

# MATHEMATICS

## Class-VIII

### Topic-4

## LINEAR EQUATION IN ONE VARIABLE



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# CH-04

## LINEAR EQUATION IN ONE VARIABLE

Algebraic expression, Constant, Variables, Linear equation, Degree, Solution, root, term, Right hand Side, Left hand side, Equation, Standard Form, Statement, Coefficient, Substitution.

### INTRODUCTION

In previous classes, we have learnt about statements of equality called equations involving only one literal number denoted by  $x$ ,  $y$ ,  $z$  ect. so the equations in which the highest power of a variable is one called linear equations. Such an equation is of the form  $ax + b = c$ , where  $a$ ,  $b$ ,  $c$  are numbers  $a \neq 0$  and  $x =$  variable.

### 4.1 LINEAR EQUATION IN ONE VARIABLE

#### (a) Equation

An equation is a statement of equality of two algebraic expressions involving constant and variables. **For example** :  $5x - 7 = 3x + 2$ .

#### (b) Linear equation

An equation, in which the maximum degree of a term is one, is called a linear equation. For example :  $2x + 3y = 7$ .

#### (c) Linear equation in one variable

A linear equation which has only one variable is called linear equation in one variable. For example :  $x + 3 = 5$ .

General form of the equation is  $ax + b = 0$ , where  $x$  is variable,  $a \neq 0$  and  $a, b \in \mathbf{R}$ .

#### (d) Solution

The value of the variable which satisfies the equation is called a **solution** or a root of the equation.

#### (e) The rules used in solving an equation are

1. We can add the same number on both sides of the equation.
2. We can subtract the same number on both sides of the equation.
3. We can multiply both sides of the equation by same non zero number.
4. We can divide both sides of the equation by same non zero number.
5. We can transpose any term of the equation from one side to other with its sign changed.

#### Illustration 4.1

Solve:  $4x + 5 = 9$

**Sol.** (a) We have  $4x + 5 = 9$

$$\Rightarrow 4x = 9 - 5 \text{ (Transposing 5 to RHS)}$$

$$\Rightarrow 4x = 4 \text{ (Transposing 4 to RHS)}$$

$$\Rightarrow x = 1$$

### Illustration 4.2

Solve the equation and check your solution:  $\frac{3x+5}{2x+7} = 5$

**Sol.** We have:  $\frac{3x+5}{2x+7} = 5$

Multiplying both sides of the equation by  $(2x + 7)$ , we have

$$\frac{3x+5}{(2x+7)} \times (2x+7) = 5 \times (2x+7)$$

$$3x+5 = 10x+35$$

$$3x - 10x = 35 - 5 \quad (\text{Transposing the terms } 10x \text{ and } 5)$$

$$-7x = 30$$

$$\frac{-7x}{-7} = \frac{30}{-7} \quad (\text{Dividing both sides by } -7)$$

$$x = \frac{-30}{7} \quad \text{Thus, } x = \frac{-30}{7} \text{ is the solution of the given equation}$$

### Illustration 4.3

Solve:  $\frac{3x}{4} - \frac{2x+5}{3} = \frac{5}{2}$

**Sol.** We have  $\frac{3x}{4} - \frac{2x+5}{3} = \frac{5}{2}$

LCM of 2, 3 and 4 = 12

$$\therefore \frac{3x}{4} \times 12 - \frac{2x+5}{3} \times 12 = \frac{5}{2} \times 12 \quad (\text{Multiplying both sides by } 12)$$

$$\Rightarrow 3x \times 3 - (2x+5) \times 4 = 5 \times 6$$

$$\Rightarrow 9x - 8x - 20 = 30 \quad (\text{solving the bracket})$$

$$\Rightarrow x - 20 = 30$$

$$\Rightarrow x = 30 + 20 \quad (\text{Transposing } 20 \text{ to RHS})$$

$$\Rightarrow x = 50$$

Hence  $x = 50$  is the required solution.

**Illustration 4.4**

Solve :  $(5x - 1)(x + 3) = (x - 5)(5x + 1) + 40$

**Sol.** Given equation :

$$\begin{aligned} \Rightarrow (5x - 1)(x + 3) &= (x - 5)(5x + 1) + 40 \\ \Rightarrow 5x^2 + 15x - x - 3 &= 5x^2 + x - 25x - 5 + 40 \quad [\text{Removing the brackets}] \\ \Rightarrow 5x^2 + 14x - 3 &= 5x^2 - 24x + 35 \\ \Rightarrow 5x^2 + 14x - 5x^2 + 24x &= 35 + 3 \\ \Rightarrow 38x = 38 \quad \Rightarrow x &= \frac{38}{38} \quad \Rightarrow x = 1. \end{aligned}$$

