MATHEMATICS

Class-VI

Topic-07

INTRODUCTION TO ALGEBRA

INDEX		
S. No.	**Topic**	**Page No.**

CHAPTER 07

INTRODUCTION TO ALGEBRA

TERMINOLOGIES

Literal numbers, coefficient, numerical coefficient, variable, constant, algebraic expression, monomial, binomial, trinomial. polynomial

INTRODUCTION

In Arithmetic numerals 1,2,3,4 ….. Etc. and four fundamental operations : addition, subtraction, multiplication, division are used to deal with various problems. In Algebra, in addition to numerals we use letters such as x, y, z in various situation to solve the problems:
Consider the following statements :
I think of a number and when I subtract 9 from it the result is 23
If x is used to represent the number I think of, then the above statement using mathematical symbols is simply written as $x - 9 = 23$

7.1 ALGEBRAIC EXPRESSION

(a) Match stick Pattern

Salman and Aamir are making pattern with match sticks. They decide to make simple patterns of the letters of the english alphabet. Salman takes two match sticks and form the letter L as shown in fig.1.
The Aamir also picks two sticks form another letter L and puts it next to the one made by salman as shown in fig 2. The Salman adds one more L and this goes on as shown in fig 3.

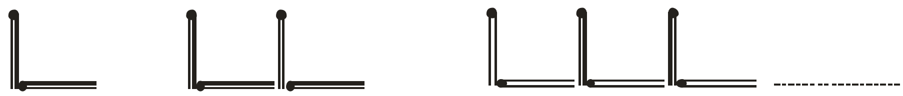


Figure 1 Figure 2 Figure 3

If we tabulate this result we obtained the following table as given below

Number of Ls formed	1	2	3	4	5	6	7	8	.....	.....
Number of matchsticks required	2	4	6	8	10	12	14	16	.....	.....

Here we observe that number of match stick required is twice the number's of L
So, we can say number of match stick required = 2 x n, where n represent the number of L's

Consider the following statements :

I think of a number and when I subtract 9 from it the result is 23.

If $\square$ is used to represent the number I think of $\square$, then the above statement using mathematical symbols, is simply written as $\square - 9 = 23$.

Illustration 7.1

Use $\square$, Δ etc. and mathematical symbols and rewrite the following statements :

(a) I think of a number, subtract 3 from it and the result is 34.

(b) I think of two numbers, add these numbers, multiply the result by 2 to get the final answer as 14.

(c) I think of two numbers. Twice difference is added by 3 gives result 15.

Sol. **(a)** $\square - 3 = 34$

(b) $2 \times (\square + \Delta) = 14$

(c) $2 \times (\square - \Delta) + 3 = 15$

Illustration 7.2

Rewrite each of the following statements without using symbols, beginning each statement with : I think of ......

(a) $\square + 9 = 28$ **(b)** $2 \times \square - 23 < 25$ **(c)** $(\square + \Delta) \div 5 = 25$

Sol. **(a)** I think of a number, when 9 is added to it gives result 28.

(b) I think of a number, when 23 is subtracted from the twice the number gives the result is less than 25.

(c) I think of two numbers, when their sum is divided by 5 gives quotient 25.

(b) Literal Numbers

We have mentioned earlier that the letters represent the numbers. These letters are called literal numbers and obey all the rules of arithmetic.

NOTE :

5 x p x q = 5pq. 5, p and q are factors of 5pq. 5 is a numerical factor and p, q are literal factors.

Illustration 7.3

Give expressions for the following cases.

(a) Rita scores x marks in Maths and 46 marks in English. What is her total score in Maths and English.

(b) The difference of x and 9 where $x > 9$.

(c) The product of a and b added to the difference of a and b $(a > b)$.

(d) One-half of a multiplied by the sum of x and y.

(e) The total distance travelled by a car in x hours at a constant speed of y km/h.

(f) The total number of eggs in n cartons if each carton contains k eggs.

Sol. **(a)** Total marks = $x + 46$

(b) $x - 9$

(c) $ab + a - b$

(d) $\frac{a}{2} \times (x + y)$

(e) distance = $(x \times y)$ Km.

(f) Number of eggs = $(n \times k)$ eggs

Illustration 7.4

Ali is x years old. Express the following in algebraic form :

(a) Ali's age 5 years ago.

(b) Ali's age 2 years from now.

(c) 4 times Ali's age 3 years hence.

(d) the present age of Ali's aunt who is four times as old as Ali will be 5 years from today.

(e) The present age of Ali's father who is 5 times as old as Ali was 3 years ago.

Sol. **(a)** Ali's age 5 years ago = $(x - 5)$ years

(b) Ali's age 2 years from now = $(x + 2)$ years

(c) Ali's age 3 years hence = $(x + 3)$ years
4 times Ali's age 3 years hence = $4(x + 3)$ years

(d) Ali's age after 5 years = $(x + 5)$ years
Ali's aunt age = $4(x + 5)$ years

(e) Ali's age before 3 years = $(x - 3)$ years
Ali's father age = $5(x - 3)$ years

(c) Powers Of Literal Numbers

We have read earlier that $2 \times 2 \times 2 = 2^3$ and $(-3) \times (-3) = (-3)^2$
Similarly, $a \times a \times a = a^3$ and $(-y) \times (-y) \times (-y) \times (-y) = (-y)^4$
a^3 is read as 'a to the power three' or 'a raised to the power three' or 'a cube' or 'third power of a' and $(-y)^4$ is read as '$-y$ to the power four' or '$-y$ raised to the power four' or fourth power of $-y$'.
In a^3, a is called base and 3 is called exponent or index.

(d) Coefficient

The number expressed in figures or symbols, standing before an algebraic term as a multiplier is called its coefficient. Thus in 3abc, 3 is the coefficient of abc, 3a is the coefficient of bc and 3ab is the coefficient of c. When one of the factors is an Arithmetic number it is always written first and is called a numerical coefficient. Thus in 3xyz, 3 is the numerical coefficient of xyz. When the coefficient is expressed in letter, it is called a literal coefficient. Thus in axy a is the literal coefficient of xy. When the coefficient is 1 or – 1, the number 1 is usually omitted. Thus 1 x is written as x and – 1 x as –x, 1xy is written as xy and – 1 xy as – xy.

(e) Variables and Constants

In algebra we come across two types of symbols, namely variables and constants. A symbol having a fixed value is called a constant whereas a symbol which takes on various numerical values is called a variable.
For example, the perimeter p of rectangle is given by the formula p = 2(l + b), where l and b are its length and breadth. Here 2 is a fixed number and hence a constant but the literal numbers p, l and b depends on different sizes of the rectangle and hence they are variables.

Illustration 7.5

Write down the coefficient of :

	(a)	x in 3xy	**(b)**	abc in – 5abc	**(c)**	y in 2xyz	**(d)**	a^2 in – a^2bc
Sol.	**(a)**	3y	**(b)**	– 5	**(c)**	2xz	**(d)**	– bc

Illustration 7.6

Write down the numerical coefficient in each of the following :

	(a)	5 ab	**(b)**	– 3xyz	**(c)**	px	**(d)**	–y
Sol.	**(a)**	5	**(b)**	–3	**(c)**	1	**(d)**	– 1

(f) Algebraic expression

Any combination of letters or of numerals and letters connected by the symbols +, –, ×, ÷ is called an Algebraic expression. For example, 2x – 3y + 5z is an algebraic expression.
The several parts of an expression connected by the signs + and – are called the terms of the expression.

NOTE :

Only the signs + and – separate the terms of an expression. 5xy is one term whereas x – y are two terms x and – y.
An expression consisting of one term is called a monomial,. 2x, 5ab, – 7xy, 20 are all examples of monomials. An expression consisting of two terms is called a Binomial. Some examples of the binomials are 2x – 3y, 5a – 2b, p + 2q etc. An expression consisting of three terms is called a trinomial. The expression consisting of several terms is called multinomial or polynomial expression.

Illustration 7.7

Ruchika buys 5 copies for Maths, 2x copies for English and y^2 copies for Hindi. Express the total number of copies she buys as an algebraic expression.

