

NCERT SOLUTIONS

CLASS - 8TH



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Class : 8th
Subject : Maths
Chapter : 9

Chapter Name : Algebraic Expressions and Identities

Exercise 9.1

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) $3 - pq + qr - rp$

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

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

Answer. The terms and the respective coefficients of the given expressions are as follows.

-	Terms	Coefficients
(i)	$5xyz^2$ $- 3zy$	5 - 3
(ii)	1 x x^2	1 1 1
(iii)	$4x^2y^2$ $- 4x^2y^2z^2$ z^2	4 - 4 1
(iv)	3 $- pq$ qr $- rp$	3 -1 1 -1

(v)	$\frac{x}{2}$ $\frac{y}{2}$ $- xy$	$\frac{1}{2}$ $\frac{1}{2}$ - 1
(vi)	$0.3a$ $- 0.6ab$ $0.5b$	0.3 - 0.6 0.5

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Q2 Classify the following polynomials as monomials, binomials, trinomials. Which polynomials do not

fit in any of these three categories?

$$x + y, 1000, x + x^2 + x^3 + x^4, 7 + y + 5x, 2y - 3y^2, 2y - 3y^2 + 4y^3, 5x - 4y + 3xy$$

$$4z - 15z^2, ab + bc + cd + da, pqr, p^2q + pq^2, 2p + 2q$$

Answer. The given expressions are classified as

Monomials: 1000, pqr

Binomials: $x + y, 2y - 3y^2, 4z - 15z^2, p^2q + pq^2, 2p + 2q$

Trinomials: $7 + y + 5x, 2y - 3y^2 + 4y^3, 5x - 4y + 3xy$

Polynomials that do not fit in any of these categories are

$$x + x^2 + x^3 + x^4, ab + bc + cd + da$$

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Q3 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) $l^2 + m^2, m^2 + n^2, n^2 + l^2$

(iv) $2lm + 2mn + 2nl$

Answer. The given expressions written in separate rows, With like terms one below the other and then the addition of these expressions are as follows.

(i)

$$\begin{array}{r} ab - bc \\ + \quad bc - ca \\ + \quad -ab \quad +ca \\ \hline 0 \end{array}$$

Thus, the sum of the given expressions is 0.

(ii)

$$\begin{array}{r} a - b + ab \\ + \quad b \quad -c + bc \\ + \quad -a \quad \quad c \quad +ac \\ \hline ab \quad +bc + ac \end{array}$$

Thus, the sum of the given expressions is $ab + bc + ac$.

(iii)

$$\begin{array}{r} 2p^2q^2 - 3pq + 4 \\ + \quad -3p^2q^2 + 7pq + 5 \\ \hline -p^2q^2 + 4pq + 9 \end{array}$$

Thus, the sum of the given expressions is $-p^2q^2 + 4pq + 9$.

(iv)

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

Thus, the sum of the given expressions is $2(l^2 + m^2 + n^2 + lm + mn + nl)$.

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Q4 (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 $18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q$

Answer. The given expressions in separate rows, with like terms one below the other and then the subtraction of these expressions is as follows.

(a)

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

(b)

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

(c)

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

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Exercise 9.2

Q1 Find the product of the following pairs of monomials.

(i) $4, 7p$

(ii) $-4p, 7p$

(iii) $-4p, 7pq$

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

(v) $4p, 0$

Answer. The product will be as follows.

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

(ii) $-4p \times 7p = -4 \times p \times 7 \times p = (-4 \times 7) \times (p \times p) = -28p^2$

(iii) $-4p \times 7pq = -4 \times p \times 7 \times p \times q = (-4 \times 7) \times (p \times p \times q) = -28p^2q$

(iv) $4p^3 \times -3p = 4 \times (-3) \times p \times p \times p \times p = -12p^4$

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

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Q2 Find the areas of rectangles with the following pairs of monomials as their lengths and breadths respectively.