**Illustration 4.5**

Solve :  $[(2x + 3) + (x + 5)]^2 + [(2x + 3) - (x + 5)]^2 = 10x^2 + 92$

**Sol.** Given equation :  $[(2x + 3) + (x + 5)]^2 + [(2x + 3) - (x + 5)]^2 = 10x^2 + 92$

$$\begin{aligned} \Rightarrow (2x + 3 + x + 5)^2 + (2x + 3 - x - 5)^2 &= 10x^2 + 92 \\ \Rightarrow (3x + 8)^2 + (x - 2)^2 &= 10x^2 + 92 \\ \Rightarrow 9x^2 + 48x + 64 + x^2 - 4x + 4 &= 10x^2 + 92 \\ [\because (a + b)^2 = (a^2 + 2ab + b^2), (a - b)^2 = (a^2 - 2ab + b^2)] \\ \Rightarrow 10x^2 + 44x + 68 &= 10x^2 + 92 \\ \Rightarrow 10x^2 + 44x - 10x^2 &= 92 - 68 \\ \Rightarrow 44x = 24 \quad \Rightarrow x &= \frac{24}{44} \quad \Rightarrow x = \frac{6}{11}. \end{aligned}$$

**Illustration 4.6**

Solve the equation and check your solution:  $\frac{5z - 3}{2z} = \frac{8}{9}$

**Sol.** We have:  $\frac{5z - 3}{2z} = \frac{8}{9}$

Cross multiplying, we have:

$$(5z - 3) \times 9 = 8 \times (2z)$$

$$5z \times 9 - 3 \times 9 = 16z$$

$$45z - 27 = 16z$$

$$45z - 16z = 27 \quad (\text{transposing } 16z \text{ and } -27)$$

$$z = \frac{27}{29}$$

Thus,  $z = \frac{27}{29}$  is the solution of the given equation.

### Illustration 4.7

Solve :  $\frac{x+b}{a-b} = \frac{x-b}{a+b}$  .

**Sol.**  $\frac{x+b}{a-b} = \frac{x-b}{a+b}$

$\Rightarrow (x+b)(a+b) = (x-b)(a-b)$  [By cross -multiplication]

$\Rightarrow x(a+b) + b(a+b) = x(a-b) - b(a-b)$

$\Rightarrow ax + bx + ba + b^2 = ax - bx - ba + b^2$

$\Rightarrow ax + bx - ax + bx = -ba + b^2 - ba - b^2$

$\Rightarrow 2bx = -2ba \Rightarrow x = \frac{-2ba}{2b} \Rightarrow x = -a$

Hence,  $x = -a$  is the solution of the given equation.

### Illustration 4.8

Solve for x:  $\frac{7x+14}{3} - \frac{17-3x}{5} = 6x - \frac{4x+2}{3} - 5$

**Sol.** We have:  $\frac{7x+14}{3} - \frac{17-3x}{5} = 6x - \frac{4x+2}{3} - 5$

LCM of 3 and 5 = 15

$$\frac{7x+14}{3} \times 15 - \frac{17-3x}{5} \times 15 = 6x \times 15 - \frac{4x+2}{3} \times 15 - 5 \times 15$$

(Multiplying both sides by 15)

$\Rightarrow (7x+14) \times 5 - (17-3x) \times 3 = 90x - (4x+2) \times 5 - 75$

$\Rightarrow 35x + 70 - 51 + 9x = 90x - 20x - 10 - 75$  (Solving the brackets)

$\Rightarrow 44x - 70x = -85 - 19$

(Transposing 70x to LHS and 19 to RHS)

$\Rightarrow -26x = -104$

$\therefore x = \frac{-104}{-26} = 4$

Hence  $x = 4$  is the required number

Ask yourself

1. Solve the following equation :  $4x - 9 = x + 2$ .
2. Solve the following equation :  $7x + \frac{9}{2} = \frac{5x}{2} - 21$ .
3. Solve the following equation :  $6x - 7 = 3x + 10$ .
4. Solve :  $4(3m + 1) - 2(2m + 3) = 3(m + 4) + 2m + 7$ .
5. Solve :  $\frac{7x}{5} + 3 = \frac{5x}{2} - 5$
6. Solve  $2(1.5x + 2.5) = 0.5x + 3$ .

Answers

1.  $\frac{11}{3}$       2.  $\frac{-51}{9}$       3.  $\frac{17}{3}$       4. 7      5.  $\frac{80}{11}$
6.  $\frac{-4}{5}$

## 4.2 WORD PROBLEMS

To solve a word problem, denote the unknown by some variable and translate the statements of the problem into a mathematical statement. Then form an equation and find the solution of the equation.