Sol. Number of copies for Maths = 5
Number of copies for English = 2x
Number of copies for Hindi = y^2
Total number of copies = 5 + 2 x + y^2

Operation	+	–	×	÷
Algebraic Expression	n + 14	n – 5	12n	4 ÷ y or $\frac{4}{y}$
Verbal Expression	• 14 added to n • n plus 14 • Sum of n and 14 • 14 more than n • n increased by 14	• 5 subtracted from n • the difference of n and 5 • n decreased by 5 • 5 less than n • n less 5 • take away 5 from n	•12 times n • product of 12 and n • n multiplied by 12 • 12 groups of n	• 4 divided by y • quotient of 4 and y • 4 divided into y groups

Illustration 7.8

Write the following , using symbols :

(i) a increased by twice b

(ii) three times the difference of 30 and c

(iii) 70 increased by the quotient of x and y

(iv) length in centimetres that is 4 cm longer than y metres

Sol. **(i)** a + 2b **(ii)** 3 (30 – c) **(iii)** $70 + \frac{x}{y}$

(iv) 100 y + 4 ($\because$ y metres = 100 × y = 100 y cm)

Illustration 7.9

Write down separately the terms of the following algebraic expression :

(a) $3x - 4y$ **(b)** $2ab + 4ac^2 - 6z$

(c) $7xyz + 2yz - 8x^2y^3$ **(d)** $-2pq^2 + 7qr^4 - 3p + 4p^2q^3r^4$

Sol. **(a)** $3x, -4y$ **(b)** $2ab, 4ac^2, -6z$

(c) $7xyz, 2yz, -8x^2y^3$ **(d)** $-2pq^2, 7qr^4, -3p, 4p^2q^3r^4$

Illustration 7.10

Write down the algebraic expressions whose terms are given below :

(a) $2a, -3b, -4c$ **(b)** $5bc^2, -2ab, 7a^2c$

(c) $3t^2uw^3, 7t^2w^2 - 2p^2q + 7$

Sol. **(a)** $2a - 3b - 4c$ **(b)** $5bc^2 - 2ab + 7a^2c$

(c) $3t^2uw^3 + 7t^2w^2 - 2p^2q + 7$

Illustration 7.11

Separate monomials, binomials and trinomials from the following :

$5x^2 - 3xy, 2x^4, 3x - 2y + 4z, -3y^2, 5x^3y^2 + 4y^2z - z^5, ax - by + cz^2, pq + rst$

Sol. Monomials are : $2x^4, -3y^2$

Binomials are : $5x^2 - 3xy, pq + rst$

Trinomials are : $3x - 2y + 4z, 5x^3y^2 + 4y^2z - z^5, ax - by + cz^2$

Illustration 7.12

If a = 2, b = 3, c = 4, find the value of :

(a) $a + b + c$ **(b)** $2c - b - a$ **(c)** $3a - b + 2c$
(d) $a^2 - b^2 + c^2$ **(e)** $ab - 3abc - 2ac$ **(f)** $a^2b + bc - 3c^3 - 2abc$

Sol. **(a)** $a + b + c = 2 + 3 + 4 = 9$

(b) $2c - b - a = 2 \times 4 - 3 - 2 = 8 - 3 - 2 = 3$

(c) $3a - b + 2c = 3 \times 2 - 3 + 2 \times 4 = 6 - 3 + 8 = 11$

(d) $a^2 - b^2 + c^2 = 2^2 - 3^2 + 4^2 = 4 - 9 + 16 = 11$

(e) $ab - 3abc - 2ac = 2 \times 3 - 3 \times 2 \times 3 \times 4 - 2 \times 2 \times 4 = 6 - 72 - 16 = -82$

(f) $a^2b + bc - 3c^3 - 2abc = 2^2 \times 3 + 3 \times 4 - 3 \times 4^3 - 2 \times 2 \times 3 \times 4$
$= 12 + 12 - 192 - 48 = -216$

Ask yourself

1. Find the rule which gives the number of match sticks required to make the following match stick patterns :
(a) a pattern of letters T

2. Give expressions for the following cases.
(a) a increased by twice b.
(b) three times the difference of 30 and c.
(c) 70 increased by the quotient of x and y.
(d) half of a increased by the product of 7 and b

3. Write the coefficient of :

(a) x in $-6xy^2$ **(b)** a in $\frac{2}{3}a$ **(c)** x^2y in $-\frac{4}{9}ax^2y$

4. Write down the numerical coefficient as well as the literal coefficient of each of the following:

(a) $-10x^2y$ **(b)** $\frac{6}{13}a^2bc$ **(c)** $-pq$ **(d)** $\frac{-5xy}{9z}$

5. Separate monomials, binomials and trinomials from the following :
$5x^2 - 3xy$, $2x^4$, $3x - 2y + 4z$, $-3y^2$, $5x^3y^2 + 4y^2z - z^5$

6. If a = 2 , b= 3 , c = 4 , find the value of :
(a) $a + b + c$ **(b)** $2c - b - a$ **(c)** $a^2 - b^2 - c^2$ **(d)** $ab - 3bc - 2ac$

Answers

1. **(a)** 2n (n = number of matchsticks)

2. **(a)** $a + 2b$ **(b)** $3(30 - c)$ **(c)** $70 + \frac{x}{y}$ **(d)** $\frac{1}{2}a + (7b)$

3. **(a)** $-6y^2$ **(b)** $\frac{2}{3}$ **(c)** $-\frac{4}{9}a$

4. **Numerical coeffecient** **Literal coeffecient**

(a)	-10	$-x^2y$
(b)	$\frac{6}{13}$	a^2bc
(c)	-1	$-pq$
(d)	$\frac{-5}{9}$	$\frac{-xy}{z}$

5. Monimial: $2x^4$, $-3y^2$

Binomial: $5x^2 - 3xy$

Trinomial: $3x - 2y + 4z$, $5x^3y^2 + 4y^2z - z^5$

6. **(a)** 9 **(b)** 3 **(c)** – 21 **(d)** – 46

7.2 ALGEBRAIC EQUATIONS

An equation is a mathematical statement equating two quantities. The expressions on either side of the equal sign (=) are called members of the equation. In an equation, the value of the quantity which is not known is referred to as the unknown member or the unknown. Here are some examples of equations.

$2x + 3 = 11$ $x - 3 = 8$ $y + 3 = 21$

Illustration 7.13

Rewrite the following statements by using symbols wherever needed.

(i) a exceeds b by 10

(ii) Twice the product of p and q divided by r.

(iii) x is not equal to two times y.

(iv) Four times m is greater than seven.

(v) The excess of 15 over 10 is 5.

(vi) Since two times x equal sixteen, therefore x is equal to eight.

(vii) Since four into y equal forty, therefore y equals ten.

(viii) Twice the product of p and q upon the sum of a and b equals five.

(ix) The difference of x and y is less the sum of two and ten.

(x) Nine times two is greater than ten.

Sol.

(i)	$a - b = 10$	**(ii)**	$\frac{2pq}{r}$	**(iii)**	$x \neq 2y$.
(iv)	$4m > 7$	**(v)**	$15 - 10 = 5$	**(vi)**	Since $2x = 16$ $\therefore$ $x = 8$
(vii)	Since $4y = 40$ $\therefore$ $y = 10$	**(viii)**	$\frac{2pq}{a+b} = 5$	**(ix)**	$x - y < 2 + 10$
(x)	$9\ \ 2 > 10$				

(a) Solution an Equation

To solve an equation is to determine the value (s) of the variable (or unknown) that balances the equation. That value(s) is called the root (s) of the equation or solution of the equation.

Let us take an example.

$x + 7 = 15$;

We have to find the value of x which will satisfy the equation. And we observe that if we put x = 8 in this equation it will satisfy the equation. So x = 8 is the solution or root of this equation.

(i) Solution of an equation by trial and Error

One of the simplest ways of solving an equation is by the trial-and-error method. In this, a guess is made about the value of x, and this value is then substituted in the equation to check if it is the root of the equation. Consider the following example : $4x + 3 = 23$

Our equation is $4x + 3 = 23$. So we substitute different values for x and try to find out which value of x will satisfy the equation. Make a chart as follow.

x	**L.H.S.**	**R.H.S. = 23**
1	$4 \times 1 + 3 = 7$	23
2	$4 \times 2 + 3 = 11$	23
3	$4 \times 3 + 3 = 15$	23
4	$4 \times 4 + 3 = 19$	23
5	$4 \times 5 + 3 = 23$	23

When x = 5 , $4x + 3 = 23$ so the root of the equation or the solution of the equation $4x + 3 = 23$ is 5.

