - 2PQ^2 + 5P^2Q) - (4P^2Q - 3PQ + 5PQ^2 - 8P + 7Q - 10)$

$$\Rightarrow 18 - 3P - 11Q + 5PQ - 2PQ^2 + 5P^2Q - 4P^2Q + 3PQ - 5PQ^2 + 8P - 7Q + 10$$

$$\Rightarrow 28 + 5P - 18Q + 8PQ - 7PQ^2 + 1P^2Q \text{ Ans}$$

Q1) Find the product of the following pairs of monomials:-

- (i) $4, 7p \Rightarrow 28p$
 (ii) $-4p, 7p \Rightarrow -28p^2$
 (iii) $-4p, 7pq \Rightarrow -28p^2q$
 (iv) $4p^3, -3p \Rightarrow -12p^4$
 (v) $4p, 0 \Rightarrow 0$

Q2) Find the areas _____ respectively:-

Q3) Area of rectangle = $l \times b$
 So, it is multiplication of 2 monomials.

Q4) The results can be written in Square Units

- (i) $p \times q = pq$
 (ii) $10m \times 5n = 50mn$
 (iii) $20x^2 \times 5y^2 = 100x^2y^2$
 (iv) $4x \times 3x^2 = 12x^3$
 (v) $3mn \times 4np = 12mn^2p$

3. Complete the following table of products:

First monomial → Second monomial ↓	$2x$	$-5y$	$3x^2$	$-4xy$	$7x^2y$	$-9x^2y^2$
$2x$	$4x^2$
$-5y$	$-15x^2y$
$3x^2$
$-4xy$
$7x^2y$
$-9x^2y^2$

Solution:

First monomial	$2x$	$-5y$	$3x^2$	$-4xy$	$7x^2y$	$-9x^2y^2$
Second monomial						
$2x$	$4x^2$	$-10xy$	$6x^3$	$-8x^2y$	$14x^3y$	$-18x^3y^2$
$-5y$	$-10xy$	$25y^2$	$-15x^2y$	$20xy^2$	$-35x^2y^2$	$45x^2y^3$
$3x^2$	$6x^3$	$-15x^2y$	$9x^4$	$-12x^3y$	$21x^4y$	$-27x^4y^2$
$-4xy$	$-8x^2y$	$20xy^2$	$-12x^3y$	$16x^2y^2$	$-28x^3y^2$	$36x^3y^3$
$7x^2y$	$14x^3y$	$-35x^2y^2$	$21x^4y$	$-28x^3y^2$	$49x^4y^2$	$-63x^4y^3$
$-9x^2y^2$	$-18x^3y^2$	$45x^2y^3$	$-27x^4y^2$	$36x^3y^3$	$-63x^4y^3$	$81x^4y^4$

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Q4. Obtain the volume of rectangular boxes with the following length, breadth and height respectively:-

(a) Volume of rectangle = $l \times b \times h$

(i) $5a, 3a^2, 7a^4 \Rightarrow 105a^7$

(ii) $2p, 4q, 8r \Rightarrow 64pqr$

(iii) $2y, 2x^2y, 2xy^2 \Rightarrow 4x^2y^4$

(iv) $a, 2b, 3c \Rightarrow 6abc$

(*)

Q5. Obtain the product of :-

(i) $xy, yz, zx \Rightarrow x^2y^2z^2$

(ii) $a, -a^2, a^3 \Rightarrow -a^6$

(iii) $2, 4y, 8y^2, 16y^3 \Rightarrow 1024y^6$

(iv) $a, 2b, 3c, 6abc \Rightarrow 36a^2b^2c^2$

(v) $m, -mn, mnp \Rightarrow -m^3n^2p$

Ex - 9.3

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Q1 Carry out the multiplication of the expressions in each of the following pairs:-

