

FlexiPrep

Math's: Algebra and Algebraic Expressions: Addition and Subtraction of Polynomials (For CBSE, ICSE, IAS, NET, NRA 2022)

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Addition and Subtraction of Polynomials

- For adding polynomials, we add their like terms together. Similarly, in subtracting a polynomial from another polynomial, we subtract a term from a like term.
- For Ex- $5x^3$ and $8x^3$ can be added as-
- $5x^3 + 8x^3 = 5 \times x^3 + 8 \times x^3 = (5 + 8) x^3 = 13x^3$
- (In short, the numerical coefficients of the like terms will be added and then multiplied with the common variable)
- Similarly, $15x^2y^3 - 7x^2y^3 = 8x^2y^3$

The steps to carry out addition or subtraction of polynomials can be summarized as-

- **Step 1-** Group the like terms of the given polynomials together.
- **Step 2-** Add or subtract the like terms together to get the sum or difference of the given polynomials.
 - The sum of two (or more) like terms is a like term whose numerical coefficient is the sum of the numerical coefficients of the like terms.
 - The difference of two like terms is a like term whose numerical coefficient is the difference of the numerical coefficients of the like terms.

1. Add the polynomials $8x + 2y - 5x^2$, $5y + 3x$ and $6x - 13y - 9x^2$

Solution:

$$8x + 2y - 5x^2$$

$$3x + 5y$$

$$6x - 13y - 9x^2$$

$$17x - 6y - 13x^2$$

2. Subtract $6y^2 + 4x^3 - 2$ from $7x^3 - 6x + 16$.

Solution:

$$7x^3 - 6x + 16$$

$$6y^2 + 4x^3 - 2$$

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$$-6y^2 + 3x^3 - 6x + 18$$

Multiplication of Polynomials

To multiply a polynomial by another polynomial, we multiply each term of one polynomial by each term of the other polynomial and simplify the result by combining the terms. It is advisable to arrange both the polynomials in increasing or decreasing powers of the variable.

Example – Multiply $(-5x + 2x^2 + 1)$ by $(1 + x)$

Sol- Firstly, arrange the terms of the polynomial in decreasing order of powers-

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

$$2x^2 \times x + 2x^2 \times 1 - 5x \times x - 5x \times 1 + 1 \times x + 1 \times 1$$

$$2x^3 + 2x^2 - 5x^2 - 5x + x + 1$$

$$2x^3 - 3x^2 - 4x + 1$$

Division of Polynomials

The steps involved in the process of division of a polynomial by another polynomial are listed below -

- **Step 1:** Arrange the terms of both the polynomials in decreasing powers of the variable common to both the polynomials.
- **Step 2:** Divide the first term of the dividend by the first term of the divisor to obtain the first term of the quotient.
- **Step 3:** Multiply all the terms of the divisor by the first term of the quotient and subtract the result from the dividend, to obtain a remainder (as next dividend)
- **Step 4:** Divide the first term of the resulting dividend by the first term of the divisor and write the result as the second term of the quotient.
- **Step 5:** Multiply all the terms of the divisor by the second term of the quotient and subtract the result from the resulting dividend of Step 4.
- **Step 6:** Repeat the process of Steps 4 and 5, till you get either the remainder zero or a polynomial having the highest exponent of the variable lower than that of the divisor.

Example- Divide $10 - 1x^3 + 2x^4 - 7x^2 - 3x$ by $x - 2$.

Solution:

$$x - 2 \overline{) 2x^4 - 1x^3 - 7x^2 - 3x + 10} \quad (2x^3 + 3x^2 - 1x - 5$$

$$2x^4 - 4x^3$$

$$0 \ 3x^3 - 7x^2 - 3x + 10$$

$$3x^3 - 6x^2$$

$$0 - x^2 - 3x + 10$$

$$-x^2 + 2x$$

$$0 - 5x + 10$$

$$-5x + 10$$

$$0$$

$$\text{Quotient : } 2x^3 + 3x^2 - 1x - 5$$

$$\text{Remainder : } 0$$

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