Illustration 7.14

Determine if 3 is the root of the equation $5x – 10 = 5$.

Sol. If we put x = 3, then L.H.S. = $5x – 10 = 5 \times 3 – 10 = 15 – 10 = 5$

R.H.S. = 5

$\therefore$ L.H.S. = R.H.S

Thus, 3 is a root of the given equation.

Illustration 7.15

Express the following as algebraic equations and solve.

(a) Twice a number increased by 7 is 13. What is the number ?

(b) Seven times a number decreased by 4 is 10 . Find the number .

Sol. **(a)** Let the number be x

$\therefore$ Twice the number = 2x

$\therefore 2x + 7 = 13$

x	**L.H.S. = 2x + 7**	**R.H.S. = 13**
1	$2 \times 1 + 7 = 9$	13
2	$2 \times 2 + 7 = 11$	13
3	$2 \times 3 + 7 = 13$	13

Thus for x = 3, L.H.S. = R.H.S.

So the required number is 3.

(b) Let the numbers be x.

$\therefore 7x – 4 = 10$

x	**L.H.S. = 7x – 4**	**R.H.S. = 10**
x = 1	$7 \times 1 – 4 = 3$	10
x = 2	$7 \times 2 – 4 = 10$	10

Here for x = 2, L.H.S. = R.H.S.

$\therefore$ The required number is 2.

Illustration 7.16

If 20 is subtracted from a number, the result is 45. Convert this statement into an algebraic equation.

Sol. Let us suppose that x is the unknown number.
Then $x - 20$ stands for 20 subtracted from the number x. This is equal to 45.
Hence, $x - 20 = 45$
Once you convert a statement into an algebraic equation, it is easier to solve and find the root.

Illustration 7.17

Sunny is twice as old as Manoj. Convert this statement into an algebraic equation.

Sol. Let sunny's age be s and Manoj's age be m. Twice Manoj's age is 2m.
Hence, the equation is $s = 2m$.

(ii) Systematic Method

A much better method of solving an equation is the systematic method as the trial and error method could take a lot of time.

Property - 1 : We can add the same number to both sides of the equation;

Illustration 7.18

Solve the equation $x - 7 = -2$ and check the result.

Sol. We have, $x - 7 = -2$.
In order to solve this equation, we have to get x by itself on the L.H.S., We need to shift –7. This can be done by adding 7 to both sides of the given equation. Thus,

$x - 7 = -2$

$\Rightarrow$ $x - 7 + 7 = -2 + 7$ [Adding 7 to both sides]

$\Rightarrow$ $x + 0 = 5$ [$\because -7 + 7 = 0$ and $-2 + 7 = 5$]

$\Rightarrow$ $x = 5$

Thus, $x = 5$ is the solution of the given equation.
L.H.S. $= 5 - 7 = -2$ and R.H.S. $= -2$
Thus, when $x = 5$, we have L.H.S. = R.H.S.

Property - 2 : We can subtract the same number from both sides of the equation.

Illustration 7.19

Solve the equation $x + 4 = -2$ and check the result.

Sol. In order to solve this equation, we have to obtain x by itself on L.H.S. To get x by itself on L.H.S., we need to shift 4. This can be done by subtracting 4 from both sides of the given equation.
Thus, $x + 4 = -2$

$\Rightarrow$ $x + 4 - 4 = -2 - 4$ [Subtracting 4 from both sides]

$\Rightarrow$ $x + 0 = -6$ [$\because 4 - 4 = 0$ and $-2 - 4 = -6$]

$\Rightarrow$ $x = -6$

Thus, $x = -6$ is the solution of the given equation.

Property - 3 : We can multiply both sides of the equation by the same non-zero number.

Illustration 7.20

Solve the equation $\frac{y}{12} = 48$ and check the result.

Sol. In order to solve this equation, we have to get y by itself on L.H.S. To get y by itself on L.H.S., we have to remove 12 from L.H.S. This can be done by multiplying both sides of the equation by 12, thus we have

$\frac{y}{12} = 48$

$\Rightarrow \quad \frac{y}{12} \times 12 = 48 \times 12$ [Multiplying both sides by 12] $\Rightarrow \quad y = 576$

Check : Putting, y = 576 in the given equation, we get

L.H.S. = $\frac{576}{12} = 48$ and R.H.S. = 48.

Thus, for y = 576, we have L.H.S. = R.H.S

Property-4 : We can divide both sides of the equation by the same non-zero number.

Illustration 7.21

Solve the equation $\frac{2}{3}x = 18$ and check the result.

Sol. We have,

$\frac{2}{3}x = 18$

Multiplying both sides by $\frac{3}{2}$

$\Rightarrow \quad \frac{2}{3} \times \frac{3}{2} \times x = \frac{3}{2} \times 18$

$\Rightarrow \quad x = 27$

Thus, x = 27 is the solution of the given equation.

Check Putting x = 27 in the given equation, we get

L.H.S. = $\frac{2}{3} \times 27 = 18$ and R.H.S. = 18

Thus, for x = 27, we have L.H.S. = R.H.S.

Property - 4 : In an equation, we can drop a term from one side and put it on the other side with the opposite sign. This process is known as transposition.

Illustration 7.22

Solve : 3(x + 3) – 2 (x – 1) = 5 (x – 5).

Sol. We have,

$3(x + 3) - 2(x - 1) = 5(x - 5)$

$\Rightarrow \quad 3x + 9 - 2x + 2 = 5x - 25$ [Expanding brackets on both side]

$\Rightarrow \quad 3x - 2x + 9 + 2 = 5x - 25$

$\Rightarrow \quad x + 11 = 5x - 25$ [Taking 5x to the L.H.S. and 11 to the R.H.S.]

$\Rightarrow \quad -4x = -36$

$\therefore \quad x = 9$

Ask yourself

1. Determine if 6 is the root of the equation $7x-10 = 32$.

2. Solve the equation $x+ 8 = 18$ and check the result.

3. Solve the equation $6x-9 = 22$ and check the result.

4. Solve the following equations and verify the answers in each case :

   (i) $x+ 5 = 9$ **(ii)** $9x + 5= 14$ **(iii)** $\frac{z}{7} - 9 = 5$

   (iv) $4a = 328$ **(v)** $- 6y + 5 = - 7$

5. Solve : $9(x + 9) - 3(4x - 1) = 3(x - 3)$.

Answers

1. Yes **2.** $x = 10$ **3.** $x = \frac{31}{6}$

4. **(i)** $x = 4$ **(ii)** $x = 1$ **(iii)** $x = 14$ **(iv)** $a = 82$ **(v)** $y = 2$ **5.** $x = \frac{31}{2}$

Add your knowledge

(a) **Polynomial** : A polynomial is an algebraic expression with one or more terms.

For example : $6x$, $x^3 + 3x^2 + 9x + 7$, $3x^2 - 4xy + 7y^2$ etc. are all polynomials.

(b) **Degree of polynomial** : The **degree** of a polynomial of one variable is the highest power of the variable in the given polynomial. For example $P(x) = 2x^3 + 3x^2 - 6x + 4$. The highest power of x in all terms of polynomial is 3. Hence, the degree of the polynomial is 3.

(c) **Classification of polynomial according to degree**

(a) **Constant polynomial :** Polynomial having degree zero is known as **constant polynomial**.

For ex : 7, 8, $\frac{3}{2}$.

(b) **Linear polynomial :** Polynomial having degree one is known as **linear polynomial**.

For ex : $2x - 5$, $x + 3$.

(c) **Quadratic polynomial :** Polynomial having degree two is known as **quadratic polynomial**.

For ex : $x^2 + 1$, $7x^2$, $x^2 + 2x - 1$.

(d) **Cubic polynomial :** Polynomial having degree three is known as **cubic polynomial**.

For ex : $7x^3 + 5x^2 + 1$, $x^3 - x + 1$.

(e) **Biquadratic polynomial :** Polynomial having degree four is known as **biquadratic polynomial**.
For ex : $x^4 + 1$, $x^4 + x^2 + 1$.

(d) Like And Unlike terms :

Like terms

The terms having the same literal factors are called like or similar terms.

