

NCERT Solutions for Class 9 Maths Chapter 2: Here are the NCERT Solutions for Class 9 Maths Chapter 2 Polynomials. These NCERT Solutions for Class 9 Maths Chapter 2 are created by our knowledgeable faculty to aid students in test preparation.

Our offers NCERT Solutions for Class 9 Maths Chapter 2 that make problem-solving easier for pupils. They provide a thorough and methodical breakdown of every solution to the issues presented in the Class 9 NCERT textbook exercises.

NCERT Solutions for Class 9 Maths Chapter 2 Polynomials Overview

In NCERT Solutions for Class 9 Maths Chapter 2, titled "Polynomials," students explore the concept of polynomials, which are algebraic expressions consisting of variables and coefficients combined using addition, subtraction, and multiplication. The NCERT Solutions for Class 9 Maths Chapter 2 covers key topics such as the definition of polynomials, their degrees, and the different types (monomials, binomials, and trinomials).

Students also learn about the polynomial equations and their roots, the Remainder Theorem, and the Factor Theorem. These concepts help in understanding how to solve polynomial equations and factorize them, which are foundational skills for algebra. The NCERT Solutions for Class 9 Maths Chapter 2 includes various examples and exercises to practice these concepts and develop problem-solving skills.

NCERT Solutions for Class 9 Maths Chapter 2

Below we have provided NCERT Solutions for Class 9 Maths Chapter 2 Polynomials. This NCERT Solutions for Class 9 Maths Chapter 2 will help students to understand the chapter better.

1. Which of the following expressions are polynomials in one variable, and which are not? State reasons for your answer.

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

Solution:

The equation $4x^2 - 3x + 7$ can be written as $4x^2 - 3x^1 + 7x^0$

Since x is the only variable in the given equation and the powers of x (i.e. 2, 1 and 0) are whole numbers, we can say that the expression $4x^2 - 3x + 7$ is a polynomial in one variable.

(ii) $y^2 + \sqrt{2}$

Solution:

The equation $y^2 + \sqrt{2}$ can be written as $y^2 + \sqrt{2}y^0$

Since y is the only variable in the given equation and the powers of y (i.e., 2 and 0) are whole numbers, we can say that the expression $y^2 + \sqrt{2}$ is a polynomial in one variable.

(iii) $3\sqrt{t} + t\sqrt{2}$

Solution:

The equation $3\sqrt{t} + t\sqrt{2}$ can be written as $3t^{1/2} + \sqrt{2}t$

Though t is the only variable in the given equation, the power of t (i.e., $1/2$) is not a whole number. Hence, we can say that the expression $3\sqrt{t} + t\sqrt{2}$ is **not** a polynomial in one variable.

(iv) $y + 2/y$

Solution:

The equation $y + 2/y$ can be written as $y + 2y^{-1}$

Though y is the only variable in the given equation, the power of y (i.e., -1) is not a whole number. Hence, we can say that the expression $y + 2/y$ is **not** a polynomial in one variable.

(v) $x^{10} + y^3 + t^{50}$

Solution:

Here, in the equation $x^{10} + y^3 + t^{50}$

Though the powers, 10, 3, 50, are whole numbers, there are 3 variables used in the expression

$x^{10} + y^3 + t^{50}$. Hence, it is **not** a polynomial in one variable.

2. Write the coefficients of x^2 in each of the following:

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

Solution:

The equation $2 + x^2 + x$ can be written as $2 + (1)x^2 + x$

We know that the coefficient is the number which multiplies the variable.

Here, the number that multiplies the variable x^2 is 1

Hence, the coefficient of x^2 in $2+x^2+x$ is 1.

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

Solution:

The equation $2-x^2+x^3$ can be written as $2+(-1)x^2+x^3$

We know that the coefficient is the number (along with its sign, i.e. – or +) which multiplies the variable.

Here, the number that multiplies the variable x^2 is -1

Hence, the coefficient of x^2 in $2-x^2+x^3$ is -1.

(iii) $(\pi/2)x^2+x$

Solution:

The equation $(\pi/2)x^2+x$ can be written as $(\pi/2)x^2 + x$

We know that the coefficient is the number (along with its sign, i.e. – or +) which multiplies the variable.

Here, the number that multiplies the variable x^2 is $\pi/2$.

Hence, the coefficient of x^2 in $(\pi/2)x^2+x$ is $\pi/2$.

(iii) $\sqrt{2}x-1$

Solution:

The equation $\sqrt{2}x-1$ can be written as $0x^2+\sqrt{2}x-1$ [Since $0x^2$ is 0]

We know that the coefficient is the number (along with its sign, i.e. – or +) which multiplies the variable.

Here, the number that multiplies the variable x^2 is 0

Hence, the coefficient of x^2 in $\sqrt{2}x-1$ is 0.

3. Give one example each of a binomial of degree 35, and of a monomial of degree 100.

Solution:

Binomial of degree 35: A polynomial having two terms and the highest degree 35 is called a binomial of degree 35.

For example, $3x^{35}+5$

Monomial of degree 100: A polynomial having one term and the highest degree 100 is called a monomial of degree 100.

For example, $4x^{100}$

4. Write the degree of each of the following polynomials:

(i) $5x^3+4x^2+7x$

Solution:

The highest power of the variable in a polynomial is the degree of the polynomial.

Here, $5x^3+4x^2+7x = 5x^3+4x^2+7x^1$

The powers of the variable x are: 3, 2, 1

The degree of $5x^3+4x^2+7x$ is 3, as 3 is the highest power of x in the equation.

(ii) $4-y^2$

Solution:

The highest power of the variable in a polynomial is the degree of the polynomial.

Here, in $4-y^2$,

The power of the variable y is 2

The degree of $4-y^2$ is 2, as 2 is the highest power of y in the equation.

(iii) $5t-\sqrt{7}$

Solution:

The highest power of the variable in a polynomial is the degree of the polynomial.

Here, in $5t-\sqrt{7}$

The power of the variable t is: 1

The degree of $5t-\sqrt{7}$ is 1, as 1 is the highest power of y in the equation.

(iv) 3

Solution:

The highest power of the variable in a polynomial is the degree of the polynomial.

Here, $3 = 3 \times 1 = 3 \times x^0$

The power of the variable here is: 0

Hence, the degree of 3 is 0.

5. Classify the following as linear, quadratic and cubic polynomials:

Solution:

We know that,

Linear polynomial: A polynomial of degree one is called a linear polynomial.

