

## समिकरण (Equation)

### कठीन महत्वपूर्ण बुदाहरु (Some Key Points):-

1. याहा नभएको राशीलाई  $x, y, z$  आदिले जनाउने। (Unknown quantities are denoted by  $x, y, z$  etc.)
2. समस्यामा दिइएको भनाइलाई गणितीय वाक्यमा लेख्ने। (Express statement of question into the equations.)
3. प्राप्त समिकरणलाई हटाउने विधि, प्रतिस्थापन विधि हल गर्ने।  
(Solve the equations by using any one of the method elimination, substitution.)
4. संख्या (Numbers)
  - (a) अनुवर्ती संख्याहरु (Consecutive numbers):  $x, x + 1, x + 2 \dots$
  - (b) अनुवर्ती जोर संख्याहरु (Consecutive even numbers):  $x, x + 2, x + 4, x + 6 \dots$
  - (c) अनुवर्ती विजोर संख्याहरु (Consecutive odd numbers):  $x, x + 2, x + 4, x + 6 \dots$
  - (d)  $x$  को व्युक्तमानुपाती  $\frac{1}{x}$  हुन्छ (Reciprocal of  $x$  is  $\frac{1}{x}$ )
5. दुई अंकको संख्या (two digit number)  
y र x कमश: एक स्थान र दश स्थानमा भएका दुई अडकको संख्यालाई  $10x + y$  ले जनाइन्छ र यसले विपरित संख्यालाई  $10y + x$  ले जनाइन्छ।  
Two digit number having  $y$  and  $x$  as units and ten's digits respectively is equal to  $10x + y$  and the number obtained by reversing the order of the digits is  $10y + x$ .
6. दूरी र वेग सम्बन्ध समस्याहरु  
Problems based on time distance and speed.  
 (a) दूरी (Distance) = वेग (speed) × समय (time)  
 (b) समय (Time) = 
$$\frac{\text{दूरि} (\text{Distence})}{\text{वेग} (\text{Speed})}$$
  
 (c) वेग (Speed) = 
$$\frac{\text{दूरि} (\text{Distence})}{\text{समय} (\text{Time})}$$
  
 (d) दुईओटामा एउटाको वेग =  $x$  km/hr र अर्कोको वेग =  $y$  km/hr भए  
If one's speed =  $x$  km/hr & that of another =  $y$  km/hr speed  
Then, विपरित दिशातिर वेग (Speed in opposite direction)  $(x - y)$  km/hr  
एउटै दिशातिर वेग (Speed in same direction) =  $(x + y)$  km/hr
7. उमेरसंग सम्बन्धित समस्याहरु (Problems based on Ages)  
यदि दुइजना व्यक्तिहरुको हालको उमेर  $x$  वर्ष र  $y$  वर्ष भए  
If the present ages of two persons are  $x$  and  $y$   
 (i) a वर्ष पछि उनिहरुको उमेर कमश:  $(x + a)$  र  $(y + a)$  वर्ष हुन्छ।  
If 'a' years after/later/hence will be  $(x + a)$  years and  $(y + a)$  years.  
 (ii) a वर्ष अघिको उमेर कमश:  $(x - a)$  र  $(y - a)$  वर्ष हुन्छ।  
Ages 'a' years before/earlier/ago were  $(x - a)$  years and  $(y - a)$  years.
8. वर्ग समिकरण (Quadratic Equation)  
एउटा वर्ग समिकरण  $ax^2 + bx + c = 0$  मा  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$  हुन्छ।  
In a quadratic equation  $ax^2 + bx + c = 0$   $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

## 12.1 युगपतरेखीय समिकरण सम्बन्धी शालिक समस्याहरू

### Verbal problems leading to simultaneous equation

#### Short Questions

##### Model 1

दुई संख्याहरूको योगफल 22 र फरक 10 छ भने ति संख्या पत्ता लगाउनुहोस् ।  
If the sum of two numbers is 22 and their difference is 10, find the number

**Solution:**

Let the numbers be  $x$  and  $y$  suppose  $x > y$  from the 1<sup>st</sup> condition

$$x + y = 22 \dots \dots \dots \text{(i)}$$

and from 2<sup>nd</sup> condition

$$x - y = 10 \dots \dots \dots \text{(ii)}$$

Solving (i) and (ii)

$$x + y = 22$$

$$\underline{x - y = 10}$$

$$2x = 32$$

$$x = 16$$

Putting the value of  $x$  in (i)

$$16 + y = 22$$

$$y = 22 - 16 = 6$$

$$\therefore y = 6$$

The required numbers are 16, and 6.

##### Model 2

एउटा संख्या अर्कोको तेब्वर छ । यदि तिनीहरूको योगफल 28 छ भने ति संख्या पत्ता लगाउनुहोस् ।  
A number is thrice of the other if their sum is 28 find the numbers.