### Illustration 4.9

Meera's mother is four times as old as Meera. After five years, her mother will be three times as old as she will be then. What are their present ages ?

**Sol.** Let present age of Meera be  $x$  years.

Then the present age of Meera's mother =  $4x$  years.

Meera's age after five years =  $(x + 5)$  years.

Mera's mother age after five years =  $(4x + 5)$  years.

B the given condition, we have:

$$4x + 5 = 3(x + 5)$$

$$4x + 5 = 3x + 15$$

$$4x - 3x = 15 - 5 \text{ (Transposing } 3x \text{ and } 5)$$

Thus, age of Meera = 10 years and that of Meers's mother =  $4 \times 10 = 40$  years.

**Illustration 4.10**

If the sum of two consecutive numbers is 11, find the numbers.

**Sol.** Let the two consecutive numbers be  $x$  and  $x + 1$ .

$$x + x + 1 = 11$$

$$\Rightarrow 2x + 1 = 11$$

$$\Rightarrow 2x = 11 - 1 \text{ (Transposing 1 to RHS)}$$

$$\Rightarrow 2x = 10$$

$$x = 5$$

Hence, the required numbers are 5 and  $5 + 1 = 6$ .

**Illustration 4.11**

The ratio of number of boys and girls in a class is 4 : 1. If total number of students in class is 60, find the number of boys and girls in the class.

**Sol.** Let number of boys =  $4x$

Number of girls =  $x$

Total number = 60

$$4x + x = 60 \Rightarrow 5x = 60 \Rightarrow x = 12$$

Number of girls =  $x = 12$

Number of boys =  $4x = 4 \times 12 = 48$

Boys : Girls = 48 : 12 = 4 : 1

Total number = 48 + 12 = 60.

**Illustration 4.12**

The sum of a two-digit number and the number obtained by reversing its digits is 121. Find the number if its unit place digit is 5.

**Sol.** Unit place digit is given as 5

Let  $x$  be the tens place digit

Number formed =  $10x + 5$

Number obtained by reversing the digits =  $5 \times 10 + x = 50 + x$

As per the conditions, we have

$$5 + 10x + 50 + x = 121$$

$$\Rightarrow 11x + 55 = 121$$

$$\Rightarrow 11x = 121 - 55 \text{ (Transposing 55 to RHS)}$$



$$\Rightarrow 11x = 66$$

$$\Rightarrow x = 6$$

Thus, the tens place digit = 6

Hence the required number =  $5 + 6 \times 10 = 5 + 60 = 65$

### Illustration 4.13

The sum of two numbers is 2490. If 6.5 % of one number is equal to 8.5 % of the other, find the numbers.

**Sol.** Let the first number be  $x$ .

Then, second number =  $2490 - x$

$$\text{Now, 6.5\% of the first number} = \frac{6.5}{100} \times x = \frac{65x}{1000}$$

$$8.5\% \text{ of the second number} = \frac{8.5}{100} \times (2490 - x) = \frac{85}{1000} (2490 - x)$$

It is given that 6.5 % of the first number is equal to 8.5 % of the other.

$$\therefore \frac{65x}{1000} = \frac{85}{1000} (2490 - x)$$

$$\Rightarrow 65x = 85 (2490 - x) \text{ [Multiplying both sides by 1000]}$$

$$\Rightarrow 65x = 2490 \times 85 - 85x \quad \Rightarrow \quad 65x + 85x = 249085$$

$$\Rightarrow x = \frac{2490 \times 85}{150} \quad \Rightarrow \quad x = 1411$$

First number = 1411.

Second number =  $2490 - 1411 = 1079$ .

$$\text{We have, 6.5 \% of first number} = \frac{6.5}{100} \times 1411 = \frac{91715}{1000}$$

$$8.5\% \text{ of the second number} = \frac{8.5}{100} \times 1079 = \frac{91715}{1000}$$

Clearly, 6.5% of the first number is equal to 8.5% of the second number, which is the same as given in the problem.

### Ask yourself

1. A rational number is such that when you multiply it by  $\frac{3}{7}$  and subtract  $\frac{4}{7}$  from the product, you get  $\frac{-4}{11}$ . What is the number ?
2. The width of a rectangle is three-fourths its length. If the perimeter is 210 m, find the dimensions of the rectangle.
3. Rama has only 10 paise and 25 paise coins in her purse. If in all she has 60 coins worth Rs. 8.25, how many coins of each denomination does she have ?

