

PROBLEMS BASED ON SIMPLE EQUATIONS

In this chapter, we shall be using simple algebraic equations to find the solutions of given word problems.

18.1 TO SOLVE THE PROBLEMS

1. Read the given problem carefully to know what is given and what we are required to find.
2. Represent the quantity, required to find by letter x or by letter y (other letters such as : a, b, c, \dots , etc., can also be taken instead of x and y).
3. According to the condition(s), given in the problem, write the relation (equation) between the knowns and the unknowns.
4. Solve the equation to obtain the value of the unknown.

Example 1 :

If 8 is added to twice a certain number, the sum is 36. Find the number.

Solution :

Let the required number be x .

When 8 is added to twice of it, we get : $2x + 8$.

$$\begin{aligned} \text{Since, this sum is equal to 36} & \Rightarrow 2x + 8 = 36 \\ & \Rightarrow 2x = 36 - 8 \\ & \Rightarrow 2x = 28 \text{ and } x = 14 \end{aligned}$$

\therefore The **required number** is **14**

(Ans.)

Example 2 :

Three times a certain number, diminished by four, equals 20. Find the number.

Solution :

Let the number be x .

$$\begin{aligned} \therefore 3x - 4 = 20 & \Rightarrow 3x = 20 + 4 \quad [\text{Given : 3 times the number diminished by 4} = 20] \\ & \Rightarrow x = \frac{24}{3} = 8 \end{aligned}$$

\therefore The **required number** is **8**

(Ans.)

Example 3 :

The sum of three consecutive odd natural numbers is 45. Find the numbers.

Solution :

Let the smallest odd natural number be x .

\therefore The other two odd natural numbers are $x + 2$ and $x + 4$.

Given, the sum of these three consecutive odd natural numbers = 45

Consecutive
odd numbers
differ by 2.

$$\Rightarrow x + (x + 2) + (x + 4) = 45$$

$$\Rightarrow 3x + 6 = 45$$

$$\Rightarrow 3x = 45 - 6 \Rightarrow x = \frac{39}{3} = 13$$

\therefore The **required natural numbers** are : $x, x + 2$ and $x + 4$

$$= 13, 13 + 2 \text{ and } 13 + 4 = \mathbf{13, 15 \text{ and } 17} \quad (\text{Ans.})$$

1. *Consecutive natural numbers are taken as : $x, x + 1, x + 2, \dots$ or as : $x, x - 1, x - 2, \dots$*

Reason : *Consecutive natural numbers differ by 1.*

2. *Since, the consecutive even natural numbers differ by 2, they are taken as : $x, x + 2, x + 4, \dots$ or as : $x, x - 2, x - 4, \dots$*

3. *Consecutive odd natural numbers are also taken as : $x, x + 2, x + 4, \dots$ or as : $x, x - 2, x - 4, \dots$, as the consecutive odd numbers also differ by 2.*

4. *All the above said three results are true for whole numbers and integers also.*

Example 4 :

Find four consecutive integers such that one-third of the smallest of these numbers exceeds one-sixth of the largest by 2.

Solution :

Let the required integers be $x, x + 1, x + 2$ and $x + 3$.

$$\text{Given : } \frac{1}{3} \text{ of } x - \frac{1}{6} \text{ of } (x + 3) = 2$$

$$\Rightarrow \frac{2x - (x + 3)}{6} = 2$$

$$\Rightarrow 2x - x - 3 = 12$$

$$\Rightarrow x = 12 + 3 = 15$$

\therefore **Required integers** are : $x, x + 1, x + 2$ and $x + 3$

$$= 15, 15 + 1, 15 + 2 \text{ and } 15 + 3$$

$$= \mathbf{15, 16, 17 \text{ and } 18} \quad (\text{Ans.})$$

EXERCISE 18(A)

- Five decreased from a number equals 11. Find the number.
- Twice a number increased by 9 equals 17. Find the number.
- Five times a number exceeds 12 by 3. Find the number.
- Find a number which is greater than one-fifth of itself by 12.
- If 5 is subtracted from a number and the result is multiplied by 10, the answer is 20. Find the number.
- Three times a number increased by 8 is same as twice the number increased by 15. Find the number.
- The sum of four times a number and 9 is same as one-third that number increased by 31. Find the number.
- One-third of a certain number diminished by one-fourth of it is equal to 5. Find the number.

9. The sum of three consecutive whole numbers is 48. Find the numbers.
10. The sum of two consecutive odd natural numbers is 28. Find the numbers.
11. If three consecutive even whole numbers are added together the result is 42. Find the numbers.
12. A number is as much less than 75 as it is greater than 45. Find the number.
13. Make two parts of 75 such that one part is two-third of the second part.
14. Find three consecutive whole numbers such that three-times the middle number is greater than the sum of the other two by 11.
15. The difference between two numbers is 642. When the greater number is divided by the smaller number, the quotient is 8 and the remainder is 19. Find the numbers.

