**CLASS-8** **SUB-MATHS**

**CHAPTER - 9**

## Algebraic Expressions and Identities (Ex. 9.1)

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

**(I)** $5xyz^2 - 3zy$

**(ii)** $1 + x + x^2$

**(iii)** $4x^2y^2 - 4x^2y^2z^2 + z^2$

**(iv)** $3 - pq + qr - rp$

**(v)** $\frac{x}{2} + \frac{y}{2} - xy$

**(vi)** $0.3a - 0.6ab + 0.5b$

**Ans. (i)** Terms: $5xyz^2$ and $-3zy$

Coefficient in $5xyz^2$ is 5 and in $-3zy$ is $-3$.

**(ii)** Terms: $1, x$ and $x^2$. Coefficient of $x$ and of $x^2$ is1.

**(iii)** Terms: $4x^2y^2, -4x^2y^2z^2$ and $z^2$.

Coefficient in $4x^2y^2$ is 4, coefficient of $-4x^2y^2z^2$ is $-4$ and coefficient of $z^2$ is 1.

**(iv)** Terms: $3, -pq, qr$ and $-rp$

Coefficient of $-pq$ is $-1$, coefficient of $qr$ is 1 and coefficient of $-rp$ is $-1$.

**(v)** Terms: $\frac{x}{2}, \frac{y}{2}$ and $-xy$

Coefficient of $\frac{x}{2}$ is $\frac{1}{2}$, coefficient of $\frac{y}{2}$ is $\frac{1}{2}$ and coefficient of $-xy$ is $-1$.

**(vi)** Terms: $0.3a, -0.6ab$ and $0.5b$

Coefficient of $0.3a$ is 0.3, coefficient of $-0.6ab$ is $-0.6$ and coefficient of $0.5b$ is 0.5.

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

$x+y, 1000, x+x^2+x^3+x^4, 7+y+5x, 2y-3y^2, 2y-3y^2+4y^3, 5x-4y+3xy,$
$4z-15z^2, ab+bc+cd+da, pqr, p^2q+pq^2, 2p+2q$

**Ans. (i)** Since $x+y$ contains two terms. Therefore it is binomial.

**(ii)** Since 1000 contains one terms. Therefore it is monomial.

**(iii)** Since $x+x^2+x^3+x^4$ contains four terms. Therefore it is a polynomial and it does not fit in above three categories.

**(iv)** Since $7+y+5x$ contains three terms. Therefore it is trinomial.

**(v)** Since $2y-3y^2$ contains two terms. Therefore it is binomial.

**(vi)** Since $2y-3y^2+4y^3$ contains three terms. Therefore it is trinomial.

**(vii)** Since $5x-4y+3xy$ contains three terms. Therefore it is trinomial.

**(viii)** Since $4z-15z^2$ contains two terms. Therefore it is binomial.

**(ix)** Since $ab+bc+cd+da$ contains four terms. Therefore it is a polynomial and it does not fit in above three categories.

**(x)** Since $pqr$ contains one terms. Therefore it is monomial.

**(xi)** Since $p^2q+pq^2$ contains two terms. Therefore it is binomial.

**(xii)** Since $2p+2q$ contains two terms. Therefore it is binomial.

**3. Add the following:**

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

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

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

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

**Ans. (i)** $ab-bc, bc-ca, ca-ab$

$$\begin{array}{l} ab-bc \\ \quad +bc-ca \\ -ab \quad +ca \\ \boxed{0+0+0} \end{array}$$

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

$$\begin{array}{l} a-b-ab \\ \quad +b \quad -c+bc \\ -a \quad +c \quad +ac \\ \boxed{0+0+ab+0+bc+ac} \end{array}$$

Hence the sum if 0.

Hence the sum is $ab+bc+ac$.

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

$$\begin{array}{l} 2p^2q^2-3pq+4 \\ -3p^2q^2+7pq+5 \\ \boxed{-p^2q^2+4pq+9} \end{array}$$

**(iv)**

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

$$\begin{array}{l} l^2+m^2 \\ +\quad m^2+n^2 \\ +l^2\quad +n^2 \\ +\qquad\qquad 2lm+2mn+2nl \\ \hline 2l^2+2m^2+2n^2+2lm+2mn+2nl \end{array}$$

Hence the sum is

$$2\left(l^2+m^2+n^2+lm+mn+nl\right).$$

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**4. (a) Subtract** $4a-7ab+3b+12$ **from** $12a-9ab+5b-3.$

