

**EXERCISE 9.1**
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- Q1. 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)  $3 - pq + qr - p$  (v)  $(x/2) + (y/2) - xy$  (vi)  $0.3a - 0.6ab + 0.5b$

**Solution :**

Sl. No.	Expression	Term	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: $3$ -pq qr -p	3 -1 1 -1
v)	$(x/2) + (y/2) - xy$	Term: $x/2$ $y/2$ -xy	$\frac{1}{2}$ $\frac{1}{2}$ -1
vi)	$0.3a - 0.6ab + 0.5b$	Term: $0.3a$ -0.6ab 0.5b	0.3 -0.6 0.5

- 2. Classify the following polynomials as monomials, binomials, trinomials. Which polynomials do not fit in any of these three categories?**  $x + y$ ,  $1000$ ,  $x + x^2 + x^3 + x^4$ ,  $7 + y + 5x$ ,  $2y - 3y^2$ ,  $2y - 3y^2 + 4y^3$ ,  $5x - 4y + 3xy$ ,  $4z - 15z^2$ ,  $ab + bc + cd + da$ ,  $pqr$ ,  $p^2q + pq^2$ ,  $2p + 2q$

**Solution:**

Let us first define the classifications of these 3 polynomials:

Monomials contain only one term.

Binomials contain only two terms.

Trinomials contain only three terms.

$x + y$	two terms	Binomial
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1000	one term	Monomial
$x + x^2 + x^3 + x^4$	four terms	Polynomial, and it does not fit in the listed three categories
$2y - 3y^2$	two terms	Binomial
$2y - 3y^2 + 4y^3$	three terms	Trinomial
$5x - 4y + 3xy$	three terms	Trinomial
$4z - 15z^2$	two terms	Binomial
$ab + bc + cd + da$	four terms	Polynomial, and it does not fit in the listed three categories
$pqr$	one term	Monomial
$p^2q + pq^2$	two terms	Binomial
$2p + 2q$	two terms	Binomial
$7 + y + 5x$	three terms	Trinomial

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

**Solution:**

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

$$= ab - bc + bc - ca + ca - ab$$

$$= ab - ab - bc + bc - ca + ca$$

$$= 0$$

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

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

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

$$= 0 + 0 + 0 + ab + bc + ca$$

$$= ab + bc + ca$$

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

$$= (2p^2q^2 - 3pq + 4) + (5 + 7pq - 3p^2q^2)$$

$$= 2p^2q^2 - 3p^2q^2 - 3pq + 7pq + 4 + 5$$

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

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

$$= l^2 + l^2 + m^2 + m^2 + n^2 + n^2 + 2lm + 2mn + 2nl$$

$$= 2l^2 + 2m^2 + 2n^2 + 2lm + 2mn + 2nl$$

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

**Solution:**

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

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

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

$$= 8a - 2ab + 2b - 15$$

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

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

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

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

c)  $(18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q) - (4p^2q - 3pq + 5pq^2 - 8p + 7q - 10)$

$$= 18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q - 4p^2q + 3pq - 5pq^2 + 8p - 7q + 10$$

$$= 18 + 10 - 3p + 8p - 11q - 7q + 5pq + 3pq - 2pq^2 - 5pq^2 + 5p^2q - 4p^2q - q$$

$$= 28 + 5p - 18q + 8pq - 7pq^2 + p^2q$$

**EXERCISE 9.2****PAGE NO: 143****1. Find the product of the following pairs of monomials.**

- (i)  $4, 7p$
- (ii)  $-4p, 7p$
- (iii)  $-4p, 7pq$
- (iv)  $4p^3, -3p$
- (v)  $4p, 0$

**Solution:**

- (i)  $4, 7p = 4 \times 7 \times p = 28p$
- (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)  $4p \times 0 = 0$

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

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

**Solution:**

Area of rectangle = Length  $\times$  breadth. So, it is multiplication of two monomials.

