NCERT solutions for class 9 Maths Polynomials Ex 2.5

Q1. Use suitable identities to find the following products:

(i) $(x+4)(x+10)$

(ii) $(x+8)(x-10)$

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

(iv) $\left(y^2+\frac{3}{2}\right)\left(y^2-\frac{3}{2}\right)$

(v) $(3-2x)(3+2x)$

Ans: (i) $(x+4)(x+10)$

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

We need to apply the above identity to find the product $(x+4)(x+10)$

$(x+4)(x+10)=x^2+(4+10)x+(4\times 10)$

$=x^2+14x+40$

Therefore, we conclude that the product $(x+4)(x+10)$ is $x^2+14x+40$.

(ii) $(x+8)(x-10)$

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

We need to apply the above identity to find the product $(x+8)(x-10)$

$(x+8)(x-10)=x^2+[8+(-10)]x+[8\times(-10)]$

$=x^2-2x-80.$

Therefore, we conclude that the product $(x+8)(x-10)$ is $x^2-2x-80$.

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

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

We need to apply the above identity to find the product $(3x+4)(3x-5)$

$(3x+4)(3x-5)=(3x)^2+[4+(-5)]3x+[4\times(-5)]$

$=9x^2-3x-20.$

Therefore, we conclude that the product $(3x+4)(3x-5)$ is $9x^2-3x-20$.

(iv) $\left(y^2+\frac{3}{2}\right)\left(y^2-\frac{3}{2}\right)$

We know that $(x+y)(x-y)=x^2-y^2$.

We need to apply the above identity to find the product $\left(y^2+\frac{3}{2}\right)\left(y^2-\frac{3}{2}\right)$

$\left(y^2+\frac{3}{2}\right)\left(y^2-\frac{3}{2}\right)$

$=\left(y^2\right)^2-\left(\frac{3}{2}\right)^2=y^4-\frac{9}{4}.$

Therefore, we conclude that the product $\left(y^2+\frac{3}{2}\right)\left(y^2-\frac{3}{2}\right)$ is $\left(y^4-\frac{9}{4}\right)$.

(v) $(3+2x)(3-2x)$

We know that $(x+y)(x-y)=x^2-y^2$.

We need to apply the above identity to find the product $(3+2x)(3-2x)$

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

$=9-4x^2.$

Therefore, we conclude that the product $(3+2x)(3-2x)$ is $\left(9-4x^2\right)$.

Q2. Evaluate the following products without multiplying directly:

(i) 103×107

(ii) 98×96

(iii) 104×96

Ans: (i) 103×107

103×107 can also be written as $(100+3)(100+7)$.

We can observe that, we can apply the identity $(x+a)(x+b)=x^2+(a+b)x+ab$

$(100+3)(100+7)=(100)^2+(3+7)(100)+3\times7$

=10000+1000+21

=11021

Therefore, we conclude that the value of the product 103×107 is 11021.

(ii) 95×96

95×96 can also be written as $(100-5)(100-4)$

We can observe that, we can apply the identity $(x+a)(x+b)=x^2+(a+b)x+ab$

$(100-5)(100-4)=$

$(100)^2+[(-5)+(-4)](100)+(-5)\times(-4)$

=10000-900+20

=9120

Therefore, we conclude that the value of the product 95×96 is 9120.

(iii) 104×96

104×96 can also be written as $(100+4)(100-4)$.

We can observe that, we can apply the identity $(x+y)(x-y)=x^2-y^2$ with respect to the expression $(100+4)(100-4)$, to get

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

=10000-16

=9984

Therefore, we conclude that the value of the product 104×96 is 9984.

Q3. Factorize the following using appropriate identities:

(i) $9x^2+6xy+y^2$

(ii) $4y^2-4y+1$

(iii) $x^2-\frac{y^2}{100}$

Ans: (i) $9x^2+6xy+y^2$

$9x^2+6xy+y^2=(3x)^2+2\times 3x\times y+(y)^2$

We can observe that, we can apply the identity $(x+y)^2=x^2+2xy+y^2$

$\Rightarrow (3x)^2+2\times 3x\times y+(y)^2=(3x+y)^2$.

(ii) $4y^2-4y+1$

$4y^2-4y+1=(2y)^2-2\times 2y\times 1+(1)^2$

We can observe that, we can apply the identity $(x-y)^2=x^2-2xy+y^2$

$\Rightarrow (2y)^2-2\times 2y\times 1+(1)^2=(2y-1)^2$.

(iii) $x^2-\frac{y^2}{100}$

We can observe that, we can apply the identity $(x)^2-(y)^2=(x+y)(x-y)$

$\Rightarrow (x)^2-\left(\frac{y}{10}\right)^2=\left(x+\frac{y}{10}\right)\left(x-\frac{y}{10}\right)$.

Q4. Expand each of the following, using suitable identities:

(i) $(x+2y+4z)^2$

(ii) $(2x-y+z)^2$

(iii) $(-2x+3y+2z)^2$

(iv) $(3a-7b-c)^2$

(v) $(-2x+5y-3z)^2$

(vi) $\left(\frac{1}{4}a-\frac{1}{2}b+1\right)^2$

Ans: (i) $(x+2y+4z)^2$

We know that $(x+y+z)^2=x^2+y^2+z^2+2xy+2yz+2zx$.

We need to apply the above identity to expand the expression $(x+2y+4z)^2$.

$$\begin{aligned}(x+2y+4z)^2&=(x)^2+(2y)^2+(4z)^2+2\times x\times 2y+2\times 2y\times 4z+2\times 4z\times x\\&=x^2+4y^2+16z^2+4xy+16yz+8zx\end{aligned}$$

(ii) $(2x-y+z)^2$

We know that $(x+y+z)^2=x^2+y^2+z^2+2xy+2yz+2zx$.