**Solution:**

Suppose numbers are  $x$  and  $y$ .

$$\text{From 1}^{\text{st}} \text{ condition } x = 3y \dots \dots \dots \text{(i)}$$

$$\text{Again, 2}^{\text{nd}} \text{ condition } x + y = 28 \dots \dots \dots \text{(ii)}$$

Putting the value of equation (i) in equation (ii)

$$\text{or, } 3y + y = 28$$

$$\text{or, } 4y = 28$$

$$\therefore y = \frac{28}{4} = 7$$

Again putting the value of  $y$  in equation (i), we get

$$\text{Now, } x = 3 \times 7 = 21$$

The required number are 7 and 21

##### Model 3

दुई संख्याहरूको योगफल 16 र गुणनफल 63 भए ति संख्या पत्ता लगाउनुहोस् ।  
The sum of two numbers is 16 and their produs is 63 find the numbers.

**Solution:**

Suppose the number are  $x$  and  $y$

According to first condition

$$x + y = 16 \dots \dots \dots \text{(i)}$$





$$x - 6y = 0 \dots \dots \dots \text{(i)}$$

From the 2<sup>nd</sup> condition

$$x - y = 35 \dots \dots \dots \text{(ii)} \times 6$$

From the equation (i) and (ii), we get

$$x - 6y = 0$$

$$6x - 6y = 210$$

$$\begin{array}{r} - + - \\ \hline -5x = -210 \end{array}$$

$$\therefore x = 42$$

$\therefore$  The age of mother is 42 yrs.

### Model 8

एउटा संख्या अर्को भन्दा 5 गुणा ठूलो छ । ठूलो संख्याको 3 गुणा सानो संख्यामा जाह्यो भने योगफल 96 हुन्छ भने उक्त संख्याहरू पता लगाउनुहोस् ।

The number is 5 times the other number. If 3 times the large number is added with the number the smaller number its result is 96.

**Solution:**

Let the larger number and smaller number be x and y.

From 1<sup>st</sup> condition

$$x = 5y \dots \dots \text{(i)}$$

From 2<sup>nd</sup> condition

$$3x + y = 96 \dots \dots \text{(ii)}$$

Putting the value of x in equation (ii)

$$\text{or, } 3 \times 5y + y = 96$$

$$\text{or, } 16y = 96$$

$$\therefore y = 6$$

Again putting the value of y in equation (i)

$$x = 5y = 5 \times 6 = 30$$

The required numbers are 6 an 30.

### Model 9

120 मीटर परिमिति भएको आयतकार बगैचाको लम्बाई चौडाईको दोब्बर छ भने उक्त बगैचाको लम्बाई र चौडाई पता लगाउनुहोस् ।

If the perimeter of a rectangular garden is 120 m where length is double its breadth, then find the length and breadth of the garden.

**Solution:**

Let the length and breadth of rectangle garde be x and y.

From the 1<sup>st</sup> condition

$$2(x + y) = 120$$

$$\therefore x + y = 60 \dots \dots \text{(i)}$$

From the 2<sup>nd</sup> condition

$$x = 2y \dots \dots \text{(ii)}$$

Putting the value of x in equation (i)

$$2y + y = 60$$

$$\text{or, } 3y = 60$$

$$\therefore y = 20$$

Putting the value of y in equation (i)

$$\text{or, } x + y = 60$$

$$\text{or, } x = 20 = 60$$

$$\therefore x = 40$$

Length and breadth of rectangular garden 40m and 20m.

### Practice Yourself

1. यदि 2 संख्याहरूको योगफल 10 र तिनीहरूको अन्तर 2 भए ति संख्याहरू पत्ता लगाउनुहोस् ।  
If the sum of two number is 10 and their difference is 2, find the numbers. (Ans : (6, 4))
2. बाबुको उमेरको  $\frac{1}{5}$  भाग छोराको उमेर छ । यदि तिनीहरूको उमेरको योगफल 42 वर्ष भए बाबुको उमेर पत्ता लगाउनुहोस् ।  
 $\frac{1}{5}$  of the age of father is age of his son if the sum of their ages is 42 years determine the age of father. (Ans : 35 years)
3. दुई संख्याको अन्तर 4 र गुणनफल 221 भए उक्त संख्याहरू पत्ता लगाउनुहोस् ।  
The difference of two numbers is 4 and the product is 221 find the numbers. (Ans: 17,13)
4. दुईजना शिक्षकहरूको हालको उमेरको योगफल 54 वर्ष छ । यदि एकजना शिक्षकले उमेर अर्को भन्दा 4 वर्षले बढि छ भने उनीहरूको हालको उमेर पत्ता लगाउनुहोस् ।  
The sum of the present age of two teachers is 54 yrs If the age of one teacher is 4 yrs increase then the others. Find their present age.  
Ans: 25 yrs 29 yrs.
5. दुईओटा घनात्मक संख्याहरूको योगफल 29 छ । यदि एउटा अर्को भन्दा 5 ले बढि छ भने ती संख्याहरू पत्ता लगाउनुहोस् ।  
If sum of two positive number is 29. If one of them is 5 more than that of the other, find the number. (Ans: 17 and 12)
6. एउटा संख्या अर्को भन्दा दुई गुणा छ । ती संख्याहरूको योगफल 60 भए ती संख्याहरू पत्ता लगाउनुहोस् ।  
A number is two times the other numbers and its sum of the number is 60, find the numbers. (Ans: 20, 40)
7. दुई अंकको एउटा संख्यामा एक स्थानको अंक र दशस्थानको अनुको अनुपात 1:2 छ । यदि अंकहरूको योगफल 12 भए त्यो संख्या पत्ता लगाउनुहोस् ।  
In a two digits number the ratio of digits of unit place is 1:2. if the sum of digits is 12 then find the number. (Ans: 4,8)
8. मनिताले 22 वर्षमा छोरा जन्माइन अहिले आमा र छोराको योगफल 42 वर्ष छ भने छोरा करि वर्षको रहेछ ? पत्ता लगाउनुहोस् ।  
Manita game birth to her son at the age of 22 yrs. If sum of present age of mother and son is 42 yrs. Find the age of her son.  
(Ans: 10 yrs)