In the algebraic expression $12a^2 - 15b^2 + b^2 - 17a^2 + 8ab + 9$, we have, $12a^2$ and $-17a^2$ as like terms and also $-15b^2$ and b^2 are like terms.

Unlike terms
The terms not having same literal factors are called unlike or dissimilar terms.

In the algebraic expression $3p^2q + 5pq^2 - 7pq - 9qp^2$, $5pq^2$ and $-7pq$ are unlike terms.

(e) Addition or Subtraction Of Like Terms

The sum or difference of several like terms is another like term whose coefficient is the sum or difference of those like terms.

Ex.1 Add the following : 7xy, 20xy and 8xy.
Sol. The sum of the numerical coefficients of the given like terms is 7 + 20 + 8 = 35.
Thus, the sum of the given like terms is another like term whose numerical coefficient is 35.
Hence, $7xy + 20xy + 8xy = 35xy$.

Ex.2 Add the following : $6x + 5y + 8$ and $x + 9y + 6$.
Sol. $(6x + 5y + 8) + (x + 9y + 6)$
$= (6x + x) + (5y + 9y) + (8 + 6)$
$= (6 + 1)x + (5 + 9)y + (8 + 6)$
$= 7x + 14y + 14$

NOTE:

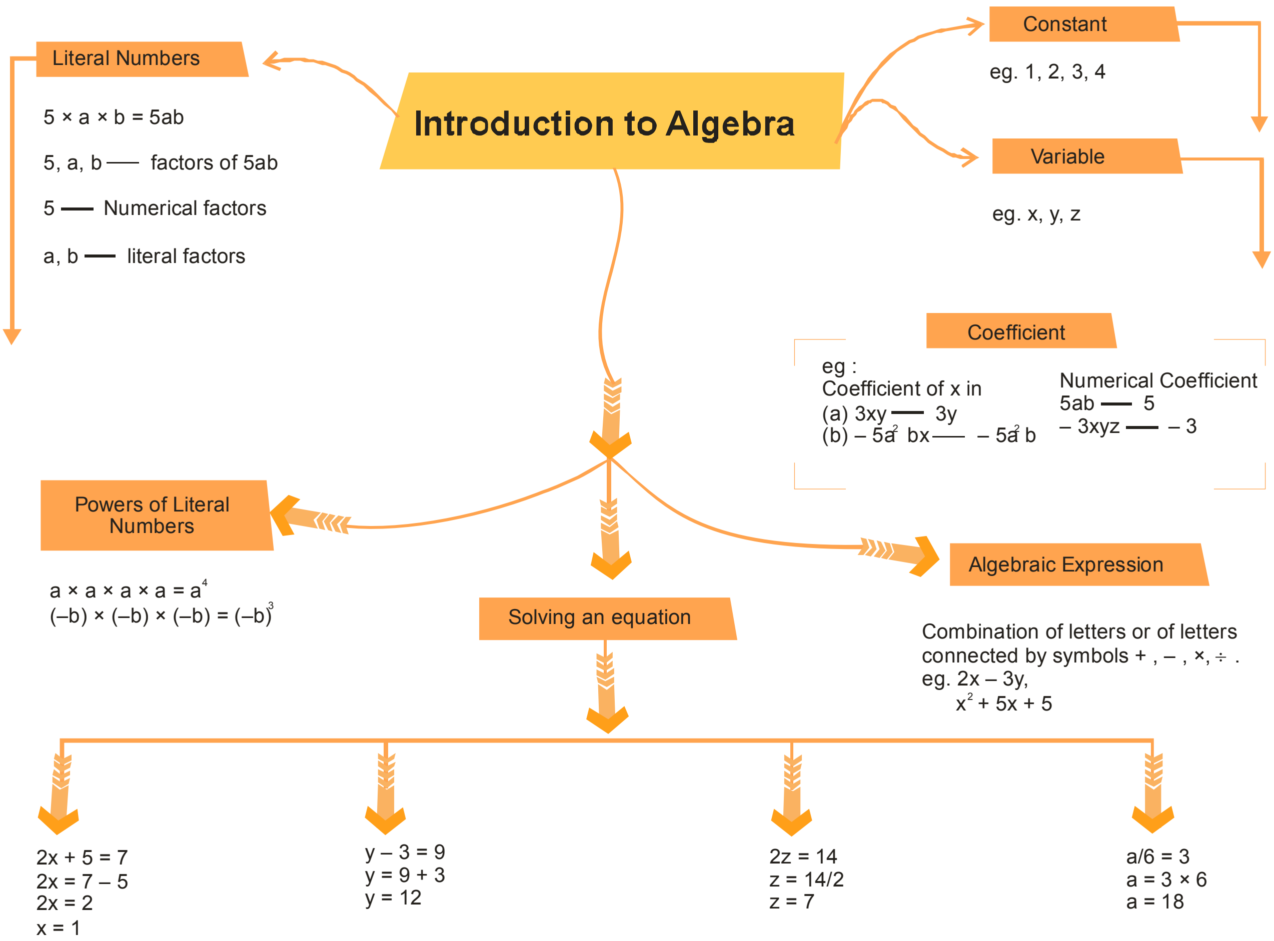
To subtract an expression from another, we change the sign (from' + ' to ' – ' and from' – ' to '+') of each term of the expression to be subtracted and then add the two expressions.

Ex.3 Subtract :
(i) 3p from 7p **(ii)** – 8x from 9x
(iii) – 3a from 7a **(iv)** – 9b from – 2b

Sol. **(i)** $7p - 3p = (7 - 3)p = 4p$
(ii) $9x - (-8x) = 9x + 8x = (9 + 8)x = 17x$
(iii) $7a - (-3a) = 7a + 3a = (7 + 3)a = 10a$
(iv) $-2b - (-9b) = -2b + 9b = (-2 + 9)b = 7b$

Ex.4 Simplify : $2x - \{4y - (3x - 5y)\}$.
Sol. We first remove the innermost grouping symbol ( ) and then braces { }.
Thus, we have
$2x - \{4y - (3x - 5y)\}$
$= 2x - \{4y - 3x + 5y\}$ [Removing ( )]
$= 2x - \{9y - 3x\}$
$= 2x - 9y + 3x = 2x + 3x - 9y = 5x - 9y$.

Concept Map


Introduction to Algebra
Literal Numbers
5 × a × b = 5ab
5, a, b — factors of 5ab
5 — Numerical factors
a, b — literal factors
Constant
eg. 1, 2, 3, 4
Variable
eg. x, y, z
Coefficient
eg :
Coefficient of x in
(a) 3xy — 3y
(b) – 5a² bx — – 5a² b
Numerical Coefficient
5ab — 5
– 3xyz — – 3
Powers of Literal Numbers
a × a × a × a = a⁴
(–b) × (–b) × (–b) = (–b)³
Algebraic Expression
Combination of letters or of letters connected by symbols + , – , ×, ÷ .
eg. 2x – 3y,
x² + 5x + 5
Solving an equation
2x + 5 = 7
2x = 7 – 5
2x = 2
x = 1
y – 3 = 9
y = 9 + 3
y = 12
2z = 14
z = 14/2
z = 7
a/6 = 3
a = 3 × 6
a = 18

Summary

1. Algebra is often called as arithmetic of literal or variables.

2. Literal are letters and they represent numbers.

3. All the four fundamental operations i.e. , addition , subtraction, multiplication and division , as well as their properties are equally applicable to literals too.

4. Constants have fixed values , whereas variables have no fixed value.
   e.g. In $x+8$, x is variable and 8 is constant.

5. Any combination of letters or of numerals and letters connected by the symbols + ,- , × , ÷, is called an algebraic expression.

6. Terms are separated by only + and -

7. An expression is called monomial, binomial, trinomial , multinomial (polynomial) according to its having one , two, three or several terms.