(i) $4p, q + r \Rightarrow 4pq + 4pr$

(ii) $ab, a - b \Rightarrow a^2b - ab^2$

(iii) $a + b, 7a^2b^2 \Rightarrow 7a^3b^2 + 7a^2b^3$

(iv) $a^2 - 9, 4a \Rightarrow 4a^3 - 36a$

(v) $pq + qr + rp, 0 \Rightarrow 0$

Q2

Q3 Find the product

(i) $(a^2) \times (2a^{22}) \times (4a^{26}) \Rightarrow 8a^{50}$

(ii) $\left(\frac{2}{3}xy\right) \times \left(\frac{-9}{10}x^2y^2\right) \Rightarrow \frac{-18}{30} = \frac{-6}{10}x^3y^3$

(iii) $\left(-\frac{10}{3}pq^3\right) \times \left(\frac{6}{5}p^3q\right) \Rightarrow \frac{-60}{15} = -4p^4q^4$

(iv) $x \times x^2 \times x^3 \times x^4 \Rightarrow x^{10}$

2 Complete the table:

	First expression	Second expression	Product
(i)	a	$b + c + d$	$ab + ac + ad$
(ii)	$x + y - 5$	$5xy$	$5x^2y + 5xy^2 - 25xy$
(iii)	p	$6p^2 - 7p + 5$	$6p^3 - 7p^2 + 5p$
(iv)	$4p^2q^2$	$p^2 - q^2$	$4p^4q^2 - 4p^2q^4$
(v)	$a + b + c$	abc	$a^2bc + ab^2c + abc^2$

Q4. (a) Simplify $-3x(4x-5)+3$ and find its value for (i) $x=3$ (ii) $x=\frac{1}{2}$

$$\begin{aligned} \text{(i)} \quad & -3x(4x-5)+3 \\ & 12x^2 - 15x + 3 \quad \Rightarrow (x=3) \\ \Rightarrow & 12(3)^2 - 15(3) + 3 \\ \Rightarrow & 12 \times 9 - 45 + 3 \\ \Rightarrow & 108 - 45 + 3 \\ \Rightarrow & 111 - 45 = 66 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & x = \frac{1}{2} \\ & 12\left(\frac{1}{2}\right)^2 - 15\left(\frac{1}{2}\right) + 3 \\ & 12 \times \frac{1}{4} - \frac{15}{2} + 3 \\ & \frac{3}{1} - \frac{15}{2} + \frac{3}{1} \\ & \frac{6 - 15 + 6}{2} \Rightarrow \frac{-15 + 12}{2} \Rightarrow -\frac{3}{2} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & a(a^2 + a + 1) + 5 \quad \Rightarrow (a=0) \\ & a^3 + a^2 + a + 5 \\ & (0)^3 + (0)^2 + 0 + 5 \\ & 0 + 0 + 0 + 5 = 5 \end{aligned}$$

ii) $(a=1)$

$$\begin{aligned} & (1)^3 + (1)^2 + 1 + 5 \\ & 1 + 1 + 1 + 5 = 9 \end{aligned}$$

iii) $(a=-1)$

$$\begin{aligned} & (-1)^3 + (-1)^2 + (-1) + 5 \\ & -1 + 1 - 1 + 5 = 4 \end{aligned}$$

Q5. Add :- $P(P-Q)$, $Q(Q-R)$ and $R(R-P)$

$$(P^2 - PQ) + (Q^2 - QR) + (R^2 - RP)$$

$$P^2 + Q^2 + R^2 - PQ - QR - PR$$

(b) Add :- $2x(z-x-y)$ and $2y(z-y-x)$

$$(2xz - 2x^2 - 2xy) + (2yz - 2y^2 + 2xy)$$

$$-2x^2 - 2y^2 + 2xz - 4xy + 2yz$$

(c) Subtract :- $3l(l-4m+5n)$ from $4l(10n-3m+2l)$

$$(40ln - 12lm + 8l^2) - (3l^2 - 12lm + 15ln)$$

$$40ln - 12lm + 8l^2 - 3l^2 + 12lm - 15ln$$

$$25ln + 5l^2$$

(d) Subtract :- $3a(a+b+c) - 2b(a-b+c)$
from $4c(-a+b+c)$.

$$(-4ac + 4bc + 4c^2) + (3a^2 + 3ab + 3ac - 2ab + 2b^2 - 2bc)$$

$$-4ac + 4bc + 4c^2 - 3a^2 - 3ab - 3ac + 2ab - 2b^2 + 2bc$$

$$-7ac + 6bc - ab - 3a^2 - 2b^2 + 4c^2$$

Q1. Multiply the binomials.