### Long Questions

#### **Model 1**

दुई अड्कले बनेको एउटा संख्यामा अड्कहरूको योग 10 छ । यदि उक्त संख्यामा 36 जोड्दा उक्त अंकहरूको स्थान बदलिन्छ भने सो संख्या पत्ता लगाउनुहोस् ।

A number consist of the digits the sum of digit is 10. If 36 is added to the number, the place of the digits interchanged, find the numbers.

#### **Solution:**

Let, two digits number =  $10x + y$

digits involved in this number are  $x$  and  $y$

According to question

$$x + y = 10 \dots \dots \dots \text{(i)} \times 9$$

If the place of digits interchanged, then number will be  $10y + x$

Again, from second condition of question

$$10x + y + 36 = 10y + x$$

$$\text{or, } 9x - 9y = -36 \dots \dots \dots \text{(ii)}$$







$$\begin{aligned} \text{or, } x - 66 &= -30 \\ \therefore x &= 66 - 30 = 36 \\ \therefore \text{men's age} &= 36 \text{ yrs} \\ \text{His son's age} &= 11 \text{ yrs} \end{aligned}$$

### Model 7

कुनै भिन्नको अंश हर भन्दा 1 ले कम छ । यदि उक्त भिन्नको अंशमा 1 र हरमा 5 जोड्यो भने नयाँ भिन्न  $\frac{1}{2}$  हुन्छ भने बास्तविक भिन्न पता लगाउनुहोस् ।

In a fraction the numerator is 1 less than the denominator. If 1 is added to the numerator and 5 to the denominator, the fraction becomes  $\frac{1}{2}$ . Find the original fraction.

**Solution:**

Let the original fraction be  $\frac{x}{y}$

$x$  = numerator

$y$  = denominator

According to question

$$x = y - 1$$

$$x - y = -1 \dots \dots \dots \text{(i)} \times 2$$

Again

$$\frac{x+1}{y+5} = \frac{1}{2}$$

$$2x + 2 = y + 5$$

$$2x - y = 3 \dots \dots \dots \text{(ii)}$$

Solving (i) and (ii)

$$2x - 2y = -2$$

$$2x - y = 3$$

$$\begin{array}{r} - + - \\ -y = -5 \end{array}$$

$$y = 5$$

Put  $y$  in (i) we get

$$x - 5 = -1$$

$$x = -1 + 5 = 4$$

$$\therefore \text{Original fraction } \frac{x}{y} = \frac{4}{5}$$

### Model 8

एउटा भिन्नको अंशलाई 2 ले गुणा गरेर हरलाई 3 ले घटायो भने 2 आउँछ । तर यदि अंशलाई 8 ले बढाइ हरलाई दोब्बर गन्यो भने 1 आउँछ भने उक्त भिन्न पता लगाउनुहोस् ।

In a fraction, if the numerator is multiplied by 2 and denominator is reduced by 3 we get 2. But if the numerator of the fraction is increased by 8 and the denominator is two times, we get 1. Find the fraction.