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 <sup>2</sup>	-4xy	7x <sup>2</sup> y	-9x <sup>2</sup> y <sup>2</sup>
2x	4x <sup>2</sup>					
-5y			-15x <sup>2</sup> y			
3x <sup>2</sup>						
-4xy						
7x <sup>2</sup> y						
-9x <sup>2</sup> y <sup>2</sup>						

**Solution:**

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

**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)  $a, 2b, 3c$

**Solution:**

Volume of rectangle = length × breadth × height. To evaluate volume of rectangular boxes, multiply all the monomials.

- (i)  $5a \times 3a^2 \times 7a^4 = (5 \times 3 \times 7)(a \times a^2 \times a^4) = 105a^7$
- (ii)  $2p \times 4q \times 8r = (2 \times 4 \times 8)(p \times q \times r) = 64pqr$
- (iii)  $y \times 2x^2y \times 2xy^2 = (1 \times 2 \times 2)(x \times x^2 \times x \times y \times y \times y^2) = 4x^4y^4$
- (iv)  $a \times 2b \times 3c = (1 \times 2 \times 3)(a \times b \times c) = 6abc$

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)  $m, -mn, mnp$

**Solution:**

(i)  $xy \times yz \times zx = x^2 y^2 z^2$

(ii)  $a \times -a^2 \times a^3 = -a^6$

(iii)  $2 \times 4y \times 8y^2 \times 16y^3 = 1024 y^6$

(iv)  $a \times 2b \times 3c \times 6abc = 36a^2 b^2 c^2$

(v)  $m \times -mn \times mnp = -m^3 n^2 p$

## EXERCISE 9.3

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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)  $pq + qr + rp, 0$

**Solution:**

- (i)  $4p(q + r) = 4pq + 4pr$
- (ii)  $ab(a - b) = a^2b - ab^2$
- (iii)  $(a + b)(7a^2b^2) = 7a^3b^2 + 7a^2b^3$
- (iv)  $(a^2 - 9)(4a) = 4a^3 - 36a$
- (v)  $(pq + qr + rp) \times 0 = 0$  ( Anything multiplied by zero is zero )

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)	$a + b + c$	$abc$	.....

**Solution:**

	First expression	Second expression	Product
(i)	$a$	$b + c + d$	$a(b+c+d)$ $= a \times b + a \times c + a \times d$ $= ab + ac + ad$
(ii)	$x + y - 5$	$5xy$	$5 xy (x + y - 5)$

			$= 5xyx^x + 5xyx^y - 5xyx^5$ $= 5x^2y + 5xy^2 - 25xy$
(iii)	p	$6p^2 - 7p + 5$	$p(6p^2 - 7p + 5)$ $= p \times 6p^2 - p \times 7p + p \times 5$ $= 6p^3 - 7p^2 + 5p$
(iv)	$4p^2q^2$	$P^2 - q^2$	$4p^2q^2 * (p^2 - q^2)$ $= 4p^4q^2 - 4p^2q^4$
(v)	$a + b + c$	abc	$abc(a + b + c)$ $= abc \times a + abc \times b + abc \times c$ $= a^2bc + ab^2c + abc^2$

**3. Find the product.**

- i)  $a^2 \times (2a^{22}) \times (4a^{26})$   
 ii)  $(2/3 xy) \times (-9/10 x^2y^2)$   
 iii)  $(-10/3 pq^3) \times (6/5 p^3q)$   
 iv)  $(x) \times (x^2) \times (x^3) \times (x^4)$

**Solution:**

$$\begin{aligned} i) & a^2 \times (2a^{22}) \times (4a^{26}) \\ &= (2 \times 4) (a^2 \times a^{22} \times a^{26}) \\ &= 8 \times a^{2+22+26} \\ &= 8a^{50} \end{aligned}$$

$$\begin{aligned} ii) & (2xy/3) \times (-9x^2y^2/10) \\ &= (2/3 \times -9/10) (x \times x^2 \times y \times y^2) \\ &= (-3/5 x^3y^3) \end{aligned}$$

$$\begin{aligned} iii) & (-10pq^3/3) \times (6p^3q/5) \\ &= (-10/3 \times 6/5) (p \times p^3 \times q^3 \times q) \\ &= (-4p^4q^4) \\ iv) & (x) \times (x^2) \times (x^3) \times (x^4) \\ &= x^{1+2+3+4} \end{aligned}$$

$$= x^{10}$$

- 4. (a) Simplify  $3x(4x - 5) + 3$  and find its values for (i)  $x = 3$  (ii)  $x = 1/2$**   
**(b) Simplify  $a(a^2 + a + 1) + 5$  and find its value for (i)  $a = 0$ , (ii)  $a = 1$  (iii)  $a = -1$ .**