(i) $(2x + 5)$ and $(4x - 3)$.

$$\Rightarrow 2x(4x - 3) + 5(4x - 3)$$

$$8x^2 - 6x + 20x - 15$$

$$8x^2 + 14x - 15 \text{ Ans}$$

(iii) $(2.5l - 0.5m)$ and $(2.5l + 0.5m)$

$$2.5l(2.5l + 0.5m) - 0.5m(2.5l + 0.5m)$$

$$6.25l^2 + 1.25lm - 1.25lm - 0.25m^2$$

$$6.25l^2 - 0.25m^2$$

Class –VIII Mathematics (Ex. 9.4)

NCERT SOLUTION

1. Multiply the binomials:

(i) $(2x + 5)$ and $(4x - 3)$

(ii) $(y - 8)$ and $(3y - 4)$

(iii) $(2.5l - 0.5m)$ and $(2.5l + 0.5m)$

(iv) $(a + 3b)$ and $(x + 5)$

(v) $(2pq + 3q^2)$ and $(3pq - 2q^2)$

(vi) $\left(\frac{3}{4}a^2 + 3b^2\right)$ and $4\left(a^2 - \frac{2}{3}b^2\right)$

$$(i) (2x+5) \times (4x-3)$$

$$= 2x(4x-3) + 5(4x-3)$$

$$= 2x \times 4x - 2x \times 3 + 5 \times 4x - 5 \times 3$$

$$= 8x^2 - 6x + 20x - 15$$

$$= 8x^2 + 14x - 15$$

$$(ii) (y-8) \times (3y-4) = y(3y-4) - 8(3y-4)$$

$$= y \times 3y - y \times 4 - 8 \times 3y - 8 \times -4$$

$$= 3y^2 - 4y - 24y + 12$$

$$= 3y^2 - 28y + 12$$

$$(iii) (2.5l - 0.5m) \times (2.5l + 0.5m)$$

$$= 2.5l \times (2.5l + 0.5m) - 0.5m \times (2.5l + 0.5m)$$

$$= 2.5l \times 2.5l + 0.5l \times 0.5m - 0.5m \times 2.5l - 0.5m \times 0.5m$$

$$= 6.25l^2 + 1.25lm - 1.25lm - 0.25m^2$$

$$= 6.25l^2 - 0.25m^2$$

$$(iv) (a + 3b) \times (x + 5) = a(x + 5) + 3b(x + 5)$$

$$= a \times x + a \times 5 + 3b \times x + 3b \times 5$$

$$= ax + 5a + 3bx + 15b$$

$$(v) (2pq + 3q^2)(3pq - 2q^2)$$

$$= 2pq \times (3pq - 2q^2) + 3q^2(3pq - 2q^2)$$

$$= 2pq \times 3pq - 2pq \times 2q^2 + 3q^2 \times 3pq - 3q^2 \times 2q^2$$

$$= 6p^2q^2 - 4pq^3 + 9pq^3 - 6q^4$$

$$= 6p^2q^2 + 5pq^3 - 6q^4$$

$$(vi) \left(\frac{3}{4}a^2 + 3b^2\right) \times 4\left(a^2 - \frac{2}{3}b^2\right)$$

$$= \left(\frac{3}{4}a^2 + 3b^2\right) \times \left(4a^2 - \frac{8}{3}b^2\right)$$

$$= \frac{3}{4}a^2 \times \left(4a^2 - \frac{8}{3}b^2\right) + 3b^2 \times \left(4a^2 - \frac{8}{3}b^2\right)$$

$$= \frac{3}{4}a^2 \times 4a^2 - \frac{3}{4}a^2 \times \frac{8}{3}b^2 + 3b^2 \times 4a^2 - 3b^2 \times \frac{8}{3}b^2$$