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

**(c) Subtract** $4p^2q-3pq+5pq^2-8p+7q-10$ **from**

$18-3p-11q+5pq-2pq^2+5p^2q.$

**Ans. (a)**

$$\begin{array}{l} 12a-9ab+5b-3 \\ 4a-7ab+3b+12 \\ (-)\quad (+)\quad (-)(-) \\ \hline 8a-2ab+2b-15 \end{array}$$

**(b)**

$$\begin{array}{l} 5xy-2yz-2zx+10xyz \\ 3xy+5yz-7zx \\ (-)\quad (-)\quad (+) \\ \hline 2xy-7yz+5zx+10xyz \end{array}$$

**(c)**

$$\begin{array}{l} 5p^2q-2pq^2+5pq-11q-3p+18 \\ 4p^2q+5pq^2-3pq+7q\ -8p-10 \\ (-)\quad (-)\quad (+)\quad (-)\quad (+)\quad (+) \\ \hline p^2q-7pq^2+8pq-18q+5p+28 \end{array}$$

# Ex. 9.2

**1. Find the product of the following pairs of monomials:**

(i) $4, 7p$

(ii) $-4p, 7p$

(iii) $-4p, 7pq$

(iv) $4p^3, -3p$

(iv) $4p, 0$

Ans.

**(i)** $4 \times 7p = 4 \times 7 \times p = 28p$

**(ii)** $-4p \times 7p = (-4 \times 7) \times (p \times p)$

$= -28p^2$

**(iii)** $-4p \times 7pq = (-4 \times 7)(p \times pq)$

$= -28p^2q$

**(iv)** $4p^3 \times -3p = (4 \times -3)(p^3 \times p)$

$= -12p^4$

**(v)** $4p \times 0 = (4 \times 0)(p) = 0$

**2. Find the areas of rectangles with the following pairs of monomials as their lengths and breadths respectively:**

$(p, q)$; $(10m, 5n)$; $(20x^2, 5y^2)$; $(4x, 3x^2)$; $(3mn, 4np)$

Ans.

**(i)** Area of rectangle

$= length \times breadth$

$= p \times q = pq$ sq. units

**(ii)** Area of rectangle

$= length \times breadth$

$= 10m \times 5n = (10 \times 5)(m \times n)$

$= 50mn$ sq. units

**(iii)** Area of rectangle $= length \times breadth$

$= 20x^2 \times 5y^2 = (20 \times 5)(x^2 \times y^2)$

$= 100x^2y^2$ sq. units

**(iv)** Area of rectangle $= length \times breadth$

$= 4x \times 3x^2 = (4 \times 3)(x \times x^2)$

$= 12x^3$ sq. units

**(v)** Area of rectangle $= length \times breadth$

$= 3mn \times 4np = (3 \times 4)(mn \times np)$

$= 12mn^2p$ sq. units

**3. Complete the table of products:**

(i)

| **First monomial** $\longrightarrow$ **Second monomial** $\downarrow$ | $2x$ | $-5y$ | $3x^2$ | $-4xy$ | $7x^2y$ | $-9x^2y^2$ |
|---|---|---|---|---|---|---|
| $2x$ | $4x^2$ | ..... | ..... | ..... | ..... | ..... |
| $-5y$ | ..... | ..... | $-15x^2y$ | ..... | ..... | ..... |
| $3x^2$ | ..... | ..... | ..... | ..... | ..... | ..... |
| $-4xy$ | ..... | ..... | ..... | ..... | ..... | ..... |
| $7x^2y$ | ..... | ..... | ..... | ..... | ..... | ..... |
| $-9x^2y^2$ | ..... | ..... | ..... | ..... | ..... | ..... |

Ans. (i)

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

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

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

(ii) $2p, 4q, 8r$

(iii) $xy, 2x^2y, 2xy^2$

(iv) $a, 2b, 3c$

**Ans. (i)** Volume of rectangular box

$= length \times breadth \times height$

$= 5a \times 3a^2 \times 7a^4 = (5 \times 3 \times 7)(a \times a^2 \times a^4)$

$= 105a^7$ cubic units

**(ii)** Volume of rectangular box

$= length \times breadth \times height$

$= 2p \times 4q \times 8r = (2 \times 4 \times 8)(p \times q \times r)$

$= 64pqr$ cubic units

**(iii)** Volume of rectangular box

$= length \times breadth \times height$

$= xy \times 2x^2y \times 2xy^2$

$= (1 \times 2 \times 2)(x \times x^2 \times x \times y \times y \times y^2)$

$= 4x^4y^4$ cubic units

**(iv)** Volume of rectangular box

$= length \times breadth \times height$

$= a \times 2b \times 3c = (1 \times 2 \times 3)(a \times b \times c)$

$= 6abc$ cubic units

**5. Obtain the product of:**

(i) $xy, yz, zx$

(ii) $a, -a^2, a^3$

(iii) $2, 4y, 8y^2, 16y^3$

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

**(v)** $m, -mn, mnp$

Ans.

