Algebraic Expressions

Exercise 11.1

Q. 1. A. Find the product of the following pairs:

6, 7k

Answer : Given: 6 and 7k

The product of 6 and 7k is = 6×7k = 42k

Hence the product of 6 and 7k is 42k.

Q. 1. B. Find the product of the following pairs:

−3l, −2m

Answer : Given: -3l and -2m

The product of -3l and -2m is = -3l × -2m = 6lm

Hence the product of -3l and -2m is 6lm.

Q. 1. C. Find the product of the following pairs:

$-5t^2$ $-3t^2$

Answer : Given: $-5t^2$ and $-3t^2$

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

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

$\Rightarrow 15t^4$

Hence the product of $-5t^2$ and $-3t^2$ is $15t^4$.

Q. 1. D. Find the product of the following pairs:

6n, 3m

Answer : Given: 6n and 3m

The product of 6n and 3m

⇒ $6n \times 3m = 18nm$

Hence the product of 6n and 3m is 18nm.

Q. 1. E. Find the product of the following pairs:

$-5p^2$, $-2p$

Answer : Given: $-5p^2$ and $-2p$

The product of $-5p^2$ and $-2p$

⇒$-5p^2 \times -2p = 10(p^2.p)$

⇒$10p^3$

Hence the product of $-5p^2$ and $-2p$ is $10p^3$.

Q. 2. Complete the table of the products.

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

Answer :

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

Here the product is calculated in the following manner:

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

For example, when $-2y^2$ is on the X axis (observe the 1st row 3rd column) and 3x is on the Y axis(2nd row 1st column) then ,the product

Becomes $-2y^2 \times 3x = -6xy^2$(observe the 2nd row 3rd column).

Q. 3. Find the volumes of rectangular boxes with given length, breadth and height in the following table.

S.No.	Length	Breadth	Height	Volume (v) = l×b×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)	$6kl$	$3l^2$	2k2	V = ...
(v)	$3pr$	$2qr$	$4pq$	V = ...

Answer :

S.No.	Length	Breadth	Height	Volume (v) = l×b×h
(i)	$3x$	$4x^2$	5	$V = 3x\times 4x^2\times 5 = 60x^3$
(ii)	$3a^2$	4	$5c$	$V = 3a^2\times4\times5c = 60a^2c$
(iii)	$3m$	$4n$	$2m^2$	$V = 3m\times4n\times2m^2 = 24m^3n$
(iV)	$6kl$	$3l^2$	$2k^2$	$V = 6kl\times3l^2\times2k^2 = 36k^3l^3$
(v)	$3pr$	$2qr$	$4pq$	$V = 3pr\times2qr\times4pq = 24p^2q^2r^2$

Here we have calculated the Volume V using the Length, Breadth and Height.

V = Length × Breadth × Height

Q. 4. A. Find the product of the following monomials

xy, x^2y, xy, x

Answer : Here we have xy,x^2y,xy,x

Hence the product of the above terms is $(xy) \times (x^2y) \times (x) =$

$(x.x^2.x)\ (y.y)$

$= x^4y^2$

Q. 4. B. Find the product of the following monomials

a, b, ab, a^3b, ab^3

Answer : Here we have a,b,ab,a^3b,ab^3

Hence the product of the above terms is $(a)\times(b)\times(ab)\times(a^3b)\times(ab^3)$

$= (a.a.a^3.a)(b.b.b.b^3)$

$= a^6b^6$

Q. 4. C. Find the product of the following monomials

kl, lm, km, klm

Answer : Here we have kl,lm,km,klm

Hence the product of the above terms is $(kl) \times (lm) \times (km) \times (klm)$

$= (k.k.k)\ (l.l.l)\ (m.m.m)$

$= k^3l^3m^3$

Q. 4. D. Find the product of the following monomials

pq ,pqr, r

Answer : Here we have pq,pqr,r

Hence the product of the above terms is $(pq)\times(pqr)\times(r)$

$= (p.p)(q.q)(r.r)$

$= p^2q^2r^2$

Q. 4. E. Find the product of the following monomials

−3a, 4ab, −6c, d

Answer : Here we have -3a,4ab,-6c,d

Hence the product of the above terms is $(-3a) \times (4ab)\times(-6c)\times(d)$

$= (-3\times4\times-6)(a.a)(b)(c)(d)$

$= 72a^2bcd$

Q. 5. If A = xy, B = yz and C = zx, then find ABC = ...

Answer : Here we have A = xy ,B = yz and C = zx.

Therefore the product of A, B and C will be $ABC = (xy)\times(yz)\times(zx) = x^2y^2z^2$.

Q. 6

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

Answer :

Here we have $P = 4x^2$, $T = 5x$ and $R = 5y$.

Therefore the product of P,T and R will be $PTR = (4x^2)\times(5x)\times(5y) = 100x^3y$

Hence $\frac{PTR}{100}$ is equal to $\frac{100x^3y}{100}$ i.e. x^3y.