$$= 3a^4 - 2a^2b^2 + 12a^2b^2 - 8b^4$$

$$= 3a^4 + 10a^2b^2 - 8b^4$$

2. Find the product:

(i) $(5 - 2x)(3 + x)$

(ii) $(x + 7y)(7x - y)$

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

(iv) $(p^2 - q^2)(2p + q)$

Ans. (i) $(5 - 2x)(3 + x)$

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

$$= 5 \times 3 + 5 \times x - 2x \times 3 - 2x \times x$$

$$= 15 + 5x - 6x - 2x^2 = 15 - x - 2x^2$$

$$(ii) (x+7y)(7x-y)$$

$$= x(7x-y) + 7y \times (7x-y)$$

$$= x \times 7x - x \times y + 7y \times 7x - 7y \times y$$

$$= 7x^2 - xy + 49xy - 7y^2$$

$$= 7x^2 + 48xy - 7y^2$$

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

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

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

$$= a^3 + a^2b^2 + ab + b^3$$

$$(iv) (p^2 - q^2)(2p + q)$$

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

$$= p^2 \times 2p + p^2 \times q - q^2 \times 2p - q^2 \times q$$

$$= 2p^3 + p^2q - 2pq^2 - q^3$$

3. Simplify:

(i) $(x^2 - 5)(x + 5) + 25$

(ii) $(a^2 + 5)(b^2 + 3) + 5$

(iii) $(t + s^2)(t^2 - s)$

(iv) $(a + b)(c - d) + (a - b)(c + d) + 2(ac + bd)$

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

(vi) $(x + y)(x^2 - xy + y^2)$

(vii) $(1.5x - 4y)(1.5x + 4y + 3) - 4.5x + 12y$

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

$$\text{Ans. (i) } (x^2 - 5)(x + 5) + 25$$

$$= x^2(x + 5) - 5(x + 5) + 25$$

$$= x^2 \times x + x^2 \times 5 - 5 \times x - 5 \times 5 + 25$$

$$= x^3 + 5x^2 - 5x - 25 + 25$$

$$= x^3 + 5x^2 - 5x$$

$$\text{(ii) } (a^2 + 5)(b^3 + 3) + 5$$

$$= a^2(b^3 + 3) + 5(b^3 + 3) + 5$$

$$= a^2 \times b^3 + a^2 \times 3 + 5 \times b^3 + 5 \times 3 + 5$$

$$= a^2b^3 + 3a^2 + 5b^3 + 15 + 5$$

$$= a^2b^3 + 3a^2 + 5b^3 + 20$$

$$(iii) (t+s^2)(t^2-s) = t(t^2-s) + s^2(t^2-s)$$

$$= t \times t^2 - t \times s + s^2 \times t^2 - s^2 \times s$$

$$= t^3 - st + s^2t^2 - s^3$$

$$(iv) (a+b)(c-d) + (a-b)(c+d) + 2(ac+bd)$$

$$= a(c-d) + b(c-d) + a(c+d) - b(c+d) + 2ac + 2bd$$

$$= ac - ad + bc - bd + ac + ad - bc - bd + 2ac + 2bd$$

$$= ac + ac - ad + ad + bc - bc - bd - bd + 2ac + 2bd$$

$$= 2ac - 2bd + 2ac + 2bd$$

$$= 4ac$$

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

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

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

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

$$= 3x^2 + 4xy - y^2$$

$$(vi) (x+y)(x^2 - xy + y^2)$$

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

$$= x^3 - x^2y + xy^2 + x^2y - xy^2 + y^3$$

$$= x^3 - x^2y + x^2y + xy^2 - xy^2 + y^3$$

$$= x^3 + y^3$$

$$(vii) (1.5x - 4y)(1.5x + 4y + 3) - 4.5x + 12y$$

$$= 1.5x(1.5x + 4y + 3) - 4y(1.5x + 4y + 3) - 4.5x + 12y$$

=

$$2.25x^2 + 6.0xy + 4.5x - 6.0xy - 16y^2 - 12y - 4.5x + 12y$$

=

$$2.25x^2 + 6.0xy - 6.0xy + 4.5x - 4.5x - 16y^2 - 12y + 12y$$

$$= 2.25x^2 - 16y^2$$

$$\text{(viii)} \quad (a+b+c)(a+b-c)$$

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

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

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

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

Ex-9.5

Q1. Use a suitable identity to get each of the following products.

