11. Algebric Expressions

Exercise - 11.1

1. Find the product of the following pairs.

i] $6, 7k$

Soln:-

Given, 6 & $7k$

$\therefore$ Product of 6 & $7k = 6 \times 7k = 42k$

Hence product of 6 & $7k$ is $\underline{42k}$.

ii] $-3l, -2m$

Soln:-

Given $-3l$ & $-2m$

The product of $-3l$ & $-2m$ is $= -3l \times -2m$
$= 6lm$

$\therefore$ Hence the product of $-3l$ & $-2m$ is $\underline{6lm}$

iii] $-5t^2, -3t^2$

Soln:-

Given $-5t^2$ & $-3t^2$

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The product of $-5t^2$ & $-3t^2$

$= -5t^2 \times -3t^2 = 15(t^2 \cdot t^2)$

$= \underline{15t^4}$

Hence, the product of $-5t^2$ & $-3t^2$ is $\underline{15t^4}$

iv] $6n, 3m$

Sol^n: Given, $6n$ & $3m$

The product of $6n$ & $3m$

$= 6n \times 3m = \underline{18nm}$

Hence, the product of $6n$ & $3m$ is $\underline{18nm}$.

v] $-5p^2, -2p$

Sol^n: The product of $-5p^2$ & $-2p$

$= -5p^2 \times -2p = 10(p^2 \cdot p)$

$= \underline{10p^3}$

Hence, the product of $-5p^2$ & $-2p$ is $\underline{10p^3}$.

2. Complete the table of products.

$\times$	$5x$	$-2y^2$	$3x^2$	$6xy$	$3y^2$	$-3xy^2$	$4xy^2$	x^2y^2
$3x$	$15x^2$							
$4y$								
$-2x^2$	$-10x^3$	$4x^2y^2$						
$6xy$								
$2y^2$								
$3x^2y$								
$2xy^2$								
$5x^2y^2$								

Soln:-

$\times$	$5x$	$-2y^2$	$3x^2$	$6xy$	$3y^2$	$-3xy^2$	$4xy^2$	x^2y^2
$3x$	$15x^2$	$-6xy^2$	$9x^3$	$18x^2y$	$9xy^2$	$-9x^2y^2$	$12x^2y^2$	$3x^3y^2$
$4y$	$20xy$	$-8y^3$	$12x^2y$	$24xy^2$	$12y^3$	$-12xy^3$	$16xy^3$	$4x^2y^2$
$-2x^2$	$-10x^3$	$4x^2y^2$	$-6x^3y$	$-12x^3y$	$-6x^2y^2$	$6x^3y^2$	$-8x^4y^2$	$-2x^4y^2$
$6xy$	$30x^2y$	$-12xy^2$	$18x^3y$	$36x^2y^2$	$18xy^3$	$-18x^2y^2$	$24x^2y^3$	$6x^3y^3$
$2y^2$	$10xy^2$	$-4y^4$	$6x^2y^2$	$12xy^3$	$6y^4$	$-6xy^4$	$8xy^4$	$2x^2y^4$
$3x^2y$	$15x^3y^2$	$-6x^2y^2$	$9x^4y$	$18x^3y^2$	$9x^2y^3$	$-9x^3y^3$	$12x^3y^3$	$3x^4y^3$
$2xy^2$	$10x^2y^2$	$-4xy^4$	$6x^4y^2$	$12x^2y^3$	$4xy^4$	$-6x^2y^4$	$8x^2y^4$	$2x^3y^4$
$5x^2y^2$	$25x^3y^2$	$-10x^2y^4$	$15x^4y^2$	$30x^3y^3$	$15x^2y^4$	$-13x^2y^4$	$20x^3y^4$	$5x^4y^4$

Here, the product is calculated in the following manner.

We multiply the terms on the x-axis (horizontal) & y-axis (vertical).

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3. Find the volumes of rectangular boxes with given length, bredth & height in the following table.