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

Answer : The monomials are (i) $5x, 6y, 7z$ and (ii) $3x^2y, 4xy^2, 7x^3y^3$

(i) The given monomial is $5x, 6y, 7z$.

Therefore the product of above terms is $(5x) \times (6y)\times(7z) = 210xyz$

(ii) The given monomial is $3x^2y, 4xy^2, 7x^3y^3$.

Therefore the product of above terms is $(3x^2y) \times (4xy^2)\times(7x^3y^3) = 84x^6y^6$

Exercise 11.2

Q. 1. Complete the table:

S.No.	First Expression	Second Expression	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	$a^2bc + b^2cd-abd^2$	$a^2b^2c^2$	………………

Answer :

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

Here we have the First and Second expressions as $5q$ and $p + q-2r$ respectively.

The process involved in the multiplication is :

Step1.Write the product of the expressions using multiplication symbol: $5q \times (p + q-2r)$

Step 2.**Use distributive law** :Multiply the monomial by the first term of the polynomial then multiply the monomial by the second term and then multiply the monomial by the third term of the polynomial and add their products: $5pq + 5q^2 - 10qr$

Step 3.Simplify the terms: $5q^2 + 5pq - 10qr$

2. Similarly, following the above process we calculate

$(kl + lm + mn)(3k)$

$= (3k)(kl) + (3k)(lm) + (3k)(mn)$

$= 3k^2l + 3klm + 3kmn$

3. Similarly, following the above process we calculate

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

4. Similarly, following the above process we calculate

$(x-2y + 3z)(xyz) = (x-2y + 3z)\times(xyz) = x^2yz-2xy^2z + 3xyz^2$

5. Similarly, following the above process we calculate

$(a^2bc + b^2cd-abd^2)(a^2b^2c^2) = (a^2bc + b^2cd- abd^2)\times(a^2b^2c^2) = a^4b^3c^3 + a^2b^4c^3d-a^3b^3c^2d^2$

Q. 2. Simplify: 4y(3y + 4)

Answer : Here we have 4y and 3y + 4.

Now the product of these terms is as follows:

The procedure involved in the multiplication is :

Step1.Write the product of the expressions using multiplication symbol: 4y(3y + 4).

Step2.**Use distributive law** :Multiply the monomial by the first term of the binomial then multiply the monomial by the second term of the binomial and then add their products: 4y(3y) + 4y(4)

Step3.Simplify the terms: $12y^2 + 16y$

Hence $4y(3y + 4) = 12y^2 + 16y$

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

Answer : Here we have the monomial x and polynomial $2x^2-7x + 3$

Now the product of these terms is as follows:

The process involved in the multiplication is :

Step1.Write the product of the expressions using multiplication symbol:

$x(2x^2-7x + 3)$.

Step2.**Use distributive law** :Multiply the monomial by the first term of the trinomial then multiply the monomial by the second term of the trinomial and then the monomial by the third term of the trinomial and then add their products: $x(2x^2)-x(7x) + x(3)$

Step3.Simplify the terms: $2x^3-7x^2 + 3x$

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

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

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

Q. 4. Add the product: a(a−b), b(b−c), c(c−a)

Answer : Here we have the expressions a(a-b),b(b-c) and c(c-a)

Using the **distributive law** $a(a-b) = a^2-ab$,$b(b-c) = b^2-bc$ and $c(c-a) = c^2-ca$

Now we add the 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 $a^2 + b^2 + c^2-ab-bc-ca$.

Q. 5. Add the product: x(x + y−r), y(x−y + r), z(x−y−z)

Answer : Here we have the expressions x(x + y-r),y(x-y + r) and z(x-y-z)

Using the **distributive law** x(x + y-r)

$= x^2 + xy-xr$,

y(x-y + r)

$= xy-y^2 + yr$ and

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

Now we add these terms $(x^2 + xy - xr) + (xy - y^2 + yr) + (xz - yz - z^2)$

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

Hence addition of the product of the above expressions is $x^2 - y^2 - z^2 + 2xy - xr + yr + xz - yz$.

Q. 6. Subtract the product of 2x(5x−y) from product of 3x(x + 2y)

Answer : Here we have $2x(5x-y)$ and $3x(x + 2y)$

Using the **distributive law** $2x(5x-y) = 2x(5x) - 2x(y)$

$= 10x^2 - 2xy$

And $3x(x + 2y)$

$= 3x(x) + 3x(2y)$

$= 3x^2 + 6xy$.

Now , we have to subtract $10x^2 - 2xy$ from $3x^2 + 6xy$.

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

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

$= -7x^2 + 8xy$

Hence after subtraction of the product of $2x(5x-y)$ from the product of $3x(x + 2y)$ is

$-7x^2 + 8xy$.