4. The ratio of 2 numbers is 8 : 1. If their difference is 623, find the numbers.
5. Find two consecutive even number such that smaller of the 2 number is  $\frac{8}{9}$  times the larger number.
6. Rohit is now one- third of his fathers age. After twelve year, age of rohit father will be twice the age of rohit. Find their present ages.

**Answers**

- |                    |                        |            |             |
|--------------------|------------------------|------------|-------------|
| 1. $\frac{16}{33}$ | 2. L = 60 m , B = 45 m | 3. 45 , 15 | 4. 89 , 712 |
| 5. 16 , 18         | 6. 12 yrs , 36 yrs     |            |             |

## Add to Your Knowledge

**Linear Equations in Two Variables**

An equation of the form  $Ax + By + C = 0$  is called a linear equation.

Where A is called coefficient of x, B is called coefficient of y and C is the constant term (free from x & y)

$A, B, C, \in R$  [ $\in \rightarrow$  belongs to,  $R \rightarrow$  Real No.]

But A and B can not be simultaneously zero.

Since it involves two variables therefore a single equation will have infinite set of solution i.e. indeterminate solution. So we require a pair of equation i.e. simultaneous equations.

**Standard form of pair of linear equation :**

(Standard form refers to all positive coefficients)

$$a_1x + b_1y + c_1 = 0 \quad \dots(i)$$

$$a_2x + b_2y + c_2 = 0 \quad \dots(ii)$$

**Solution by Elimination By Substitution :**

**Example.** Solve :  $x + 4y = 14$  &  $7x - 3y = 5$ .

**Sol.**  $x + 4y = 14 \quad \dots\dots(i)$

$7x - 3y = 5 \quad \dots\dots(ii)$

From equation (i)  $x = 14 - 4y \quad \dots\dots(iii)$

Substitute the value of x in equation (ii)

$$\Rightarrow 7(14 - 4y) - 3y = 5 \quad \Rightarrow 98 - 28y - 3y = 5$$

$$\Rightarrow 98 - 31y = 5 \quad \Rightarrow 93 = 31y$$

$$\Rightarrow y = \frac{93}{31} \quad \Rightarrow y = 3.$$

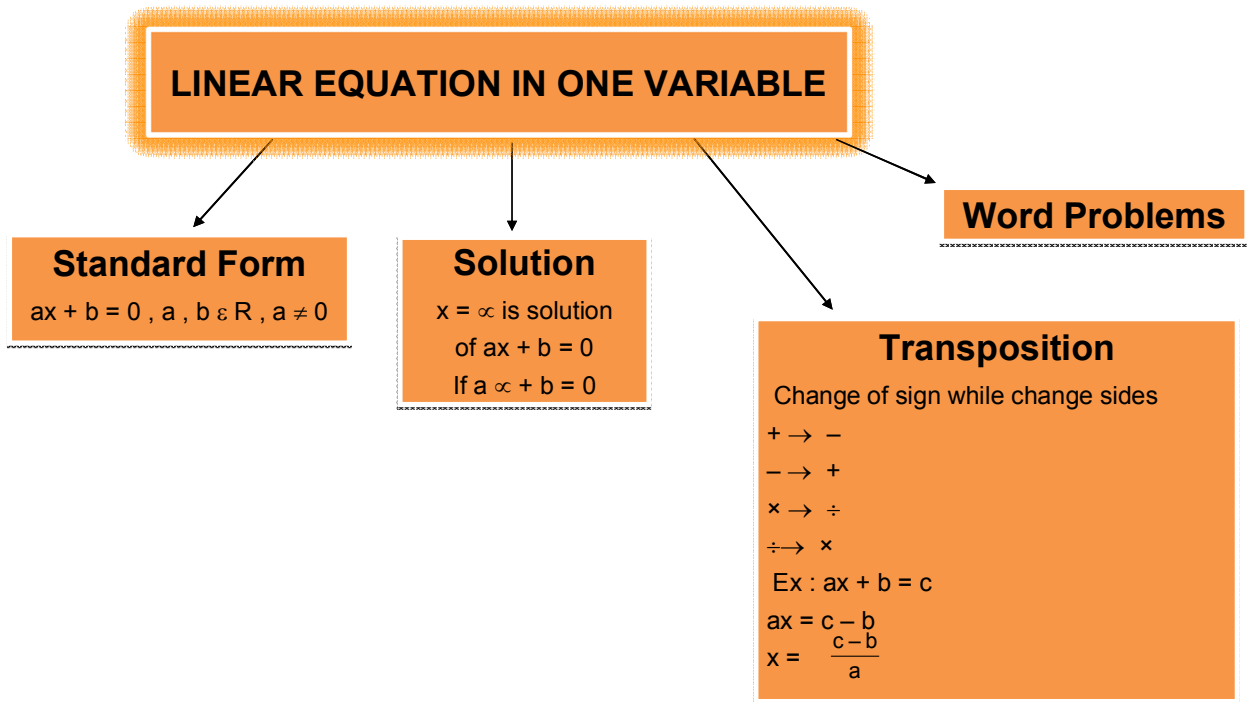
Now substitute value of y in equation (i)