(i) $(x+3)(x+3)$
 $(a+b)(a+b) = (a+b)^2 = a^2 + 2ab + b^2$

$$(x)^2 + 2 \times x \times 3 + (3)^2$$
$$x^2 + 6x + 9 \text{ Ans}$$

(ii) $(2y+5)(2y+5)$
 $(a+b)^2 = a^2 + 2ab + b^2$
 $(2y)^2 + 2 \times 2y \times 5 + (5)^2$
 $4y^2 + 20y + 25 \text{ Ans}$

(iii) $(2a-7)(2a-7)$
 $(a-b)^2 = a^2 - 2ab + b^2$
 $\Rightarrow (2a)^2 - 2 \times 2a \times 7 + (7)^2$
 $\Rightarrow 4a^2 - 28a + 49 \text{ Ans}$

(iv) $(3a - \frac{1}{2})(3a - \frac{1}{2})$
 $(a-b)^2 = a^2 - 2ab + b^2$
 $\Rightarrow (3a)^2 - 2 \times 3a \times \frac{1}{2} + (\frac{1}{2})^2$
 $\Rightarrow 9a^2 - 3a + \frac{1}{4}$

$$(vi) (1.1m - 0.4)(1.1m + 0.4)$$

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

$$\Rightarrow (1.1m)^2 - (0.4)^2$$

$$\Rightarrow 1.21m^2 - 0.16$$

$$(vii) \begin{aligned} (a^2 + b^2)(-a^2 + b^2) \\ (b^2 + a^2)(b^2 - a^2) &= (b^2)^2 - (a^2)^2 \\ &\Rightarrow b^4 - a^4 \end{aligned}$$

$$(viii) \begin{aligned} (6x - 7)(6x + 7) \\ (a - b)(a + b) &= a^2 - b^2 \\ &\Rightarrow (6x)^2 - (7)^2 \\ &36x^2 - 49 \end{aligned}$$

$$(ix) \begin{aligned} (-a + c)(-a + c) &= (-a + c)^2 \\ (a + b)^2 &= a^2 + 2ab + b^2 \\ &\Rightarrow (-a)^2 + 2 \times -a \times c + (c)^2 \\ &a^2 - 2ac + c^2 \end{aligned}$$

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

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

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

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

(x) $(7a - 9b)(7a - 9b) = a^2 - 2ab + b^2$
 $(a - b)(a - b) + (a - b)$
 $(7a)^2 - 2 \times 7a \times 9b + (9b)^2$
 $49a^2 - 126ab + 81b^2$ Ans.

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

$$\text{Ans. (i) } (x+3)(x+7)$$

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

$$[\text{Using identity } (x+a)(x+b) = x^2 + (a+b)x + ab]$$

$$= x^2 + 10x + 21$$

$$\text{(ii) } (4x+5)(4x+1)$$

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

$$[\text{Using identity } (x+a)(x+b) = x^2 + (a+b)x + ab]$$

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

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

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

$$[\text{Using identity } (x+a)(x+b) = x^2 + (a+b)x + ab]$$

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

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

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

$$[\text{Using identity } (x+a)(x+b) = x^2 + (a+b)x + ab]$$

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

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

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

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

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

$$[\text{Using identity } (x+a)(x+b) = x^2 + (a+b)x + ab]$$

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

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

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

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

$$[\text{Using identity } (x+a)(x+b) = x^2 + (a+b)x + ab]$$

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

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

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

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

$$[\text{Using identity } (x + a)(x + b) = x^2 + (a + b)x + ab]$$

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

3. Find the following squares by using identities:

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

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

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

(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 $(a - b)^2 = a^2 - 2ab + b^2$]
 $= b^2 - 14b + 49$