Quadratic polynomial: A polynomial of degree two is called a quadratic polynomial.

Cubic polynomial: A polynomial of degree three is called a cubic polynomial.

(i) x^2+x

Solution:

The highest power of x^2+x is 2

The degree is 2

Hence, x^2+x is a quadratic polynomial

(ii) $x-x^3$

Solution:

The highest power of $x-x^3$ is 3

The degree is 3

Hence, $x-x^3$ is a cubic polynomial

(iii) $y+y^2+4$

Solution:

The highest power of $y+y^2+4$ is 2

The degree is 2

Hence, $y+y^2+4$ is a quadratic polynomial

(iv) $1+x$

Solution:

The highest power of $1+x$ is 1

The degree is 1

Hence, $1+x$ is a linear polynomial.

(v) $3t$

Solution:

The highest power of $3t$ is 1

The degree is 1

Hence, $3t$ is a linear polynomial.

(vi) r^2

Solution:

The highest power of r^2 is 2

The degree is 2

Hence, r^2 is a quadratic polynomial.

(vii) $7x^3$

Solution:

The highest power of $7x^3$ is 3

The degree is 3

Hence, $7x^3$ is a cubic polynomial.

NCERT Solutions for Class 9 Maths Chapter 2 Exercise 2.2

Below we have provided NCERT Solutions for Class 9 Maths Chapter 2 Polynomials -

1. Find the value of the polynomial $f(x)=5x-4x^2+3$.

(i) $x = 0$

(ii) $x = -1$

(iii) $x = 2$

Solution:

Let $f(x) = 5x-4x^2+3$

(i) When $x = 0$

$$f(0) = 5(0)-4(0)^2+3$$

$$= 3$$

(ii) When $x = -1$

$$f(x) = 5x-4x^2+3$$

$$f(-1) = 5(-1)-4(-1)^2+3$$

$$= -5-4+3$$

$$= -6$$

(iii) When $x = 2$

$$f(x) = 5x-4x^2+3$$

$$f(2) = 5(2)-4(2)^2+3$$

$$= 10-16+3$$

$$= -3$$

2. Find $p(0)$, $p(1)$ and $p(2)$ for each of the following polynomials:

(i) $p(y)=y^2-y+1$

Solution:

$$p(y) = y^2-y+1$$

$$\therefore p(0) = (0)^2-(0)+1 = 1$$

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

$$p(2) = (2)^2 - (2) + 1 = 3$$

$$\text{(ii) } p(t) = 2 + t + 2t^2 - t^3$$

Solution:

$$p(t) = 2 + t + 2t^2 - t^3$$

$$\therefore p(0) = 2 + 0 + 2(0)^2 - (0)^3 = 2$$

$$p(1) = 2 + 1 + 2(1)^2 - (1)^3 = 2 + 1 + 2 - 1 = 4$$

$$p(2) = 2 + 2 + 2(2)^2 - (2)^3 = 2 + 2 + 8 - 8 = 4$$

$$\text{(iii) } p(x) = x^3$$

Solution:

$$p(x) = x^3$$

$$\therefore p(0) = (0)^3 = 0$$

$$p(1) = (1)^3 = 1$$

$$p(2) = (2)^3 = 8$$

$$\text{(iv) } P(x) = (x-1)(x+1)$$

Solution:

$$p(x) = (x-1)(x+1)$$

$$\therefore p(0) = (0-1)(0+1) = (-1)(1) = -1$$

$$p(1) = (1-1)(1+1) = 0(2) = 0$$

$$p(2) = (2-1)(2+1) = 1(3) = 3$$

3. Verify whether the following are zeroes of the polynomial indicated against them.

$$\text{(i) } p(x) = 3x + 1, x = -1/3$$

Solution:

$$\text{For, } x = -1/3, p(x) = 3x + 1$$

$$\therefore p(-1/3) = 3(-1/3)+1 = -1+1 = 0$$

$\therefore -1/3$ is a zero of $p(x)$.

(ii) $p(x) = 5x - \pi$, $x = 4/5$

Solution:

For, $x = 4/5$, $p(x) = 5x - \pi$

$$\therefore p(4/5) = 5(4/5) - \pi = 4 - \pi$$

$\therefore 4/5$ is not a zero of $p(x)$.

(iii) $p(x) = x^2 - 1$, $x = 1, -1$

Solution:

For, $x = 1, -1$;

$$p(x) = x^2 - 1$$

$$\therefore p(1) = 1^2 - 1 = 1 - 1 = 0$$

$$p(-1) = (-1)^2 - 1 = 1 - 1 = 0$$

$\therefore 1, -1$ are zeros of $p(x)$.

(iv) $p(x) = (x+1)(x-2)$, $x = -1, 2$

Solution:

For, $x = -1, 2$;

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

$$\therefore p(-1) = (-1+1)(-1-2)$$

$$= (0)(-3) = 0$$

$$p(2) = (2+1)(2-2) = (3)(0) = 0$$

$\therefore -1, 2$ are zeros of $p(x)$.

(v) $p(x) = x^2$, $x = 0$

Solution:

For, $x = 0$ $p(x) = x^2$

$$p(0) = 0^2 = 0$$

$\therefore 0$ is a zero of $p(x)$.

(vi) $p(x) = lx+m, x = -m/l$

Solution:

For, $x = -m/l$; $p(x) = lx+m$

$$\therefore p(-m/l) = l(-m/l) + m = -m + m = 0$$

$\therefore -m/l$ is a zero of $p(x)$.

(vii) $p(x) = 3x^2-1, x = -1/\sqrt{3}, 2/\sqrt{3}$

Solution:

For, $x = -1/\sqrt{3}, 2/\sqrt{3}$; $p(x) = 3x^2-1$

$$\therefore p(-1/\sqrt{3}) = 3(-1/\sqrt{3})^2 - 1 = 3(1/3) - 1 = 1 - 1 = 0$$

$$\therefore p(2/\sqrt{3}) = 3(2/\sqrt{3})^2 - 1 = 3(4/3) - 1 = 4 - 1 = 3 \neq 0$$

$\therefore -1/\sqrt{3}$ is a zero of $p(x)$, but $2/\sqrt{3}$ is not a zero of $p(x)$.

(viii) $p(x) = 2x+1, x = 1/2$

Solution:

For, $x = 1/2$ $p(x) = 2x+1$

$$\therefore p(1/2) = 2(1/2) + 1 = 1 + 1 = 2 \neq 0$$

$\therefore 1/2$ is not a zero of $p(x)$.