Sr. No.	Length	Breadth	Height	Volume(V) = l X b X h
i]	$3x$	$4x^2$	5	$V = 3x \times 4x^2 \times 5 = 60x^3$
ii]	$3a^2$	4	$5c$	$V =$
iii]	$3m$	$4n$	$2m^2$	$V =$
iv]	$6kl$	$3l^2$	$2k^2$	$V =$
v]	$3pr$	$2qr$	$4pq$	$V =$

Soln:

Sr. No.	Length	Breadth	Height	Volume (V) = l X b X h
i)	$3x$	$4x^2$	5	$V = 3x \times 4x^2 \times 5 = 60x^3$
ii)	$3a^2$	4	$5c$	$V = 3a^2 \times 4 \times 5c = 60a^2c$
iii)	$3m$	$4n$	$2m^2$	$V = 3m \times 4n \times 2m^2 = 24m^3n$
iv)	$6kl$	$3l^2$	$2k^2$	$V = 6kl \times 3l^2 \times 2k^2 = 36k^3l^3$
v]	$3pr$	$2qr$	$4pq$	$V = 3pr \times 2qr \times 4pq = 24p^2q^2r^2$

Here, we have calculated the volume 'V' using the length, Breadth & Height

V = Length X Breadth X Height

4. Find the product of the following monomials.

i) xy, x^2y, xy, x

Soln:

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Soln: The product of xy, x^2y, xy, x

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

$= x^5 \times y^3 = \underline{\underline{x^5y^3}}$

ii) a, b, ab, a^3b, ab^3

Soln:

The product of a, b, ab, a^3b, ab^3

$= a \times b \times ab \times a^3b \times ab^3$

$= a^6 \times b^6$

$= \underline{\underline{a^6b^6}}$

iii) kl, lm, km, klm

Soln:

The product of kl, lm, km, klm

$= kl \times lm \times km \times klm$

$= k^3 \times l^3 \times m^3$

$= \underline{\underline{k^3l^3m^3}}$

iv) pq, pqr, r

Soln: The product of pq, pqr, r

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$= pq \times pqr \times r = p^2 \times q^2 \times r^2$

$= \underline{p^2q^2r^2}$.

v) $-3a, 4ab, -6c, d$

Soln: The product of $-3a, 4ab, -6c, d$

$= (-3a) \times 4ab \times (-6c) \times d$

$= 72a^2 \times b \times c \times d$ ...... $(\because (-3 \times 4 \times -6)(a \cdot a)(b)(c)d)$

$= \underline{72a^2bcd}$

5. If $A = xy$, $B = yz$ & $C = 2x$, then find $ABC = ...$

Soln: Given, $A = xy$, $B = yz$, $C = 2x$

We multiply given binomials, A, B & C.

$\therefore ABC = (xy)(yz)(2x)$
$= (x \times y) \times (y \times z) \times (2 \times x)$

$= (x \times x) \times (y \times y) \times (z \times z)$

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

$\therefore \underline{ABC} = \underline{x^2y^2z^2}$.

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6. If $P = 4x^2$, $T = 5x$ & $R = 5y$, then $\frac{PTR}{100} = $ ___

Soln:- Here we have $P = 4x^2$, $T = 5x$ & $R = 5y$.

Therefore the product of P, T & R, will be $PTR = (4x^2) \times (5x) \times (5y)$

$$PTR = 100x^3y$$

Hence, $\frac{PTR}{100} = \frac{100x^3y}{100}$

$$\therefore \frac{PTR}{100} = x^3y.$$

7. Write some monomials of your own and find their products.

Soln:- The monomials are:

i] $5x, 6y, 7z$

$\therefore$ Product is $(5x) \times (6y) \times (7z)$

$= 210xyz.$

ii] $3x^2y, 4xy^2, 7x^3y^3$

$\therefore$ Product is $(3x^2y) \times (4xy^2) \times (7x^3y^3)$

$= 84x^6y^6.$

Exercise - 11.2

1. Complete the table :

S.No.	First Expn	Second Expn	Product
1.	$5q$	$p+q-2r$	$5q(p+q-2r) = 5pq + 5q^2 - 10qr$
2.	$kl+lm+mn$	$3k$	
3.	ab^2	$a+b^2+c^3$	
4.	$x-2y+3z$	xyz	—
5.	$a^2bc+b^2cd-abd^2$	$a^2b^2c^2$	