**Solution:**

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

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

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

(i) Putting  $x=3$  in the equation we get  $12x^2 - 15x + 3 = 12(3^2) - 15(3) + 3$

$$= 108 - 45 + 3$$

$$= 66$$

(ii) Putting  $x=1/2$  in the equation we get

$$12x^2 - 15x + 3 = 12(1/2)^2 - 15(1/2) + 3$$

$$= 12(1/4) - 15/2 + 3$$

$$= 3 - 15/2 + 3$$

$$= 6 - 15/2$$

$$= (12 - 15)/2$$

$$= -3/2$$

b)  $a(a^2 + a + 1) + 5$

$$= a \times a^2 + a \times a + a \times 1 + 5 = a^3 + a^2 + a + 5$$

(i) putting  $a=0$  in the equation we get  $0^3 + 0^2 + 0 + 5 = 5$

(ii) putting  $a=1$  in the equation we get  $1^3 + 1^2 + 1 + 5 = 1 + 1 + 1 + 5 = 8$

(iii) Putting  $a = -1$  in the equation we get  $(-1)^3 + (-1)^2 + (-1) + 5 = -1 + 1 - 1 + 5 = 4$

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

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

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

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

**Solution:**

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

$$= (p^2 - pq) + (q^2 - qr) + (r^2 - pr)$$

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

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

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

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

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

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

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

$$= 25ln + 5l^2$$

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

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

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

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

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

## EXERCISE 9.4

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### 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)  $(3/4 a^2 + 3b^2)$  and  $4(a^2 - 2/3 b^2)$

### Solution :

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

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

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

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

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

$$= y \times 3y - 4y - 8 \times 3y + 32$$

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

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

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

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

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

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

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

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

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

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

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

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

$$(vi) (3/4 a^2 + 3b^2) \text{ and } 4(a^2 - 2/3 b^2)$$

$$=(3/4 a^2 + 3b^2) \times 4(a^2 - 2/3 b^2)$$

$$=(3/4 a^2 + 3b^2) \times (4a^2 - 8/3 b^2)$$

$$=3/4 a^2 \times (4a^2 - 8/3 b^2) + 3b^2 \times (4a^2 - 8/3 b^2)$$

$$=3/4 a^2 \times 4a^2 - 3/4 a^2 \times 8/3 b^2 + 3b^2 \times 4a^2 - 3b^2 \times 8/3 b^2$$

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

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

## 2. Find the product.

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

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

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

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

### Solution:

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

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

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

$$= 15 - x - 2x^2$$

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

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

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

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

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

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

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

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

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

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

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

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

### 3. Simplify.

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

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

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

#### Solution:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$= 4ac$$

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

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

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

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

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

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

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

$$= 2.25x^2 + 6xy + 4.5x - 6xy - 16y^2 - 12y - 4.5x + 12y = 2.25x^2 - 16y^2$$

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

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

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

## EXERCISE 9.5

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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)  $(3a - 1/2)(3a - 1/2)$
- (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)  $(1/2x + 3/4y)(1/2x + 3/4y)$
- (x)  $(7a - 9b)(7a - 9b)$

