Class 9, Mathematics

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Chapter-5 Simultaneous Linear Equation in two variables – II (contd...)

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Word Problems :-

Problems stated in words are called word or applied problems.

Solving word problems :-

Due to the wide variety of word (or applied) problems, there is no single technique that works in all cases. However, the following general suggestions should prove helpful :-

Step 1 :- Read and reread the statement of the problem carefully, and determine what quantities must be found.

Step 2 :- Represent the unknown quantities by letters. x and y (Take any two letters)

Step 3 :- According to given conditions, form two linear equations in x and y

Step 4 :- Solve these equations simultaneously.

TYPE - I Number problem

Example 1 :- Find two numbers such that the larger number added to three times the smaller number gives 7 and twice the larger number added to the smaller number gives 9.

Solution :- Let the larger number be x and the smaller number be y. According to given,

$x + 3y = 7$ ----- (i) and $2x + y = 9$ ----- (ii)

Here, coefficient of x are 1 and 2, L.C.M = 2

$\Rightarrow [x + 3y = 7] \times 2 \Rightarrow 2x + 6y = 14$

$[2x + y = 9] \times 1 \quad 2x + y = 9$

$5y = 5 \Rightarrow y = 1$

On substituting value of y in (i), we get

$x + 3(1) = 7 \Rightarrow x = 4$ So, larger number is 4 and smaller number is 1.

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TYPE-II Digits based problem

Example 2:- The sum of the digits of a two digit number is 9. If the digits are reversed the new number decreased by 9 is equal to 4 times the original number.

Solution:- Let the digit in tens place be x and digit in unit's place be y. (OR Assume vice-versa)

Then, the original number $= 10x + y$

and reverse number $= 10y + x$

Given, sum of digits $= 9 \Rightarrow x + y = 9$ ------ (i)

According to given condition,

(Reverse number) $- 9 = 4$ (Original number)

$\Rightarrow 10y + x - 9 = 4(10x + y) \Rightarrow x - 40x + 10y - 4y = 9$

$\Rightarrow -39x + 6y = 9 \Rightarrow 39x - 6y = -9$

$\Rightarrow 13x - 2y = -3$ ------ (ii)

From equation (i), $x + y = 9 \Rightarrow x = 9 - y$

On substituting, $x = 9 - y$ in equation (ii), we get

$13(9-y) - 2y = -3 \Rightarrow 117 - 13y - 2y = -3$

$\Rightarrow -15y = -3 - 117 \Rightarrow -15y = -120 \Rightarrow y = 8$

On substituting $y = 8$ in (i), we get

$x + 8 = 9 \Rightarrow x = 1$

Therefore, required number $= 10x + y = 10(1) + 8 = 18$

TYPE - III Problems based on fractions:-

Example 3:- A fraction becomes $4/5$ when 1 is added to both the numerator and denominator. If 5 is subtracted from both numerator and denominator, the fraction becomes $1/2$. Find the fraction.

Solution:- Let the fraction be $\frac{x}{y}$

Then, according to question,

$$\frac{x+1}{y+1} = \frac{4}{5} \Rightarrow 5x + 5 = 4y + 4 \Rightarrow 5x - 4y = -1 \text{ --- (i)}$$

and $$\frac{x-5}{y-5} = \frac{1}{2} \Rightarrow 2x - 10 = y - 5 \Rightarrow 2x - y = 5 \text{ --- (ii)}$$

(Contd...)

Coefficient of x and y in equation (i) and (ii) are 1 and 4, L.C.M = 4

$\Rightarrow [5x - 4y = -1] \times 1 \Rightarrow 5x - 4y = -1$

$[2x - y = 5] \times 4 \Rightarrow 8x - 4y = 20$

$-3x = -21 \Rightarrow x = 7$

On substituting $x = 7$ in equation (ii), we get

$2 \times 7 - y = 5 \Rightarrow 14 - y = 5 \Rightarrow y = 9$

Hence, the required fraction $\frac{x}{y} = \frac{7}{9}$

TYPE - IV Problems based on age

Example 4:- A man is three times as old as his son. Five years later, the father will be two and a half times as old as the son. How old are the father and the son?

Solution :- Let the father's age be 'x' years and the son's age be 'y' years

Given, man's age = 3 (son's age) $\Rightarrow x = 3y$ -- (i)

Five years later, father's age = $(x + 5)$ years

and son's age = $(y + 5)$ years

Then, $(x + 5) = 2\frac{1}{2}(y + 5) \Rightarrow (x + 5) = \frac{5}{2}(y + 5)$

$\Rightarrow 2(x + 5) = 5y + 25 \Rightarrow 2x + 10 = 5y + 25$

$\Rightarrow 2x - 5y = 15$ ---- (ii), substituting $x = 3y$ in equation (ii), we get $2 \times 3y - 5y = 15$

$\Rightarrow 6y - 5y = 15 \Rightarrow y = 15$

Therefore, father's age = $3 \times 15 = 45$ years

and son's age = 15 years.