Soln :-

S.No.	First Expn	Second Expn	Product
1.	$5q$	$p+q-2r$	$5q(p+q-2r) = 5pq+5q^2-10qr$
2.	$kl+lm+mn$	$3k$	$3k(kl+lm+mn) = 3k^2l+3klm+3kmn$
3.	ab^2	$a^2+b^2+c^3$	$ab^2(a+b^2+c^3) = a^2b^2+ab^4+ab^2c^3$
4.	$x-2y+3z$	xyz	$xyz(x-2y+3z) = x^2yz-2xy^2z+3xyz^2$
5.	$a^2bc+b^2cd-abd^2$	$a^2b^2c^2$	$a^2b^2c^2(a^2bc+b^2cd-abd^2) =$
			$a^4b^3c^2+a^2b^4c^3d-a^3b^3c^2d^2$

2. Simplify ; $4y(3y+4)$

Soln :- Given expression is,

$$4y(3y+4)$$

Multiplying the factors, we get,

$$= 4y \times 3y + 4y \times 4$$
$$= \underline{12y^2 + 16y}.$$

Hence, $4y(3y+4) = \underline{12y^2+16y}$.

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3. Simplify $x(2x^2-7x+3)$ and find the values of it for (i) $x=1$ & ii) $x=0$

Soln: Given is $x(2x^2-7x+3)$

Here monomial is x & polynomial $2x^2-7x+3$.

By Using distributive law,

We have,

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

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

$$= 2x^3 - 7x^2 + 3x$$

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

Now, i] $x=1$, then;

$$2x^3-7x^2+3x = 2(1)^3-7(1)^2+3(1)$$

$$= -2$$

ii] $x=0$, then,

$$2x^3-7x^2+3x = 2(0)^3-7(0)^2+3(0)$$

$$= 0$$

4. Add the product : $a(a-b)$, $b(b-c)$, $c(c-a)$.

Soln: Here, we have the expressions $a(a-b)$, $b(b-c)$, $c(c-a)$.

By using distributive law, we get

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

Now, we add terms,

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

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

Hence, addition of the product of the above expressions is $a^2 + b^2 + c^2 - ab - bc - ca$

5. Add the product : $x(x+y-z)$, $y(x-y+z)$, $z(x-y-z)$

Soln: Here we have the expressions $x(x+y-z)$, $y(x-y+z)$, $z(x-y-z)$.

Using distributive law, we get

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

By adding these terms,

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

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

Hence, this is the addition.

6. Substract the product of $2x(5x-y)$ from product of $3x(x+2y)$

Soln: We have,

$2x(5x-y)$ & $3x(x+2y)$

By using distributive law,

$2x(5x-y) = 2x(5x)-2x(y) = 10x^2-2xy$

$3x(x+2y) = 3x(x)+3x(2y) = 3x^2+6xy.$

We have to substract these, we get

$(3x^2+6xy)-(10x^2-2xy)$

$= 3x^2+6xy-10x^2+2xy$

$= -7x^2+8xy$

7. Substract $3k(5k - l + 3m)$ from $6k(2k + 3l - 2m)$.

Soln - Given, $3k(5k - l + 3m)$ & $6k(2k + 3l - 2m)$.

By using distributive law, we get

$3k(5k - l + 3m) = 15k^2 - 3kl + 9km$ &

$6k(2k + 3l - 2m) = 12k^2 + 18kl - 12km$

Now, we have to substract, then,

$(12k^2 + 18kl - 12km) - (15k^2 - 3kl + 9km) =$

$= -3k^2 + 21kl - 21k^2m^2$.

8. Simplify : $a^2(a-b+c) + b^2(a+b-c) - c^2(a-b-c)$.

Soln - We have polynomials,

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

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

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

Hence, simplified.