Q. 7. Subtract 3k(5k−l + 3m) from 6k(2k + 3l−2m)

Answer : Here we have $3k(5k-l + 3m)$ and $6k(2k + 3l-2m)$

Using the **distributive law** $3k(5k-l + 3m) = 15k^2 - 3kl + 9km$

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

Now, we have to subtract $15k^2 - 3kl + 9km$ from $12k^2 + 18kl - 12km$.

i.e. $(12k^2 + 18kl - 12km) - (15k^2 - 3kl + 9km) = -3k^2 + 21kl - 21k^2m^2$

Hence after subtraction of the product of 3k(5k−l + 3m) from the product of 6k(2k + 3l−2m) is = $-3k^2 + 21kl - 21k^2m^2$

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

Answer : Here we have the polynomials as $a^2(a-b+c)$, $b^2(a+b-c)$ and $c^2(a-b-c)$

Now using the **distributive law**, $a^2(a-b+c) = a^2(a) - a^2(b) + a^2(c) = a^3 - a^2b + a^2c$

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

Now we will simplify it, $a^2(a-b+c) + b^2(a+b-c) - c^2(a-b-c) = (a^3 - a^2b + a^2c) + (ab^2 + b^3 - b^2c) - (c^2a - c^2b - c^3) = a^3 - a^2b + a^2c + ab^2 + b^3 - b^2c - c^2a + c^2b + c^3 = a^3 + b^3 + c^3 - a^2b + a^2c + ab^2 - b^2c - c^2a + c^2b$

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

Exercise 11.3

Q. 1. A. Multiply the binomials:

2a−9 and 3a + 4

Answer : Consider two binomials as 2a−9 and 3a + 4

Now, to get the product of two binomials 2a−9 and 3a + 4 we use the

Distributive law i.e. $(2a-9)\times(3a+4) = 2a(3a) + 2a(4) - 9(3a) - 9(4) = 6a^2 + 8a - 27a - 36 = 6a^2 - 19a - 36$

Therefore, the product of 2a−9 and 3a + 4 is $6a^2 - 19a - 36$.

Q. 1. B. Multiply the binomials:

x−2y and 2x−y

Answer : Consider two binomials as x−2y and 2x−y

Now, to get the product of two binomials x−2y and 2x−y we use the

Distributive law i.e. $(x-2y)\times(2x-y) = x(2x) - x(y) - 2y(2x) - 2y(-y) = 2x^2 - xy - 4xy + 4y^2$

Therefore, the product of x−2y and 2x−y is $2x^2 + 4y^2 - 5xy$.

Q. 1. C. Multiply the binomials:

kl + lm and k−l

Answer : Consider two binomials as kl + lm and k-l

Now, to get the product of two binomials kl + lm and k-l we use the

Distributive law i.e. $(kl + lm)\times(k-l) = kl(k) + kl(-l) + lm(k) + lm(-l) = k^2l-kl^2 + klm-l^2m$

Therefore, the product of (kl + lm) and (k-l) is $k^2l-kl^2 + klm-l^2m$

Q. 1. D. Multiply the binomials:

m^2-n^2 and m + n

Answer : Consider two binomials as m^2-n^2 and m + n

Now, to get the product of two binomials) m^2-n^2 and m + n we use the

Distributive law i.e. $(m^2-n^2)\times(m + n) = m^2(m) + m^2(n)-n^2(m)-n^2(n) =$

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

Therefore, the product of m^2-n^2 and m + n is $m^3 + m^2n-mn^2-n^3$.

Q. 2. A. Find the product:

(x + y)(2x−5y + 3xy)

Answer : Consider the binomial x + y and the trinomial 2x−5y + 3xy.

Now, to get the product of above expressions x + y and 2x−5y + 3xy,we use the

Distributive law i.e $(x + y)\times(2x-5y + 3xy) = x(2x-5y + 3xy) + y(2x-5y + 3xy)$

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

Therefore, the product of x + y and 2x−5y + 3xy is $2x^2-5y^2 + 3x^2y + 3xy^2-5xy$

Q. 2. B. Find the product:

(mn−kl + km) (kl−lm)

Answer : Consider the trinomial mn−kl + km and the binomial kl−lm.

Now, to get the product of $mn-kl + km$ and $kl-lm$,we use the

Distributive law i.e. $(mn-kl + km)\times(kl-lm) = mn(kl-lm)-kl(kl-lm) + km(-lm)$

$= mnkl-m^2nl-k^2l^2 + kl^2m + kml-klm^2$

Therefore, the product of $mn-kl + km$ and $kl-lm$ is $mnkl-m^2nl-k^2l^2 + kl^2m + kml-klm^2$

Q. 2. C. Find the product:

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

Answer : Consider the trinomial $a-2b + 3c$ and the binomial ab^2-a^2b.

Now, to get the product of $a-2b + 3c$ and ab^2-a^2b,we use the

Distributive law i.e. $(a-2b + 3c)\times(ab^2-a^2b) = a(ab^2-a^2b)-2b(ab^2-a^2b) + 3c(ab^2-a^2b)$

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

Therefore, the product of $a-2b + 3c$ and ab^2-a^2b is $3a^2b^2-a^3b-2ab^3 + 3ab^2c-3a^2bc$

Q. 2. D. Find the product:

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

Answer : Consider the binomial $p^3 + q^3$ and the trinomial $p-5q + 6r$.