**Solution:**

Suppose required fraction  $= \frac{x}{y}$

from 1<sup>st</sup> condition of question

$$\frac{2x}{y-3} = 2$$

$$\text{or, } 2x = 2y - 6$$

$$\therefore 2x - 2y = -6 \dots \text{(i)}$$

Again, from 2<sup>nd</sup> condition of question

$$\frac{x+8}{2y} = 1$$

$$\text{or, } 2y = x + 8$$

$$\therefore x - 2y = -8 \dots \dots \dots \text{(ii)}$$

Solving (1) and (2)

$$2x - 2y = -6$$

$$x - 2y = -8$$

$$\begin{array}{r} - + = + \\ x = 2 \end{array}$$

$$x = 2$$

Putting value of  $x$  in (i) we get

$$\text{or, } 2 \times 2 - 2y = -6$$

$$\text{or, } -2y = -6 - 4$$

$$\text{or, } -2y = -10 \Rightarrow y = 5$$

$$\therefore \text{Required fraction } \left( \frac{x}{y} \right) = \frac{2}{5}$$

**Model 9**

1 कोटा कलम र 3 कपिको संयुक्त मूल्य रु 210 पर्छ । त्यसै खाले 3 वटा कलम र 5 वटा कपिको संयुक्त मूल्य रु 430 पर्छ । 2 वटा कपि र 2 वटा कलमको संयुक्त मूल्य पत्ता लगाउनुहोस् ।

The combined price of 1 pen and 3 copies is Rs 210. The combined price of 3 pen and 5 copies same quality is Rs. 430. What is the combined price of 2 pens and 2 copies.

**Solution:**

Suppose price if 1 pen =  $x$

price of 1 copy =  $y$

Price of 3 copies =  $3y$

According to question

$$x + 3y = 210 \dots \text{(i)} \times 3$$

Again, price of 2 pen =  $2x$

price of 5 copies =  $5y$

$$\text{Now, } 2x + 5y = 430 \dots \text{(ii)}$$

Solving (1) and (ii)

$$3x + 9y = 630$$

$$3x + 5y = 430$$

$$\begin{array}{r} - \\ - \\ \hline 4y = 200 \end{array}$$

$$y = 50$$

Putting the value of  $y$  in (i)

$$\text{or, } x + 3 \times 50 = 210$$

$$\text{or, } x + 150 = 210$$

$$\therefore x = 210 - 150 = 60$$

$$\therefore \text{Price of 1 pen} = 60$$

$$\text{Price of 1 copy} = 50$$

Now, combined price of 2 pen and 2 copies

$$= 2 \times 60 + 2 \times 50 = 120 + 150 = \text{Rs } 220$$

**Model 10**

10 र 100 बीचमा पर्ने एउटा संख्याहरू त्यसको अङ्कको स्थान परिवर्तन गरी 17 जोड्दा त्यो संख्याको दोब्बर हुन्छ । यदि त्यो संख्यामा 5 चाहियो भने त्यसका अंकहरूको योगफलको 5 गुणा हुन्छ । उक्त संख्या पत्ता लगाउनुहोस् ।

In a number lying between 10 and 100 when the places. It becomes two times of this number. If 5 added to this number its become 5 times of the sum of its digits find the number.

**Solution:**

Let the two digits numbers are  $x$  and  $y$  respectively, the required number =  $10x + y$  its reversed number =  $10y + x$

From the 1<sup>st</sup> condition

$$2(10x + y) = 10y + x + 17$$

$$\text{or, } 20x + 2y = 10y + x + 17$$

$$\text{or, } 20x + 2y - 10y - x = 17$$

$$\therefore 19x - 8y = 17 \dots \text{(i)}$$

From the 2<sup>nd</sup> condition

$$10x + y + 5 = 5(x + y)$$

$$\text{or, } 10x + y + 5 = 5x + 5y$$

$$\text{or, } 10x + y - 5x - 5y = 5$$

$$\therefore 5x - 4y = -5 \dots \text{(ii)} \times 2$$

To solve equation (i) and (ii) we get

$$\text{or, } 19x - 8y = 17$$

$$\text{or, } 10x - 8y = 10$$

$$\text{or, } 9x = 27$$

$$\therefore x = 3$$

Putting the value of  $x$  in equation (i) we get

$$19x - 8y = 17$$

$$\text{or, } 19 \times 3 - 8y = 17$$

$$\text{or, } 57 - 8y = 17$$

$$\text{or, } -8y = 17 - 57$$

$$\text{or, } 8y = 40$$

$$\therefore y = 5$$

The required two digits number =  $10x + y = 10 \times 3 + 5 = 35$



$$\begin{array}{r} - + + \\ \hline \therefore x = 5 \end{array}$$

Putting the value of x in equation (i) we get

$$\begin{aligned} & 2x - y = 1 \\ \text{or, } & 2 + 5 - y = 1 \\ \text{or, } & y = 1 - 10 \\ \therefore & y = 9 \end{aligned}$$

The required two digits number =  $10x + y = 10 \times 5 + 9 = 59$

### Model 13

एउटा दुई अंकको संख्या र त्यसका अंकहरूको स्थान बदल्दा बन्ने संख्याको अनुपात 6:5 यदि अङ्कहरूको अन्तर 1 भए उक्त संख्या पता लगाउनुहोस् ।

The ratio of a two digits number and the number obtained by interchanging the digits is 6:5. if the difference of the digits is 1. Find the number.