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Exercise - 11.3

1. Multiply the binomials :

i] $2a-9$ & $3a+4$

Soln:- We have,

$2a-9$ & $3a+4$

$\therefore (2a-9)\times(3a+4) = 2a(3a+4) - 9(3a+4)$

$= 6a^2 + 8a - 27a - 36$

$= 6a^2 - 19a - 36.$

$\therefore (2a-9)(3a+4) = 6a^2 - 19a - 36.$

ii) $x-2y$ & $2x-y$

Soln:- We have,

$x-2y$ & $2x-y$

$\therefore (x-2y)\times(2x-y) = x(2x-y) - 2y(2x-y)$

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

$= 2x^2 - 5xy + 2y^2$

$\therefore (x-2y)(2x-y) = 2x^2 - 5xy + 2y^2.$

iii) $kl + lm$ & $k - l$

Soln: We have,

$kl + lm$ & $k - l$

$\therefore (kl + lm) \times (k - l) = kl(k - l) + lm(k - l)$

$= k^2l - kl^2 + klm - l^2m$

$\therefore (kl + lm)(k - l) = \underline{\underline{k^2l - kl^2 + klm - l^2m}}.$

iv) $m^2 - n^2$ & $m + n$

Soln: We have,

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

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

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

$\therefore (m^2 - n^2)(m + n) = \underline{\underline{m^3 + m^2n - n^2m - n^3}}.$

2. Find the product :

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

soln: Given, $(x+y)$ & $(2x-5y+3xy)$

$\therefore (x+y)(2x-5y+3xy) =$

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

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

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

ii] $(a-2b+3c)(ab^2-a^2b)$

soln: Given, $(a-2b+3c)$ & (ab^2-a^2b)

$\therefore (a-2b+3c)(ab^2-a^2b) =$

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

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

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

iii) $(mn - kl + km)(kl - lm)$

Soln: We have, $(mn - kl + km)$ & $(kl - lm)$

$\therefore (mn - kl + km)(kl - lm) = mn(kl - lm) - kl(kl - lm) + km(kl - lm)$

$= klmn - lm^2n - k^2l^2 + kl^2m + k^2ml - klm^2$

$= klmn - k^2l^2 + k^2lm - lm^2n + kl^2m - klm^2.$

iv) $(p^3 + q^3)(p - 5q + 6r)$

Soln: We have, $(p^3 + q^3)$ & $(p - 5q + 6r)$

$\therefore (p^3 + q^3)(p - 5q + 6r) = p^3(p - 5q + 6r) + q^3(p - 5q + 6r)$

$= p^4 - 5p^3q + 6p^3r + q^3p - 5q^4 + 6q^3r$

$= p^4 - 5q^4 - 5p^3q + 6p^3r + pq^3 + 6rq^3.$

3. Simplify the following :

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

Soln:- We have,

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

$= (y-3x)[x-2y-(4x-5y)]+(x+y)(x-3y)$

$= (y-3x)[x-2y-4x+5y]+(x+y)(x-3y)$

$= (y-3x)(3y-3x)+(x+y)(x-3y)$

$= y(3y-3x)-3x(3y-3x)+x(x-3y)+y(x+3y)$

$= 3y^2-3xy-9xy-9x^2+x^2-3xy+xy-3y^2$

$= 10x^2-14xy.$

ii] $(m+n)(m^2-mn+n^2)$

Soln:- We have,

$(m+n)(m^2-mn+n^2) = m(m^2-mn+n^2)+n(m^2-mn+n^2)$

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

$= m^3+n^3$

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iii) $(a-2b+5c)(a-b)-(a-b-c)\cdot(2a+3c)+(6a+b)$
$(2c-3a-5b)$

Soln: We have,

$(a-2b+5c)(a-b)-(a-b-c)(2a+3c)+(6a+b)$
$(2c-3a-5b) =$

$= a(a-2b+5c)-b(a-2ab+5c)-2a(a-b-c)-$
$3c(a-b-c)+6a(2c-3a-5b)+b(2c-3a-5b)$

$= a^2-2ab+5ac-ab+2b^2-5bc-2a^2+2ab+$
$2ac-3ac+3bc+3c^2+12ac-18a^2-30ab$
$+2bc-3ab-5b^2$

$= -19a^2-3b^2-34ab+16ac+3c^2.$

iv) $(pq-qr+pr)(pq+qr)-(pr+pq)(p+q-r)$

Soln: We have,

$(pq-qr+pr)(pq+qr)-(pr+pq)(p+q-r)$

$(pq-qr+pr)+qr(pq-qr+pr)-pr(p+q-r)$

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

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

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

Hence, simplified.

4. If, a, b, c are positive real numbers such that $\frac{a+b-c}{c} = \frac{a-b+c}{b} = \frac{-a+b+c}{a}$,

find the value of $\frac{(a+b)(b+c)(c+a)}{abc}$.

