

WORKSHEET

Exercise 12.1

ALGEBRIC
EXPRESSION

Cl. 12

ALGEBRIC
EXPRESSION
class 7

1. Write an algebraic expression for the following.

- Seven more than a number divided by $(a - b)$.
- One-fifth of a number multiplied by the difference of x and y .
- Half of a number added to sixteen.
- ' a ' cubed less than ' y ' squared.
- The square of a number subtracted from three times of another number.
- Thrice a number added to twice of another number.
- 4 times the reciprocal of ' a ' added to ' a ' times the reciprocal of 7.
- Twice the sum of a number and another number.
- Five less than the quotient of a by b .
- 2 times a number increased by 3.
- Six times a number added to its reciprocal.
- The product of two numbers added to their sum.

2. Evaluate the following for $a = 2$, $b = -1$, $c = -2$.

(i) $3a^2 + b$

(ii) $2a^2b^2 - 5ab + 7$

(iii) $\frac{1}{5}a^3 - b + c$

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

(v) $a + b + c$

3. Express the following as formulae.

- The price of one item is p . The cost (c) of n items is _____.
- The perimeter (p) of a square of side x is $p =$ _____.
- The area (A) of a rectangle with length (l) and breadth (b) is $A =$ _____.
- The perimeter (p) of a regular polygon of n sides with each side of length l is $p =$ _____.

4. Write the numerical coefficient of.

(i) $-101x^2y^3z$

(ii) $-3 \times 7 \times 15 \times x \times y \times y \times z \times z$

(iii) $-p^2q^3r$

(iv) $-17x^3 + 12x^3$

5. A number has two digits with a in tens place and b in the units place. If the digits are reversed, what will be the new number?6. Sonia is twice as old as Rahul. If Rahul is x years old, what is the sum of Sonia's and Rahul's age?

7. Identify the like terms in the following.

(i) $x^2, -15x^2, y^2, z^2$

(ii) $-3x^2y, 2y^2x^2, -5yx^2, -2x^2y^2$

(iii) $-6x, \frac{-1}{5}y, \frac{-3}{2}x, -7yz$

(iv) $a^3b^3c, a^2b^2c, a^2cb^2, -5a^2b^2c$

8. Write the coefficient of.

(i) x in $-15xy^2$

(ii) p^2 in $\frac{16}{3}p^2q^3r$

(iii) a in $-17ab^2c$

(iv) r^3 in p^3qr^3

9. Write the constant term of.

(i) $-6x^2 + 7x - 3$

(ii) $16a^3 - 2a - \frac{17}{5}$

(iii) $\frac{1}{3}p^2 - 2q + 2$

10. If $p = -3$, $q = -1$ and $r = 2$, find the value of $3p^2q^2r^2 - 2pqr + 7$.

Operations on Algebraic Expressions

1. ADDITION OF ALGEBRAIC EXPRESSIONS

The key to understand addition of algebraic expression is that only like terms can be added. It is very simple.

For example; if you have 5 apples and 8 bananas, we can say that there are 13 fruits in all but when we add 5 apples + 8 bananas \neq 13 apples or 13 bananas Thus, only like terms can be added.

For example; $2x^2 + 6x^2 + 3x^2 = 8x^2 + 3x^2 = 11x^2$

If extend the rule to integral values it will follow the rules for addition of integers.

For example; the sum of $a^2, -3a^2, +6a^2, 2a^2$ will be $a^2 + (-3a^2) + 6a^2 + 2a^2 = (1 - 3 + 6 + 2) a^2 = 6a^2$

There are two methods of addition:

1. Linear Method

2. Column Method

LINEAR METHOD

Collect all the like terms and add their numerical coefficients with their respective signs.

COLUMN METHOD

Each expression is written in a separate row such that their like terms are arranged one below the other in a column. Thereafter, addition is done column-wise.

2. SUBTRACTION OF ALGEBRAIC EXPRESSIONS

When we subtract a given expression from another expression we change the sign of each term of the expression to be subtracted and then add it to the expression from which subtraction is to be done. Let's see the examples.

Here also you may use linear method or column method.

Simplification of Algebraic Expressions

An expression containing brackets is simplified by removing the brackets and then combining the like terms.