EXERCISE 01

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

1. Which of the following is monomial
(A) x+y+z (B) 2xy (C) p + q + r + s (D) 2x–3

2. The numerical coefficient of –7xyz
(A) 7 (B) –7 (C) 1 (D) – 1

3. The coefficient of r of 2pqr
(A) 2 (B) pq (C) 2pq (D) 2pqr

4. Write 2 x p x p x p x q x q in exponential form
(A)2pq (B) $2p^3q^2$ (C) $2p^2q^2$ (D) $2p^3q^3$

5. Exponential form of P × P × P ×......... 9 times is :
(A) 9P (B) 9 + P (C) P^9 (D) $3P^3$

6. 7 less than a number x is :
(A) x + 7 (B) 7 – x (C) x – 7 (D) –x + 7

7. The algebraic expression for the statement : Twice a number p plus 3 is 17 is:
(A) p + 3 = 17 (B) 2 + p + 3 = 17 (C) 2p + 3 = 17 (D) 2p – 3 = 17

8. Mathematical form of statement "Five times a number is equal to 65" is :
(A) x = 5 × 65 (B) x + 5 = 65 (C) 5x = 65 (D) none of these

9. The cost of 1 pen is Rs y, then cost of 5 pens is :
(A) y + 5 (B) 5y (C) y ÷ 5 (D) y – 5

10. 6 taken away from the product of x and y is written as:
(A) 6 – xy (B) 6 – (x + y) (C) xy – 6 (D) (x + y) – 6

11. Which verbal expression does not match the algebraic expression 13x ?
(A) 13 times x (B) x multiplied by 13
(C) 13 made into x groups (D) the product of x and 13

12. Value of $x^2 – xy + y^2$ when x = 0 & y =1 is :
(A) –1 (B) 0 (C) 1 (D) 4

13. The algebraic expression of the statement 'product of numbers a and b subtracted from 7' is
(A) ab – 7 (B) 7 – ab (C) ab (D) 7ab

14. Solve for x : $\frac{3}{5}x = 27$
(A) 9 (B) 45 (C) 5 (D) 54

15. Solve for x : 7x–19=30
(A) 7 (B) 9 (C) 11 (D) 13

16. For what value of x, x + 9 = 7 ?
(A) 2 (B) 3 (C) –2 (D) 4

17. Which equation has a solution – 3 ?
(A) x – 3 = 6 (B) 6 + x = 3 (C) x – 6 = 3 (D) x – 6 = – 3

18. For what value of x, 2x + 9 = 7 ?
(A) 2 (B) 3 (C) –1 (D) 4

19. Solve for x : 2 (x + 7) = 5 (7 – x)
(A)3 (B) 6 (C) 9 (D) 2

20. The sum of 3 times a number plus –7 is 14. What is that number ?
(A) 6 (B) –7 (C) 7 (D) –6

FILL IN THE BLANKS

1. The numerical coefficient in 8xy is ____

2. A symbol which takes on various numerical values is called a ______

3. In 10x , we have 10 as numerical factor and x as ____ factor

4. A symbol having a fixed numerical value is called a _____

5. "8 times a number n" , as an algebraic expressions equal _____

6. The value of x in 8x = 40 is ______

7. The value of the expression 25 - g for g = 13 is ______

8. The value of y in 2(y-5) = 8 is _____

9. For the equation 3r - 4 = 2, the value of r is ____

10. A number added to 38 gives 45. The number is ____

TRUE / FALSE

1. $7x^4$ is a monomial.

2. $2x^4 - x^4$ is a binomial.

3. Terms having same literal factors are known as like terms.

4. In trinomial their are 2 terms.

5. A match stick pattern of letter T as. To make two such T's, number of match sticks required is 4

6. If we subtract 5x from 2x answer is -3x.

7. The solution of the equation 2x+10 = -6 is -7

8. The sign between the two sides LHS and RHS of a equation is =

9. If 3x + 4 = - x + 8, then the value of x is 1

10. The sum of 6 and x is 10 , then the value of x is 6

MATCH THE COLUMN

1.

	Column–I		**Column–II**
(A)	$10x + 2x$	**(p)**	binomial
(B)	$y \times y \times y \times y$	**(q)**	$14x^4$
(C)	$6x - 9y$	**(r)**	trinomial
(D)	$6x^4 + 8x^4$	**(s)**	y^4
(E)	$8x^3y^2z - 6x^3y^2z$	**(t)**	$12x$
(F)	Expression having 3 terms is	**(u)**	3
(G)	Degree of $3x^3 - 8x + \frac{5}{2}$	**(v)**	$2x^3y^2z$
(H)	$2x + 4x - 2x$	**(w)**	$4x$

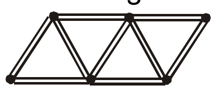
SECTION - B (FREE RESPONSE TYPE)

VERY SHORT ANSWER TYPE

1. Find the rule which gives the number of match sticks required to make the following match stick patterns. Use a variable to write the rule.

(a) a pattern of Z as Z **(b)** a pattern of S as S

2. In the given match stick pattern of triangle. Find the general rule that gives number of match sticks in terms of the number of triangles.



3. Write down the coefficient of :

(a) x in $-8xyz$ **(b)** ab in $7abc$ **(c)** z in $8xyz$ **(d)** a^2 in $-7a^2bc$

4. Write down the numerical coefficient in each of the following :

(a) $-9xyz$ **(b)** ab **(c)** $-pqr$ **(d)** $-8y$

5. Write down separately the terms of the following algebraic expression :

(a) $7p - 8q$ **(b)** $9 + abc - 2c$

6. Separate monomials, binomials and trinomials from the following :
abc,a + b + c, ab + c, 2x – 3y + 5z, 4xy + 1, 7

7. Write down the algebraic expressions whose terms are given below :
(a) $3x, -4y, 5z$ **(b)** $7xy^2, -8yz, 7x^2z$

8. Find the solution of $5x - 3 = 17$ using trial and error method:

9. Is $x = 3$ is the solution of equation $5x-7=6$

SHORT ANSWER TYPE

10. Use $\square$, Δ etc. and mathematical symbols and rewrite the following statements :
(a) I think of a number, add 2 to it and the result is greater than 8.
(b) I think of two numbers. Twice the first number added to 3 times the second number gives a result of 23.

11. Rewrite each of the following statements without using symbols, beginning each statement with : I think of ......
(a) $(\square + 3) > 9$ **(b)** $(\square + 5) \times \Delta = 21$

12. Shinchan went to market. He buys 2x kg of tomato, 7y kg of potato, z^2 kg of onion. How many kg of vegetable he bought.

13. Write the following in exponential form :
(i) $p \times p \times p \times$ ----- 11 times **(ii)** $a \times a \times a \times$ ----- 21 times
(iii) $14 \times p \times p \times p \times p + q$ **(iv)** $7 \times x \times x \times x \times x \times y \times y$

14. Write down the following in product form :
(i) x^3y^4 **(ii)** $7y^6$ **(iii)** $8xy^2z^3$ **(iv)** $11a^4b^4c^4$

15. Give expressions for the following cases.
(a) Five times b added to 3 times c.
(b) The quotient of x and y, if x is divided by y, added to the product of x and y.
(c) The perimeter of a rectangle is twice the sum of its length and breadth.
(d) The distance covered is product of speed and time.

16. If A = 2, B = – 1, C = – 3, find the value of :
(i) $A + B - C$ **(ii)** $(A + B)(B + C)(C + A)$
(iii) $(A - B)(B - C)(C - A)$ **(iv)** $A^3 + B^3 + C^3$
(v) $A^2 + B^2 + 2AB$ **(vi)** $(A + B)(A - B)$
(vii) $-2A + 3B - 4C$

17. Solve for x:
(i) $5x+7=27$ **(ii)** $9x-5=3(x+7)-20$

18. Verify by substitution that :
(i) The root of $3x + 4 = 13$ is 3. **(ii)** The root of $5x - 8 = 7$ is 3.
(iii) The root of $\frac{4x}{7} - 12 = 0$ is 21. **(iv)** The root of $3x = \frac{20}{7} - x$ is $\frac{5}{7}$
(v) The root of $2y = 5(3 + y)$ is -5

LONG ANSWER TYPE

19. Write the given statements in the mathematical form using signs and symbols :

(i) Two times six equals twelve.

(ii) Twelve divided by x, equals three.

(iii) Ten decreased by three equals seven.

(iv) a plus b minus c equals two.

(v) Five is greater than p.

(vi) Twelve is less than two times 7.

(vii) Eight is not equal to ten minus y.

(viii) Nine times x is not equal to ten

(ix) The difference between ten and six is equal to y.

(x) Since three times x equals twelve, therefore x is equal to 4.