Soln:- We have,

$$\frac{a+b-c}{c} = \frac{a-b+c}{b}$$

$$\therefore \quad b(a+b-c) = c(a-b+c)$$

$$\therefore \quad ab + b^2 - bc = ac - bc + c^2$$

As bc is on both side, it gets substracted

$$\therefore \quad ab + b^2 = ac + c^2$$

$$\therefore \quad ab - ac = c^2 - b^2$$

$$\therefore \quad a(b-c) = (c-b)(c+b)$$

$$\therefore \quad -a(c-b) = (c+b)(c-b)$$

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$\therefore \quad -a = (c+b)$ $\quad$ ($\because$ $(c-b)$ is on both side of division is 1)

$\therefore \quad (b+c) = -a$ ..... (Commutative prop.) —— ①

We have,

$\cancel{a+b}$

$$\frac{a-b+c}{b} = \frac{-a+b+c}{a}$$

$\therefore \quad a(a-b+c) = b(a+b+c)$

$\therefore \quad a^2 - ab + ac = -ab + b^2 + bc$

$\therefore \quad a^2 + ac = b^2 + bc$

$\therefore \quad a^2 - b^2 = bc - ac$

$\therefore \quad (a+b)(a-b) = -c(a-b)$

$\therefore \quad a+b = -c$ —— ②

We have,

$$\frac{a+b-c}{c} = \frac{-a+b+c}{a}$$

$\therefore \quad a(a+b-c) = c(-a+b+c)$

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$\therefore a^2 + ab - ac = -ac + bc + c^2$

$\therefore a^2 + ab = bc + c^2$

$\therefore a^2 - c^2 = bc - ab$

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

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

$\therefore a+c = -b \quad \text{——} \quad (3)$

$\therefore$ from eq (1), (2) & (3),

$\therefore \dfrac{(a+b)(b+c)(c+a)}{abc} = \dfrac{(-c)(-a)(-b)}{abc}$

$= \dfrac{-abc}{abc}$

$= -1$

$\therefore$ Value of $\dfrac{(a+b)(b+c)(c+a)}{abc} = -1$

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Exercise - 11.4

1. select a suitable identity & find the following products.

i) $(3k+4l)(3k+4l)$

Soln: Given, $(3k+4l)$ & $(3k+4l)$

find it in the form of $(a+b)^2$

$\therefore (3k+4l)(3k+4l) = (3k+4l)^2$

$\therefore$ This is in form of $(a+b)^2$.

$\therefore (3k+4l)^2 = (3k)^2 + 2(3k)(4l) + (4l)^2$

$= 9k^2 + 24kl + 16l^2$.

ii) $(ax^2+by^2)(ax^2+by^2)$

Soln: Given, (ax^2+by^2) & (ax^2+by^2)

$\therefore (ax^2+by^2)(ax^2+by^2) = (ax^2+by^2)^2$
is in the form of $(a+b)^2$

$= (ax^2)^2 + 2 \times ax^2 \times by^2 + (by^2)^2$

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

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$= ax^2 \times ax^2 + 2abx^2y^2 + by^2 \times by^2$

$= a^2x^4 + 2abx^2y^2 + b^2y^4$

$\therefore$ Product is $a^2x^4 + 2ab\,x^2y^2 + b^2y^4$.

iii) $(7d-9e)(7d-9e)$

Soln:- Given, $(7d-9e)$ & $(7d-9e)$

$\therefore (7d-9e)(7d-9e) = (7d-9e)^2$ is in the from of $(a-b)^2$.

$= (7d)^2 - 2\times 7d \times 9e + (9e)^2$

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

$= 7d \times 7d - 126de + 9e \times 9e$

$= \underline{49d^2 - 126de + 81e^2}$

iv] $(m^2-n^2)(m^2+n^2)$

Soln:- Given, (m^2-n^2) & (m^2+n^2)

$\therefore (m^2-n^2)(m^2+n^2) =$ is in the from of $(a+b)(a-b)$.