Now, to get the product of $p^3 + q^3$ and $p-5q + 6r$, we use the

Distributive law i.e $(p^3 + q^3)(p-5q + 6r) = p^3(p-5q + 6r) + q^3(p-5q + 6r) = (p^3.p-5p^3q + p^3.6r) + (p.q^3-5q.q^3 + 6q^3r) = p^4-5p^3q + 6p^3r + pq^3-5q^4 + 6q^3r$

Therefore, the product of $p^3 + q^3$and $p-5q + 6r$ is $p^4-5p^3q + 6p^3r + pq^3-5q^4 + 6q^3r$

Q. 3. A. Simplify the following:

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

Answer : Here we have $(x-2y)(y-3x) + (x + y)(x-3y)-(y-3x)(4x-5y)$
Re-arranging, we get,$(x - 2y)(y - 3x) - (y - 3x)(4x - 5y) + (x + y)(x - 3y)= (y - 3x)[(x - 2y) - (4x - 5y)] + (x + y)(x - 3y)= (y - 3x)(-3x + 3y) + (x + y)(x - 3y)= - 3 (y - 3x)(x - y) + (x + y)(x - 3y)= -3 (xy - y^2 - 3x^2 + 3xy) + x^2 - 3xy + xy - 3y^2$
$= 9x^2 + 3y^2 - 12xy + x^2 - 3y^2 - 2xy$
$= 10x^2 - 14xy$

Q. 3. B. Simplify the following:

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

Answer : We have the binomial m + n and trinomial $m^2 - mn + n^2$

Here we will use the **distributive law** as follows:

$(m + n)(m^2 - mn + n^2) = m(m^2 - mn + n^2) + n(m^2 - mn + n^2) = (m.m^2 - m.mn + m.n^2) + (n.m^2 - mn.n + n.n^2) = m^3 - m^2n + mn^2 + m^2n - mn^2 + n^3 = m^3 + n^3$

Hence, $(m + n)(m^2 - mn + n^2) = m^3 + n^3$

Q. 3. C. Simplify the following:

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

Answer : We have $(a-2b + 5c)(a-b) - (a-b-c)(2a + 3c) + (6a + b)(2c-3a-5b)$

Here, $(a-2b + 5c)(a-b) = (a-b)(a-2b + 5c)$(using **Commutative law**)

$= a(a-2b + 5c)-b(a-2b + 5c)$(using **distributive law**)

$= a^2-2ab + 5ac-ab + 2b^2-5bc = a^2 + 2b^2-3ab + 5ac-5bc$

$(a-b-c)(2a + 3c) = (2a + 3c)(a-b-c)$ (using **Commutative law**)

$= 2a(a-b-c) + 3c(a-b-c)$ (using **distributive law**)

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

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

And $(6a + b)(2c-3a-5b) = 6a(2c-3a-5b) + b(2c-3a-5b) = 12ac-18a^2-30ab + 2bc-3ab-5b^2 = -18a^2 + 5b^2-33ab + 2bc + 12ac$

Therefore, $a-2b + 5c)(a-b) - (a-b-c)(2a + 3c) + (6a + b)(2c-3a-5b) = a^2 + 2b^2-3ab + 5ac-5bc-(2a^2 + ac-2ab-3bc-3c^2) + (-18a^2 + 5b^2-33ab + 2bc + 12ac) =$

$a^2 + 2b^2-3ab + 5ac-5bc-2a^2-2ac + 2ab + 3bc + 3c^2-18a^2 + 5b^2-33ab + 2bc + 12ac =$

$= -19a^2 + 7b^2 + 3c^2-34ab + 15ac$

Q. 3. D. Simplify the following:

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

Answer : We have , $(pq-qr + pr)(pq + qr)-(pr + pq)(p + q-r)$

$(pq-qr + pr)(pq + qr) = (pq + qr)(pq-qr + pr)$ (using **Commutative law**)

$= pq(pq-qr + pr) + qr(pq-qr + pr)$ (using **distributive law**)

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

$(pr + pq)(p + q-r) = pr(p + q-r) + pq(p + q-r)$ (using **distributive law**)

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

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

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

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

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

Q. 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 $\frac{(a+b)(b+c)(c+a)}{abc}$

Answer :

Given:

$\frac{a+b-c}{c} = \frac{a-b+c}{b} = \frac{-a+b+c}{a}$, where a, b, c are positive real numbers

Here, we have $\frac{a+b-c}{c} = \frac{a-b+c}{b}$

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

$\Rightarrow ab + b^2 - bc = ac - bc + c^2$(bc is on both the sides and they get subtracted)

$\Rightarrow ab + b^2 = ac + c^2$

$\Rightarrow ab - ac = c^2 - b^2$

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

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

$\Rightarrow -a = (c + b)$[Here (c-b) is on both the sides, so when they get divided and the result is 1]

