CBSE NCERT Solutions for Class 8 Mathematics Chapter 9

Back of Chapter Questions

Exercise 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) $0.3a - 0.6ab + 0.5b$

Solution:

(i) Given expression is $5xyz^2 - 3zy$.

This expression contains two terms $5xyz^2$ and $-3zy$.

Here the coefficient of xyz^2 is 5 and of zy is −3.

(ii) Given expression is $1 + x + x^2$

This expression contains three terms $1, x$ and x^2.

Here the coefficient of x and x^2 is 1.

(iii) Given expression is $4x^2y^2 - 4x^2y^2z^2 + z^2$.

This expression contains three terms $4x^2y^2, -4x^2y^2z^2$ and z^2 .

Here the coefficient of x^2y^2 is 4, coefficient of $x^2y^2z^2$ is −4 and coefficient of z^2 is 1.

(iv) Given expression is $3 - pq + qr - rp$.

This expression contains four terms $3, -pq, qr$ and $-rp$

Here the coefficient of pq is −1, coefficient of qr is 1 and the coefficient of rp is −1.

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

This expression contains three terms $\frac{x}{2}$, $\frac{y}{2}$ and $-xy$

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

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

This expression contains three terms $0.3a, -0.6ab$ and $0.5b$.

Here the coefficient of a is 0.3, coefficient of ab is -0.6 and the coefficient of b is 0.5.

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

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

Solution:

Given polynomial is $x + y$

Since $(x + y)$ contains two terms. Therefore, it is binomial.

Given polynomial is 1000

Since 1000 contains only one term. Therefore, it is monomial.

Given polynomial is $x + x^2 + x^3 + x^4$

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

Given polynomial is $7 + y + 5x$

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

Given polynomial is $2y - 3y^2$

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

Given polynomial is $2y - 3y^2 + 4y^3$

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

Given polynomial is $5x - 4y + 3xy$

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

Given polynomial is $4x - 15z^2$

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

Given polynomial is $ab + bc + cd + da$.

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

Given polynomial is pqr.

Since pqr contains only one term. Therefore, it is monomial.

Given polynomial is $p^2q + pq^2$

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

Given polynomial is $2p + 2q$

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

3. Add the following:

$ab - bc, bc - ca, ca - ab$

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

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

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

Solution:

$(ab - bc) + (bc - ca) + (ca - ab) = (ab - ab) + (bc - bc) + (ca - ca) = 0$

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

$= ab + bc + ac$

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

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

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

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) Given polynomials are $4a - 7ab + 3b + 12$ and $12a - 9ab + 5b - 3$

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

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

(b) Given polynomials are $3xy + 5yz - 7zx$ and $5xy - 2yz - 2zx + 10xyz$

Now, $(5xy - 2yz - 2zx + 10xyz) - (3xy + 5yz - 7zx) = (5xy - 3xy) + (-2yz - 5yz) + (-2zx + 7zx) + 10xyz$

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

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

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

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

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

Exercise 9.2

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

(i) $4, 7p$

(ii) $-4p, 7p$

(iii) $-4p, 7pq$

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

(v) $4p, 0.$

Solution:

$4 \times 7p = 28p$

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

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

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

$4p \times 0 = 0$

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:

(i) Area of rectangle = length × breadth = $p \times q = pq$ sq. units.

(ii) Area of rectangle = length × breadth = $10m \times 5n = 50mn$ sq. units.

(iii) Area of rectangle = length × breadth = $20x^2 \times 5y^2 = 100x^2y^2$ sq. units

(iv) Area of rectangle = length × breadth = $4x \times 3x^2 = 12x^3$ sq. units.

(v) Area of rectangle = length × breadth = $3mn \times 4np = 12mn^2p$ sq. units

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

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) $a, 2b, 3c.$

Solution:

Volume of rectangular box = length × breadth × height

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

$= 105a^7$ cubic units

Volume of rectangular box = length × breadth × height

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

$= 64pqr$ cubic units.