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

$\therefore (m^2+n^2)(m^2-n^2) = (m^2)^2-(n^2)^2$
$= m^4-n^4.$

v] $(3t+9s)(3t-9s)$

soln: We haven, $(3t+9s)$ & $(3t-9s)$

$\therefore (3t+9s)(3t-9s)$ is in the form of $(a+b)(a-b)$.

$\therefore (3t+9s)(3t-9s) = (3t)^2-(9s)^2$

$= 3t\times3t - 9s\times9s$

$= 9t^2-81s^2.$

vi] $(kl-mn)(kl+mn)$

soln: We have, $(kl-mn)(kl+mn)$

$\therefore (kl-mn)(kl+mn) = (kl)^2-(mn)^2$
$[\because (a+b)(a-b) = a^2-b^2]$

$= kl\times kl - mn\times mn$

$= k^2l^2-m^2n^2$

vii] $(6x+5)(6x+6)$

Soln:- We have, $(6x+5)$ & $(6x+6)$

$\therefore (6x+5)(6x+6)$ is in the form of $(ax+b)(ax+c)$.

$\therefore (ax+b)(ax+c) = a^2x^2 + ax(b+c) + bc$

$\therefore (6x+5)(6x+6) = (6)^2x^2 + 6x(5+6) + 5\times6$

$= 36x^2 + 6x(11) + 30$

$= 36x^2 + 66x + 30$

viii) $(2b-a)(2b+c)$

Soln:- Given, $(2b-a)$ & $(2b+c)$,

$\therefore (2b-a)(2b+c)$ is in the form of $(ax-b)(ax+c)$.

$\therefore (ax-b)(ax+c) = a^2x^2 + ax(c-b) - cb$

$\therefore (2b-a)(2b+c) = (2)^2(b)^2 + 2b(c-a) - ca$

$= 4b^2 + 2bc - 2ab - ca$

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2. Evaluate the following by using suitable identities.

i) 304^2

Soln: Given, $304^2 = (300+4)^2$ is in the form of $(a+b)^2$.

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

where, $a = 300$, $b = 4$

$\therefore (300+4)^2 = (300)^2 + 2(300)(4) + (4)^2$

$= 300 \times 300 + 2400 + 4 \times 4$

$= 90,000 + 2400 + 16$

$= \underline{\underline{92416}}$.

ii) 509^2

Soln: Given, $509^2 = (500+9)^2$ is in $(a+b)^2$ form.

where, $a = 500$ & $b = 9$.

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

$\therefore (500+9)^2 = (500)^2 + 2 \times 500 \times 9 + (9)^2$

$= 2,50,000 + 9000 + 81$

$= \underline{259081}$.

iii) 992^2

soln: Given, $992^2 = (1000-8)^2$ is in th form of $(a-b)^2$

where, $a = 1000$, $b = 8$.

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

$\therefore (1000-8)^2 = (1000)^2 - 2 \times 1000 \times 8 + (8)^2$

$= 10,00,000 - 16000 + 64$

$= 10,00,064 - 1600$

$= 9,98,464$.

iv) 799^2

soln: Given, $(799)^2 = (800-1)^2$ in form $(a-b)^2$

where $a = 800$ & $b = 1$

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

$\therefore (800-1)^2 = (800)^2 - 2 \times 800 \times 1 + (1)^2$

$= 6,40,000 - 1600 + 1$

$= 6,38,401$.

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v) 304 × 296

Soln Given 304 × 296 = (300 + 4)(300 − 4) is in the form of (a+b)(a−b)

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

$\therefore (300+4)(300-4) = (300)^2 - (4)^2$

$= 90{,}000 - 16$

$= \underline{89{,}984}$

vi) 83 × 77

Soln- Given, 83 × 77 = (80 + 3)(80 − 3) is in form of (a+b)(a−b)

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

$\therefore (80+3)(80-3) = (80)^2 - (3)^2$

$= 6400 - 9$

$= \underline{6391}$.