**Solution:**

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

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

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

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

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

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

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

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

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

$$(iv) (3a - 1/2)(3a - 1/2) = (3a - 1/2)^2$$

$$= 9a^2 - 3a + (1/4)$$

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

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

$$= 1.21m^2 - 0.16$$

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

$$\text{vi)} (a^2 + b^2)(-a^2 + b^2)$$

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

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

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

$$\text{vii)} (6x - 7)(6x + 7)$$

$$= 36x^2 - 49$$

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

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

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

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

$$\text{ix)} \left(\frac{1}{2}x + \frac{3}{4}y\right)\left(\frac{1}{2}x + \frac{3}{4}y\right) = \left(\frac{1}{2}x + \frac{3}{4}y\right)^2$$

$$= (x^2/4) + (9y^2/16) + (3xy/4)$$

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

$$\text{x)} (7a - 9b)(7a - 9b) = (7a - 9b)^2$$

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

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

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

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

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

$$\text{(iii)} (4x - 5)(4x - 1)$$

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

$$\text{(v)} (2x + 5y)(2x + 3y)$$

$$\text{(vi)} (2a^2 + 9)(2a^2 + 5)$$

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

**Solution:**

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

$$= x^2 + (3+7)x + 21$$

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

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

$$= 16x^2 + 4x + 20x + 5$$

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

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

$$= 16x^2 - 4x - 20x + 5$$

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

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

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

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

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

$$= 4x^2 + (5y + 3y)2x + 15y^2$$

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

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

$$= 4a^4 + (9+5)2a^2 + 45$$

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

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

$$= x^2y^2z^2 + (-4 -2)xyz + 8$$

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

**3. Find the following squares by using the identities.**

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

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

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

(iv)  $[(2m/3) + (3n/2)]^2$

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

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

**Solution:**

Using identities:

$$(a - b)^2 = a^2 + b^2 - 2ab \quad (a + b)^2 = a^2 + b^2 + 2ab$$

(i)  $(b - 7)^2 = b^2 - 14b + 49$

(ii)  $(xy + 3z)^2 = x^2y^2 + 6xyz + 9z^2$

(iii)  $(6x^2 - 5y)^2 = 36x^4 - 60x^2y + 25y^2$

(iv)  $[(2m/3) + (3n/2)]^2 = (4m^2/9) + (9n^2/4) + 2mn$

(v)  $(0.4p - 0.5q)^2 = 0.16p^2 - 0.4pq + 0.25q^2$

(vi)  $(2xy + 5y)^2 = 4x^2y^2 + 20xy^2 + 25y^2$

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

**Solution:**

i)  $(a^2 - b^2)^2 = a^4 + b^4 - 2a^2b^2$

ii)  $(2x + 5)^2 - (2x - 5)^2$   
 $= 4x^2 + 20x + 25 - (4x^2 - 20x + 25) = 4x^2 + 20x + 25 - 4x^2 + 20x - 25 = 40x$

iii)  $(7m - 8n)^2 + (7m + 8n)^2$   
 $= 49m^2 - 112mn + 64n^2 + 49m^2 + 112mn + 64n^2$   
 $= 98m^2 + 128n^2$

iv)  $(4m + 5n)^2 + (5m + 4n)^2$   
 $= 16m^2 + 40mn + 25n^2 + 25m^2 + 40mn + 16n^2$   
 $= 41m^2 + 80mn + 41n^2$

v)  $(2.5p - 1.5q)^2 - (1.5p - 2.5q)^2$   
 $= 6.25p^2 - 7.5pq + 2.25q^2 - 2.25p^2 + 7.5pq - 6.25q^2$   
 $= 4p^2 - 4q^2$

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

vii)  $(m^2 - n^2m)^2 + 2m^3n^2$   
 $= m^4 - 2m^3n^2 + m^2n^4 + 2m^3n^2$   
 $= m^4 + m^2n^4$

### 5. Show that.

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

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

(iii)  $(4/3m - 3/4n)^2 + 2mn = 16/9 m^2 + 9/16 n^2$

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

$$\begin{aligned} &= 9x^2 + 42x + 49 - 84x \\ &= 9x^2 - 42x + 49 \\ &= \text{RHS} \end{aligned}$$

LHS = RHS

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

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

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

$$\text{RHS} = (9p + 5q)^2$$

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

$$\text{LHS} = \text{RHS}$$

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

$$\begin{aligned} &= \frac{16}{9}m^2 + \frac{9}{16}n^2 - 2mn + 2mn \\ &= \frac{16}{9}m^2 + \frac{9}{16}n^2 \\ &= \text{RHS} \end{aligned}$$