$$\Rightarrow 7x - 3(3) = 5 \quad \Rightarrow 7x - 3(3) = 5$$

$$\Rightarrow 7x = 14 \quad \Rightarrow x = \frac{14}{7} = 2$$

So, solution is  $x = 2$  and  $y = 3$ .

## Concept Map



## Summary

- In order to solve equations of the type  $\frac{ax + b}{cx + d} = k$ ,  $cx + d \neq 0$  where  $a, b, c, d$  and  $k$  are numbers, we write them as  $ax + b = k(cx + d)$ . This is called method of cross multiplication.
- To solve a word problem, denote the unknown by some variable and translate the statements given in the problem step by step into a mathematical statement. From relevant equalities and solve the corresponding equations.

**Exercise-1**
**SECTION -A (FIXED RESPONSE TYPE)**
**OBJECTIVE QUESTIONS**

- If  $4x + \frac{3}{5} = 5$ , then  $x =$   
 (A)  $\frac{11}{10}$                       (B)  $\frac{13}{14}$                       (C)  $\frac{16}{17}$                       (D)  $\frac{12}{11}$
- If  $\frac{x}{3} - \frac{5}{2} = 6$ , then  $x = ?$   
 (A)  $\frac{51}{2}$                       (B)  $\frac{52}{3}$                       (C)  $\frac{53}{4}$                       (D)  $\frac{54}{5}$
- If  $0.6x + 0.8 = 0.28x + 1.16$ , then  $x = ?$   
 (A)  $\frac{6}{7}$                       (B)  $\frac{9}{8}$                       (C)  $\frac{11}{2}$                       (D)  $\frac{13}{5}$
- If  $\frac{\frac{2}{3}x + 1}{x + \frac{1}{4}} = \frac{5}{3}$ , then  $x = ?$   
 (A)  $\frac{7}{12}$                       (B)  $\frac{5}{13}$                       (C)  $\frac{6}{13}$                       (D)  $\frac{7}{14}$
- A positive value of  $x$  which satisfies the equation  $\frac{x^2 + 1}{x^2 - 1} = \frac{5}{4}$  is :  
 (A) 4                      (B) 9                      (C) 5                      (D) 3
- If  $\frac{2x + 7}{5x + 8} = \frac{2x + 6}{5x + 4}$ , then  $x = ?$   
 (A)  $-6\frac{2}{3}$                       (B)  $-3\frac{1}{2}$                       (C)  $-2\frac{1}{2}$                       (D)  $-3\frac{6}{7}$
- If  $\frac{5x}{4} + \frac{6 - x}{8} = \frac{6(x + 3)}{3} - \frac{1}{6}$ , then  $x = ?$   
 (A)  $-\frac{121}{22}$                       (B)  $\frac{121}{12}$                       (C)  $\frac{212}{21}$                       (D)  $-\frac{122}{21}$
- Length of a rectangle is 8 m less than twice its breadth. If the perimeter of the rectangle is 56 m. Find its length and breadth.  
 (A) Length = 16 m and breadth = 12 m                      (B) Length = 13 m, breadth = 15 m  
 (C) Length = 14 m, breadth = 17 m                      (D) Length = 18 m, breadth = 21 m
- The age of father is 3 times the age of the son. If sum of their ages is 48 years, then the age of father and son are (in years) :  
 (A) Father = 36, Son = 12                      (B) Father = 45, Son = 15  
 (C) Father = 39, Son = 13                      (D) Father = 42, Son = 14

10. One number is 3 times another number. If 15 is added to both the numbers, then one of the new numbers becomes twice that of the other new number. The numbers are :  
 (A) 15, 45                      (B) 12, 36                      (C) 13, 39                      (D) 14, 42
11. Sum of the digits of a two digit number is 12. The given number exceeds the number obtained by interchanging the digits by 36. The given number is :  
 (A) 81                              (B) 82                              (C) 83                              (D) 84
12. The denominator of a rational number is 4 more than the numerator. If 2 is added to the numerator and 3 is added to denominator then the new number becomes  $\frac{3}{4}$ . Find the original number.  
 (A)  $\frac{13}{17}$                               (B)  $\frac{12}{16}$                               (C)  $\frac{11}{15}$                               (D)  $\frac{10}{14}$