(i) $xy \times yz \times zx = x \times x \times y \times y \times z \times z$

$= x^2y^2z^2$

**(ii)** $a \times (-a^2) \times a^3 = (-1)(a \times a^2 \times a^3)$

$= -a^6$

**(iii)** $2 \times 4y \times 8y^2 \times 16y^3$

$= (2 \times 4 \times 8 \times 16)(y \times y^2 \times y^3)$

$= 1024y^6$

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

$= (1 \times 2 \times 3 \times 6)(a \times b \times c \times abc)$

$= 36a^2b^2c^2$

**(v)** $m \times -mn \times mnp$ =(-1) (m x m x m x n x n x p)

= $-m^3n^2p$

# Ex. 9.3

**1. Carry out the multiplication of the expressions in each of the following pairs:**

(i) $4p, q+r$ (ii) $ab, a-b$ (iii) $a+b, 7a^2b^2$ (iv)

$a^2-9, 4a$

(v) $pq+qr+rp, 0$ Ans.

(i) $4p\times(q+r)=4p\times q+4p\times r$

$=4pq+4pr$

(ii) $ab\times(a-b)=ab\times a-ab\times b$

$=a^2b-ab^2$

**(iii)** $(a+b)\times 7a^2b^2=a\times 7a^2b^2+b\times 7a^2b^2=7a^3b^2+7a^2b^3$

**(iv)** $(a^2-9)\times 4a=a^2\times 4a-4a\times 9=4a^3-36a$

**(v)** $(pq+qr+rp)\times 0=pq\times 0+qr\times 0+rp\times 0$

$=0+0+0=0$

**2. Complete the table:**

| | First expression | Second expression | Product |
|---|---|---|---|
| | | | |

| | | | |
|---|---|---|---|
| **(i)** | $a$ | $b+c+d$ | ..... |
| **(ii)** | $x+y-5$ | $5xy$ | ..... |
| **(iii)** | $p$ | $6p^2-7p+5$ | ..... |
| **(iv)** | $4p^2q^2$ | $p^2-q^2$ | ..... |
| **(v)** | $a+b+c$ | $abc$ | ..... |

**ANS:**

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

**3. Find the product:**

(i) $\left(a^2\right)\times\left(2a^{22}\right)\times\left(4a^{26}\right)$

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

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

(iv) $x\times x^2\times x^3\times x^4$ Ans.

(i) $\left(a^2\right)\times\left(2a^{22}\right)\times\left(4a^{26}\right)$

$=(2\times4)\left(a^2\times a^{22}\times a^{26}\right)$

$=8\times a^{2+22+26}=8a^{50}$

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

$=\left(\frac{2}{3}\times\frac{-9}{10}\right)\left(x\times x^2\times y\times y^2\right)$

$=\frac{-3}{5}x^3y^3$

(iii) $\left(\frac{-10}{3}pq^3\right)\left(\frac{6}{5}p^3q\right)$

$=\left(\frac{-10}{3}\times\frac{6}{5}\right)\left(p\times p^3\times q^3\times q\right)$

$=-4p^4q^4$

**(iv)** $x \times x^2 \times x^3 \times x^4 = x^{1+2+3+4} = x^{10}$

**4. (a)Simplify:** $3x(4x-5)+3$ **and find values for**

**(i)** $x = 3$

(ii) $x = \frac{1}{2}$.

(b)Simplify: $a(a^2+a+1)+5$ and find its value for

(i) $a = 0$

(ii) $a = 1$

(iii) $a = -1$.