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

$$\begin{aligned} & \text{[Using identity } (a - b)^2 = a^2 - 2ab + b^2 \text{]} \\ & = b^2 - 14b + 49 \end{aligned}$$

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

$$\begin{aligned} & \text{[Using identity } (a + b)^2 = a^2 + 2ab + b^2 \text{]} \\ & = x^2y^2 + 6xyz + 9z^2 \end{aligned}$$

$$\begin{aligned} \text{(iii) } & (6x^2 - 5y)^2 \\ & = (6x^2)^2 - 2 \times 6x^2 \times 5y + (5y)^2 \end{aligned}$$

$$\begin{aligned} & \text{[Using identity } (a - b)^2 = a^2 - 2ab + b^2 \text{]} \\ & = 36x^4 - 60x^2y + 25y^2 \end{aligned}$$

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

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

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

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

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

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

$$[\text{Using identity } (a + b)^2 = a^2 + 2ab + b^2]$$

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

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

$$\text{Ans. (i) } (a^2 - b^2)^2$$

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

$$[\text{Using identity } (a - b)^2 = a^2 - 2ab + b^2]$$

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

$$\text{(ii) } (2x + 5)^2 - (2x - 5)^2$$

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

$$[\text{Using identities } (a + b)^2 = a^2 + 2ab + b^2 \text{ and}$$

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

$$= 4x^2 + 20x + 25 - [4x^2 - 20x + 25]$$

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

$$= 40x$$

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

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

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

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

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

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

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

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

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

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

$$[\text{Using identity } (a + b)^2 = a^2 + 2ab + b^2]$$

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

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

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

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

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

$$[\text{Using identity } (a - b)^2 = a^2 - 2ab + b^2]$$

=

$$6.25p^2 - 7.50pq + 2.25q^2 - [2.25p^2 - 7.50pq + 6.25q^2]$$

=

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

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

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

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

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

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Ex-9.5

Qs. Show that:-

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

Ans LHS

$$\begin{aligned} (3x+7)^2 - 84x &= a^2 + 2ab + b^2 \\ 9x^2 + 42x + 49 - 84x &= \\ 9x^2 - 42x + 49 &= \\ (3x-7)^2 & \end{aligned}$$

LHS = RHS.

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

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

$$\begin{aligned} (a-b)^2 &= a^2 - 2ab + b^2 \\ 81p^2 - 90pq + 25q^2 + 180pq &= \\ 81p^2 + 90pq + 25q^2 &= \\ (9p+5q)^2 & \end{aligned}$$

LHS = RHS.

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

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

$$\begin{aligned} (a-b)^2 &= a^2 - 2ab + b^2 \\ \Rightarrow \frac{16}{9}m^2 - 2mn + \frac{9}{16}n^2 + 2mn &= \\ \Rightarrow \frac{16}{9}m^2 + \frac{9}{16}n^2 & \end{aligned}$$

LHS = RHS.

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

Ans LHS $(4pq + 3q)^2 - (4pq - 3q)^2$

$(a+b)^2 = a^2 + 2ab + b^2$; $(a-b)^2 = a^2 - 2ab + b^2$
 $\Rightarrow 16p^2q^2 + 24pq^2 + 9q^2 - (16p^2q^2 - 24pq^2 + 9q^2)$

$\Rightarrow 16p^2q^2 + 24pq^2 + 9q^2 - 16p^2q^2 + 24pq^2 - 9q^2$
 $\Rightarrow 48pq^2$
 LHS = RHS.

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

Ans LHS
 $(a-b)(a+b) + (b-c)(b+c) + (c-a)(c+a)$
 $a^2 - b^2 + b^2 - c^2 + c^2 - a^2 = 0$
 LHS = RHS.

Q6. Using identities, evaluate.

(i) $(71)^2 = (70 + 1)^2$
 $(a+b)^2 = a^2 + 2ab + b^2$
 $\Rightarrow (70)^2 + 2 \times 70 \times 1 + (1)^2$
 $\Rightarrow 4900 + 140 + 1 \Rightarrow 5041$

(ii) $(99)^2 = (100 - 1)^2$
 $(a-b)^2 = a^2 - 2ab + b^2$
 $\Rightarrow (100)^2 - 2 \times 100 \times 1 + (1)^2$
 $10000 - 200 + 1$
 9801.