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

Answer. We know that,

Area of rectangle = Length x Breadth

$$\text{Area of 1}^{\text{st}} \text{ rectangle} = p \times q = pq$$

$$\text{Area of 2}^{\text{nd}} \text{ rectangle} = 10m \times 5n = 10 \times 5 \times m \times n = 50mn$$

$$\text{Area of 3}^{\text{rd}} \text{ rectangle} = 20x^2 \times 5y^2 = 20 \times 5 \times x^2 \times y^2 = 100x^2y^2$$

$$\text{Area of 4}^{\text{th}} \text{ rectangle} = 4x \times 3x^2 = 4 \times 3 \times x \times x^2 = 12x^3$$

$$\text{Area of 5}^{\text{th}} \text{ rectangle} = 3mn \times 4np = 3 \times 4 \times m \times n \times n \times p = 12mn^2p$$

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Q3 Complete the table of products.

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

Answer. The tabel can be completed as follows.

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

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Q4 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) $a, 2b, 3c$

Answer. We know that,

Volume = Length x Breadth X Height

$$(i) \text{ Volume} = 5a \times 3a^2 \times 7a^4 = 5 \times 3 \times 7 \times a \times a^2 \times a^4 = 105a^7$$

$$(ii) \text{ Volume} = 2p \times 4q \times 8r = 2 \times 4 \times 8 \times p \times q \times r = 64pqr$$

$$(iii) \text{ Volume} = xy \times 2x^2y \times 2xy^2 = 2 \times 2 \times xy \times x^2y \times xy^2 = 4x^4y^4$$

$$(iv) \text{ Volume} = a \times 2b \times 3c = 2 \times 3 \times a \times b \times c = 6abc$$

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Q5 Obtain the product of

$$(i) xy, yz, zx$$

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

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

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

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

$$\text{Answer. (i) } xy \times yz \times zx = x^2y^2z^2$$

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

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

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

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

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Exercise 9.3

Q1 Carry out the multiplication of the expressions in each of the following pairs.

$$(i) 4p, q + r$$

$$(ii) ab, a - b$$

$$(iii) a + b, 7a^2b^2$$

$$(iv) a^2 - 9, 4a$$

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

$$\text{Answer. (i) } (4p) \times (q + r) = (4p \times q) + (4p \times r) = 4pq + 4pr$$

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

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

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

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

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Q2 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	...

Answer. The table can be completed as follows.

-	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	$a^2bc + ab^2c + abc^2$

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Q3 Find the product.

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

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

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

(ii) $\left(\frac{2}{3}xy\right) \times \left(\frac{-9}{10}x^2y^2\right) = \left(\frac{2}{3}\right) \times \left(\frac{-9}{10}\right) \times x \times y \times x^2 \times y^2 = \frac{-3}{5}x^3y^3$

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

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

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Q4 (a) Simplify $3x(4x - 5) + 3$ and find its 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) $a = -1$

Answer. (a) $3x(4x - 5) + 3 = 12x^2 - 15x + 3$

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

$$= 108 - 45 + 3$$

$$= 66$$

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

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

$$= 3 - \frac{15}{2} + 3 = 6 - \frac{15}{2}$$

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

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

$$(i) \text{ For } a = 0, a^3 + a^2 + a + 5 = 0 + 0 + 0 + 5 = 5$$

$$(ii) \text{ For } a = 1, a^3 + a^2 + a + 5 = (1)^3 + (1)^2 + 1 + 5$$

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

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

$$= -1 + 1 - 1 + 5 = 4$$

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Q5 (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 $4c(-a + b + c)$

Answer. (a) First expression = $p(p - q) = p^2 - pq$

Second expression = $q(q - r) = q^2 - qr$

Third expression = $r(r - p) = r^2 - pr$

Adding the three expressions, we obtain

$$\begin{array}{r} p^2 - pq \\ + \quad \quad q^2 - qr \\ + \quad \quad \quad r^2 - pr \\ \hline p^2 - pq + q^2 - qr + r^2 - pr \end{array}$$

Therefore, the sum of the given expressions is $p^2 + q^2 + r^2 - pq - qr - rp$.