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vii) 109×108

Soln:- Given, $109 \times 108 = (100+9)(100+8)$

$= 100^2 + (9+8)100 + 9 \times 8$

$= 10000 + 1700 + 72$

$= \underline{\underline{11,772}}.$

viii) 204×206

Soln:- Given, $204 \times 206 = (205-1)(205+1)$

$= (205)^2 - (1)^2$

$= 42,025 - 1$

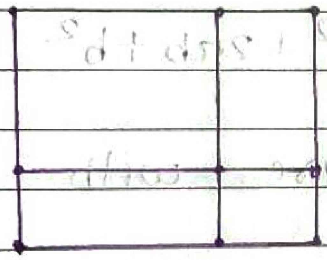
$= \underline{\underline{42,024}}.$

Exercise – 10.5 – 11.5

1. Verify the identity $(a+b)^2 = a^2 + 2ab + b^2$ geometrically by taking

i] $a = 2$ units, $b = 4$ units.

Soln:



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

Draw a square with the side $a+b$ i.e. $2+4$.

L.H.S. of whole square $= (2+4)^2 = (6)^2 = \underline{36}$.

R.H.S. ~~of~~ = Area of square with 2 units + Area of square with 4 units + Area of 2,4 units + Area of square with 4, 2 units.

$= 2^2 + 4^2 + 2 \times 4 + 2 \times 4$

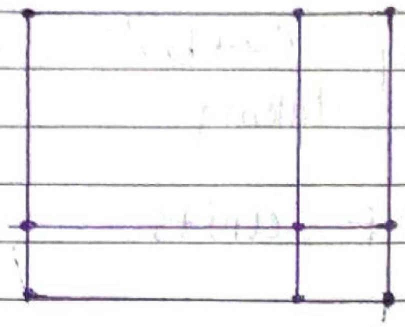
$= 4 + 16 + 8 + 8 = 36$

$\therefore$ L.H.S. = R.H.S.

Hence, identity is verified.

ii) $a = 3$ units , $b = 1$ unit

soln:



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

Draw a square with side $a+b$ i.e., $3+1$

L.H.S. of whole square $= (3+1)^2 = (4)^2 = 16$

R.H.S. = Area of square with 3 units + Area of the square with 1 unit + Area of 3, 1 unit + Area of square with 1, 3 units =

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

$= 9 + 1 + 3 + 3$

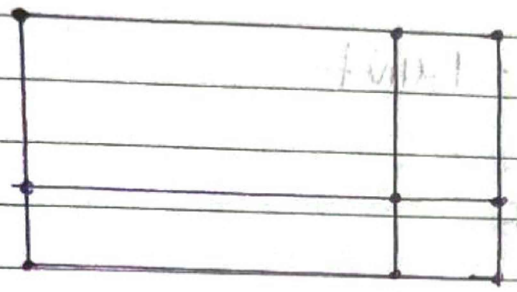
R.H.S. = 16

$\therefore$ L.H.S. = R.H.S.

Hence, the identity is verified.

iii) $a = 5$ units, $b = 2$ unit

Soln.



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

Draw a square with side $a+b$ i.e., $5+2$

L.H.S. of whole square $= (5+2)^2 = (7)^2 = 49$

R.H.S. = Area of square with 5 units + Area of square with 2 units + Area of 5, 2 units + Area of square with 2, 5 units

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

R.H.S. $= 49$

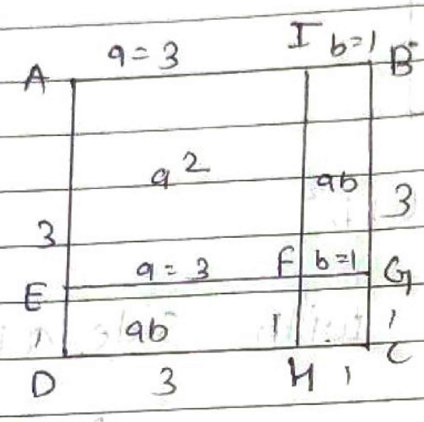
$\therefore$ L.H.S. = R.H.S

Hence, the identity is verified.