Let the greater number = x = dividend

\therefore The smaller number = $x - 642$ = divisor

Now apply : **Dividend = Quotient \times Divisor + Remainder**

18.2 PROBLEMS INVOLVING AGE

Example 5 :

A man is 26 years older than his son. After 10 years, he will be three times as old as his son. Find their present ages.

Solution :

Let the son's present age be x years.

\therefore Father's present age = $(x + 26)$ years

After 10 years :

Son's age = $(x + 10)$ years

and, father's age = $(x + 26 + 10)$ years = $(x + 36)$ years.

Given, after 10 years, father's age = 3 times of the son's age.

$$\Rightarrow x + 36 = 3(x + 10)$$

On solving, we get : $x = 3$.

\therefore Son's age = x years = **3 years**

and, father's age = $(x + 26)$ years = $(3 + 26)$ years = **29 years** (Ans.)

18.3 MISCELLANEOUS PROBLEMS

Example 6 :

The length of a rectangular field is 8 m more than its width and the perimeter of the field is 76 m. Find its length and width.

Solution :

Let width = x m

\therefore Length = $(x + 8)$ m

\therefore $2(\text{length} + \text{width}) = \text{Perimeter}$

\therefore $2[(x + 8) + x] = 76$

\Rightarrow $2x + 16 + 2x = 76$

\Rightarrow $4x = 76 - 16 = 60$

\therefore $x = \frac{60}{4} = 15$

$$\therefore \text{Length} = (x + 8)m = (15 + 8)m = 23 \text{ m}$$

and, $\text{width} = x \text{ m} = 15 \text{ m}$ (Ans.)

Example 7 :

Rajesh had some money. He gave one-fourth of it to his friend Rohit and still has ₹ 144 left with him. Find, how much money he had in the beginning.

Solution :

Let, in the beginning, Rajesh had ₹ x

So, he gave ₹ $\frac{x}{4}$ to his friend Rohit

$$\therefore x - \frac{x}{4} = 144$$

$$\Rightarrow \frac{4x - x}{4} = 144$$

$$\Rightarrow 3x = 144 \times 4 \text{ and } x = \frac{144 \times 4}{3} = 192$$

\therefore In the beginning, Rajesh had ₹ 192 (Ans.)

EXERCISE 18(B)

1. A man is 24 years older than his son. After two years, his age will be three times that of his son. Find their present ages.
2. The daughter's age is 5 years and the mother is 32 years old. After x years, the mother's age will be four times that of her daughter. Find the value of x .
3. The father is 37 years old and his son's age is 5 years. After how many years, the father's age will be five times that of his son ?
4. The father is nine times the age of his son. After three years, the father's age will be five times the age of his son. Find their present ages.
5. The length of a rectangular field is four times its breadth. If the perimeter of the field is 60 m, find its length and breadth.
6. A has some money. If he gives one-fifth of it to B, he is still left with ₹ 20. How much money had he at first ?
7. Ramesh has a certain money in his pocket. If he gets four times of this pocket money from his father, the total money in his pocket becomes ₹ 60. How much money does Ramesh has in his pocket?
8. A has ₹ 80 and B has ₹ 40. How much money must A give to B so that B's money becomes twice the money that is left with A ?
9. The difference between the length and the breadth of a rectangular field is 15 m. If the perimeter of the field is 190 m, find its length and breadth.
10. John has ₹ 50 more than what Smith has. If Smith takes ₹ 35 from John, the money Smith has now is twice of what is left with John. Find, how much money each had originally ?

11. The cost of 5 pens and 8 pencils is ₹ 142, in which one pencil costs ₹ 18 less than the cost of one pen. Taking the cost of each pen to be ₹ x ; find :
- cost of 1 pencil, in terms of x .
 - cost of 5 pens and 8 pencils, in terms of x .

Now use the given information to form an equation.

Then, find the cost of 1 pen and the cost of 1 pencil.

12. Two supplementary angles differ by 40° . Find the angles.
13. The total number of viewers in a cinema-hall is 560. If number of males in the cinema-hall is three-fifth the number of females, find the exact number of males and females in the hall.
14. A purse contains some ₹ 5 coins and some ₹ 10 coins. If the total number of these coins is 20 and the total value of these coins is ₹ 165; find the number of ₹ 10 coins in the purse.
15. The given figure shows an isosceles triangle in which $AB = AC$,
 $AB = (4x - 3)$ cm,
 $AC = (3x + 5)$ cm and
 $BC = (2x + 3)$ cm.

Find : (i) the value of x .

(ii) the perimeter of the given triangle ABC.