(b) First expression = $2x(z - x - y) = 2xz - 2x^2 - 2xy$

Second expression = $2y(z - y - x) = 2yz - 2y^2 - 2yx$

Adding the two expressions, we obtain

$$\begin{array}{r} 2xz - 2x^2 - 2xy \\ + \quad \quad -2yx + 2yz - 2y^2 \\ \hline 2xz - 2x^2 - 4xy + 2yz - 2y^2 \end{array}$$

Therefore, the sum of the given expressions is $-2x^2 - 2y^2 - 4xy + 2yz + 2zx$.

(c) $3l(l - 4m + 5n) = 3l^2 - 12lm + 15ln$

$4l(10n - 3m + 2l) = 40ln - 12lm + 8l^2$

Subtracting these expressions, we obtain

$$\begin{array}{r} 40ln - 12lm + 8l^2 \\ 15ln - 12lm + 3l^2 \\ (-) \quad (+) \quad (-) \\ \hline +25ln \quad \quad +5l^2 \end{array}$$

Therefore, the result is $5l^2 + 25ln$

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

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

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

Subtracting these expressions, we obtain

$$\begin{array}{r} -4ac + 4bc + 4c^2 \\ 3ac - 2bc \quad + 3a^2 + 2b^2 + ab \\ (-) \quad (+) \quad (-) \quad (-) \quad (-) \\ \hline -7ac + 6bc + 4c^2 - 3a^2 - 2b^2 - ab \end{array}$$

Therefore, the result is $-3a^2 - 2b^2 + 4c^2 - ab + 6bc - 7ac$.

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Exercise 9.4

Q1 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 $4\left(a^2 - \frac{2}{3}b^2\right)$

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

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

$$= 8x^2 + 14x - 15 \text{ (By adding like terms)}$$

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

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

$$= 3y^2 - 28y + 32 \text{ (By adding like terms)}$$

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

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

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

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

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

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

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

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

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

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

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

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

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Q2 Find the product.

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

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

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

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

Answer. (i) $(5 - 2x)(3 + x) = 5(3 + x) - 2x(3 + x)$

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

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

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

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

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

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

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

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

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

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Q3 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) $(a + b + c)(a + b - c)$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$= 4ac$$

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

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

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

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

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

$$\begin{aligned}
 & \text{(vi)} \quad (x + y)(x^2 - xy + y^2) \\
 &= x(x^2 - xy + y^2) + y(x^2 - xy + y^2) \\
 &= x^3 - x^2y + xy^2 + x^2y - xy^2 + y^3 \\
 &= x^3 + y^3 + (xy^2 - xy^2) + (x^2y - x^2y) \\
 &= x^3 + y^3
 \end{aligned}$$

$$\begin{aligned}
 & \text{(vii)} \quad (1.5x - 4y)(1.5x + 4y + 3) - 4.5x + 12y \\
 &= 1.5x(1.5x + 4y + 3) - 4y(1.5x + 4y + 3) - 4.5x + 12y \\
 &= 2.25x^2 + 6xy + 4.5x - 6xy - 16y^2 - 12y - 4.5x + 12y \\
 &= 2.25x^2 + (6xy - 6xy) + (4.5x - 4.5x) - 16y^2 + (12y - 12y) \\
 &= 2.25x^2 - 16y^2
 \end{aligned}$$

$$\begin{aligned}
 & \text{(viii)} \quad (a + b + c)(a + b - c) \\
 &= a(a + b - c) + b(a + b - c) + c(a + b - c) \\
 &= a^2 + ab - ac + ab + b^2 - bc + ca + bc - c^2 \\
 &= a^2 + b^2 - c^2 + (ab + ab) + (bc - bc) + (ca - ca) \\
 &= a^2 + b^2 - c^2 + 2ab
 \end{aligned}$$

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Exercise 9.5

Q1 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) $(7a - 9b)(7a - 9b)$

Answer. The products will be as follows.