$\Rightarrow (b + c) = -a$(**commutative property**)

We have , $\frac{a-b+c}{b} = \frac{-a+b+c}{a}$

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

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

$\Rightarrow a^2 + ac = b^2 + bc$

$\Rightarrow a^2 - b^2 = bc - ac$

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

$\Rightarrow a + b = -c$

We have, $\frac{a+b-c}{c} = \frac{-a+b+c}{a}$

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

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

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

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

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

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

$\Rightarrow a + c = -b$

Therefore, $\frac{(a+b)(b+c)(c+a)}{abc} = \frac{(-c)(-a)(-b)}{abc} = \frac{-abc}{abc} = -1$ (Here we have substituted the values of (a + b),(b + c),(c + a) from above evaluation)

Exercise 11.4

Q. 1. A. Select a suitable identity and find the following products

(3k + 4l) (3k + 4l)

Answer : Given: (3k + 4l) (3k + 4l),it is a product of 2 binomial expressions which have the same terms 3k + 4l and 3k + 4l.

Now when we compare these expressions with the identities, we find it in the form of $(a + b)^2$,where a = 3k and b = 4l,

The identity $(a + b)^2 = a^2 + 2ab + b^2$,

Hence, $(3k + 4l)(3k + 4l) = (3k + 4l)^2 = (3k)^2 + 2(3k)(4l) + (4l)^2 = 9k^2 + 24kl + 16l^2$

Q. 1. B. Select a suitable identity and find the following products

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

Answer : Given: $(ax^2 + by^2)(ax^2 + by^2)$,it is a product of 2 binomial expressions which have the same terms $ax^2 + by^2$ and $ax^2 + by^2$.

Now when we compare these expressions with the identities, we

find it in the form of $(a + b)^2$,where $a = ax^2$ and $b = by^2$,

The identity $(a + b)^2 = a^2 + 2ab + b^2$,

Hence, $(ax^2 + by^2)(ax^2 + by^2) = (ax^2 + by^2)^2 = (ax^2)^2 + 2(ax^2)(by^2) + (by^2)^2$

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

Q. 1. C. Select a suitable identity and find the following products

(7d – 9e) (7d – 9e)

Answer : Given: (7d – 9e) (7d – 9e),it is a product of 2 binomial expressions which have the same terms 7d – 9e and 7d – 9e.

Now when we compare these expressions with the identities, we

find it in the form of $(a-b)^2$,where a = 7d and b = 9e,

The identity $(a-b)^2 = a^2-2ab + b^2$,

Hence, $(7d – 9e) (7d – 9e) = (7d-9e)^2 = (7d)^2-2(7d)(9e) + (9e)^2 = 49d^2-126de + 81e^2$

Q. 1. D. Select a suitable identity and find the following products

$(m^2 – n^2) (m^2 + n^2)$

Answer : Given:($m^2 – n^2$) ($m^2 + n^2$),it is a product of 2 binomial expressions which have the terms ($m^2 – n^2$) and ($m^2 + n^2$).

Now when we compare these expressions with the identities, we

find it in the form of (a-b)(a + b),where a = m^2 and b = n^2,

The identity $(a-b)(a + b) = a^2-b^2$,

Hence, $(m^2 – n^2) (m^2 + n^2) = (m^2)^2-(n^2)^2 = m^4-n^4$

Q. 1. E. Select a suitable identity and find the following products

(3t + 9s) (3t – 9s)

Answer : Given:(3t + 9s) (3t – 9s),it is a product of 2 binomial expressions which have the terms :(3t + 9s) and (3t – 9s).

Now when we compare these expressions with the identities, we

find it in the form of (a-b)(a + b),where a = 3t and b = 9s,

The identity $(a-b)(a + b) = a^2-b^2$,

Hence, $(3t + 9s) (3t – 9s) = (3t)^2-(9s)^2 = 9t^2-81s^2$

Q. 1. F. Select a suitable identity and find the following products

(kl – mn) (kl + mn)

Answer : Given:(kl – mn) (kl + mn),it is a product of 2 binomial expressions which have the terms :(kl – mn) and (kl + mn).

Now when we compare these expressions with the identities, we find it in the form of (a-b)(a + b),where a = kl and b = mn,

The identity $(a-b)(a + b) = a^2-b^2$,

Hence, $(kl – mn) (kl + mn) = (kl)^2-(mn)^2$

Q. 1. G. Select a suitable identity and find the following products

(6x + 5) (6x + 6)

Answer : Given:(6x + 5) (6x + 6),it is a product of 2 binomial expressions which have the terms (6x + 5) and (6x + 6).

Now when we compare these expressions with the identities, we find it in the form of (x + a)(x + b),where x = 6x and a = 5 and b = 6,

Thus,$(x + a)(x + b) = x^2 + x(b + a) + ab$

Hence, $(6x + 5) (6x + 6) = (6x)^2 + 6x(5 + 6) + 30 = 12x^2 + 66x + 30$

Q. 1. H. Select a suitable identity and find the following products

(2b – a) (2b + c)

Answer : Given: (2b – a) (2b + c),it is a product of 2 binomial expressions which have the terms (2b – a) (2b + c).