**Solution:**

Let the two digits number be x and y respectively then the required two digits number =  $10x + y$  and its interchanging of digits its.

$$\text{reverse number} = 10y + x$$

From the 1 st condition

$$\begin{aligned} & 10x + y : 10y + x = 6:5 \\ \text{or, } & \frac{10x + y}{10y + x} = \frac{6}{5} \\ \text{or, } & 50x + 5y = 60y + 6x \\ \text{or, } & 50x + 5y - 60y - 6x = 0 \\ \text{or, } & 44x - 55y = 0 \\ \text{or, } & 11(4x - 5y) = 0 \\ \therefore & 4x - 5y = 0 \dots \dots \dots \text{(ii)} \end{aligned}$$

From the 2 nd condition

$$x - y = 1 \dots \dots \dots \text{(ii)} \times 5$$

Solve to equation (i) and (ii), we get

$$\begin{array}{r} 4x - 5y = 0 \\ 5x - 5y = 5 \\ \hline - x = - 5 \\ \therefore x = 5 \end{array}$$

Again, putting the value of x equation (ii)

$$\begin{array}{r} x - y = 1 \\ \text{or, } 5 - y = 1 \\ \therefore y = 4 \end{array}$$

The required two digits number =  $10x + y = 10 \times 5 + 4 = 54$

### Model 14

दुइओटा अड्ले बनेका एउटा धनात्मक संख्यामा भएका अङ्कहरू मध्ये एक स्थानको अङ्कलाई दशस्थानको अंकले भाग गर्दा भागफल 3 छ । त्यो संख्यामा 36 जोड्यो भने त्यो संख्याको विपरित संख्या बन्दछ भने त्यो संख्या पता लगाउनुहोस् ।

The positive number consists of two digits. When digit in the unit place is divided by the digit in the tenth digit then quotient is 3. If 36 is added to the number then digits of the number are reversed.

**Solution:**

Let the digits number be x and y respectively. then, the two digits number =  $10x + y$  and its reversed number =  $10y + x$

From the 1<sup>st</sup> condition



**Model 16**

3 वर्ष अधि बाबुको उमेर र उसको छोराको उमेरको योगफल 54 वर्ष थियो । 3 वर्ष पछि बाबुको उमेर छोराको 9 वर्ष पछिको उमेरको दोब्बर हुन्छ । बाबु र छोराको हालको उमेर पत्ता लगाउनुहोस् ।

Three yrs ago the sum of the ages of the father and his son is 54 yrs. 3 yrs later the father's age will be double of the son's age after 9 yrs. Find the present age of the father and son.

**Solution:**

Let the present ages of father and son be  $x$  and  $y$  respectively.

From the 1<sup>st</sup> condition

$$3 \text{ yrs ago father's age} = x - 3$$

$$3 \text{ yrs ago son's age} = y - 3$$

$$(x - 3) + (y - 3) = 54$$

$$\text{or, } x - 3 + y - 3 = 54$$

$$\text{or, } x + y - 6 = 54$$

$$\therefore x + y = 60 \dots\dots\dots (i)$$

From the 2<sup>nd</sup> condition

$$3 \text{ yrs later age of father} = x + 3$$

$$9 \text{ yrs later age of son} = y + 9$$

$$x + 3 = (y + 9) \times 2$$

$$\text{or, } x + 3 = 2y + 18$$

$$\text{or, } x - 2y = 18 - 3$$

$$\therefore x - 2y = 15 \dots\dots\dots (ii)$$

To solve equation (i) and (ii) we get

$$x + y = 60$$

$$x - 2y = 15$$

$$\begin{array}{r} - \\ + \\ \hline \end{array}$$

$$\therefore y = 15$$

Substituting the value of  $y$  in equation (i), we get

$$x + y = 60$$

$$\text{or, } x + 15 = 60$$

$$\text{or, } x = 60 - 15$$

$$\therefore x = 45$$

$\therefore$  The present age of father and son are 45 yrs and 15 yrs respectively.

**Model 17**

बाबु र छोराको हालको उमेरको योग 45 वर्ष क्ष । बाबुको हालको उमेर जति नै छोराको हुँदा दुबै जना बाँचिरहे भने त्यस वेला उनीहरूको उमेरको योग 45 वर्ष हुन्छ उनीहरूको हालको उमेर पत्ता लगाउनुहोस् ।

The sum of the age of father and son at present is 45 yrs of both alive on until the son's age become equal to the father age the sum of their age then will be 95 yrs find their present age.

**Solution:**

Let the present age of father and son be  $x$  and  $y$  respectively.

From the 1<sup>st</sup> condition

$$x + y = 45 \dots\dots\dots (i)$$

According to the question

Where difference age =  $(x - y)$

Age of son =  $x$  than age of father =  $x + (x - y)$

$$\text{Now, } x + (x - y) + x = 95$$

$$\text{or, } 3x - y = 95 \dots\dots\dots (ii)$$

To solve equation (i) and (ii), we get

$$x + y = 45$$

$$3x - y = 95$$

$$4x = 140$$

$$x = \frac{140}{4}$$

$$\therefore x = 35$$

Substituting the value of x in equation (i)

$$x + y = 45$$

$$\text{or, } 35 + y = 45$$

$$\text{or, } y = 45 - 35$$

$$\therefore y = 10$$

The present age of father and son are 35 yrs and 10 yrs respectively.