### FILL IN THE BLANKS

1. The solution of the equation  $3x - 4 = 1 - 2x$  is \_\_\_\_\_.
2. The solution of the question  $2y - 5y = \frac{18}{5}$  \_\_\_\_\_.
3.  $\frac{x}{5} + 30 = 18$  has the solution is \_\_\_\_\_.
4. If two-third of a number is equal to one-fifth of the same number , then the number is\_\_\_\_\_.
5. If twice of a number is 5 less than thrice of that number , then the number is \_\_\_\_\_.
6. If one-third of a number when added to one-half of the same number results in 5, then the number is \_\_\_\_\_.
7. If x% of a number is equal to 6% of one-third of that number, then the value of x is\_\_\_\_\_.
8. A two-digit number is equal to the number obtained by interchanging the digits. If the ten's place digit is 5, then unit's place digit is \_\_\_\_\_

### TRUE / FALSE

1. An equation, in which the maximum degree of a term is one, is called a linear equation.
2. We cannot subtract the same number on both sides of the equation.
3. We can multiply both sides of the equation by same non zero number.
4. We can divide both sides of the equation by same number.
5. If we transpose any term of the equation from one side to other with its sign gets changed.
6.  $8x - 3 = 25 + 174$  then x is a rational number.

7. A linear equation in one variable has two solution.
8. In a linear equation the highest power of the variable appearing in the equation is one.
9. If  $\frac{x}{11} = 15$  then  $x = \frac{11}{15}$ .
10. If  $6x = 18$  then  $18x = 54$ .

**MATCH THE COLUMN**

- | 1. Column-I                  | Column-II             |
|------------------------------|-----------------------|
| (A) $4x = 36$                | (p) $x = 33$          |
| (B) $\frac{x}{3} = 11$       | (q) $x = \frac{6}{5}$ |
| (C) $5x + 3 = 9$             | (r) $x = 9$           |
| (D) $3(x - 1) = 4(x - 5)$    | (s) $x = 1$           |
| (E) $9x - 1 = 8$             | (t) $x = -3$          |
| (F) $x = \frac{3}{4}(x - 1)$ | (u) $x = 17$          |

**SECTION -B (FREE RESPONSE TYPE)**
**VERY SHORT ANSWER TYPE**

1. Solve the following equation and check your solutions :
 

(i) $\frac{2y+5}{y+7} = 1$	(ii) $\frac{1-9y}{19-3y} = \frac{5}{8}$
----------------------------	-----------------------------------------
2. Solve :  $\frac{y - (7 - 8y)}{9y - (3 + 4y)} = \frac{2}{3}$ .
3. The sum of two numbers is 45 and their ratio is 7 : 8. Find the numbers.
4. A is 20 years older than B. He is also six times as old as B. Find their ages.

**SHORT ANSWER TYPE**

5. Solve :  $\frac{0.4z - 3}{1.5z + 9} = -\frac{5}{7}$ .
6. Solve :  $\frac{2x - (2x - 3)}{3x - (4x + 3)} = -1$ .
7. If sum of two numbers is 30 and 2 times one number is 3 times the other then find the numbers.
8. If p is 2 years younger than q and 2 years older than r and the sum of their ages is 90 then find the age of p

**LONG ANSWER TYPE**

9. One fourth of a number exceeds one fifth of its succeeding number by 3. Find the number.
10. The numerator of a rational number is less than its denominator by 3. If the numerator becomes three times and the denominator is increased by 20, the new number becomes  $\frac{1}{8}$ . Find the original number.
11. The cost price of a desk and a chair is Rs. 371. If the desk costs 12 % more than the chair. Find the cost price of each.

**Exercise-2**
**SECTION -A (COMPETITIVE EXAMINATION QUESTION)**
**OBJECTIVE QUESTIONS**

1. One fifth of a number diminishes one fourth of its successor by one. The number is  
 (A) 12                      (B) 9                      (C) 15                      (D) 20
2. If we represent the fraction  $\frac{5}{26}$  by  $\frac{3x-1}{2x+5}$  then x =  
 (A)  $\frac{3}{4}$                       (B)  $\frac{4}{3}$                       (C)  $\frac{3}{7}$                       (D)  $\frac{7}{3}$
3. If half of the one third of a number is 15 less then the number, then number is .....  
 (A) 18                      (B) 17                      (C) 16                      (D) 15
4. Solve for x :  $\frac{2x-a}{x-b} = 1$   
 (A) a – b                      (B) b – a                      (C) a + b                      (D) –a – b
5. A number has two digits. The unit digit is four times than tens digits. If the difference between the number obtained by reversing the digits and the original number is 54, find the original number.  
 (A) 28                      (B) 82                      (C) 14                      (D) 41
6. If I drive at a speed of 24 km/hr., I reach school 5 minutes late and if I drive at a 30 kmph, I reach 4 minutes too soon. Find the distance of the school from my residence (in kilometer).  
 (A) 18 km                      (B) 30 km                      (C) 15 km                      (D) 36 km
7. The sum of two numbers, which are in the ratio 5 : 7, is 120. Find the numbers.  
 (A) 30, 40                      (B) 50, 70                      (C) 70, 90                      (D) 150, 170