Volume of rectangular box = length × breadth × height

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

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

Volume of rectangular box = length × breadth × height

$= a \times 2b \times 3c$

$= 6abc$ 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) $m, -mn, mnp.$

Solution:

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

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

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

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

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

Exercise 9.3

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

$4p, q + r$

$ab, a - b$

$a + b, 7a^2b^2$

$a^2 - 9, 4a$

$pq + qr + rp, 0$

Solution:

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

$= 7a^3b^2 + 7a^2b^3$

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

$= 4a^3 - 36a$

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

Complete the following 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)	$x + y - 5$	$5xy$	$(x + y - 5)5xy$ $= x(5xy) + y(5xy) - 5(5xy)$ $= 5x^2y + 5xy^2 - 25xy$
(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)	$4p^2q^2$	$p^2 - q^2$	$4p^2q^2(p^2 - q^2)$

			$= (4p^2q^2 \times p^2) - (4p^2q^2 \times q^2)$ $= 4p^4q^2 - 4p^2q^4$
(v)	$a + b + c$	abc	$abc(a + b + c)$ $= (abc \times a) + (abc \times b) + (abc \times c)$ $= a^2bc + ab^2c + abc^2$

2. Find the product:

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

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

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

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

Solution:

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

$= 8a^{2+22+26}$

$= 8a^{50}$

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

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

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

$= -4p^4q^4$

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

3. (a) Simplify: $3x(4x - 5) + 3$ and find the value 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) $a = -1$

Solution:

(a) $3x(4x - 5) + 3 = (3x \times 4x) - (3x \times 5) + 3 = 12x^2 - 15x + 3$

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

$= (12 \times 9) - 45 + 3$

$= 108 - 45 + 3$

$= 66$

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

$= \left(12 \times \frac{1}{4}\right) - \frac{15}{2} + 3$

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

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

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

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

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

$= 0 + 0 + 0 + 5$

$= 5$

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

$= 1 + 1 + 1 + 5$

$= 8$

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

$= -1 + 1 - 1 + 5$

$= 4$

4. (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) $p(p - q) + q(q - r) + r(r - p) = (p \times p) - (p \times q) + (q \times q) - (q \times r) + (r \times r) - (r \times p)$

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

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

(b) $2x(z - x - y) + 2y(z - y - x) = 2zx - 2x^2 - 2xy + 2yz - 2y^2 - 2xy$

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

(c) $4l(10n - 3m + 2l) - 3l(l - 4m + 5n) = 40ln - 12lm + 8l^2 - 3l^2 + 12lm - 15ln$

$= 5l^2 + 25ln$

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

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

Exercise 9.4

1. Multiply the binomials.

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

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

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

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

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

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

Solution:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2. Find the product.

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

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

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

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

Solution:

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

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

$= 15 - x - 2x^2$

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

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

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

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

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

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

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

3. Simplify.

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

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

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

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

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

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

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

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

Solution:

(a) $(x^2 - 5)(x + 5) + 25 = (x^2 \times x) + (-5 \times x) + (x^2 \times 5) + (-5 \times 5) + 25$

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

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

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

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

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

(c) $(t + s^2)(t^2 - s) = (t \times t^2) + (s^2 \times t^2) + (t \times -s) + (s^2 \times -s)$

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

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

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

$= 4ac$

(e) $(x + y)(2x + y) + (x + 2y)(x - y) = (x \times 2x) + (y \times 2x) + (x \times y) + (y \times y) + (x \times x) + (2y \times x) + (x \times -y) + (2y \times -y)$

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

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

(f) $(x + y)(x^2 - xy + y^2) = (x \times x^2) + (y \times x^2) + (x \times -xy) + (y \times -xy) + (x \times y^2) + (y \times y^2)$

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

$= x^3 + y^3$

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

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

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

(h) $(a + b + c)(a + b - c) = (a \times a) + (a \times b) + (a \times -c) + (b \times a) + (b \times b) + (b \times -c) + (c \times a) + (c \times b) + (c \times -c)$

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

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

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

Solution:

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

We know that $(a + b)^2 = a^2 + 2ab + b^2$

Here $a = x, b = 3$

Hence, $(x + 3)^2 = x^2 + 2x(3) + 3^2$

$= x^2 + 6x + 9$

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

We know that $(a + b)^2 = a^2 + 2ab + b^2$

Here $a = 2y, b = 5$

Hence, $(2y + 5)^2 = (2y)^2 + 2(2y)(5) + 5^2$

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

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

We know that $(a-b)^2 = a^2 - 2ab + b^2$

Here $a = 2a, b = 7$

Hence, $(2a-7)^2 = (2a)^2 - 2(2a)(7) + 7^2$

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

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

We know that $(a-b)^2 = a^2 - 2ab + b^2$

Here $a = 3a, b = \frac{1}{2}$

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

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

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

We know that $(a+b)(a-b) = a^2 - b^2$

Here $a = 1.1m, b = 0.4$

Hence, $(1.1m - 0.4)(1.1m + 0.4) = (1.1m)^2 - 0.4^2$

$= 1.21m^2 - 0.16$

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

We know that $(a+b)(a-b) = a^2 - b^2$

Here $a = b^2, b = a^2$

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

$= b^4 - a^4$

(vii) We know that $(a+b)(a-b) = a^2 - b^2$

Here $a = 6x, b = 7$

Hence, $(6x - 7)(6x + 7) = (6x)^2 - 7^2$

$= 36x^2 - 49$

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

We know that $(a-b)^2 = a^2 - 2ab + b^2$

Here $a = c, b = a$

Hence, $(c-a)^2 = (c)^2 - 2(c)(a) + a^2$

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

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

We know that $(a+b)^2 = a^2 + 2ab + b^2$

Here $a = \frac{x}{2}, b = \frac{3y}{4}$

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

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

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

We know that $(a-b)^2 = a^2 - 2ab + b^2$

Here $a = 7a, b = 9b$

Hence, $(7a - 9b)^2 = (7a)^2 - 2(7a)(9b) + (9b)^2$

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

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

Solution:

(i) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $a = 3, b = 7$

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

$= x^2 + 10x + 21$

(ii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

$(4x + 5)(4x + 1) = 16\left(x + \frac{5}{4}\right)\left(x + \frac{1}{4}\right)$

$= 16(x^2 + \left(\frac{5}{4} + \frac{1}{4}\right)x + \frac{5}{16})$

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

(iii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

$(4x - 5)(4x - 1) = 16\left(x - \frac{5}{4}\right)\left(x - \frac{1}{4}\right)$

$= 16\left(x^2 - \frac{6}{4}x + \frac{5}{16}\right)$

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

(iv) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

$(4x + 5)(4x - 1) = 16\left(x + \frac{5}{4}\right)\left(x - \frac{1}{4}\right)$

$= 16\left(x^2 + x - \frac{5}{16}\right)$

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

(v) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

$(2x + 5y)(2x + 3y) = 4\left(x + \frac{5}{2}y\right)\left(x + \frac{3}{2}y\right)$

$= 4\left(x^2 + 4xy + \frac{15}{4}\right)$

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

(vi) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Here $x = 2a^2, a = 9, b = 5$

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

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

(vii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Here $x = xyz, a = -4, b = -2$

$(xyz - 4)(xyz - 2) = (xyz)^2 + (-4 - 2)xyz + 8$

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

3. Find the following squares by using the identities.

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

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

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

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

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

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

Solution:

(i) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Here $a = b, b = 7$

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

$= b^2 - 14b + 49$

(ii) We know that $(a + b)^2 = a^2 + 2ab + b^2$

Here $a = xy, b = 3z$

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

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

(iii) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Here $a = 6x^2, b = 5y$

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

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

(iv) We know that $(a + b)^2 = a^2 + 2ab + b^2$

Here $a = \frac{2}{3}m, b = \frac{3}{2}n$

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

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

(v) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Here $a = 0.4p, b = 0.5q$

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

$= 0.16p^2 - 0.4pq + 0.25q^2$

(vi) We know that $(a + b)^2 = a^2 + 2ab + b^2$

Here $a = 2xy, b = 5y$

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

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

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) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Here $a = a^2, b = b^2$

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

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

(ii) We know that $(a + b)^2 - (a - b)^2 = 4ab$

Here $a = 2x, b = 5$

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

$= 40x$

(iii) We know that $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$

Here $a = 7m, b = 8n$

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

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

(iv) We know that $(a + b)^2 = a^2 + 2ab + b^2$

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

$= 16m^2 + 25n^2 + 2(4m)(5n) + 25m^2 + 16n^2 + 2(5m)(4n)$

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

(v) We know that $(a - b)^2 = a^2 - 2ab + b^2$

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

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

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

(vi) We know that $(a + b)^2 = a^2 + 2ab + b^2$

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

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

(vii) We know that $(a - b)^2 = a^2 - 2ab + b^2$

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

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

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

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

Solution:

(i) We know that $(a + b)^2 = a^2 + 2ab + b^2$

$\Rightarrow (a + b)^2 - 4ab = a^2 + 2ab + b^2 - 4ab$

$\Rightarrow (a + b)^2 - 4ab = a^2 - 2ab + b^2$ ….. (i)

And $(a - b)^2 = a^2 - 2ab + b^2$ ……(ii)

From (i) and (ii)

