3.5 WORD PROBLEMS

For solving daily - life problems with the help of simultaneous linear equation in two variables or equations reducible to them proceed as :-

(i) Represent the unknown quantities by same variable x and y, which are to be determined.

(ii) Find the conditions given in the problem and translate the verbal conditions into a pair of simultaneous linear equation.

(iii) Solve these equations & obtain the required quantities with appropriate units.

Type of Problems:

(i) Determining two numbers when the relation between them is given.

(ii) Problems regarding fractions.

(iii) Problem regarding two digits of a number.

(iv) Problemregarding ages of persons.

(v) Problems regarding current of a river.

(vi) Problems regarding time & distance.

(vii) Problems regarding menstruation and geometry.

(viii) Problems regarding time & work

(ix) Problems regarding mixtures, cots of articles, porting & loss, discount etc.

Ex.5 Find two numbers such that the sum of twice the first and thrice the second is 89 and four times the first exceeds five times the second by 13.

Sol. Let the two numbers be x and y.

Then, equation formed are $2x + 3y = 89$ ....(i)

$4x - 5y = 13$ ...(ii)

On solving eq. (i) & (ii) we get

$x = 22$

$y = 15$

Hence required numbers are 22 & 15.

Ex.6 The numerator of a fraction is 4 less than the denominator If the numerator is decreased and the denominator is increased by 1, then the denominator is eight time the numerator, find the reaction.

Sol. Let the numerator and denominator of a fraction be x and y

Then, equation formed are $y - x = 4$ ....(i)

$y + 1 = 8 (x - 2)$ ....(ii)

On solving eq. (i) & (ii) we get

$x = 3$

and $y = 7$

Hence, fractions is $\frac{3}{7}$.

Ex.7 A number consists of two digits, the sum of the digits being 12. If 18 is subtracted from the number, the digits are reversed. Find the number

Sol. Let the two digits number be 1y + x

Then, equations formed are

$10y + x - 18 = 10x + y \quad \Rightarrow \quad y - x = 2 \quad$ .....(i)

and $x + y = 12 \quad$ .....(ii)

On solving eq. (i) & (ii) we get

$x = 5$

and $y = 7$

Hence number is 75.

Ex.8 The sum of a two - digit number and the number obtained by reversing the order of its digits is 165. If the digits differ by 3, find the number

Sol. Let unit digit be x ten's digit be y no. will be 10y + x.

Acc. to problem $(10y + x) + (10x + y) = 165$

$\Rightarrow \quad x + y = 15 \quad$ ...(i)

and $x - y = 3 \quad$ ...(ii)

or $-(x - y) = 3 \quad$ ....(iii)

On solving eq. (i) and (ii)

we gets = 9 and y = 6

$\therefore$ The number will be 69. **Ans.**

On solving eq. (i) and (iii)

we gets x = 6 and y = 9

$\therefore$ The number will be 96. **Ans.**

Ex.9 Six years hence a men's age will be three times the age of his son and three years ago he was nine times as old as his son. Find their present ages

Sol. Let man's present age be x yrs & son's present age be 'y' yrs.

According to problem $x + 6 = 3 (y + 6)$ [After 6 yrs]

and $x - 3 = 9 (y - 3)$ [Before 3 yrs.]

On solving equation (i) & (ii) we gets x = 30, y = 6.

So, the present age of man = 30 years, present age of son = 6 years.

Ex.10 A boat goes 12 km upstream and 40 km downstream in 8 hrs. It can go 16 km. upstream and 32 km downstream in the same time. Find the speed of the boat it still water and the speed of the stream.

Sol. Let the speed of the boat in still water be x km/hr and the speed of the stream be y km/hr then speed of boat in downstream is (x + y) km/hr and the speed of boat upstream is (x - y) km/hr.

Time taken to cover 12 km upstream $= \frac{12}{x-y}$ hrs.

Time taken to cover 40 km downstream $= \frac{40}{x+y}$ hrs.

But, total time taken 8 hr

$\therefore \quad \frac{12}{x-y} + \frac{40}{x+y} = 8 \quad$ .....(i)

Time taken to cover 16 km upstream $= \frac{16}{x-y}$ hrs.

Time taken to cover 32 km downstream $= \frac{32}{x+y}$ hrs.

Total time taken = 8 hr

$\therefore \quad \frac{16}{x-y} + \frac{32}{x+y} = 8 \quad$ .....(ii)

Solving equation (i) & (ii) we gets x = 6 and y = 2.

Hence, speed of boat in still water = 6 km/hr and speed of stream = 2 km/hr.

Ex.11 Ramesh travels 760 km to his home partly by train and partly by car. He taken 8 hr, if he travels 160 km by train and the rest by car. He takes 12 minutes more, if he travels 240 km by train and the rest by car. Find the speed of train and the car.

Sol. Let the speed of train be x km/hr & car be y km/hr respectively.