8. When 4 is subtracted from three times a number and the result is divided by 3 more than the number, we get  $\frac{2}{5}$ . Find the number.  
 (A) 2 (B) 3 (C) 5 (D) 4
9. A steamer goes down stream from one port to another in 5 hours while it covers the same distance upstream in 6 hours. If the speed of the stream is 3 kmph, find the speed of the steamer in still water.  
 (A) 18 km/hr (B) 30 km/hr (C) 20 km/hr (D) 33 km/hr
10. The denominator of a fraction exceeds numerator by 3. If numerator is doubled and the denominator is increased by 14, then fraction becomes  $\frac{2}{3}$ rd of the original fraction. Find the fraction.  
 (A)  $\frac{4}{7}$  (B)  $\frac{5}{7}$  (C)  $\frac{6}{7}$  (D)  $\frac{3}{7}$

### SECTION -B (TECHIE STUFF)

11. If  $29x + 37y = 103$ ,  $37x + 29y = 95$ , then :  
 (A)  $x = 1, y = 2$  (B)  $x = 2, y = 1$  (C)  $x = 2, y = 3$  (D)  $x = 3, y = 2$
12. If Rs. 50 is distributed among 150 children giving 50 p to each boy and 25 p to each girl. Then the number of boys is :  
 (A) 25 (B) 40 (C) 36 (D) 50

## Exercise-3

### PREVIOUS YEAR EXAMINATION QUESTIONS

1. The sum of three numbers is 98. The ratio of the first to the second is  $\frac{2}{3}$  and the ratio of the second to the third is  $\frac{5}{8}$ . The second number is **[NSTSE - 2010]**  
 (A) 15 (B) 20 (C) 30 (D) 32
2. What is the value of x in the given equation? **(IMO 2010)**  

$$\frac{(3x+1)}{16} + \frac{(2x-3)}{7} = \frac{(x+3)}{8} + \frac{(3x-1)}{14}$$
 (A) 2 (B) 4 (C) 3 (D) 5
3. Which expression is equivalent  $5[4 + 3(x - 6)]$ ? **(IMO 2010)**  
 (A)  $15x - 10$  (B)  $15x - 70$  (C)  $15x - 14$  (D)  $15x - 110$
4. Jasmine is a much better tennis player than Reshma. They decide to have a contest. Every time Jasmine wins a game, she will earn 3 points and every time Reshma wins a game, she will earn 5 points. If they play 48 games and the final score is tiled, how many games did Jasmine win? **(IMO 2010)**  
 (A) 50 (B) 40 (C) 30 (D) 18



5. Madhuri is on the fourth floor of a building. Her car is in the parking garage three levels below the ground floor. She gets in the elevator and travels from the fourth floor above ground level to the third floor below ground level. How many floors did she travel? **(IMO 2010)**
- (A) 3                      (B) 1                      (C) 4                      (D) 7
6. Mrs. Ravina needs to take a taxi to the doctor's clinic. The taxi ride costs Rs.13.00 for the First km and 6 for each km thereafter. How much does Mrs. Ravina pay for a 2.3 km taxi ride? **(IMO 2010)**
- (A) Rs. 25                      (B) Rs.28                      (C) Rs.32                      (D) Rs.30
7. Of the three numbers, the first is twice the second and is half the third. If the average of three numbers is 56, the three numbers in order are **[Aryabhata-2011]**
- (A) 48, 24, 96                      (B) 48, 36, 96                      (C) 48, 12, 14                      (D) 24, 12, 48
8. The sum of a two digit number and the number obtained by interchanging the digits of the number is 121. If the digits differ by 5, then find the number **[Aryabhata-2011]**
- (A) 38, 83                      (B) 27, 72                      (C) 39, 93                      (D) 61, 16
9. The ages of Mira, Tina and Sania are in the ratio 6 : 4 : 7 respectively, if the sum of their ages is 34 years, what is Sania's age? **(IMO 2011)**
- (A) 12 years                      (B) 10 years                      (C) 18 years                      (D) 14 years
10.  $\left(\frac{3}{4}\right)^{th}$  of a number is 20 more than half of the same number. The required number is \_\_\_\_\_. **(IMO 2011)**
- (A) 50                      (B) 180                      (C) 90                      (D) 80
11. The ratio of ages of Kunal and Deepesh is 3 : 5. After 10 years this ratio becomes 5 : 7. What is the present age of Deepesh? **(IMO 2011)**
- (A) 20 years                      (B) 25 years                      (C) 50 years                      (D) 15 years
12. Mohan gets 3 marks for each correct answer and loses 2 marks for each wrong answer. He attempts 30 problems and obtains 40 marks. The number of problems solved correctly is. **(IMO 2011)**
- (A) 10                      (B) 15                      (C) 20                      (D) 25
13. Neeta's volvo bus takes 50 boys to a field trip. Some of them take Rs. 20 tickets while the rest take Rs. 45 tickets. If the total cost of tickets purchased is Rs. 2000, how many boys took the tickets of Rs. 20 each? **[NSTSE - 2012]**
- (A) 7                      (B) 10                      (C) 12                      (D) 15
14. Solve for  $x : x - \left[2x - \frac{5x-1}{3}\right] = \frac{x-1}{3} + \frac{1}{2}$  **(IMO 2012)**
- (A)  $\frac{3}{2}$                       (B) - 31                      (C) - 20                      (D)  $\frac{1}{2}$