4. Find the zero of the polynomials in each of the following cases:

(i) $p(x) = x+5$

Solution:

$$p(x) = x+5$$

$$\Rightarrow x+5 = 0$$

$$\Rightarrow x = -5$$

$\therefore -5$ is a zero polynomial of the polynomial $p(x)$.

$$\text{(ii) } p(x) = x-5$$

Solution:

$$p(x) = x-5$$

$$\Rightarrow x-5 = 0$$

$$\Rightarrow x = 5$$

$\therefore 5$ is a zero polynomial of the polynomial $p(x)$.

$$\text{(iii) } p(x) = 2x+5$$

Solution:

$$p(x) = 2x+5$$

$$\Rightarrow 2x+5 = 0$$

$$\Rightarrow 2x = -5$$

$$\Rightarrow x = -5/2$$

$\therefore x = -5/2$ is a zero polynomial of the polynomial $p(x)$.

$$\text{(iv) } p(x) = 3x-2$$

Solution:

$$p(x) = 3x-2$$

$$\Rightarrow 3x-2 = 0$$

$$\Rightarrow 3x = 2$$

$$\Rightarrow x = 2/3$$

$\therefore x = 2/3$ is a zero polynomial of the polynomial $p(x)$.

$$\text{(v) } p(x) = 3x$$

Solution:

$$p(x) = 3x$$

$$\Rightarrow 3x = 0$$

$$\Rightarrow x = 0$$

$\therefore 0$ is a zero polynomial of the polynomial $p(x)$.

(vi) $p(x) = ax, a \neq 0$

Solution:

$$p(x) = ax$$

$$\Rightarrow ax = 0$$

$$\Rightarrow x = 0$$

$\therefore x = 0$ is a zero polynomial of the polynomial $p(x)$.

(vii) $p(x) = cx+d, c \neq 0, c, d$ are real numbers.

Solution:

$$p(x) = cx + d$$

$$\Rightarrow cx+d=0$$

$$\Rightarrow x = -d/c$$

$\therefore x = -d/c$ is a zero polynomial of the polynomial $p(x)$.

NCERT Solutions for Class 9 Maths Chapter 2 Exercise 2.3

Below we have provided NCERT Solutions for Class 9 Maths Chapter 2 Polynomials -

1. Find the remainder when x^3+3x^2+3x+1 is divided by

(i) $x+1$

Solution:

$$x+1=0$$

$$\Rightarrow x = -1$$

∴ Remainder:

$$p(-1) = (-1)^3 + 3(-1)^2 + 3(-1) + 1$$

$$= -1 + 3 - 3 + 1$$

$$= 0$$

(ii) $x - 1/2$

Solution:

$$x - 1/2 = 0$$

$$\Rightarrow x = 1/2$$

∴ Remainder:

$$p(1/2) = (1/2)^3 + 3(1/2)^2 + 3(1/2) + 1$$

$$= (1/8) + (3/4) + (3/2) + 1$$

$$= 27/8$$

(iii) x

Solution:

$$x = 0$$

∴ Remainder:

$$p(0) = (0)^3 + 3(0)^2 + 3(0) + 1$$

$$= 1$$

(iv) $x + \pi$

Solution:

$$x + \pi = 0$$

$$\Rightarrow x = -\pi$$

∴ Remainder:

$$p(-\pi) = (-\pi)^3 + 3(-\pi)^2 + 3(-\pi) + 1$$

$$= -\pi^3 + 3\pi^2 - 3\pi + 1$$

(v) $5+2x$

Solution:

$$5+2x = 0$$

$$\Rightarrow 2x = -5$$

$$\Rightarrow x = -5/2$$

\therefore Remainder:

$$(-5/2)^3 + 3(-5/2)^2 + 3(-5/2) + 1 = (-125/8) + (75/4) - (15/2) + 1$$

$$= -27/8$$

2. Find the remainder when $x^3 - ax^2 + 6x - a$ is divided by $x - a$.

Solution:

$$\text{Let } p(x) = x^3 - ax^2 + 6x - a$$

$$x - a = 0$$

$$\therefore x = a$$

Remainder:

$$p(a) = (a)^3 - a(a^2) + 6(a) - a$$

$$= a^3 - a^3 + 6a - a = 5a$$

3. Check whether $7+3x$ is a factor of $3x^3+7x$.

Solution:

$$7+3x = 0$$

$$\Rightarrow 3x = -7$$

$$\Rightarrow x = -7/3$$

\therefore Remainder:

$$3(-7/3)^3 + 7(-7/3) = -(343/9) + (-49/3)$$

$$= (-343-(49)3)/9$$

$$= (-343-147)/9$$

$$= -490/9 \neq 0$$

$\therefore 7+3x$ is not a factor of $3x^3+7x$

NCERT Solutions for Class 9 Maths Chapter 2 Exercise 2.4

Below we have provided NCERT Solutions for Class 9 Maths Chapter 2 Polynomials -

1. Determine which of the following polynomials has $(x + 1)$ a factor:

(i) x^3+x^2+x+1

Solution:

$$\text{Let } p(x) = x^3+x^2+x+1$$

The zero of $x+1$ is -1 . [$x+1 = 0$ means $x = -1$]

$$p(-1) = (-1)^3+(-1)^2+(-1)+1$$

$$= -1+1-1+1$$

$$= 0$$

\therefore By factor theorem, $x+1$ is a factor of x^3+x^2+x+1

(ii) $x^4+x^3+x^2+x+1$

Solution:

$$\text{Let } p(x) = x^4+x^3+x^2+x+1$$

The zero of $x+1$ is -1 . [$x+1 = 0$ means $x = -1$]

$$p(-1) = (-1)^4+(-1)^3+(-1)^2+(-1)+1$$

$$= 1-1+1-1+1$$

$$= 1 \neq 0$$

\therefore By factor theorem, $x+1$ is not a factor of $x^4 + x^3 + x^2 + x + 1$

(iii) $x^4+3x^3+3x^2+x+1$

Solution:

Let $p(x) = x^4+3x^3+3x^2+x+1$

The zero of $x+1$ is -1 .

$$p(-1) = (-1)^4 + 3(-1)^3 + 3(-1)^2 + (-1) + 1$$

$$= 1 - 3 + 3 - 1 + 1$$

$$= 1 \neq 0$$

\therefore By factor theorem, $x+1$ is not a factor of $x^4+3x^3+3x^2+x+1$

(iv) $x^3 - x^2 - (2+\sqrt{2})x + \sqrt{2}$

Solution:

Let $p(x) = x^3 - x^2 - (2+\sqrt{2})x + \sqrt{2}$

The zero of $x+1$ is -1 .

$$p(-1) = (-1)^3 - (-1)^2 - (2+\sqrt{2})(-1) + \sqrt{2} = -1 - 1 + 2 + \sqrt{2} + \sqrt{2}$$

$$= 2\sqrt{2} \neq 0$$

\therefore By factor theorem, $x+1$ is not a factor of $x^3 - x^2 - (2+\sqrt{2})x + \sqrt{2}$

2. Use the Factor Theorem to determine whether $g(x)$ is a factor of $p(x)$ in each of the following cases:

(i) $p(x) = 2x^3+x^2-2x-1$, $g(x) = x+1$

Solution:

$$p(x) = 2x^3+x^2-2x-1, g(x) = x+1$$

$$g(x) = 0$$

$$\Rightarrow x+1 = 0$$

$$\Rightarrow x = -1$$

\therefore Zero of $g(x)$ is -1 .

Now,

$$p(-1) = 2(-1)^3 + (-1)^2 - 2(-1) - 1$$

$$= -2 + 1 + 2 - 1$$

$$= 0$$

∴ By factor theorem, $g(x)$ is a factor of $p(x)$.

$$(ii) \ p(x) = x^3 + 3x^2 + 3x + 1, \ g(x) = x + 2$$

Solution:

$$p(x) = x^3 + 3x^2 + 3x + 1, \ g(x) = x + 2$$

$$g(x) = 0$$

$$\Rightarrow x + 2 = 0$$

$$\Rightarrow x = -2$$

∴ Zero of $g(x)$ is -2 .

Now,

$$p(-2) = (-2)^3 + 3(-2)^2 + 3(-2) + 1$$

$$= -8 + 12 - 6 + 1$$

$$= -1 \neq 0$$

∴ By factor theorem, $g(x)$ is not a factor of $p(x)$.

$$(iii) \ p(x) = x^3 - 4x^2 + x + 6, \ g(x) = x - 3$$

Solution:

$$p(x) = x^3 - 4x^2 + x + 6, \ g(x) = x - 3$$

$$g(x) = 0$$

$$\Rightarrow x - 3 = 0$$

$$\Rightarrow x = 3$$

∴ Zero of $g(x)$ is 3 .

Now,

$$p(3) = (3)^3 - 4(3)^2 + (3) + 6$$

$$= 27 - 36 + 3 + 6$$

$$= 0$$

∴ By factor theorem, $g(x)$ is a factor of $p(x)$.

3. Find the value of k , if $x-1$ is a factor of $p(x)$ in each of the following cases:

(i) $p(x) = x^2 + x + k$

Solution:

If $x-1$ is a factor of $p(x)$, then $p(1) = 0$

By Factor Theorem

$$\Rightarrow (1)^2 + (1) + k = 0$$

$$\Rightarrow 1 + 1 + k = 0$$

$$\Rightarrow 2 + k = 0$$

$$\Rightarrow k = -2$$

(ii) $p(x) = 2x^2 + kx + \sqrt{2}$

Solution:

If $x-1$ is a factor of $p(x)$, then $p(1) = 0$

$$\Rightarrow 2(1)^2 + k(1) + \sqrt{2} = 0$$

$$\Rightarrow 2 + k + \sqrt{2} = 0$$

$$\Rightarrow k = -(2 + \sqrt{2})$$

(iii) $p(x) = kx^2 - \sqrt{2}x + 1$

Solution:

If $x-1$ is a factor of $p(x)$, then $p(1) = 0$

By Factor Theorem

$$\Rightarrow k(1)^2 - \sqrt{2}(1) + 1 = 0$$

$$\Rightarrow k = \sqrt{2}-1$$

$$\text{(iv) } p(x)=kx^2-3x+k$$

Solution:

If $x-1$ is a factor of $p(x)$, then $p(1) = 0$

By Factor Theorem

$$\Rightarrow k(1)^2-3(1)+k = 0$$

$$\Rightarrow k-3+k = 0$$

$$\Rightarrow 2k-3 = 0$$

$$\Rightarrow k = 3/2$$

4. Factorise:

$$\text{(i) } 12x^2-7x+1$$

Solution:

Using the splitting the middle term method,

We have to find a number whose sum = -7 and product = $1 \times 12 = 12$

We get -3 and -4 as the numbers $[-3+-4=-7$ and $-3 \times -4 = 12]$

$$12x^2-7x+1 = 12x^2-4x-3x+1$$

$$= 4x(3x-1)-1(3x-1)$$

$$= (4x-1)(3x-1)$$

$$\text{(ii) } 2x^2+7x+3$$

Solution:

Using the splitting the middle term method,

We have to find a number whose sum = 7 and product = $2 \times 3 = 6$

We get 6 and 1 as the numbers $[6+1 = 7$ and $6 \times 1 = 6]$

$$2x^2+7x+3 = 2x^2+6x+1x+3$$

$$= 2x(x+3)+1(x+3)$$

$$= (2x+1)(x+3)$$

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

Solution:

Using the splitting the middle term method,

We have to find a number whose sum = 5 and product = $6 \times -6 = -36$

We get -4 and 9 as the numbers $[-4+9 = 5$ and $-4 \times 9 = -36]$

$$6x^2+5x-6 = 6x^2+9x-4x-6$$

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

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

(iv) $3x^2-x-4$

Solution:

Using the splitting the middle term method,

We have to find a number whose sum = -1 and product = $3 \times -4 = -12$

We get -4 and 3 as the numbers $[-4+3 = -1$ and $-4 \times 3 = -12]$

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

$$= x(3x-4)+1(3x-4)$$

$$= (3x-4)(x+1)$$

5. Factorise:

(i) x^3-2x^2-x+2

Solution:

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

Factors of 2 are ± 1 and ± 2

Now,

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

$$p(-1) = (-1)^3 - 2(-1)^2 - (-1) + 2$$

$$= -1 - 2 + 1 + 2$$

$$= 0$$

Therefore, $(x+1)$ is the factor of $p(x)$

$$\begin{array}{r}
 x^2 - 3x + 2 \\
 \hline
 x+1 \overline{) x^3 - 2x^2 - x + 2} \\
 \underline{x^3 + x^2} \\
 -3x^2 - x + 2 \\
 \underline{-3x^2 - 3x} \\
 2x + 2 \\
 \underline{2x + 2} \\
 0
 \end{array}$$