20. State the following in words :

(i)	$7 + 3$	**(ii)**	$3 - 4 + 5$	**(iii)**	$a + b - c$	**(iv)**	5×4
(v)	$p \times q \times r$	**(vi)**	$\frac{x \times z}{y}$	**(vii)**	$9 \div 2$	**(viii)**	$3 \times 7 \div 4$
(ix)	$a \times b \div c$	**(x)**	$5 \times \frac{2}{3}$	**(xi)**	$m \times \frac{1}{4}$	**(xii)**	$\frac{9 \times 3}{2}$
(xiii)	$9 > 3$	**(xiv)**	$5 < 8$	**(xv)**	$7a = 14$	**(xvi)**	$x < y < z$
(xvii)	$4 \times 5 = 20$	**(xviii)**	$ab \times 3/4$	**(xix)**	$3 \times 8 > 20$	**(xx)**	$25 \div 5 \neq 8$.

21. Write each of the following statements as an equation:

(i) A number increased by 10 equals 26

(ii) Five times a number is equal to 65.

(iii) Thrice a number decreased by 5 is equal to 27.

(iv) If a number is doubled and 30 subtracted from the result , we get 56.

(v) The sum of three consecutive integers is 34.

(vi) The sum of three odd consecutive numbers is 37.

(vii) The sum of three even consecutive numbers is 68.

(viii) After 16 years Manoj will be five times as old as he is now.

(ix) 40 decreased by a number is 15.

(x) A number is divided by 7. The quotient is added to 5 and the result is 15.

22. Write a statement for each of the equations given below :

(i)	$5x = 40$	**(ii)**	$x + 8 = 15$	**(iii)**	$25 - x = 7$	**(iv)**	$x - 5 = 3$
(v)	$3x - 5 = 16$	**(vi)**	$x - 12 = 24$	**(vii)**	$19 - 2x = 11$	**(viii)**	$\frac{x}{8} = 7$
(ix)	$4x - 3 = 17$	**(x)**	$6x = x + 5$				

23. Solve the given equations :

(i)	$x + 6 = 2$	**(ii)**	$a - 3 = 4$	**(iii)**	$x + 3 = 6$	**(iv)**	$a - 2 = 0$
(v)	$1 = y - 7$	**(vi)**	$7x - 6 = 1$	**(vii)**	$a + 2\frac{1}{2} = 5$	**(viii)**	$y + 10 = 20$
(ix)	$x + 0.4 = 2.4$	**(x)**	$p + 0.6 = 1$	**(xi)**	$5x = 10$	**(xii)**	$4x = 16$
(xiii)	$p + 0.6 = 3.6$	**(xiv)**	$8x = 14$	**(xv)**	$-3p = 24$		

24. Solve the following equations and verify the answers in each case :

(i) $m/2 = 5$ **(ii)** $3x + 2 = 8$ **(iii)** $4x - 3 = 5$ **(iv)** $6a + 6 = 12$

(v) $-2x + 4 = -8$ **(vi)** $a + 6 = 8 + \frac{1}{2}$ **(vii)** $\frac{y}{4} - 8 = 1$ **(viii)** $\frac{x}{3} + 4 = 8$

(ix) $-9x - 1 = -10$ **(x)** $\frac{2}{3}x = \frac{8}{9}$

25. Solve the following equations by the trial and error method :

(i) $x + 7 = 12$ **(ii)** $x - 15 = 20$ **(iii)** $5x = 30$ **(iv)** $14 - x = 8$

(v) $z - 2 = -6$ **(vi)** $\frac{x}{8} = 9$ **(vii)** $19 = 17 + x$ **(viii)** $\frac{1}{3}x - 8 = 11$

(ix) $3x + 4 = 5x - 4$ **(x)** $2x - 7 = 9$

EXERCISE 02

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

1. Amulya is x years of age now , 5 years ago her age was

(A) (5-x) years (B) (5+x) years (C) (x-5) years (D) (5 ÷ x) years

2. If x takes the value 2 , then the value of x+10 is

(A) 20 (B) 12 (C) 5 (D) 8

3. If the perimeter of a regular hexagon is x metres , then the length of each of its sides is

(A) (x + 6) metres (B) (x ÷ 6) metres (C) (x - 6) metres (D) (6 ÷ x) metres

4. Which of the following equations has x=2 as a solution ?

(A) x+2 =5 (B) x-2 =0 (C) 2x+1 =0 (D) x+3 =6

5. In algebra , letters may stand for

(A) Known quantities (B) Unknown quantities

(C) fixed numbers (D) none of these

6. 10 – x means

(A) 10 is subtracted x times (B) x is subtracted 10 times

(C) x is subtracted from 10 (D) 10 is subtracted from x

7. The area of a square having each side x is

(A) x × x (B) 4x (C) x + x (D) 4 + x

8. The equation 4x = 16 is satisfied by the following value of x.

(A) 4 (B) 2 (C) 12 (D) -12

9. I think of a number and on adding 13 to it , I get 27. the equation for this is

(A) x – 27 =13 (B) x –13 = 27 (C) x + 27 = 13 (D) x +13 = 27

10. Simplify $5x - \left[\frac{2}{3}x + \left(\frac{1}{3}x + 5y\right)\right]$

(A) 4x + 5y (B) 4x – 5y (C) 5x – 5y (D) 4x – 4y

11. The algebraic expression for the statement : 'Product of x and a subtracted from the product of b and y'.
(A) $ax - by$ (B) $x + a - by$ (C) $by - ax$ (D) $xa - b - y$

12. Savitri has a sum of Rs x. She spent Rs1000 on grocery , Rs 500 on clothes and Rs 400 on education, and received Rs 200 as a gift. How much money (in Rs) is left with her?
(A) $x - 1700$ (B) $x - 1900$ (C) $x + 200$ (D) $x - 2100$

13. In a piggy bank the number of 25 paise coins are five times the number of 50 paise coins. If there are 120 coins find the amount in the bank ?
(A) Rs. 25 (B) Rs. 10 (C) Rs. 35 (D) Rs. 40

SECTION -B (TECHIE STUFF)

14. Which of the following polynomial having degree 4 :
(A) $2 + p^2$ (B) $4x^2 - x^4$ (C) $x^2 + xyz + y^3$ (D) $4p^2 + 6p^3 + 8p^5$

15. Which of the following is Linear polynomial :
(A) $2x^3$ (B) $2x^2 + 3x$ (C) $-a + 3b$ (D) $a^4 + 4a^2b^2 + b^4$

16. In the following polynomials, a trinomial is
(A) $x^3 + x^2 - 2x$ (B) $x^2 - 2x$ (C) $12x + 5$ (D) $5x^2$

17. The sum of the algebraic expressions ab - 4a, 4b - ab and 4a - 4b is
(A) 0 (B) $2ab - 8a - 8b$ (C) $2ab + 8a + 8b$ (D) $2ab - 8a + 8b$

18. If 'X' is subtracted from $2a + 8b + 10$ to get $-3a + 7b + 16$, then the value of 'X' is
(A) $5a + b - 6$ (B) $-5a - b + 6$ (C) $-3a + b + 6$ (D) $3a - b - 6$

19. The expression, that should be added to $3x^2 + 4xy - y^2$ in order to get $5x^2 - 3y^2$, is
(A) $2x^2 - 2y^2 - 4xy$ (B) $-2x^2 + 2y^2 + 4xy$ (C) $2x^2 + 2y^2$ (D) $2x^2 - 4xy$.

EXERCISE 03

(PREVIOUS YEAR EXAMINATION QUESTIONS)

1. In a party room, 20 workers will decorate 70 tables. Each table will be decorated with 10 silver balloons and 15 gold balloons. Which equation could be used to find x, the total number of silver and gold balloons needed to decorate all the tables? **[NSTSE 2009]**
(A) $x = 70(10 + 15)$ (B) $X = 15(70 + 10)$
(C) $x = 70 + (10 \times 15)$ (D) $x = 20(70+10+15)$

2. If 6 notebooks cost Rs. x, how many notebooks can I buy with Rs. 8? **[NSTSE 2010]**
(A) $\frac{x}{3}$ (B) $\frac{3x}{4}$ (C) $\frac{4x}{3}$ (D) $\frac{48}{x}$

3. The letters S and T stand for numbers. If S - 100 = T - 100, which statement is true? **(IMO 2010)**
(A) S = T (B) S > T (C) S = T + 100 (D) S> T+ 100

4. The list given below shows the number of students out of 30 who chose different foods in the cafeteria. **(IMO 2010)**

(i) 11 students chose pizza.