$$\begin{aligned}
 & \text{(i)} \quad (x + 3)(x + 3) = (x + 3)^2 \\
 &= (x)^2 + 2(x)(3) + (3)^2 \quad [(a + b)^2 = a^2 + 2ab + b^2] \\
 &= x^2 + 6x + 9
 \end{aligned}$$

$$\begin{aligned}
 & \text{(ii)} \quad (2y + 5)(2y + 5) = (2y + 5)^2 \\
 &= (2y)^2 + 2(2y)(5) + (5)^2 \quad [(a + b)^2 = a^2 + 2ab + b^2] \\
 &= 4y^2 + 20y + 25
 \end{aligned}$$

$$\begin{aligned}
 & \text{(iii)} \quad (2a - 7)(2a - 7) = (2a - 7)^2 \\
 &= (2a)^2 - 2(2a)(7) + (7)^2 \quad [(a - b)^2 = a^2 - 2ab + b^2] \\
 &= 4a^2 - 28a + 49
 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & \left(3a - \frac{1}{2}\right) \left(3a - \frac{1}{2}\right) = \left(3a - \frac{1}{2}\right)^2 \\ & = (3a)^2 - 2(3a) \left(\frac{1}{2}\right) + \left(\frac{1}{2}\right)^2 \\ & = 9a^2 - 3a + \frac{1}{4} \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad & (1.1m - 0.4)(1.1m + 0.4) \\ & = (1.1m)^2 - (0.4)^2 \quad [(a+b)(a-b) = a^2 - b^2] \\ & = 1.21m^2 - 0.16 \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & (a^2 + b^2) (-a^2 + b^2) = (b^2 + a^2) (b^2 - a^2) \\ & = (b^2)^2 - (a^2)^2 \quad [(a+b)(a-b) = a^2 - b^2] \\ & = b^4 - a^4 \end{aligned}$$

$$\begin{aligned} \text{(vii)} \quad & (6x - 7)(6x + 7) = (6x)^2 - (7)^2 \quad [(a+b)(a-b) = a^2 - b^2] \\ & = 36x^2 - 49 \end{aligned}$$

$$\begin{aligned} \text{(viii)} \quad & (-a + c)(-a + c) = (-a + c)^2 \\ & = (-a)^2 + 2(-a)(c) + (c)^2 \quad [(a+b)^2 = a^2 + 2ab + b^2] \\ & = a^2 - 2ac + c^2 \end{aligned}$$

$$\begin{aligned} \text{(ix)} \quad & \left(\frac{x}{2} + \frac{3y}{4}\right) \left(\frac{x}{2} + \frac{3y}{4}\right) = \left(\frac{x}{2} + \frac{3y}{4}\right)^2 \\ & = \left(\frac{x}{2}\right)^2 + 2\left(\frac{x}{2}\right) \left(\frac{3y}{4}\right) + \left(\frac{3y}{4}\right)^2 \\ & = \frac{x^2}{4} + \frac{3xy}{4} + \frac{9y^2}{16} \end{aligned}$$

$$\begin{aligned} \text{(x)} \quad & (7a - 9b)(7a - 9b) = (7a - 9b)^2 \\ & = (7a)^2 - 2(7a)(9b) + (9b)^2 \quad [(a-b)^2 = a^2 - 2ab + b^2] \\ & = 49a^2 - 126ab + 81b^2 \end{aligned}$$

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Q2 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) $(xyz - 4)(xyz - 2)$

Answer. The products will be as follows.

$$\begin{aligned} \text{(i)} \quad & (x + 3)(x + 7) = x^2 + (3 + 7)x + (3)(7) \\ & = x^2 + 10x + 21 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & (4x + 5)(4x + 1) = (4x)^2 + (5 + 1)(4x) + (5)(1) \\ & = 16x^2 + 24x + 5 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & (4x - 5)(4x - 1) = (4x)^2 + [(-5) + (-1)](4x) + (-5)(-1) \\ & = 16x^2 - 24x + 5 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & (4x + 5)(4x - 1) = (4x)^2 + [(5) + (-1)](4x) + (5)(-1) \\ & = 16x^2 + 16x - 5 \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad & (2x + 5y)(2x + 3y) = (2x)^2 + (5y + 3y)(2x) + (5y)(3y) \\ & = 4x^2 + 16xy + 15y^2 \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & (2a^2 + 9)(2a^2 + 5) = (2a^2)^2 + (9 + 5)(2a^2) + (9)(5) \end{aligned}$$

$$\begin{aligned}
 &= 4a^4 + 28a^2 + 45 \\
 \text{(vii)} \quad &(xyz - 4)(xyz - 2) \\
 &= (xyz)^2 + [(-4) + (-2)](xyz) + (-4)(-2) \\
 &= x^2y^2z^2 - 6xyz + 8
 \end{aligned}$$