DATE: / /

$$\text{(iii)} \quad (102)^2 = (100+2)^2$$
$$\Rightarrow (100)^2 + 2 \times 100 \times 2 + (2)^2$$
$$10000 + 400 + 4 \Rightarrow 10404.$$

$$\text{(iv)} \quad (998)^2 = (1000-2)^2$$
$$\Rightarrow (1000)^2 - 2 \times 1000 \times 2 + (2)^2$$
$$\Rightarrow 1000000 - 4000 + 4 \Rightarrow 996004.$$

$$\text{(v)} \quad (5.2)^2 = (5+0.2)^2$$
$$\Rightarrow (5)^2 + 2 \times 5 \times 0.2 + (0.2)^2$$
$$\Rightarrow 25 + 2 + 0.4 \Rightarrow 27.4$$

$$\text{(vi)} \quad 297 \times 303 \Rightarrow (300-3)(300+3)$$
$$(a-b)(a+b) = a^2 - b^2$$
$$\Rightarrow (300)^2 - (3)^2 \Rightarrow 90000 - 9$$
$$\Rightarrow 89991$$

$$\text{(vii)} \quad 78 \times 82 \Rightarrow (80-2)(80+2)$$
$$\Rightarrow (80)^2 - (2)^2 \Rightarrow 6400 - 4 = 6396.$$

$$\text{(viii)} \quad (8.9)^2 = (9-0.1)^2$$
$$\Rightarrow (9)^2 - 2 \times 9 \times 0.1 + (0.1)^2$$
$$\Rightarrow 81 - 1.8 + 0.01 \Rightarrow 79.21$$

$$\text{(ix)} \quad 10.5 \times 9.5 \Rightarrow (10+0.5)(10-0.5)$$
$$\Rightarrow (10)^2 - (0.5)^2$$
$$\Rightarrow 100 - 0.25$$
$$\Rightarrow 99.75.$$

Q7. Using $(a^2 - b^2) = (a+b)(a-b)$ find:-

(i) $51^2 - 49^2$
 $(a^2 - b^2) = (a+b)(a-b)$
 $\Rightarrow (51+49)(51-49)$
 $\Rightarrow 100 \times 2 \Rightarrow 200.$

(ii) $(1.02)^2 - (0.98)^2$
 $(a^2 - b^2) = (a+b)(a-b)$
 $\Rightarrow (1.02 + 0.98)(1.02 - 0.98)$
 $\Rightarrow 2 \times 0.04 \Rightarrow 0.08.$

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

(iv) $12.1^2 - 7.9^2$
 $(a^2 - b^2) = (a+b)(a-b)$
 $\Rightarrow (12.1 + 7.9)(12.1 - 7.9)$
 $\Rightarrow 20 \times 4.2 = 84.$

Q8. Using $(a+b)^2 = a^2 + (a+b)2 + ab$ find

(i) $103 \times 104 = (a+b)(a+b) = a^2 + (a+b)2 + ab$
 $\Rightarrow (100+3)(100+4) = (100)^2 + (3+4)100 + 3 \times 4$
 $\Rightarrow 10000 + 700 + 12$
 $\Rightarrow 10712.$

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

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

$$25 + 1.5 + 0.02 \Rightarrow 26.52$$

$$(iii) 103 \times 98 \Rightarrow (100 + 3)(100 - 2)$$

$$\Rightarrow (100)^2 + (3 - 2)100 + 3 \times (-2)$$

$$10000 + 100 - 6$$

$$\Rightarrow 10094$$

$$(iv) 9.7 \times 9.8 = (9 + 0.7)(9 + 0.8)$$

$$\Rightarrow (9)^2 + (0.7 + 0.8)9 + 0.7 \times 0.8$$

$$81 + 13.5 + 0.56 \Rightarrow 95.06 \text{ Ans.}$$