### Model 18

A जन्मदा B को उमेर 7 वर्ष थियो। B ले A लाई भन्यो अहिले मेरो उमेर म हालको तिग्रो उमेरको हुदाँको तिग्रो दुइगुना हुन्छ। उनीहस्को हालको उमेर पता लगाउनुहोस्।

B was 7 yrs old as when A was born B said to A "I am twice as old as you were when I was as old as you are." Find their present age.

**Solution:**

Let present age of B and A x and y respectively.

From the 1<sup>st</sup> condition

$$x - y = 7 \dots\dots (i) \times 2$$

According to the question

difference age of B and A =  $(x - y)$

$$\therefore x - (x - y) = 2 [y - (x - y)]$$

$$\text{or, } x - x + y = 2 [(y - x + y)]$$

$$\text{or, } y = 2(2y - x)$$

$$\text{or, } y = 4y - 2x$$

$$y = 4y - 2x$$

$$\therefore 2x - 3y = 0 \dots\dots (ii)$$

To solve equation (i) and (ii), we get

$$2x - 2y = 14$$

$$2x - 3y = 0$$

$$\begin{array}{r} - \\ + \\ \hline y = 14 \end{array}$$

Putting the value y in equation (i) we get

$$x - y = 7$$

$$\text{or, } x - 14 = 7$$

$$\therefore x = 21$$

The present age of B and A are 21 yrs 14 yrs respectively.

### Model 19

2064 र 2074 सालमा वावुको उमेर उसको छोराको उमेर उसका छोराको उमेर भन्दा कमश 3 गुणा र 2 गुणा थियो र छोराको जन्म साल पता लगाउनुहोस्।

In 2064 and 2074 the age of father was three times and two times of his son respectively find the both year of his son.

**Solution:**

In 2064, BS let the age of father and son be a and y respectively.

Form the 1<sup>st</sup> condition

$$x = 3y \dots\dots (i)$$

From the 2<sup>nd</sup> condition

$$\text{Diff of age} = 2074 - 2064 = 10 \text{ yrs}$$

$$\text{Now } (x + 10) = 2(y + 10)$$



$$\text{or, } \frac{x-2}{2} = \frac{2y}{3}$$

$$\text{or, } 3x - 6 = 4y$$

$$\therefore 3x - 4y = 6 \dots\dots\dots \text{(ii)}$$

Putting the value of equation (i) in equation (ii) we, get

$$\text{or, } 3x - 4y = 6$$

$$\text{or, } 3x - 4(4x - 34) = 6$$

$$\text{or, } 3x - 16x + 136 = 6$$

$$\text{or, } -13x = 6 - 136$$

$$\text{or, } -13x = -130$$

$$\therefore x = 10$$

Again, putting the value of x in equation (i)

$$4x - 34 = y$$

$$\text{or, } 4 \times 10 - 34 = y$$

$$\text{or, } 40 - 34 = y$$

$$\therefore y = 6$$

The required number are 10 and 6

### Model 22

दुईओटा संख्यामा पहिलो सङ्ख्यामा 36 जोडयो भने योगफल दोओ त्रैसी सङ्ख्याको पाँचगुणा हुन्छ । यदि दोओ सङ्ख्या 36 बाट घटाइयो भने अन्तर पहिलो सङ्ख्याको  $\frac{1}{4}$  हुन्छ । ती सङ्ख्याहरू पता लगाउनुहोस् ।

When the first number of two number is added to 36, the sum is first times the second number if the second number is subtracted from 36, the difference as  $\frac{1}{4}$  of first number find the three numbers.

#### Solution:

Let the first number and second number are x and y respectively.

From the 1<sup>st</sup> condition

$$x + 36 = 5y$$

$$\therefore x = 5y - 36 \dots\dots\dots \text{(i)}$$

From the 2<sup>nd</sup> condition

$$36 - y = \frac{1}{4} \text{ of } x$$

$$\text{or, } 36 - y = \frac{x}{4}$$

$$\text{or, } 144 - 4y = x$$

$$\therefore x = 144 - 4y \dots\dots\dots \text{(ii)}$$

From the equation (i) and (ii)

$$5y - 36 = 144 - 4y$$

$$\text{or, } 5y + 4y + 144 - 36$$

$$\text{or, } 9y = 180$$

$$\therefore y = 20$$

Putting the value of y in equation (i)

$$x = 5y - 36$$

$$\text{or, } x = 5 \times 20 - 36$$

$$\text{or, } x = 100 - 36$$

$$\therefore x = 64$$

The required two number are 64 and 20 respectively.