2. Verify the identity $(a-b)^2 \equiv a^2 - 2ab + b^2$ geometrically by taking

i) $a = 3$ units, $b = 1$ unit

Soln:



Area of $\square$ AIFE + Area DFGHC = $(a-b)^2$ = $= a^2 - 2ab + b^2$

[Area of AIFE - area of IBGF - Area of EFHD + Area of FGCH]

$= 3 \times 3 - 1 \times 3 - 3 \times 1 + 1 \times 1$

$= 9 - 3 - 3 + 1 = 4$

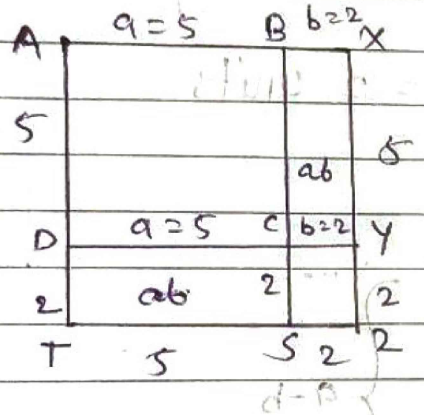
$\therefore (a-b)^2 = 4$ sq. units

$[\because (3-1)^2 = 2^2 = 4]$

Hence verified.

ii) $a = 5$ units, $b = 2$ units

soln:-



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

$\therefore$ Area of $\square ABCD$ + Area of $\square CYZS = a^2 - 2ab + b^2$

$\therefore$ Area of $\square ABCD$ - area of $\square BXYC$ - Area of DCST + area of CYZS

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

$= 25 - 10 - 10 + 4$

$= 9$ sq. unit.

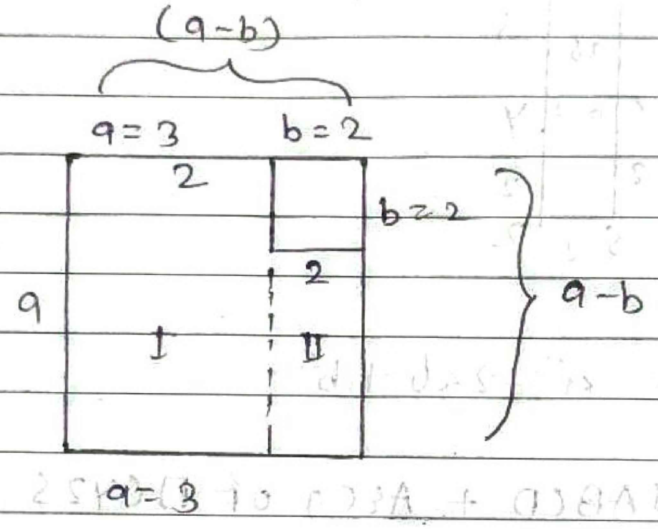
$[\because (5-2)^2 = (3)^2 = 9]$

Hence, Verified.

3. verify the identity $(a+b)\cdot(a-b) = a^2-b^2$. geometrically by taking

i) $a = 3$ units, $b = 2$ units

Soln:-



$a^2-b^2 =$ Area of fig I + Area of fig II

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

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

$= 3\times3 - 2\times2$

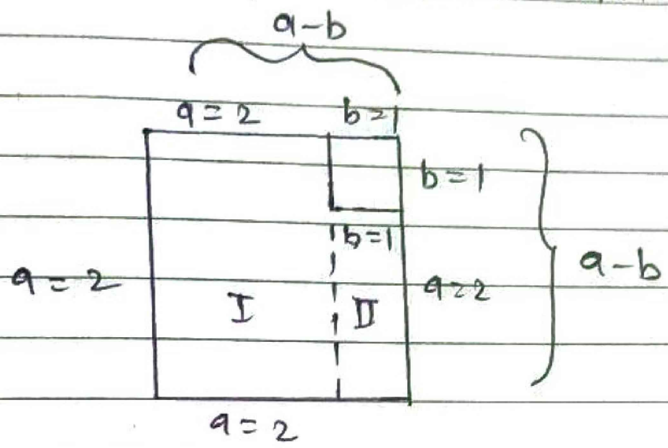
$\therefore a^2-b^2 = 9-4 = 5$ sq. units.

$[\because 3^2-2^2 = 9-4 = 5]$

Hence, verified.

ii) $a = 2$ units, $b = 1$ unit

soln:



$$a^2 - b^2 = \text{Area of fig I} + \text{Area of fig II}$$

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

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

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

$$= 3 \times 1 = 3$$

$\therefore \; a^2 - b^2 = 3$ sq. units

$[\because (2^2 - 1^2) = 4 - 1 = 3]$

Hence, verified.