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Q3 Find the following squares by using the 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) $(2xy + 5y)^2$

Answer. (i) $(b - 7)^2 = (b)^2 - 2(b)(7) + (7)^2$ $[(a - b)^2 = a^2 - 2ab + b^2]$
 $= b^2 - 14b + 49$
(ii) $(xy + 3z)^2 = (xy)^2 + 2(xy)(3z) + (3z)^2$ $[(a + b)^2 = a^2 + 2ab + b^2]$
 $= x^2y^2 + 6xyz + 9z^2$
(iii) $(6x^2 - 5y)^2 = (6x^2)^2 - 2(6x^2)(5y) + (5y)^2$ $[(a - b)^2 = a^2 - 2ab + b^2]$
 $= 36x^4 - 60x^2y + 25y^2$
(iv) $\left(\frac{2}{3}m + \frac{3}{2}n\right)^2 = \left(\frac{2}{3}m\right)^2 + 2\left(\frac{2}{3}m\right)\left(\frac{3}{2}n\right) + \left(\frac{3}{2}n\right)^2$ $[(a+b)^2=a^2+2ab+b^2]$
 $= \frac{4}{9}m^2 + 2mn + \frac{9}{4}n^2$
(v) $(0.4p - 0.5q)^2 = (0.4p)^2 - 2(0.4p)(0.5q) + (0.5q)^2$
 $[(a - b)^2 = a^2 - 2ab + b^2]$
 $= 0.16p^2 - 0.4pq + 0.25q^2$
(vi) $(2xy + 5y)^2 = (2xy)^2 + 2(2xy)(5y) + (5y)^2$
 $[(a + b)^2 = a^2 + 2ab + b^2]$
 $= 4x^2y^2 + 20xy^2 + 25y^2$

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Q4 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) $(m^2 - n^2m)^2 + 2m^3n^2$

Answer. (i) $(a^2 - b^2)^2 = (a^2)^2 - 2(a^2)(b^2) + (b^2)^2$ $[(a - b)^2 = a^2 - 2ab + b^2]$
 $= a^4 - 2a^2b^2 + b^4$
(ii) $(2x + 5)^2 - (2x - 5)^2 = (2x)^2 + 2(2x)(5) + (5)^2 - [(2x)^2 - 2(2x)(5) + (5)^2]$

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

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

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

$$= 4x^2 + 20x + 25 - 4x^2 + 20x - 25 = 40x$$

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

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

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

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

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

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

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

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

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

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

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

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

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

$$= 6.25p^2 - 7.5pq + 2.25q^2 - [2.25p^2 - 7.5pq + 6.25q^2]$$

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

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

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

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

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

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

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

$$= (m^2)^2 - 2(m^2)(n^2m) + (n^2m)^2 + 2m^3n^2 [(a - b)^2 = a^2 - 2ab + b^2]$$

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

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

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Q5 Show that

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

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

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

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

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

$$\text{Answer. (i) L.H.S} = (3x + 7)^2 - 84x$$

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

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

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

$$\text{R.H.S} = (3x - 7)^2 = (3x)^2 - 2(3x)(7) + (7)^2$$

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

$$\text{L.H.S} = \text{R.H.S}$$

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

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

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

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

$$\text{R.H.S} = (9p + 5q)^2$$

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

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

$$\text{L.H.S} = \text{R.H.S}$$

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

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

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

$$= \frac{16}{9}m^2 + \frac{9}{16}n^2 = \text{R. H. S}$$

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

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

$$= 16p^2q^2 + 24pq^2 + 9q^2 - [16p^2q^2 - 24pq^2 + 9q^2]$$

$$= 16p^2q^2 + 24pq^2 + 9q^2 - 16p^2q^2 + 24pq^2 - 9q^2$$

$$= 48pq^2 = \text{R. H. S}$$

$$\text{(v) L.H.S} = (a - b)(a + b) + (b - c)(b + c) + (c - a)(c + a)$$

$$= (a^2 - b^2) + (b^2 - c^2) + (c^2 - a^2) = 0 = \text{R. H. S}$$

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Q6 Using identities, evaluate.