15. For a journey the cost of a child ticket is  $\frac{1}{3}$  of the cost of an adult ticket. If the cost of the tickets for 4 adults and 5 children is Rs. 85, the cost of a child ticket is **(IMO 2012)**  
 (A) Rs.5                      (B) Rs.6                      (C) Rs.10                      (D) Rs.15
16. The ratio of present ages of Rahul and Deepesh is 3 : 5. 10 years later this ratio becomes 5:7. What is the present age of Deepesh? **(IMO 2012)**  
 (A) 20 years                      (B) 50 years                      (C) 25 years                      (D) 40 years
17. Solve for  $x$ :  $\frac{3x+4}{6x+7} = \frac{x+1}{2x+3}$  **(IMO 2012)**  
 (A)  $\frac{1}{2}$                       (B)  $-\frac{5}{4}$                       (C) 1                      (D) 3
18.  $\frac{x}{x-a} + \frac{x}{x-b} = 2$  find  $x$  **[NSTSE - 2013]**  
 (A)  $\frac{a}{b}$                       (B)  $ab$                       (C)  $\frac{2ab}{a+b}$                       (D)  $2ab$
19. If  $x + y = 6$  and  $3x - y = 4$ , find the value of  $x - y$ . **[NSTSE - 2014]**  
 (A) -1                      (B) 0                      (C) 2                      (D) 4

## Answer Key

### Exercise-1

#### SECTION -A (FIXED RESPONSE TYPE) OBJECTIVE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12
Ans.	A	A	B	A	D	A	D	A	A	A	D	A

#### FILL IN THE BLANKS

- |            |                       |               |         |
|------------|-----------------------|---------------|---------|
| 1. $x = 1$ | 2. $y = -\frac{6}{5}$ | 3. $x = -60.$ | 4. zero |
| 5. 5       | 6. 6                  | 7. 2          | 8. 5    |

#### TRUE / FALSE

- |          |           |          |          |
|----------|-----------|----------|----------|
| 1. True  | 2. False  | 3. True  | 4. False |
| 5. True  | 6. True   | 7. False | 8. True  |
| 9. False | 10. True. |          |          |

#### MATCH THE COLUMN

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

#### SECTION -B (FREE RESPONSE TYPE)

#### VERY SHORT ANSWER TYPE

- |                |                   |                |           |
|----------------|-------------------|----------------|-----------|
| 1. (i) $y = 2$ | (ii) $y = -29/19$ | 2. $y = 15/17$ | 3. 21, 24 |
| 4. 24,4        |                   |                |           |

#### SHORT ANSWER TYPE

- |           |      |           |       |
|-----------|------|-----------|-------|
| 5. – 2.33 | 6. 0 | 7. 12, 18 | 8. 30 |
|-----------|------|-----------|-------|

#### LONG ANSWER TYPE

- |       |         |                                              |
|-------|---------|----------------------------------------------|
| 9. 64 | 10. 1/4 | 11. C.P. of Desk = Rs. 196 & Chair = Rs. 175 |
|-------|---------|----------------------------------------------|

### Exercise-2

#### SECTION -A (COMPETITIVE EXAMINATION QUESTION)

#### OBJECTIVE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12
Ans.	C	A	A	A	A	A	B	A	B	A	A	D

### Exercise-3

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