To solve equation (i) and (ii)

$$\begin{array}{r} 10x + 2y = -20 \\ -15x - 2y = -30 \\ \hline -5x = -50 \end{array}$$

Putting the value of x in equation (ii)

$$\begin{array}{l} 5x - y = -10 \\ 5 \times 10 - y = -10 \\ \text{or, } -y = -10 - 50 \\ \therefore y = 60 \\ \therefore \text{Number of boys} = 10 \text{ person} \\ \text{Received by each boy} = \text{Rs } 60 \end{array}$$

### Model 25

परीक्षामा रामले श्यामले भन्दा 12 नम्बर कम पायो । यदि उसले जति पाएको थियो त्यसको आधा अरु बढी पाएको भए श्यामलाई 11 नम्बर जिल्ले थियो । पत्येकले कति कति नम्बर पाएक्छन् ।

In an examination Ram obtained 12 marks less than Shyam. If he had obtained half many marks again as he did he would have been Shyam by 11 marks find the marks obtained by each.

**Solution:**

Let in an examination Ram and Shyam be x and y respectively.

From 1<sup>st</sup> condition

$$\begin{array}{l} x + 12 = y \\ \therefore y = x + 12 \dots\dots\dots (i) \end{array}$$

From the 2<sup>nd</sup> condition

$$\begin{array}{l} x + \frac{1}{2} \text{ of } x = y + 11 \\ \text{or, } x + \frac{x}{2} = y + 11 \\ \text{or, } \frac{3x}{2} = y + 11 \\ \therefore 3x = 2y + 22 \dots\dots\dots (ii) \end{array}$$

Putting the value of y in equation (ii)

$$\begin{array}{l} 3x = 2y + 22 \\ \text{or, } 3x = 2 \times (y + 12) + 22 \\ \text{or, } 3x = 2x + 24 + 22 \\ \text{or, } 3x - 2x = 46 \therefore x = 46 \end{array}$$

Again, putting the value of x in equation (ii)

$$\begin{array}{l} \text{or, } y = 46 + 12 \\ \therefore y = 58 \end{array}$$

Ram and Shyam obtained marks are 46 and 58 respectively.

### Model 26

संगिताले रीतालाई भनिन् । मलाई तिम्रो दुई ओटा गुच्चा दियो भने म सँग तिम्रोजति नै गुच्चा हुनेछ "रीताले संगितलाई भनिन् मलाई तिम्रो 3 ओटा गुच्चा दियो भने म सँग तिम्रो भन्दा 3 गुच्चा हुनेछ" प्रत्येकसँग कति कति गुच्चा रहेछ ? पता लगाउनुहोस् ।

Sangita says to Rita " Give we two of your marbles and shall have as many as you will left." Rita says to Sangita. " give we three of your marbles are I shall have three times as many as you will have. How many marbles has each.

**Solution:**

Let the number of marble with Sangita nad Rita are x and y respectively.

From the 1<sup>st</sup> condition

$$\begin{array}{l} x + 2 = y - 2 \\ \text{or, } x = y - 2 - 2 \end{array}$$

$$\therefore x = y - 4 \dots\dots\dots (i)$$

From the 2<sup>nd</sup> condition

$$3(x - 3) = y + 3$$

$$\text{or, } 3x - 9 = y + 3$$

$$\therefore 3x - y = 12 \dots\dots\dots (ii)$$

Putting the value of x in equation (ii)

$$3x - 9 = y + 3$$

$$\text{or, } 3(y - 4) - 9 = y + 3$$

$$\text{or, } 3y - 12 - 9 = y + 3$$

$$\text{or, } 3y - y = 3 + 21$$

$$\text{or, } 2y = 24$$

$$\therefore y = 12$$

Again putting the value of y in equation (i)

$$x = y - 4$$

$$\text{or, } x = 12 - 4$$

$$\therefore x = 8$$

The number of marbles are 8 and 12 respectively

### Model 27

दुई अङ्कले बनेको संख्या त्वसैको अंकहरूको योगको 3 गुणा छ । यदि सहख्यालाई 3 ले गुणन गर्दा गुणन फल अङ्कहरूको योगफल को वर्गसँग बराबर हुन्छ भने त्यो संख्या पत्ता लगाउनुहोस् ।

A number can listing two digits is equal to 3 times the sum of its digits. If it be multiplied by 3, The result becomes equal to the square of the sum of the digits find the number.