(ii) 4 students chose hamburgers.

(iii) 3 students chose tacos.

(iv) students chose salad.

How many students chose salad?

(A) 18, because 11 + 4 + 3 = 18 (B) 26, because 30 - (11 - 4 - 3) = 26

(C) 12, because 30 - 11 - 4 - 3 = 12 (D) 20, because 30 - (11 - 4) - 3 = 20

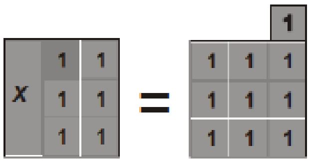
5. Rehan attended a basketball camp for two weeks. His parents paid Rs. 50.00, which was 1/3 the cost of attending the camp. Rehan had saved money to pay the rest of the cost. Which equation can be used to find c, the entire cost of attending the camp? **(IMO 2010)**

(A) $c = 50 \times \frac{1}{3}$ (B) c = 50 × 3 (C) $c = \frac{1}{(50 \times 3)}$ (D) $c = 3 \times \frac{1}{50}$

6. Prachi took a total of 2 hours to write 30 party invitations. Which of the following equations can be used to find m, the number of minutes Prachi took to write 1 invitation ? **(IMO 2010)**

(A) (60 × 30) ÷ 2 = m (B) (60×30) + 2 = m (C) (60 × 2) × 30 = m (D) (60 × 2) ÷ 30 = m

7. Which equation does this set of algebra tiles represent? **(IMO 2010)**



(A) X + 1 = 10 (B) X + 6 = 10 (C) X + 1 = 3 (D) X + 6 = 3

8. Find the value of (24 – 16) x 8 – 64 ÷ (10 – 2) + 4. **(IMO 2010)**

(A) 60 (B) 56 (C) 16 (D) 24

9. Karan is k years old. Rahul's age, r, is 6 more than 2 times Karan's age. Which of the following equations best represents Rahul's age? **(IMO 2010)**

(A) r = (6 + 2)k (B) k = 2r + 6 (C) r = 2k + 6 (D) k = (6 + 2)r

10. Abhay found the perimeter of a square to be 12 metres. Which of the following could be used to find the length (l) of one edge of the square? **(IMO 2010)**

(A) l = 4 x 12 (B) l = 12 ÷ 4 (C) l = 4 + 12 (D) l = 4 – 12

11. At a park, Ashmit intends to hire a buggy to help him get around more easily. The table shows the rate for hiring a buggy. **(IMO 2010)**

Deposit	**₹ 24**
First hour	**₹ 12**
Every additional hour and part thereof	**₹ 10**

Ashmit intends to hire the buggy from 8:15 a.m. to 2:30 p.m. How much does he have to pay?

(A) Rs. 86 (B) Rs.96 (C) Rs. 56 (D) Rs. 76

12. Coach Kabir needs to buy 12 T-shirts for the girls' basketball team. The list below shows the prices of T-shirts at 2 stores. **(IMO 2010)**
(i) Store X : One T-shirt costs Rs. 250
(ii) Store Y : A package of 6 T-shirts costs Rs.1200.
What is the amount of money coach Kabir will save if he buys 12 T-shirts from store Y?
(A) Rs. 600 (B) Rs. 400 (C) Rs. 1650 (D) Rs. 375

13. Armaan received Rs. 2800 as a gift. He wanted to use the money to go to the movies and to buy a book. He wanted to save the money he had left. Which is the correct order of steps to find the amount of money Armaan would have left to save ? **(IMO 2010)**
Step K : Find the sum of the costs of the movie and the book.
Step L : Find the difference between Rs. 2800 and the sum of the costs of the movie and the book.
Step M : Identify the cost of the movie and the cost of the book.
(A) L, K, M (B) M, K, L (C) L, M, K (D) K, L, M

14. In the multiplication shown, P, Q and R are all different digits so that:

$$\begin{array}{r} PPQ \\ \times Q \\ \hline RQ5Q \end{array}$$

What is the value of P + Q + R? **[NSTSE 2011]**
(A) 20 (B) 13 (C) 15 (D) 17

15. Mr. Z is a server at a restaurant. On Saturday Mr. Z gets up at 6 : 30 A.M., starts work at x A.M. and finishes at x P.M. How long does Mr. Z work on Saturday? **[NSTSE 2011]**
(A) 24 - 2x hours (B) 12 - x hours (C) 2x hours (D) 12 hours

16. If P = 1000 and Q = 0.01, which of the following calculations give the largest result? **[NSTSE 2011]**
(A) p + Q (B) p X Q (C) $\frac{P}{Q}$ (D) $\frac{Q}{P}$

17. A number is divided by three and multiplied by the square of a second number. The product is then divided by three. Write the algebraic term for the given statements using p as the first number and q as the second number. **[NSTSE 2011]**
(A) $9pq^2$ (B) $\frac{pq^2}{3}$ (C) $\frac{pq^2}{9}$ (D) $3pq^2$

18. Armaan was asked to multiply a number by 25. Instead he multiplied the number by 52 and got the answer 324 more than the correct answer. The number to be multiplied was **(IMO 2011)**
(A) 12 (B) 15 (C) 25 (D) 32

19. The number of girls in a class is 5 times the number of boys. Which of the following cannot be the total number of children in the class? **(IMO 2011)**
(A) 24 (B) 30 (C) 35 (D) 42

20. Represent the following expression algebraically. A number x, decreased by the sum of 2x and 5. **(IMO 2012)**
(A) (2x + 5) - x (B) x - (2x + 5) (C) x - 2x + 5 (D) (x + 2x) – 5

21. Which word describes the boxed number? **(IMO 2012)**

$\boxed{8}\,x = y$

(A) Coefficient (B) Equation (C) Term (D) Variable

22. There are three numbers A, B and C. A is double of B, C is 65 which is 17 less than A. What is the value of B ? **(IMO 2012)**

(A) 41 (B) 40 (C) 36 (D) 42

23. The expression 6(b + c) is equivalent to 6b + 6c, uses the _______ property. **(IMO 2012)**

(A) Commutative (B) Closure (C) Distributive (D) Identity

24. Write the following statement using arithmetical numbers, literal numbers and arithmetical operations.'17 more than 3 times the product of two numbers ℓ and m' **(IMO 2012)**

(A) 3lm + 17 (B) 3lm – 17 (C) $\frac{3lm}{17}$ (D) 17 × 3 (l + m)

25. Sumit secured 10 marks more than Priya. If Priya secured 'x' marks, then the marks secured by Sumit is _______. **(IMO 2012)**

(A) x – 10 (B) 10 – x (C) x + 10 (D) x × 10

26. Which of the following statement is correct ? **[NSTSE 2013]**

(A) m + m = 3 m (B) mm = m

(C) 2m + 6 = 2m + 6 (D) m + 5m + 6 = 11m

27. The difference between two numbers is 108 less than their sum . If the larger number is twice the smaller number , find the difference between the two numbers. **[NSTSE 2013]**

(A) 48 (B) 54 (C) 36 (D) 72

28. Kavya is K years old. In 7 years time , her father's age will be twice her age. how old will her father be, in terms of k in 7 years time ? **[NSTSE 2013]**

(A) $\frac{K+7}{2}$ years (B) $\frac{2K+7}{2}$ years (C) 2K+7years (D) 2(K+7)years

29. On Monday. there were thrice as many peanuts in Sack X as Sack Y. On Tuesday. 3952 peanuts in Sack X were sold. Now there were thrice as many peanuts in Sack Y as Sack X. How many peanuts were there in Sack X at first? **(IMO 2013)**

(A) 4644 (B) 6644 (C) 4446 (D) 4466

30. Three boys and four girls shared 198 sweets. Each girl received twice as many sweets as each boy. How many sweets did each girl receive? **(IMO 2013)**

(A) 36 (B) 18 (C) 24 (D) 30

31. The sum of four consecutive positive integers is 'x' . In terms of 'x', what is the sum of second and third integers? **[NSTSE 2014]**

(A) $\frac{x}{2}$ (B) $\frac{x-12}{4}$ (C) $\frac{x-6}{2}$ (D) 2x + 6

32. How much ram should pay for 'x' pencils and ý' sharpeners if each pencil costs Rs 4 and each sharpeners costs Rs 3? **[NSTSE 2014]**