Now, Dividend = Divisor \times Quotient + Remainder

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

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

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

(ii) $x^3 - 3x^2 - 9x - 5$

Solution:

$$\text{Let } p(x) = x^3 - 3x^2 - 9x - 5$$

Factors of 5 are ± 1 and ± 5

By the trial method, we find that

$$p(5) = 0$$

So, $(x-5)$ is factor of $p(x)$

Now,

$$p(x) = x^3 - 3x^2 - 9x - 5$$

$$p(5) = (5)^3 - 3(5)^2 - 9(5) - 5$$

$$= 125 - 75 - 45 - 5$$

$$= 0$$

Therefore, $(x-5)$ is the factor of $p(x)$

$$\begin{array}{r}
 x^2 + 2x + 1 \\
 \hline
 x-5 \overline{) \begin{array}{r} x^3 - 3x^2 - 9x - 5 \\ x^3 - 5x^2 \\ \hline -2x^2 - 9x - 5 \\ 2x^2 - 10x \\ \hline x - 5 \\ x - 5 \\ \hline 0 \end{array}}
 \end{array}$$

Now, Dividend = Divisor \times Quotient + Remainder

$$(x-5)(x^2+2x+1) = (x-5)(x^2+x+x+1)$$

$$= (x-5)(x(x+1)+1(x+1))$$

$$= (x-5)(x+1)(x+1)$$

$$\text{(iii) } x^3 + 13x^2 + 32x + 20$$

Solution:

$$\text{Let } p(x) = x^3 + 13x^2 + 32x + 20$$

Factors of 20 are $\pm 1, \pm 2, \pm 4, \pm 5, \pm 10$ and ± 20

By the trial method, we find that

$$p(-1) = 0$$

So, $(x+1)$ is factor of $p(x)$

Now,

$$p(x) = x^3 + 13x^2 + 32x + 20$$

$$p(-1) = (-1)^3 + 13(-1)^2 + 32(-1) + 20$$

$$= -1 + 13 - 32 + 20$$

$$= 0$$

Therefore, $(x+1)$ is the factor of $p(x)$

$$\begin{array}{r}
 x^2 + 12x + 20 \\
 \hline
 x+1 \overline{) x^3 + 13x^2 + 32x + 20} \\
 \underline{x^3 + x^2} \\
 12x^2 + 32x + 20 \\
 \underline{12x^2 + 12x} \\
 20x + 20 \\
 \underline{20x + 20} \\
 0
 \end{array}$$

Now, Dividend = Divisor \times Quotient + Remainder

$$(x+1)(x^2 + 12x + 20) = (x+1)(x^2 + 2x + 10x + 20)$$

$$= (x+1)x(x+2) + 10(x+2)$$

$$= (x+1)(x+2)(x+10)$$

(iv) $2y^3 + y^2 - 2y - 1$

Solution:

$$\text{Let } p(y) = 2y^3 + y^2 - 2y - 1$$

$$\text{Factors} = 2 \times (-1) = -2 \text{ are } \pm 1 \text{ and } \pm 2$$

By the trial method, we find that

$$p(1) = 0$$

So, $(y-1)$ is factor of $p(y)$

Now,

$$p(y) = 2y^3 + y^2 - 2y - 1$$

$$p(1) = 2(1)^3 + (1)^2 - 2(1) - 1$$

$$= 2 + 1 - 2$$

$$= 0$$

Therefore, $(y-1)$ is the factor of $p(y)$

$$\begin{array}{r} 2y^2 + 3y + 1 \\ y-1 \overline{) 2y^3 + y^2 - 2y - 1} \\ \underline{2y^3 - 2y^2} \\ 3y^2 - 2y - 1 \\ \underline{3y^2 - 3y} \\ y - 1 \\ \underline{y - 1} \\ 0 \end{array}$$

Now, Dividend = Divisor \times Quotient + Remainder

$$(y-1)(2y^2+3y+1) = (y-1)(2y^2+2y+y+1)$$

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

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

NCERT Solutions for Class 9 Maths Chapter 2 Exercise 2.5

Below we have provided NCERT Solutions for Class 9 Maths Chapter 2 Polynomials -

1. Use suitable identities to find the following products:

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

Solution:

Using the identity, $(x+a)(x+b) = x^2 + (a+b)x + ab$

[Here, $a = 4$ and $b = 10$]

We get,

$$\begin{aligned}(x+4)(x+10) &= x^2 + (4+10)x + (4 \times 10) \\ &= x^2 + 14x + 40\end{aligned}$$

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

Solution:

Using the identity, $(x+a)(x+b) = x^2 + (a+b)x + ab$

[Here, $a = 8$ and $b = -10$]

We get,

$$\begin{aligned}(x+8)(x-10) &= x^2 + (8+(-10))x + (8 \times (-10)) \\ &= x^2 + (8-10)x - 80 \\ &= x^2 - 2x - 80\end{aligned}$$

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

Solution:

Using the identity, $(x+a)(x+b) = x^2 + (a+b)x + ab$

[Here, $x = 3x$, $a = 4$ and $b = -5$]

We get,

$$\begin{aligned}(3x+4)(3x-5) &= (3x)^2 + [4+(-5)]3x + 4 \times (-5) \\ &= 9x^2 + 3x(4-5) - 20 \\ &= 9x^2 - 3x - 20\end{aligned}$$

(iv) $(y^2+3/2)(y^2-3/2)$

Solution:

Using the identity, $(x+y)(x-y) = x^2 - y^2$

[Here, $x = y^2$ and $y = 3/2$]

We get,

$$\begin{aligned}(y^2 + 3/2)(y^2 - 3/2) &= (y^2)^2 - (3/2)^2 \\ &= y^4 - 9/4\end{aligned}$$

2. Evaluate the following products without multiplying directly:

(i) 103×107

Solution:

$$103 \times 107 = (100 + 3) \times (100 + 7)$$

Using identity, $[(x+a)(x+b) = x^2 + (a+b)x + ab]$

Here, $x = 100$

$$a = 3$$

$$b = 7$$

$$\text{We get, } 103 \times 107 = (100 + 3) \times (100 + 7)$$

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

$$= 10000 + 1000 + 21$$

$$= 11021$$

(ii) 95×96

Solution:

$$95 \times 96 = (100 - 5) \times (100 - 4)$$

Using identity, $[(x-a)(x-b) = x^2 - (a+b)x + ab]$

Here, $x = 100$

$$a = -5$$

$$b = -4$$

We get, $95 \times 96 = (100-5) \times (100-4)$

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

$$= 10000 - 900 + 20$$

$$= 9120$$

(iii) 104×96

Solution:

$$104 \times 96 = (100+4) \times (100-4)$$

Using identity, $[(a+b)(a-b) = a^2 - b^2]$

Here, $a = 100$

$$b = 4$$

We get, $104 \times 96 = (100+4) \times (100-4)$

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

$$= 10000 - 16$$

$$= 9984$$

3. Factorise the following using appropriate identities:

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

Solution:

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

Using identity, $x^2 + 2xy + y^2 = (x+y)^2$

Here, $x = 3x$

$$y = y$$

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

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

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

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

Solution:

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

Using identity, $x^2 - 2xy + y^2 = (x - y)^2$

Here, $x = 2y$

$$y = 1$$

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

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

$$= (2y-1)(2y-1)$$

(iii) $x^2-y^2/100$

Solution:

$$x^2-y^2/100 = x^2-(y/10)^2$$

Using identity, $x^2-y^2 = (x-y)(x+y)$

Here, $x = x$

$$y = y/10$$

$$x^2-y^2/100 = x^2-(y/10)^2$$

$$= (x-y/10)(x+y/10)$$

4. 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) $((1/4)a-(1/2)b+1)^2$

Solution:

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

Using identity, $(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx$

Here, $x = x$

$$y = 2y$$

$$z = 4z$$

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

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

Using identity, $(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx$

Here, $x = 2x$

$$y = -y$$

$$z = z$$

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

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

Solution:

Using identity, $(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx$

Here, $x = -2x$

$$y = 3y$$

$$z = 2z$$

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

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

Solution:

Using identity $(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx$

Here, $x = 3a$

$y = -7b$

$z = -c$

$$\begin{aligned}(3a - 7b - c)^2 &= (3a)^2 + (-7b)^2 + (-c)^2 + (2 \times 3a \times -7b) + (2 \times -7b \times -c) + (2 \times -c \times 3a) \\ &= 9a^2 + 49b^2 + c^2 - 42ab + 14bc - 6ca\end{aligned}$$

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

Solution:

Using identity, $(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx$

Here, $x = -2x$

$y = 5y$

$z = -3z$

$$\begin{aligned}(-2x+5y-3z)^2 &= (-2x)^2 + (5y)^2 + (-3z)^2 + (2 \times -2x \times 5y) + (2 \times 5y \times -3z) + (2 \times -3z \times -2x) \\ &= 4x^2 + 25y^2 + 9z^2 - 20xy - 30yz + 12zx\end{aligned}$$

(vi) $((1/4)a - (1/2)b + 1)^2$

Solution:

Using identity, $(x+y+z)^2 = x^2+y^2+z^2+2xy+2yz+2zx$

Here, $x = (1/4)a$

$y = (-1/2)b$

$z = 1$

$$\begin{aligned}
 ((1/4)a - (1/2)b + 1)^2 &= (\frac{1}{4}a)^2 + (-\frac{1}{2}b)^2 + (1)^2 + (2 \times \frac{1}{4}a \times -\frac{1}{2}b) + (2 \times -\frac{1}{2}b \times 1) + (2 \times 1 \times \frac{1}{4}a) \\
 &= \frac{1}{16}a^2 + \frac{1}{4}b^2 + 1^2 - \frac{2}{8}ab - \frac{2}{2}b + \frac{2}{4}a \\
 &= \frac{1}{16}a^2 + \frac{1}{4}b^2 + 1 - \frac{1}{4}ab - b + \frac{1}{2}a
 \end{aligned}$$

5. Factorise:

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

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

Solution:

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

Using identity, $(x+y+z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

We can say that, $x^2 + y^2 + z^2 + 2xy + 2yz + 2zx = (x+y+z)^2$

$$4x^2 + 9y^2 + 16z^2 + 12xy - 24yz - 16xz = (2x)^2 + (3y)^2 + (-4z)^2 + (2 \times 2x \times 3y) + (2 \times 3y \times -4z) + (2 \times -4z \times 2x)$$

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

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

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

Using identity, $(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

We can say that, $x^2 + y^2 + z^2 + 2xy + 2yz + 2zx = (x+y+z)^2$

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

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

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

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

6. Write the following cubes in expanded form:

(i) $(2x+1)^3$

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

(iii) $\left(\frac{3}{2}x+1\right)^3$

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

Solution:

(i) $(2x+1)^3$

Using identity, $(x+y)^3 = x^3+y^3+3xy(x+y)$

$$(2x+1)^3 = (2x)^3+1^3+(3 \times 2x \times 1)(2x+1)$$

$$= 8x^3+1+6x(2x+1)$$

$$= 8x^3+12x^2+6x+1$$

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

Using identity, $(x-y)^3 = x^3-y^3-3xy(x-y)$

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

$$= 8a^3-27b^3-18ab(2a-3b)$$

$$= 8a^3-27b^3-36a^2b+54ab^2$$

(iii) $\left(\frac{3}{2}x+1\right)^3$

Using identity, $(x+y)^3 = x^3+y^3+3xy(x+y)$

$$\left(\frac{3}{2}x+1\right)^3 = \left(\frac{3}{2}x\right)^3+1^3+(3 \times \frac{3}{2}x \times 1)\left(\frac{3}{2}x+1\right)$$

$$= \frac{27}{8}x^3+1+\frac{9}{2}x\left(\frac{3}{2}x+1\right)$$

$$= \frac{27}{8}x^3+1+\frac{27}{4}x^2+\frac{9}{2}x$$

$$= \frac{27}{8}x^3+\frac{27}{4}x^2+\frac{9}{2}x+1$$

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

Using identity, $(x-y)^3 = x^3-y^3-3xy(x-y)$

$$\begin{aligned}
 \left(x - \frac{2}{3}y\right)^3 &= (x)^3 - \left(\frac{2}{3}y\right)^3 - (3 \times x \times \frac{2}{3}y)\left(x - \frac{2}{3}y\right) \\
 &= (x)^3 - \frac{8}{27}y^3 - 2xy\left(x - \frac{2}{3}y\right) \\
 &= (x)^3 - \frac{8}{27}y^3 - 2x^2y + \frac{4}{3}xy^2
 \end{aligned}$$

7. Evaluate the following using suitable identities:

(i) $(99)^3$

(ii) $(102)^3$

(iii) $(998)^3$

Solutions:

(i) $(99)^3$

Solution:

We can write 99 as $100-1$

Using identity, $(x - y)^3 = x^3 - y^3 - 3xy(x - y)$

$$(99)^3 = (100-1)^3$$

$$= (100)^3 - 1^3 - (3 \times 100 \times 1)(100-1)$$

$$= 1000000 - 1 - 300(100 - 1)$$

$$= 1000000 - 1 - 30000 + 300$$

$$= 970299$$

(ii) $(102)^3$

Solution:

We can write 102 as $100+2$

Using identity, $(x+y)^3 = x^3 + y^3 + 3xy(x+y)$

$$(100+2)^3 = (100)^3 + 2^3 + (3 \times 100 \times 2)(100+2)$$

$$= 1000000 + 8 + 600(100 + 2)$$

$$= 1000000 + 8 + 60000 + 1200$$

$$= 1061208$$

$$\text{(iii) } (998)^3$$

Solution:

We can write 99 as $1000-2$

Using identity, $(x-y)^3 = x^3 - y^3 - 3xy(x-y)$

$$(998)^3 = (1000-2)^3$$

$$= (1000)^3 - 2^3 - (3 \times 1000 \times 2)(1000-2)$$

$$= 1000000000 - 8 - 6000(1000-2)$$

$$= 1000000000 - 8 - 6000000 + 12000$$

$$= 994011992$$

8. Factorise each of the following:

$$\text{(i) } 8a^3 + b^3 + 12a^2b + 6ab^2$$

$$\text{(ii) } 8a^3 - b^3 - 12a^2b + 6ab^2$$

$$\text{(iii) } 27 - 125a^3 - 135a + 225a^2$$

$$\text{(iv) } 64a^3 - 27b^3 - 144a^2b + 108ab^2$$

$$\text{(v) } 27p^3 - \left(\frac{1}{216}\right) - \left(\frac{9}{2}\right)p^2 + \left(\frac{1}{4}\right)p$$

Solutions:

$$\text{(i) } 8a^3 + b^3 + 12a^2b + 6ab^2$$

Solution:

The expression, $8a^3 + b^3 + 12a^2b + 6ab^2$ can be written as $(2a)^3 + b^3 + 3(2a)^2b + 3(2a)(b)^2$

$$8a^3 + b^3 + 12a^2b + 6ab^2 = (2a)^3 + b^3 + 3(2a)^2b + 3(2a)(b)^2$$

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

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

Here, the identity, $(x + y)^3 = x^3 + y^3 + 3xy(x + y)$ is used.

(ii) $8a^3 - b^3 - 12a^2b + 6ab^2$

Solution:

The expression, $8a^3 - b^3 - 12a^2b + 6ab^2$ can be written as $(2a)^3 - b^3 - 3(2a)^2b + 3(2a)(b)^2$

$$8a^3 - b^3 - 12a^2b + 6ab^2 = (2a)^3 - b^3 - 3(2a)^2b + 3(2a)(b)^2$$

$$= (2a - b)^3$$

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

Here, the identity, $(x - y)^3 = x^3 - y^3 - 3xy(x - y)$ is used.

(iii) $27 - 125a^3 - 135a + 225a^2$

Solution:

The expression, $27 - 125a^3 - 135a + 225a^2$ can be written as $3^3 - (5a)^3 - 3(3)^2(5a) + 3(3)(5a)^2$

$$27 - 125a^3 - 135a + 225a^2 = 3^3 - (5a)^3 - 3(3)^2(5a) + 3(3)(5a)^2$$

$$= (3 - 5a)^3$$

$$= (3 - 5a)(3 - 5a)(3 - 5a)$$

Here, the identity, $(x - y)^3 = x^3 - y^3 - 3xy(x - y)$ is used.

(iv) $64a^3 - 27b^3 - 144a^2b + 108ab^2$

Solution:

The expression, $64a^3 - 27b^3 - 144a^2b + 108ab^2$ can be written as $(4a)^3 - (3b)^3 - 3(4a)^2(3b) + 3(4a)(3b)^2$

$$64a^3 - 27b^3 - 144a^2b + 108ab^2 = (4a)^3 - (3b)^3 - 3(4a)^2(3b) + 3(4a)(3b)^2$$

$$= (4a - 3b)^3$$

$$= (4a - 3b)(4a - 3b)(4a - 3b)$$

Here, the identity, $(x - y)^3 = x^3 - y^3 - 3xy(x - y)$ is used.

(v) $27p^3 - (1/216) - (9/2)p^2 + (1/4)p$

Solution:

The expression, $27p^3 - (1/216) - (9/2)p^2 + (1/4)p$ can be written as

$$(3p)^3 - (1/6)^3 - (9/2)p^2 + (1/4)p = (3p)^3 - (1/6)^3 - 3(3p)(1/6)(3p - 1/6)$$

$$\text{Using } (x - y)^3 = x^3 - y^3 - 3xy(x - y)$$

$$27p^3 - (1/216) - (9/2)p^2 + (1/4)p = (3p)^3 - (1/6)^3 - 3(3p)(1/6)(3p - 1/6)$$

Taking $x = 3p$ and $y = 1/6$

$$= (3p - 1/6)^3$$

$$= (3p - 1/6)(3p - 1/6)(3p - 1/6)$$

9. Verify:

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

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

Solutions:

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

$$\text{We know that, } (x + y)^3 = x^3 + y^3 + 3xy(x + y)$$

$$\Rightarrow x^3 + y^3 = (x + y)^3 - 3xy(x + y)$$

$$\Rightarrow x^3 + y^3 = (x + y)[(x + y)^2 - 3xy]$$

$$\text{Taking } (x + y) \text{ common } \Rightarrow x^3 + y^3 = (x + y)[(x^2 + y^2 + 2xy) - 3xy]$$

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

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

$$\text{We know that, } (x - y)^3 = x^3 - y^3 - 3xy(x - y)$$

$$\Rightarrow x^3 - y^3 = (x - y)^3 + 3xy(x - y)$$

$$\Rightarrow x^3 - y^3 = (x - y)[(x - y)^2 + 3xy]$$

$$\text{Taking } (x - y) \text{ common } \Rightarrow x^3 - y^3 = (x - y)[(x^2 + y^2 - 2xy) + 3xy]$$

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

10. Factorise each of the following:

(i) $27y^3+125z^3$

(ii) $64m^3-343n^3$

Solutions:

(i) $27y^3+125z^3$

The expression, $27y^3+125z^3$ can be written as $(3y)^3+(5z)^3$

$$27y^3+125z^3 = (3y)^3+(5z)^3$$

We know that, $x^3+y^3 = (x+y)(x^2-xy+y^2)$

$$27y^3+125z^3 = (3y)^3+(5z)^3$$

$$= (3y+5z)[(3y)^2-(3y)(5z)+(5z)^2]$$

$$= (3y+5z)(9y^2-15yz+25z^2)$$

(ii) $64m^3-343n^3$

The expression, $64m^3-343n^3$ can be written as $(4m)^3-(7n)^3$

$$64m^3-343n^3 =$$

$$(4m)^3-(7n)^3$$

We know that, $x^3-y^3 = (x-y)(x^2+xy+y^2)$

$$64m^3-343n^3 = (4m)^3-(7n)^3$$

$$= (4m-7n)[(4m)^2+(4m)(7n)+(7n)^2]$$

$$= (4m-7n)(16m^2+28mn+49n^2)$$

11. Factorise: $27x^3+y^3+z^3-9xyz$.

Solution:

The expression $27x^3+y^3+z^3-9xyz$ can be written as $(3x)^3+y^3+z^3-3(3x)(y)(z)$

$$27x^3+y^3+z^3-9xyz = (3x)^3+y^3+z^3-3(3x)(y)(z)$$

We know that, $x^3+y^3+z^3-3xyz = (x+y+z)(x^2+y^2+z^2-xy-yz-zx)$

$$27x^3+y^3+z^3-9xyz = (3x)^3+y^3+z^3-3(3x)(y)(z)$$

$$= (3x+y+z)[(3x)^2+y^2+z^2-3xy-yz-3xz]$$

$$= (3x+y+z)(9x^2+y^2+z^2-3xy-yz-3xz)$$

12. Verify that:

$$x^3+y^3+z^3-3xyz = (1/2) (x+y+z)[(x-y)^2+(y-z)^2+(z-x)^2]$$

Solution:

We know that,

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

$$\Rightarrow x^3+y^3+z^3-3xyz = (1/2)(x+y+z)[2(x^2+y^2+z^2-xy-yz-xz)]$$

$$= (1/2)(x+y+z)(2x^2+2y^2+2z^2-2xy-2yz-2xz)$$

$$= (1/2)(x+y+z)[(x^2+y^2-2xy)+(y^2+z^2-2yz)+(x^2+z^2-2xz)]$$

$$= (1/2)(x+y+z)[(x-y)^2+(y-z)^2+(z-x)^2]$$

13. If $x+y+z = 0$, show that $x^3+y^3+z^3 = 3xyz$.

Solution:

We know that,

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

Now, according to the question, let $(x+y+z) = 0$,

$$\text{Then, } x^3+y^3+z^3-3xyz = (0)(x^2+y^2+z^2-xy-yz-xz)$$

$$\Rightarrow x^3+y^3+z^3-3xyz = 0$$

$$\Rightarrow x^3+y^3+z^3 = 3xyz$$

Hence Proved

14. Without actually calculating the cubes, find the value of each of the following:

(i) $(-12)^3+(7)^3+(5)^3$

(ii) $(28)^3+(-15)^3+(-13)^3$

Solution:

(i) $(-12)^3+(7)^3+(5)^3$

Let $a = -12$

$b = 7$

$c = 5$

We know that if $x+y+z = 0$, then $x^3+y^3+z^3=3xyz$.

Here, $-12+7+5=0$

$$(-12)^3+(7)^3+(5)^3 = 3xyz$$

$$= 3 \times -12 \times 7 \times 5$$

$$= -1260$$

(ii) $(28)^3+(-15)^3+(-13)^3$

Solution:

$$(28)^3+(-15)^3+(-13)^3$$

Let $a = 28$

$b = -15$

$c = -13$

We know that if $x+y+z = 0$, then $x^3+y^3+z^3 = 3xyz$.

Here, $x+y+z = 28-15-13 = 0$

$$(28)^3+(-15)^3+(-13)^3 = 3xyz$$

$$= 0+3(28)(-15)(-13)$$

$$= 16380$$

15. Give possible expressions for the length and breadth of each of the following rectangles, in which their areas are given:

(i) Area: $25a^2-35a+12$

(ii) Area: $35y^2+13y-12$

Solution:

(i) Area: $25a^2 - 35a + 12$

Using the splitting the middle term method,

We have to find a number whose sum = -35 and product = $25 \times 12 = 300$

We get -15 and -20 as the numbers [$-15 + -20 = -35$ and $-15 \times -20 = 300$]

$$25a^2 - 35a + 12 = 25a^2 - 15a - 20a + 12$$

$$= 5a(5a - 3) - 4(5a - 3)$$

$$= (5a - 4)(5a - 3)$$

Possible expression for length = $5a - 4$

Possible expression for breadth = $5a - 3$

(ii) Area: $35y^2 + 13y - 12$

Using the splitting the middle term method,

We have to find a number whose sum = 13 and product = $35 \times -12 = 420$

We get -15 and 28 as the numbers [$-15 + 28 = 13$ and $-15 \times 28 = 420$]

$$35y^2 + 13y - 12 = 35y^2 - 15y + 28y - 12$$

$$= 5y(7y - 3) + 4(7y - 3)$$

$$= (5y + 4)(7y - 3)$$

Possible expression for length = $(5y + 4)$

Possible expression for breadth = $(7y - 3)$

16. What are the possible expressions for the dimensions of the cuboids whose volumes are given below?

(i) Volume: $3x^2 - 12x$

(ii) Volume: $12ky^2 + 8ky - 20k$

Solution:

(i) Volume: $3x^2 - 12x$

$3x^2 - 12x$ can be written as $3x(x - 4)$ by taking $3x$ out of both the terms.

Possible expression for length = 3

Possible expression for breadth = x

Possible expression for height = (x-4)

(ii) Volume:

$$12ky^2 + 8ky - 20k$$

$12ky^2 + 8ky - 20k$ can be written as $4k(3y^2 + 2y - 5)$ by taking 4k out of both the terms.

$$12ky^2 + 8ky - 20k = 4k(3y^2 + 2y - 5)$$

[Here, $3y^2 + 2y - 5$ can be written as $3y^2 + 5y - 3y - 5$ using splitting the middle term method.]

$$= 4k(3y^2 + 5y - 3y - 5)$$

$$= 4k[y(3y + 5) - 1(3y + 5)]$$

$$= 4k(3y + 5)(y - 1)$$

Possible expression for length = 4k

Possible expression for breadth = (3y + 5)

Possible expression for height = (y - 1)

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