Now when we compare these expressions with the identities, we

find it in the form of (x-a)(x + b),where x = 2b and a = a and b = c,

Thus,$(x-a)(x + b) = x^2 + bx-ax-ab = x^2 + x(b-a)-ab$

Hence, $(2b – a) (2b + c) = (2b)^2 + 2b(c-a)-ac = 4b^2 + 2b(c-a)-ac$

Q. 2. A. Evaluate the following by using suitable identities:

304^2

Answer : Given:$304^2 = (300 + 4)^2 = (300)^2 + 2(300)(4) + (4)^2$

= 90000 + 2400 + 16, where a = 300 and b = 4 in the identity $(a + b)^2 = a^2 + 2ab + b^2$

= 92416

Q. 2. B. Evaluate the following by using suitable identities:

509^2

Answer : Given: $509^2 = (500 + 9)^2 = (500)^2 + 2(500)(9) + (9)^2$

$= 2500 + 9000 + 81$, where a = 500 and b = 9 in the identity $(a + b)^2 = a^2 + 2ab + b^2$

$= 11581$

Q. 2. C. Evaluate the following by using suitable identities:

992^2

Answer : Given: $992^2 = (900 + 2)^2 = (900)^2 + 2(900)(2) + (2)^2$

$= 8100 + 3600 + 4$, where a = 900 and b = 2 in the identity $(a + b)^2 = a^2 + 2ab + b^2$

$= 11704$

Q. 2. D. Evaluate the following by using suitable identities:

799^2

Answer : Given: $799^2 = (800-1)^2 = (800)^2-2(800)(1) + (1)^2$

$= 6400 + 1600 + 1$, where a = 800 and b = 1 in the identity $(a-b)^2 = a^2-2ab + b^2$

$= 8001$

Q. 2. E. Evaluate the following by using suitable identities:

304 × 296

Answer : Given: $304\times296 = (300 + 4)(300-4)$

$= (300)^2-(4)^2$, where a = 300 and b = 4 in identity $(a + b)(a-b) = a^2-b^2$

$= 90000-16 = 89984$

Q. 2. F. Evaluate the following by using suitable identities:

83 × 77

Answer : Given:$83\times77 = (80 + 3)(80-3)$

$= (80)^2-(3)^2$, where a = 80 and b = 3 in identity $(a + b)(a-b) = a^2-b^2$

$= 6400-9 = 6391$

Q. 2. G. Evaluate the following by using suitable identities:

109×108

Answer : Given:$109×108 = (100 + 9)(100 + 8)$

$= (100)^2 + (9 + 8)100 + (9×8)$,

Where x = 100,a = 9 and b = 8 in identity $(x + a)(x + b) = x^2 + (a + b)x + ab$

$= 10000 + 1700 + 72$

$= 11772$

Q. 2. H. Evaluate the following by using suitable identities:

204×206

Answer : Given: $(200 + 4)(200 + 6)$

$= (200)^2 + (4 + 6)200 + (4×6)$,

Where x = 200,a = 4,b = 6 in identity $(x + a)(x + b) = x^2 + (a + b)x + ab$

$= 40000 + 2000 + 24$

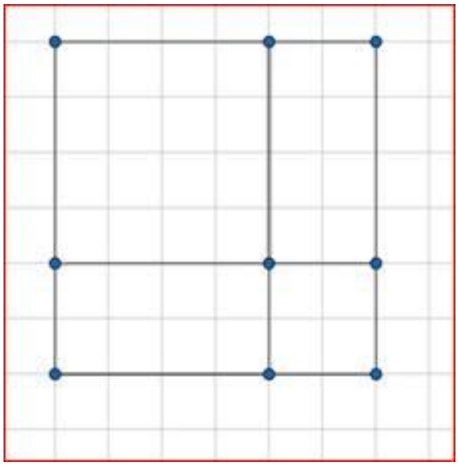
$= 42024$

Exercise 11.5

Q. 1 A. Verify the identity $(a + b)^2 \equiv a^2 + 2ab + b^2$ geometrically by taking

a = 2 units, b = 4 units

Answer :



$(a + b)^2 \equiv a^2 + 2ab + b^2$

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

L.H.S of the whole square = $(2 + 4)^2 = (6)^2 = 36$

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

Area of the 2,4 units + Area of the square with 4 ,2 units = $2^2 + 4^2 + 2\times4 + 2\times4 = 4 + 16 + 8 + 8 = 36$