LHS = RHS

$$\begin{aligned}
 \text{iv) LHS} &= (4pq + 3q)^2 - (4pq - 3q)^2 \\
 &= 16p^2q^2 + 24pq^2 + 9q^2 - 16p^2q^2 + 24pq^2 - 9q^2 \\
 &= 48pq^2 \\
 &= \text{RHS}
 \end{aligned}$$

LHS = RHS

$$\begin{aligned}
 \text{v) LHS} &= (a - b)(a + b) + (b - c)(b + c) + (c - a)(c + a) \\
 &= a^2 - b^2 + b^2 - c^2 + c^2 - a^2 \\
 &= 0 \\
 &= \text{RHS}
 \end{aligned}$$

#### **6. Using identities, evaluate.**

- (i)  $71^2$
- (ii)  $99^2$
- (iii)  $102^2$
- (iv)  $998^2$
- (v)  $5.2^2$
- (vi)  $297 \times 303$
- (vii)  $78 \times 82$
- (viii)  $8.9^2$
- (ix)  $10.5 \times 9.5$

#### **Solution:**

$$\begin{aligned}
 \text{i) } 71^2 &= (70+1)^2 \\
 &= 70^2 + 140 + 1^2 \\
 &= 4900 + 140 + 1 \\
 &= 5041
 \end{aligned}$$
  

$$\begin{aligned}
 \text{ii) } 99^2 &= (100 - 1)^2 \\
 &= 100^2 - 2 \cdot 100 \cdot 1 + 1^2 \\
 &= 10000 - 200 + 1 \\
 &= 9801
 \end{aligned}$$

$$= 100^2 - 200 + 1^2$$

$$= 10000 - 200 + 1$$

$$= 9801$$

iii)  $102^2$

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

$$= 100^2 + 400 + 2^2$$

$$= 10000 + 400 + 4 = 10404$$

iv)  $998^2$

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

$$= 1000^2 - 4000 + 2^2$$

$$= 1000000 - 4000 + 4$$

$$= 996004$$

v)  $5.2^2$

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

$$= 5^2 + 2 + 0.2^2$$

$$= 25 + 2 + 0.04 = 27.04$$

vi)  $297 \times 303$

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

$$= 300^2 - 3^2$$

$$= 90000 - 9$$

$$= 89991$$

vii)  $78 \times 82$

$$= (80 - 2)(80 + 2)$$

$$= 80^2 - 2^2$$

$$= 6400 - 4$$

$$= 6396$$

viii)  $8.9^2$

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

$$= 9^2 - 1.8 + 0.1^2$$

$$= 81 - 1.8 + 0.01$$

$$= 79.21$$

ix)  $10.5 \times 9.5$

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

$$= 10^2 - 0.5^2$$

$$= 100 - 0.25$$

$$= 99.75$$

**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)  $12.1^2 - 7.9^2$

**Solution:**

i)  $51^2 - 49^2$

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

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

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

iii)  $153^2 - 147^2$

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

iv)  $12.1^2 - 7.9^2$

$$= (12.1 + 7.9)(12.1 - 7.9) = 20 \times 4.2 = 84$$

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

(i)  $103 \times 104$

(ii)  $5.1 \times 5.2$

(iii)  $103 \times 98$

(iv)  $9.7 \times 9.8$ **Solution:**

i)  $103 \times 104$

$$= (100 + 3)(100 + 4)$$

$$= 100^2 + (3 + 4)100 + 12$$

$$= 10000 + 700 + 12$$

$$= 10712$$

ii)  $5.1 \times 5.2$

$$= (5 + 0.1)(5 + 0.2)$$

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

$$= 25 + 1.5 + 0.02$$

$$= 26.52$$

iii)  $103 \times 98$

$$= (100 + 3)(100 - 2)$$

$$= 100^2 + (3-2)100 - 6$$

$$= 10000 + 100 - 6$$

$$= 10094$$

iv)  $9.7 \times 9.8$

$$= (9 + 0.7 )(9 + 0.8)$$

$$= 9^2 + (0.7 + 0.8)9 + 0.56$$

$$= 81 + 13.5 + 0.56$$

$$= 95.06$$