$$\text{(i) } 71^2$$

$$\text{(ii) } 99^2$$

$$\text{(iii) } 102^2$$

$$\text{(iv) } 998^2$$

$$\text{(v) } 5.2^2$$

$$\text{(vi) } 297 \times 303$$

$$\text{(vii) } 78 \times 82$$

$$\text{(viii) } 8.9^2$$

$$\text{(ix) } 1.05 \times 9.5$$

Answer.

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

$$= (70)^2 + 2(70)(1) + (1)^2 \quad [(a + b)^2 = a^2 + 2ab + b^2]$$

$$= 4900 + 140 + 1 = 5041$$

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

$$= (100)^2 - 2(100)(1) + (1)^2 \quad [(a - b)^2 = a^2 - 2ab + b^2]$$

$$= 10000 - 200 + 1 = 9801$$

$$\text{(iii) } 102^2 = (100 + 2)^2$$

$$= (100)^2 + 2(100)(2) + (2)^2 \quad [(a + b)^2 = a^2 + 2ab + b^2]$$

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

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

$$= (1000)^2 - 2(1000)(2) + (2)^2 [(a - b)^2 = a^2 - 2ab + b^2]$$

$$= 1000000 - 4000 + 4 = 996004$$

$$(v) (5.2)^2 = (5.0 + 0.2)^2$$

$$(v) = (5.0)^2 + 2(5.0)(0.2) + (0.2)^2 [(a + b)^2 = a^2 + 2ab + b^2]$$

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

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

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

$$= 90000 - 9 = 89991$$

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

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

$$= 6400 - 4 = 6396$$

$$(viii) 8.9^2 = (9.0 - 0.1)^2$$

$$= (9.0)^2 - 2(9.0)(0.1) + (0.1)^2 [(a - b)^2 = a^2 - 2ab + b^2]$$

$$= 81 - 1.8 + 0.01 = 79.21$$

$$(ix) 1.05 \times 9.5 = 1.05 \times 0.95 \times 10$$

$$= (1 + 0.05)(1 - 0.05) \times 10$$

$$= [(1)^2 - (0.05)^2] \times 10$$

$$= [1 - 0.0025] \times 10 [(a + b)(a - b) = a^2 - b^2]$$

$$= 0.9975 \times 10 = 9.975$$

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

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

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

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

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

Answer.

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

$$= (100)(2) = 200$$

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

$$= (2)(0.04) = 0.08$$

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

$$= (300)(6) = 1800$$

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

$$= (20.0)(4.2) = 84$$

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

$$(i) 103 \times 104$$

$$(ii) 5.1 \times 5.2$$

$$(iii) 103 \times 98$$

$$(iv) 9.7 \times 9.8$$

Answer.

$$\begin{aligned} \text{(i) } 103 \times 104 &= (100 + 3)(100 + 4) \\ &= (100)^2 + (3 + 4)(100) + (3)(4) \\ &= 10000 + 700 + 12 = 10712 \end{aligned}$$

$$\begin{aligned} \text{(ii) } 5.1 \times 5.2 &= (5 + 0.1)(5 + 0.2) \\ &= (5)^2 + (0.1 + 0.2)(5) + (0.1)(0.2) \\ &= 25 + 1.5 + 0.02 = 26.52 \end{aligned}$$

$$\begin{aligned} \text{(iii) } 103 \times 98 &= (100 + 3)(100 - 2) \\ &= (100)^2 + [3 + (-2)](100) + (3)(-2) \\ &= 10000 + 100 - 6 \\ &= 10094 \end{aligned}$$

$$\begin{aligned} \text{(iv) } 9.7 \times 9.8 &= (10 - 0.3)(10 - 0.2) \\ &= (10)^2 + [(-0.3) + (-0.2)](10) + (-0.3)(-0.2) \\ &= 100 + (-0.5)10 + 0.06 = 100.06 - 5 = 95.06 \end{aligned}$$

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