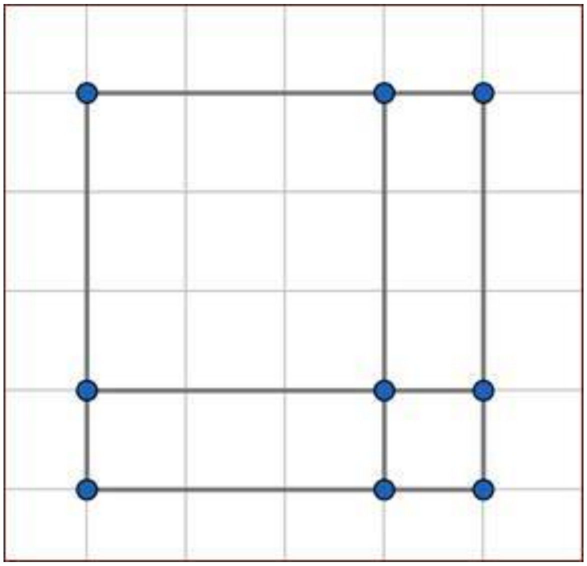
L.H.S = R.H.S

Hence, the identity is verified.

Q. 1. B. Verify the identity $(a + b)^2 \equiv a^2 + 2ab + b^2$ geometrically by taking

a = 3 units, b = 1 unit

Answer :



$(a + b)^2 \Xi a^2 + 2ab + b^2$

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

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

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

Area of the 3,1 unit + Area of the square with 1 ,3 units = $3^2 + 1^2 + 3\times1 + 1\times3 = 9 + 1 + 3 + 3 = 16$

L.H.S = R.H.S

Hence, the identity is verified.

Q. 1. C. Verify the identity $(a + b)^2 \equiv a^2 + 2ab + b^2$ geometrically by taking

a = 5 units, b = 2 unit

Answer :

$(a + b)^2 \equiv a^2 + 2ab + b^2$

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

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

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

Area of the 5,2 units + Area of the square with 2 ,5 units = $5^2 + 2^2 + 5\times2 + 2\times5 = 49$

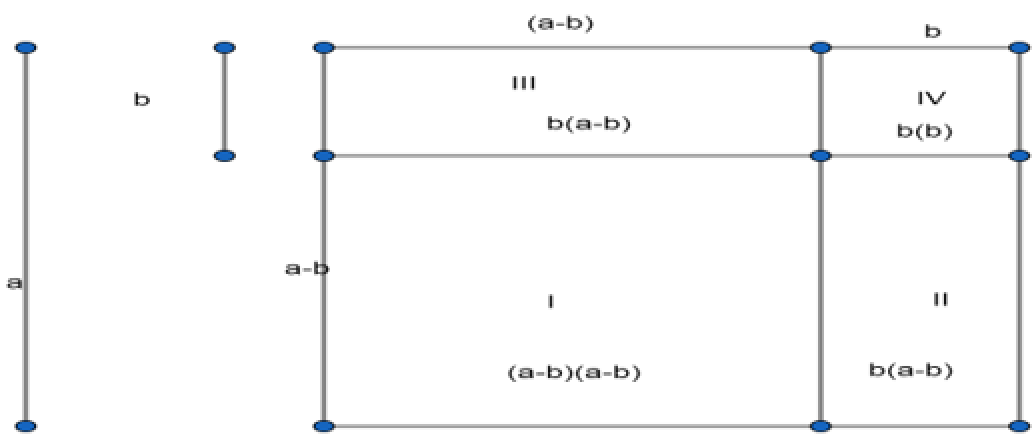
L.H.S = R.H.S

Hence, the identity is verified.

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

a = 3 units, b = 1 unit

Answer :



$(a - b)^2 \equiv a^2 - 2ab + b^2$

Consider a square with side a.i.e.a = 3

The square is divided into 4 regions.

It consists of 2 squares with sides a-b and b respectively and 2 rectangles with length and breadth as ‘a-b’ and ‘b’ respectively.

Here a = 3 and b = 1.Therefore the 2 squares consist of sides ‘3-1’ and ‘1’ respectively and 2 rectangles with length and breadth as ‘3-1’ and ‘1’ respectively.

Now area of figure I = Area of whole square with side ‘a’ i.e.3 units-Area of figure II

-Area of figure III –Area of figure IV

L.H.S of area of figure I = (3-1)(3-1) = 2(2) = 4 units

R.H.S = Area of whole square with side 3 units-Area of figure II with 1,(3-1)units

-Area of figure III with 1,(3-1) units –Area of figure IV with 1,1 unit = 3^2-(1×(3-1))-