Solved Examples

Example 1: Find the sum of.

$$2x^2y - 3yx^2 + 2xy - 7 \text{ and } -5yx^2 + 2xy - 15.$$

The sum of two expressions

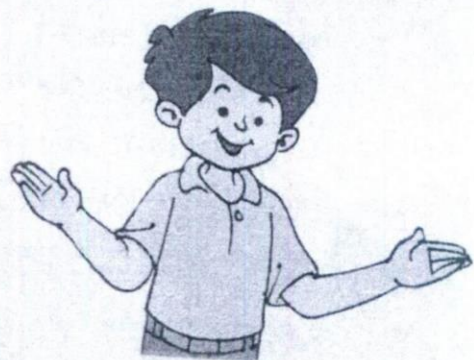
$$= 2x^2y - 3x^2y + 2xy - 7 + (-5yx^2) + 2xy - 15$$

$$\begin{aligned}
 &= (2x^2y - 3x^2y - 5x^2y) + (2xy + 2xy) + (-7 - 15) \\
 &= (2 - 3 - 5)x^2y + (2 + 2)xy - 22 \\
 &= -6x^2y + 4xy - 22.
 \end{aligned}$$

Example 2: Add: $5xy^2$, $-3xy^2$, $2xy^2$, $-7y^2x$.

The required sum = $5xy^2 + (-3xy^2) + 2xy^2 + (-7xy^2)$

$$\begin{aligned}
 &= 5xy^2 - 3xy^2 + 2xy^2 - 7xy^2 \\
 &= (5 - 3 + 2 - 7)xy^2 = -3xy^2.
 \end{aligned}$$



Example 3: Subtract: $-11p^2q^2 + 8pq + 6$ from $9p^2q^2 - 6pq - 9$.

Let's solve this with column method

$$\begin{array}{r}
 9p^2q^2 - 6pq - 9 \\
 -11p^2q^2 + 8pq + 6 \\
 + \quad - \quad - \\
 \hline
 20p^2q^2 - 14pq - 15
 \end{array}$$

(Note that the sign of each term of 2nd expression has been changed here and we operate using these signs only.)

Example 4: Subtract: $2ab - 3b^2 + 2a^2 - 1$ from $5a^2 - 2b^2 + 6ab + 3$.

We have, $(5a^2 - 2b^2 + 6ab + 3) - (2a^2 - 3b^2 + 2ab - 1)$

$$= 5a^2 - 2b^2 + 6ab + 3 - 2a^2 + 3b^2 - 2ab + 1$$

[Notice the change in sign of each term of 2nd expression.]

$$= 5a^2 - 2a^2 - 2b^2 + 3b^2 + 6ab - 2ab + 3 + 1 \quad (\text{Arranging the like terms})$$

$$= 3a^2 + b^2 + 4ab + 4.$$

Example 5: Add the following.

$6x - 4y + 3z$, $5x - 7z + 3y$ and $z - x - y$.

Step 1. Write the expressions such that the like terms are in the same column

$$6x - 4y + 3z$$

$$5x + 3y - 7z$$

$$-x - y + z$$

Step 2. Add the like terms (keeping their signs in mind)

$$6x - 4y + 3z$$

$$+ 5x + 3y - 7z$$

$$- x - y + z$$

$$\hline
 10x - 2y - 3z$$

$$(\because 6 + 5 - 1 = 10)$$

$$- 4 + 3 - 1 = -2$$

$$\text{and } 3 - 7 + 1 = -3)$$

Example 6 : Simplify: $17x^2 - 15x + 7 - (2x^2 + 5x + 10)$.

$$\begin{aligned} & \text{We have, } 17x^2 - 15x + 7 \\ & \quad - (2x^2 + 5x + 10) \\ & = 17x^2 - 15x + 7 - 2x^2 - 5x - 10 \\ & = 17x^2 - 2x^2 - 15x - 5x + 7 - 10 \\ & = 15x^2 - 20x - 3. \end{aligned}$$

Exercise 12.2

1. Add.

- $7a^2 + 5b^2 - 4c^2, -8a^2 - 5b^2 - 7c^2, 3a^2$
- $5x^2 + \frac{4}{3}x + 2, -7x^2 - \frac{1}{4}x + \frac{3}{5}, 6x^2 - \frac{5}{12}x - \frac{7}{3}$
- $3x^2 - 8y^2 + 4z^2, 2y^2 - 5x^2 + 4z^2, 6y^2 - 9x^2 + 4z^2$
- $\frac{3}{2}a^2b - \frac{1}{2}ab, 3a^2b + 2ab, -\frac{1}{2}a^2b + \frac{3}{2}ab$
- $-3a^2b^2, \frac{2}{3}a^2b^2, -\frac{1}{6}a^2b^2, \frac{1}{9}a^2b^2$
- $5a^2, -8a^2, 4a^2$