We need to apply the above identity to expand the expression $(2x-y+z)^2$.

$$\begin{aligned}(2x-y+z)^2&=[2x+(-y)+z]^2\\&=(2x)^2+(-y)^2+(z)^2+2\times 2x\times(-y)+2\times(-y)\times z+2\times z\times 2x\\&=4x^2+y^2+z^2-4xy-2yz+4zx.\end{aligned}$$

(iii) $(-2x+3y+2z)^2$

We know that $(x+y+z)^2=x^2+y^2+z^2+2xy+2yz+2zx$.

We need to apply the above identity to expand the expression $(-2x+3y+2z)^2$.

$$\begin{aligned}(-2x+3y+2z)^2&=[(-2x)+3y+2z]^2\\&=(-2x)^2+(3y)^2+(2z)^2+2\times(-2x)\times 3y+2\times 3y\times 2z+2\times 2z\times(-2x)\\&=4x^2+9y^2+4z^2-12xy+12yz-8zx\end{aligned}$$

(iv) $(3a-7b-c)^2$

We know that $(x+y+z)^2=x^2+y^2+z^2+2xy+2yz+2zx$.

We need to apply the above identity to expand the expression $(3a-7b-c)^2$.

$$(3a-7b-c)^2=[3a+(-7b)+(-c)]^2$$
$$=(3a)^2+(-7b)^2+(-c)^2+2\times 3a\times(-7b)+2\times(-7b)\times(-c)+2\times(-c)\times 3a$$
$$=9a^2+49b^2+c^2-42ab+14bc-6ac.$$

(v) $(-2x+5y-3z)^2$

We know that
$(x+y+z)^2=x^2+y^2+z^2+2xy+2yz+2zx$.

We need to apply the above identity to expand the expression $(-2x+5y-3z)^2$.

$$(-2x+5y-3z)^2=[(-2x)+5y+(-3z)]^2$$
$$=(-2x)^2+(5y)^2+(-3z)^2+2\times(-2x)\times 5y+2\times 5y\times(-3z)+2\times(-3z)\times(-2x)$$
$$=4x^2+25y^2+9z^2-20xy-30yz+12zx.$$

(vi) $\left(\frac{1}{4}a-\frac{1}{2}b+1\right)^2$

We know that $(x+y+z)^2=$
$x^2+y^2+z^2+2xy+2yz+2zx$.

$$\left(\frac{1}{4}a-\frac{1}{2}b+1\right)^2=\left[\frac{a}{4}+\left(-\frac{b}{2}\right)+1\right]^2$$
$$=\left(\frac{a}{4}\right)^2+\left(-\frac{b}{2}\right)^2+(1)^2+2\times\frac{a}{4}\times\left(-\frac{b}{2}\right)+2\times\left(-\frac{b}{2}\right)\times 1+2\times 1\times\frac{a}{4}$$
$$=\frac{a^2}{16}+\frac{b^2}{4}+1-\frac{ab}{4}-b+\frac{a}{2}.$$

Q5. Factorize:

(i) $4x^2+9y^2+16z^2+12xy-24yz-16xz$

(ii) $2x^2+y^2+8z^2-2\sqrt{2}xy+4\sqrt{2}yz-8xz$

Ans: (i) $4x^2+9y^2+16z^2+12xy-24yz-16xz$

The expression
$4x^2+9y^2+16z^2+12xy-24yz-16xz$ can also be written as

$$(2x)^2+(3y)^2+(-4z)^2+2\times 2x\times 3y+2\times 3y\times(-4z)+2\times(-4z)\times 2x.$$

We can observe that, we can apply the identity $(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx$ with respect to the expression

$(2x)^2+(3y)^2+(-4z)^2+2\times 2x\times 3y+2\times 3y\times(-4z)+2\times(-4z)\times 2x$,

to get

$(2x+3y-4z)^2$

Therefore, we conclude that after factorizing the expression $4x^2+9y^2+16z^2+12xy-24yz-16xz$, we get $(2x+3y-4z)^2$.

(ii) $2x^2+y^2+8z^2-2\sqrt{2}xy+4\sqrt{2}yz-8xz$

We need to factorize the expression $2x^2+y^2+8z^2-2\sqrt{2}xy+4\sqrt{2}yz-8xz$.

The expression $2x^2+y^2+8z^2-2\sqrt{2}xy+4\sqrt{2}yz-8xz$ can also be written as

$(-\sqrt{2}x)^2+(y)^2+(2\sqrt{2}z)^2+2\times(-\sqrt{2}x)\times y+2\times y\times(2\sqrt{2}z)+2\times(2\sqrt{2}z)\times(-\sqrt{2}x)$.

We can observe that, we can apply the identity $(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx$ with respect to the expression

$(-\sqrt{2}x)^2+(y)^2+(2\sqrt{2}z)^2+2\times(-\sqrt{2}x)\times y+2\times y\times(2\sqrt{2}z)+2\times(2\sqrt{2}z)\times(-\sqrt{2}x)$,

to get

$(-\sqrt{2}x+y+2\sqrt{2}z)^2$

Therefore, we conclude that after factorizing the expression $2x^2+y^2+8z^2-2\sqrt{2}xy+4\sqrt{2}yz-8xz$, we get $(-\sqrt{2}x+y+2\sqrt{2}z)^2$.

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