(1×(3-1))-(1×1) = 4 units

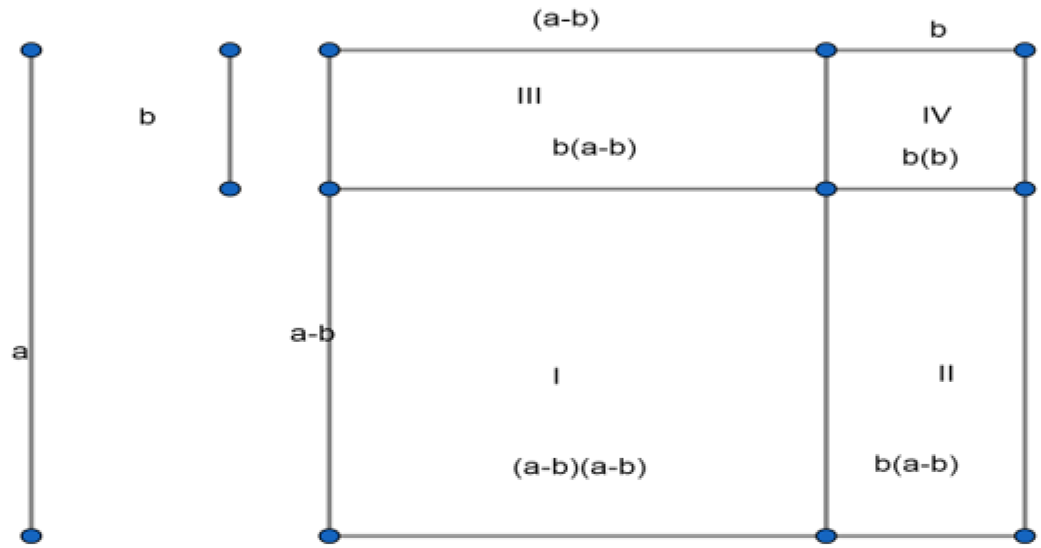
L.H.S = R.H.S

Hence, the identity is verified.

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

a = 5 units, b = 2 units

Answer :



$(a - b)^2 \equiv a^2 - 2ab + b^2$

Consider a square with side a.i.e.a = 5

The square is divided into 4 regions.

It consists of 2 squares with sides a-b and b respectively and 2 rectangles with length and breadth as ‘a-b’ and ‘b’ respectively.

Here a = 5 and b = 2.Therefore the 2 squares consist of sides ‘5-2’ and ‘2’ respectively and 2 rectangles with length and breadth as ‘5-2’ and ‘2’ respectively.

Now area of figure I = Area of whole square with side ‘a’ i.e.5 units-Area of figure II

-Area of figure III –Area of figure IV

L.H.S of area of figure I = (5-2)(5-2) = 3(3) = 9 units

R.H.S = Area of whole square with side 5 units-Area of figure II with 2,(5-2)units

-Area of figure III with 2,(5-2) units –Area of figure IV with 2,2 units = 25-(2×3)-

$(2\times3)-2^2 = 25-6-6-4 = 9$ units

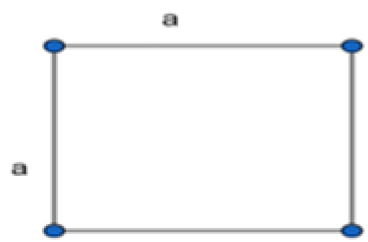
L.H.S = R.H.S

Hence, the identity is verified.

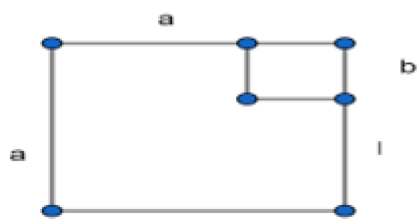
Q. 3. A. Verify the identity (a + b) (a – b) ≡ $a^2 - b^2$ geometrically by taking

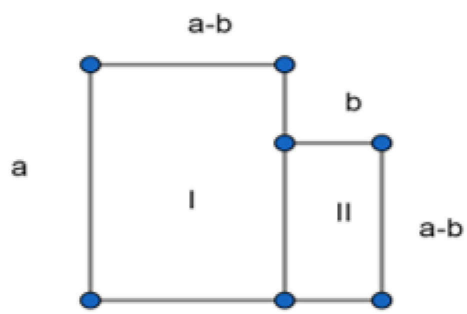
a = 3 units, b = 2 units

Answer : Remove square from this whose side is ‘b’.(b<a)



Consider a square with side ‘a’.





We get the above figure by removing the square with side ‘b’.It consists of 2 parts

I and II.

So a^2-b^2 = Area of figure I + Area of figure II = a(a-b) + b(a-b) = (a-b)(a + b)

Thus a^2-b^2 = (a-b)(a + b).

Here a = 3 units and b = 2 units

So, L.H.S = a^2-b^2 = 3^2-2^2 = 5 units

R.H.S = (a-b)(a + b) = (3-2)(3 + 2) = 1(5) = 5 units

Therefore L.H.S = R.H.S

Hence, the identity is verified.

Q. 3. B. Verify the identity (a + b) (a – b) ≡ $a^2 - b^2$ geometrically by taking

a = 2 units, b = 1 unit

Answer : Refer the above figure.

Here a^2-b^2 = Area of figure I + Area of figure II = a(a-b) + b(a-b) = (a-b)(a + b)

Thus a^2-b^2 = (a-b)(a + b).

Here a = 2 units and b = 1 units

So, L.H.S = a^2-b^2 = 2^2-1^2 = 3 units

R.H.S = (a-b)(a + b) = (2-1)(2 + 1) = 3 units

Therefore L.H.S = R.H.S

Hence, the identity is verified.