2. Subtract.

- $2a^2 + 3b^2 - 4c^2$ from $2c^2 - 3a^2 + 4b^2$
- $\frac{1}{5}a^2b^2$ from $-3a^2b^2$
- 1 from $9 + 2a + 5b - c$
- 0 from $7a^2 + 8b^2 - 9c^2$
- $-8a^2$ from $5a^2$
- $7a^2 + 8b^2 - 9c^2$ from 0
- $9 + 3a + 5b - c$ from 1
- $a^2 - 2a + \frac{1}{2}$ from $-a^2 + 2a - \frac{1}{2}$

3. Simplify.

- $-p + [6p - \{q - (3p - 2q)\}]$
- $7a - [2b - \{3a - (4a - 2b) + 8a - (2a + 5b + 3c)\}]$
- $xy - [zx - xy - \{yz - (zx + yx) - (2xy - zx)\}]$

4. Simplify $x^3 - 3x^2 + 7x - 5 + 2x^3 - 9x^2 + 3 - x$ and find the value for $x = -3$.

5. Somya earns $12a + 7b$ rupees every month. She spends $2a - 3b$ rupees. How much does she save?

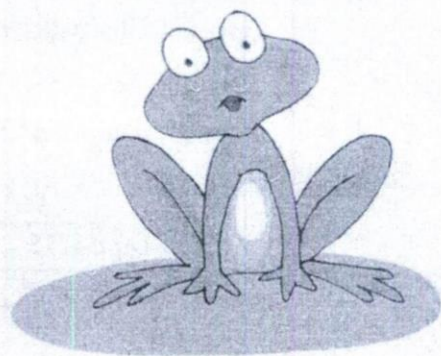
6. What must be subtracted from $p^3 - 2p^2 + 7p - 6$ to obtain $3p^2 - 2p + 3$?

7. How much larger is $16a^2 - 3b^2 + 7ab$ than $12a^2 - 9ab$?

8. Ritika spends $9a - b$ rupees for a skirt, $6a + 2b$ rupees for a mobile and $2a - 3b$ rupees for chocolates. If she had ₹ 2000 with her, how much money will she be left with?

9. From the sum of $5x^2 + 3xy + y^2$ and $-4x^2 - 3y^2$, subtract $x^2 - 5xy + y^2$. Also, write the degree of the resulting expression.

10. By how much is $2a^2 - 3b + 7$ smaller than $8 - 5a^2 + 7b$?



Objective Type Questions

I. Multiple Choice Questions.

1. If one-sixth of a number is equal to 4, then the number is:
(i) 24 (ii) $\frac{6}{4}$ (iii) $\frac{4}{6}$ (iv) 42
2. For what value of x , $6x - 14$ and $4x - 10$ are equal?
(i) 2 (ii) 3 (iii) 4 (iv) 6
3. The value of x , when $\frac{x}{2} - \frac{1}{4} = \frac{x}{3} + \frac{1}{2}$ is:
(i) $\frac{7}{2}$ (ii) $\frac{9}{2}$ (iii) $-\frac{9}{2}$ (iv) none of these
4. If 17 is subtracted from a number, the result is 39, then the number is:
(i) 65 (ii) 56 (iii) 48 (iv) 100
5. If the sum of two consecutive odd numbers is 32, the smaller number is:
(i) 15 (ii) 17 (iii) 19 (iv) 21

II. Fill in the blanks.

6. A statement of equality containing one or more variables is called _____.
7. Expression $3a + 3b - 3c$ is a _____.
8. The value of the variable that satisfies a given equation is called its _____ or _____.
9. The process of transferring the terms from L.H.S. to R.H.S. and vice versa is called _____.
10. $5x + 8 = -11x$ is an equation in _____ variable.

III. Tick (✓) for 'True' and (×) for 'False'.

11. When a term is transferred from one side of an equation to the other, its sign does not change.
12. $7a^2 + 3p$ is a trinomial.
13. The solution of $8x + 5 - 3x = 3x - 5$ is -5 .
14. When a particular number is added to both sides of an equation, its value changes.
15. If the difference of two numbers is 25, then the numbers are x and $25 + x$.