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

Put $a = 3x, b = 7$

$(3x + 7)^2 - 4(3x)7 = (3x - 7)^2$

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

(ii) We know that $(a - b)^2 = a^2 - 2ab + b^2$

$\Rightarrow (a - b)^2 + 4ab = a^2 - 2ab + b^2 + 4ab$

$\Rightarrow (a - b)^2 + 4ab = a^2 + 2ab + b^2$ …..(i)

And $(a+b)^2 = a^2 + 2ab + b^2$……(ii)

From (i) and (ii)

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

Put $a = 9p, b = 5q$

$(9p-5q)^2 + 4(9p)(5q) = (9p+5q)^2$

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

(iii) We know that $(a-b)^2 = a^2 - 2ab + b^2$

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

$= a^2 + b^2$

Put $a = \frac{4}{3}m, b = \frac{3}{4}n$

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

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

(iv) We know that $(a+b)^2 = a^2 + 2ab + b^2$ …. (i)

$(a-b)^2 = a^2 - 2ab + b^2$ …. (ii)

Adding (i) and (ii)

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

$= 4ab$

Put $a = 4pq, b = 3q$

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

$= 48q^2p$

(v) We know that $(a-b)(a+b) = a^2 - b^2$

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

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

Hence, $(a-b)(a+b) + (b-c)(b+c) + (c-a)(c+a) = a^2 - b^2 + b^2 - c^2 + c^2 - a^2$

$= 0$

6. Using identities, evaluate

(i) 71^2

(ii) 99^2

(iii) 102^2

(iv) 998^2

(v) 5.2^2

(vi) 297×303

(vii) 78×82

(viii) 8.9^2

(ix) 1.05×9.5

Solution:

(i) We know that $(a + b)^2 = a^2 + 2ab + b^2$

Put $a = 70, b = 1$

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

$= 4900 + 140 + 1 = 5041$

(ii) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Put $a = 100, b = 1$

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

$= 10000 - 200 + 1 = 9801$

(iii) We know that $(a + b)^2 = a^2 + 2ab + b^2$

Put $a = 100, b = 2$

$(102)^2 = 100^2 + 2(100)(2) + 4$

$= 10000 + 400 + 4 = 10404$

(iv) We know that $(a - b)^2 = a^2 - 2ab + b^2$

Put $a = 1000, b = 2$

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

$= 1000000 - 4000 + 4$

$= 996004$

(v) We know that $(a + b)^2 = a^2 + 2ab + b^2$

Put $a = 5, b = 0.2$

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

$= 25 + 2 + 0.04 = 27.04$

(vi) We know that $(a+b)(a-b) = a^2 - b^2$

Put $a = 300, b = 3$

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

$= 90000 - 9 = 89991$

(vii) We know that $(a+b)(a-b) = a^2 - b^2$

Put $a = 80, b = 2$

$(80-2)(80+2) = (80)^2 - 4$

$= 6396$

(viii) We know that $(a-b)^2 = a^2 - 2ab + b^2$

Put $a = 9, b = 0.1$

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

$= 81 - 1.8 + 0.01 = 79.21$

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

We know that $(a+b)(a-b) = a^2 - b^2$

$1.05 \times 0.95 \times 10 = (1+0.05)(1-0.05)(10)$

$= (1 - 0.0025)10$

$= 9.975$

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) We know that $a^2 - b^2 = (a-b)(a+b)$

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

$= 2(100) = 200$

(ii) We know that $a^2 - b^2 = (a-b)(a+b)$

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

$= (0.04)2 = 0.08$

(iii) We know that $a^2 - b^2 = (a - b)(a + b)$

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

$= 6(300) = 1800$

(iv) We know that $a^2 - b^2 = (a - b)(a + b)$

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

$= 4.2(20) = 84$

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

(i) 103×104

(ii) 5.1×5.2

(iii) 103×98

(iv) 9.7×9.8

Solution:

(i) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $x = 100, a = 3, b = 4$

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

$= 10000 + 700 + 12$

$= 10712$

(ii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $x = 5, a = 0.1, b = 0.2$

$(5 + 0.1)(5 + 0.2) = 25 + 1.5 + 0.02$

$= 26.52$

(iii) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $x = 100, a = 3, b = -2$

$(100 + 3)(100 - 2) = 10000 + 100 - 6$

$= 10094$

(iv) We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$

Put $x = 10, a = -0.2, b = -0.3$

$(10 - 0.2)(10 - 0.3) = 100 - 5 + 0.06$

$= 95.06$

♦♦♦