Acc. to problem $\frac{160}{x} + \frac{600}{y} = 8 \quad$ ....(i)

$\frac{240}{x} + \frac{520}{y} = \frac{41}{5} \quad$ ....(ii)

Solving equation (i) & (ii) we gets x = 80 and y = 100.

Hence , speed ot train = 80 km/hr and speed of car = 100km/hr.

Ex.12 Points A and B are 90 km apart from each other on a highway. A car starts from A and another from B at the same time. If they go in the same direction, they meet in 9 hrs and if they go in opposite direction, they meet in $\frac{9}{7}$ hrs. Find their speeds.

Sol. Let the speeds of the cars starting from A and B be x km/hr and y km/hr respectively.

Acc to problem $9x - 90 = 9y \quad$ ……..(i)

& $\frac{9}{7}x + \frac{9}{7}y = 90 \quad$ …..(ii)

Solving (i) & (ii) we gets x = 40 & y = 30.

Hence, speed of car starting from point A = 40 km/hr & speed of car starting from point B = 30 km/hr.

Ex.13 In a cyclic quadrilateral ABCD, $\angle A = (2x + 11)^0$, $\angle B = (y + 12)^0$, $\angle C = (3y + 6)^0$ and $\angle D = (5x - 25)^0$, find the angles of the quadrilateral.

Sol. Acc. to problem $(2x + 11)^0 + (3y + 6)^0 = 180^0$

$(y + 12)^0 + (5x - 25)^0 = 180^0$

Solving we get $x = \frac{416}{13}$ & $y = \frac{429}{13}$

$\Rightarrow$ $x = 32$ and $y = 33$

$\therefore$ $\angle A = 75^0$, $\angle B = 45^0$, $\angle C = 105^0$, $\angle D = 135^0$

Ex.15 A vessel contains mixture of 24ℓ milk and 6ℓ water and a second vessel contains a mixture of 15ℓ milk & 10ℓ water. How much mixture of milk and water should be taken from the first and the second vessel separately and kept in a third vessel so that the third vessel may contain a mixture of 25ℓ milk and 10ℓ water ?

Sol. Let x ℓ of mixture be taken from Ist vessel & y ℓ of the mixture be taken from 2nd vessel and kept in 3rd vessel so that (x + y) ℓ of the mixture in third vessel may contain 25 ℓ of milk & 10ℓ of water.

A mixture of x ℓ from 1st vessel contains $\frac{24}{30}x = \frac{4}{5}x\ell$ of milk & $\frac{x}{5}\ell$ of water and a mixture of $y\ell$ from 2nd vessel contains $\frac{3y}{5}\ell$ of milk & $\frac{2y}{5}\ell$ of water.

$\therefore$ $\frac{4}{5}x + \frac{3}{5}y = 25$ ....(i)

$\frac{x}{5} + \frac{2}{5}y = 10$ ....(ii)

Solving (i) & (ii) x = 20 litres and y = 15 litres.

Ex.15 A lady has 25 p and 50 p coins in her purse. If in all she has 40 coins totaling Rs. 12.50, find the number of coins of each type she has.

Sol. Let the lady has x coins of 25 p and y coins of 50 p.

Then acc. to problem $x + y = 40$ .....(i)

and $25x + 50y = 1250$ ....(ii

Solving for x & y we get x = 30 (25 p coins) & y = 10 (50 P coins).

Ex.16 Students of a class are made to stand in rows. If one student is extra in a row, there would be 2 rows less. If one students is less in row, there would be 3 rows more. Find the total number of students in the class.

Sol. Let x be the original no. of rows & y be the original no. of student s in each row.

$\therefore$ Total no. of students = xy.

Acc. to problem

$(y + 1)(x - 2) = xy$ ....(i)

and $(y - 1)(x + 3) = xy$ ....(ii)

Solving (i) & (ii) to get

$x = 12$ & $y = 5$

$\therefore$ Total no. of students = 60

Ex.17 A man started his job with a certain monthly salary and earned a fixed increment every year. If his salary was Rs. 4500 after 5 years. of service and Rs. 5550 after 12 years of service, what was his starting salary and what his annual increment.

Sol. Let his initial monthly salary be Rs x and annual increment be Rs y.

Then, Acc. to problem $x + 5y = 4500$ .....(i)

$x + 12\,y = 5550$ ....(ii)

Solving these two equations, we get x= Rs. 3750 y = Rs 150.

Ex.18 A dealer sold A VCR and a TV for Rs. 38560 making a profit of 12% on CVR and 15% on TV. By selling them for Rs. 38620, he would have realised a profit of 15% on CVR and 12% on TV. Find the cost price of each.

Sol. Let C.P. of CVR be Rs x & C.P. of T.V. be Rs y.

Acc. to problem $\frac{112}{100}x + \frac{115}{100}y = 38560$ .....(i)

and $\frac{115}{100} \times + \frac{112}{100}y = 38620$ ....(ii)

Solving for x & y we get x = Rs. 18000 & y = Rs. 16000.