(A) Rs (4y +3x) (B) Rs (4x +3y) (C) Rs (4x – 6y) (D) Rs 4(x-6)y

33. Priya had Rs 50. After buying 5 identical pens, she has Rs. y left. The cost of 1 pen in terms of y is _______ **[IMO 2014]**

(A) Rs $\frac{50-y}{5}$ (B) Rs 50 - $\frac{y}{5}$ (C) Rs 50 - 5y (D) Rs $\frac{50y}{5}$

34. Ali will be 6y years old in 6 years time. How old was Ali 4y years ago ? **[IMO 2014]**

(A) 6y - 6 (B) 10y - 6 (C) 2y - 6 (D) 2y + 6

35. Megha and Beena shared 272 beads. If Megha has thrice as many beads as Beena. How many beads does Megha have? **(IMO 2014)**

(A) 68 (B) 204 (C) 104 (D) 202

36. In a farm, there were 3c cows, 5p pigs and 11 d ducks. Express in terms of c, d and p, the total number of legs of the remaining animals if 3 cows, 2 pigs and 4 ducks were sold. **(IMO 2014)**

(A) 20c + 22p + 12d – 28 (B) 20c + 20p + 22d – 28
(C) 20c + 15p + 20d – 32 (D) 12c + 20p + 22d – 28

37. Your mother says to calculate your pocket money. Multiply your age by itself and then double it If your age is x years. Write an algebraic expression representing your pocket money. How much do you get as pocket money if your age is 11 years **(IMO 2014)**

(A) 4x Rs. 44 (B) $4x^2$. Rs.484 (C) $2x^2$. Rs.242 (D) $3x^2$. Rs.363

ANSWER KEY

EXERCISE 01

SECTION -A (FIXED RESPONSE TYPE)

MULTIPLE CHOICE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	B	B	C	B	C	C	C	C	B	C	C	C	B	B	A	C	B	C	A	C

FILL IN THE BLANKS

1. 8 **2.** variable **3.** literal **4.** constant

5. 8n **6.** 5 **7.** 12 **8.** 9

9. 2 **10.** 7

TRUE / FALSE

1. True **2.** False **3.** True **4.** False

5. True **6.** True **7.** False **8.** True

9. True **10.** False

MATCH THE COLUMN

1. (A)– (t), (B)–(s), (C)–(p) , (D)–(q), (E)–(v), (F)–(r), (G)–(u) , (H)–(w)

SECTION - B (FREE RESPONSE TYPE)

VERY SHORT ANSWER TYPE

1. **(a)** No of matchsticks required = 3a
where a = no. of Z

(b) No of matchsticks required = 5a
where a = no. of S

2. No. of matchsticks required = 2n + 1
where n = no. of triangles

3. **(a)** –8yz **(b)** 7c **(c)** 8xy **(d)** – 7bc

4. **(a)** –9 **(b)** 1 **(c)** –1 **(d)** –8

5. **(a)** 7p,–8q **(b)** 9,abc,–2c

6. Monomials are : abc, 7, Binomials are : ab+c ,4xy+1 , Trinomials are : a+b+c,2x–3y+5z

7. **(a)** $3x - 4y + 5z$ **(b)** $7xy^2 - 8yz + 7x^2z$ **8.** $x = 4$ **9.** No

SHORT ANSWER TYPE

10. **(a)** $\square + 2 > 8$ **(b)** $2(\square) + 3(\Delta) = 23$

11. **(a)** I think of a number, when 3 is added to it the result is more than 9.
(b) I think of two numbers. When 5 is added to first and then, multiplied with second gives product 21.

12. Shinchan bought $(2x+7y+z^2)$ kg of vegetable

13. **(i)** p^{11} **(ii)** a^{21} **(iii)** $14p^4 + q$ **(iv)** $7x^4y^2$

14. **(i)** $x \times x \times x \times y \times y \times y \times y$ **(ii)** $7 \times y \times y \times y \times y \times y \times y$
(iii) $8 \times x \times y \times y \times z \times z \times z$
(iv) $11 \times a \times a \times a \times a \times b \times b \times b \times b \times c \times c \times c \times c$

15. **(a)** $5b + 3c$ **(b)** $\frac{x}{y} + xy$ **(c)** $P = 2(l + b)$ **(d)** $d = s \times t$

16. **(i)** 4 **(ii)** 4. **(iii)** – 30. **(iv)** – 20.
(v) 1. **(vi)** 3. **(vii)** 5.

17. **(i)** 4 **(ii)** 1

LONG ANSWER TYPE

19. **(i)** $2 \; 6 = 12$ **(ii)** $12 \; x = 3$ **(iii)** $10 - 3 = 7$

(iv) $a + b - c = 2$ **(v)** $5 > \; p.$ **(vi)** $12 < 2 \; 7.$

(vii) $8 \quad 10 - y.$ **(viii)** $9x \; 10$ **(ix)** $10 - 6 = y.$

(x) $3x = 12 \therefore x = 4$

20. **(i)** seven plus three **(ii)** Three minus four plus five

(iii) a plus b minus c **(iv)** product of five and four

(v) product of p ,q and r **(vi)** product of x and z divided by y

(vii) nine upon two

(viii) product of three and seven divided by four

(ix) product of a and b divided by c

(x) five times two upon three **(xi)** m times one upon four

(xii) product of nine and three divided by two

(xiii) nine is greater than three **(xiv)** five is less than eight

(xv) Since seven times a is equal to fourteen, therfore , a is equal to two

(xvi) x is less than y and y is less than z **(xvii)** four times five is equal to twenty

(xviii) product of a and b multiplied by three upon four

(xix) three times eight is greater than twenty

(xx) twenty five divided by five not equal to eight

21. **(i)** $x + 10 = 26$ **(ii)** $5x = 65$. **(iii)** $3x - 5 = 27$.

(iv) $2x - 30 = 56$. **(v)** $x + (x + 1) + (x + 2) = 34$.

(vi) $(2x + 1) + (2x + 3) + (2x + 5) = 37$

(vii) $2x + (2x + 2) + (2x + 4) = 68$.

(viii) $x + 16 = 5x$ **(ix)** $40 - x = 15$. **(x)** $\frac{x}{7} + 5 = 15$.

22. **(i)** five times a number equals 40

(ii) a number increased by 8 equals 15

(iii) 25 decreased by a number is 7

(iv) a number decreased by 5 equals 3

(v) 5 subtracted from thrice a number is 16

(vi) if 12 is subtracted from a number , the result is 24

(vii) twice a number subtracted from 19 is 11

(viii) a number divided by 8 gives 7

(ix) 3 less from 4 times a number is 17

(x) 6 times a number is 5 more than the number

23.

(i) $x = -4$	**(ii)** $a = 7$	**(iii)** $x = 3$	**(iv)** $a = 2$
(v) $y = 8$	**(vi)** $x = 1$	**(vii)** $a = \frac{5}{2}$	**(viii)** $y = 10$
(ix) $x = 2$	**(x)** $p = 4$	**(xi)** $x = 2$	**(xii)** $x = 4$
(xiii) $p = 3$	**(xiv)** $x = \frac{7}{4}$	**(xv)** $p = -8$	

24. Solve the following equations and verify the answers in each case :

(i) $m = 10$	**(ii)** $x = 2$	**(iii)** $x = 2$	**(iv)** $a = 1$
(v) $x = 6$	**(vi)** $a = \frac{5}{2}$	**(vii)** $y = 36$	**(viii)** $x = 12$
(ix) $x = 1$	**(x)** $x = \frac{4}{3}$		

25.

(i) 5	**(ii)** 35	**(iii)** 6	**(iv)** 6
(v) –4	**(vi)** 72	**(vii)** 2	**(viii)** 57
(ix) 4	**(x)** 8		

EXERCISE 02

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Ans.	C	B	B	B	B	C	A	A	D	B	C	A	C	B	C	A	A	A	A

EXERCISE 03

(PREVIOUS YEAR EXAMINATION QUESTIONS)

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	A	D	A	C	B	D	B	A	C	B	B	A	B	D	D	C	C	A	C	B
Ques.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37			
Ans.	A	A	C	A	C	C	B	D	C	A	A	B	A	C	B	D	C			