Ans. (a) $3x(4x-5)+3$

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

$= 12x^2 - 15x + 3$

**(i)** For $x = 3$, $12x^2 + 15x + 3$

$= 12(3)^2 - 15 \times 3 + 3$

$= 12 \times 9 - 45 + 3$ $= 108 - 45 + 3 = 66$

**(ii)** For $x = \frac{1}{2}$, $12x^2 - 15x + 3$

$= 12\left(\frac{1}{2}\right)^2 - 15 \times \frac{1}{2} + 3$

$= \quad 12 \times \frac{1}{4} - \frac{15}{2} + 3$

$= \quad 6 - \frac{15}{2} = \frac{12-15}{2} = \frac{-3}{2}$

(b) $\quad a\left(a^2 + a + 1\right) + 5$

$= a \times a^2 + a \times a + a \times 1 + 5$

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

**(i)** For $a = 0,\ a^3 + a^2 + a + 5$

$= \quad (0)^3 + (0)^2 + (0) + 5$

$= \quad 0 + 0 + 0 + 5 \quad = \quad 5$

**(ii)** For $a = 1,\ a^3 + a^2 + a + 5$

$= (1)^3 + (1)^2 + (1) + 5$

$= 1 + 1 + 1 + 5 = 8$

**(iii)** For $a = -1,\ a^3 + a^2 + a + 5$

$= (-1)^3 + (-1)^2 + (-1) + 5$

$= -1 + 1 - 1 + 5 = -2 + 6 = 4$

**5. (a) Add:** $p\left(p - q\right), q\left(q - r\right)$ **and** $r\left(r - p\right)$.

**(b) Add:** $2x\left(z - x - y\right)$ **and** $2y\left(z - y - zx\right)$.

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

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

Ans. (a) $p(p-q)+q(q-r)+r(r-p)$

$= p^2-pq+q^2-qr+r^2-rp$

$= p^2+q^2+r^2-pq-qr-rp$

(b) $2x(z-x-y)+2y(z-y-x)$

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

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

$= -2x^2-2y^2-4xy+2yz+2zx$

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

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

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

$= 5l^2+25ln$

(d) $4c(-a+b+c)-[3a(a+b+c)-2b(a-b+c)]$

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

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

$= -4ac + 4bc + 4c^2 - \left[3a^2 + 2b^2 + ab + 3ac - 2bc\right]$

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

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

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

# Ex. 9.4

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

Ans.

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

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

$= 3y^2 - 4y - 24y + 32$

$= 3y^2 - 28\,y + 32$

(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 x 2.5l + 2.5l x 0.5m - 0.5m x 2.5l - 0.5m x0.5m*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$= \quad 4ac$

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

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

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

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

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

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

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

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

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

$= \quad x^3 + y^3$

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

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

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

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

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

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

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

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

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

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

## Ex. 9.5

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

$=b^4-a^4$

**(vii)** $(6x-7)(6x+7)=(6x)^2-(7)^2$

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

$=36x^2-49$

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

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

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

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

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

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

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

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

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

[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)** $(6x^2-5y)^2$

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

$= b^2-14b+49$

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

$=(0.4p)^2-2\times0.4p\times0.5q+(0.5q)^2$

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

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

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

$=(2xy)^2+2\times2xy\times5y+(5y)^2$

[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}

= (4 x) (10)

= 40 x

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

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

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

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

[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. $= (4pq + 3q)^2 - (4pq - 3q)^2$

$= (4pq)^2 + 2 \times 4pq \times 3q + (3q)^2 - \left[(4pq)^2 - 2 \times 4pq \times 3q + (3q)^2\right]$ [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) $297\times303$

(VII) $78\times82$

(VIII) $8.9^2$

**(ix)** $10.5\times 9.5$

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

$=(70)^2+2\times70\times1+(1)^2$

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

= 4900 + 140 + 1 = 5041

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

$= (100)^2 - 2\times100\times1 + (1)^2$

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

= 10000 – 200 + 1 = 9801

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

$= (100)^2 + 2\times100\times2 + (2)^2$

[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)** $297\times303$

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

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

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

= 90000 – 9 = 89991

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

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

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

= 6400 – 4 = 6396

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

$= (8)^2 + 2 \times 8 \times 0.9 + (0.9)^2$

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

= 64 + 14.4 + 0.81 = 79.21

**(ix)** 10.5 x 9.5 = $(10 + 0.5) \times (10 - 0.5)$

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

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

$=100\times 2=200$

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

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

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

$=2.00\times 0.04=0.08$

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

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

$=300\times 6=1800$

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

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

$=20.0\times 4.2=84.0=84$

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

**(i) $103\times104$**

**(ii) $5.1\times5.2$**

**(iii) $103\times98$**

**(iv) $9.7\times9.8$**

**Ans. (i)** $103\times104=(100+3)\times(100+4)$

$=(100)^2+(3+4)\times100+3\times4$

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

$=10000+7\times100+12$

$= 10000 + 700 + 12 = 10712$

**(ii)** $5.1\times5.2=(5+0.1)\times(5+0.2)$

$=(5)^2+(0.1+0.2)\times5+0.1\times0.2$

[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