**Solution:**

Let the two digits number be x and y

Now two digits number =  $10x + y$

from the 1<sup>st</sup> condition

$$10x + y = 3(x + y)$$

$$\text{or, } 10x + y = 3x + 3y$$

$$\text{or, } 10x + y - 3x - 3y = 0$$

$$\text{or, } 7x - 2y = 0$$

$$\text{or, } 7x = 2y$$

$$\therefore y = \frac{7x}{2} \dots\dots\dots (i)$$

Again, From the 2<sup>nd</sup> condition

$$(10x + y) \times 3 = (x + y)^2 \dots\dots (ii)$$

Putting the value of y in equal (ii)

$$\text{or, } (10x + y) \times 3 = (x + y)^2$$

$$\text{or, } \left(10x + \frac{7x}{2}\right) \times 3 = \left(x + \frac{7x}{2}\right)^2$$

$$\text{or, } \left(\frac{20x + 7x}{2}\right) \times 3 = \left(\frac{9x}{2}\right)^2$$

$$\text{or, } \frac{27x}{2} \times 3 = \frac{81x^2}{4}$$

$$\text{or, } 81x = \frac{81x^2}{2}$$

$$\text{or, } 81x \times 2 = 81x^2$$

$$\text{or, } 2x = x^2$$

$$\therefore x = 2$$

Again putting the value of x in equation (i)

$$\text{or, } y = \frac{7x}{2}$$

$$\text{or, } y = \frac{7 \times 2}{2}$$

$$\therefore y = 7$$

The required two digits number =  $10x + y = 10 \times 2 + 7 = 27$

**Model 28**

सन 2002 मा रविना र सविनाको उमेरको योगफल 40 वर्ष थियो र तर सन 2017 मा तिमीहरूको उमेरको अनुपात 3:4 थियो भने 2017 मा नै तिनीहरूको उमेर कति कति थियो होला ?

In 2002, the sum of age of Rabina and Sabina was yrs. In 2017 the ratio of their age was 3:4 find the their age in 2017.

**Solution:**

In 2002, Let the age of Rabina and Sabina be  $x$  and  $y$  respectively.

From the first condition

$$x + y = 40 \dots\dots\dots (i) \times 3$$

Again in 2<sup>nd</sup> condition

$$\text{Difference year} = 2017 - 2002 = 15 \text{ yrs}$$

$$\frac{x + 15}{y + 15} = \frac{3}{4}$$

$$\text{or, } 4x + 60 = 3y + 45$$

$$\text{or, } 4x - 3y = 45 - 60$$

$$\therefore x - 3y = -15 \dots\dots\dots (ii)$$

To show equation (i) and (ii)

$$3x + 3y = 120$$

$$\underline{4x - 3y = -15}$$

$$7x = 105$$

$$\therefore x = 15 \text{ yrs}$$

Putting the value of  $x$  in equation (ii)

$$\text{or, } x + y = 40$$

$$\text{or, } 15 + y = 40$$

$$\text{or, } y = 40 - 15$$

$$\therefore y = 25 \text{ yrs}$$

$\therefore$  Age of Rabina and Sabina are 15 yrs and 25 yrs respectively.

### Practice Yourself

- दुई अंकहरू मिली बनेको एउटा संख्या छ । ति अंकहरूको योगफल 16 हुन्छ । यदि त्यस सङ्ख्याबाट 18 घटाउदा अंकहरूको स्थान बदलिन्छ भने सो सङ्ख्या पत्ता लगाउनुहोस् ।  
A number consists of two digits. The sum of its digits is 16. If 18 is subtracted from the number. The digits interchange their placed. Find the number.
- 2 अंकको सङ्ख्या त्यसका अंहरूको योगको 6 गुणा छ । त्यो संख्या 9 घटायो भने त्यसका अंकहरू उलिटन्क्षत् । त्यो संख्या कति होला?  
A number of two digits is six times the sum of its digits. If 9 is subtracted from the number the digits are reversed, what is the number.  
(Ans. 54)
- 10 र 100 को बिचमा पर्ने संख्यामा अंकहरूको योगफल 9 छ । यदि सो संख्यालाई 7 ले गुणन गरियो भने अंकहरूको स्थान अदल बदल गर्दा बन्ने संख्याको 4 गुणा हुन्छ । उत्त संख्या पत्ता लगाउनुहोस् ।  
The sum of the digits of a number lying between 10 and 100 is 9. If the number is multiplied by 7, it becomes 4 times the number obtained by writing the digits in reverse order. Find the number.  
(Ans. 36)
- पाँच वर्षअघि बाबुको उमेर छोराको उमेरको 4 गुणा थियो । अहिले बाबु र छोराको उमेर जोडा 45 वर्ष हुन्छ भने उनीहरूको हालको उमेर पत्ता लगाउनुहोस् ।  
Five years ago, father's age was 4 times his son's age. Now the sum of their ages is 45 years find their present age.  
(Ans. 35, 10)
- 5 वर्षअघि एउटा मानिसको उमेर छोरीको उमेरको 5 गुणा थियो, 3 वर्ष पछि उसको उमेरको 2 गुणा छोरीको उमेरको 6 गुणासँग बराबर हुन्छ । उनीहरूको हालको उमेर कति कति होला ?

5 years ago a man's age was 5 times the age of his daughter's. 3 years hence twice his age will be equal to 6 times his daughter's age. Find their present ages.  
(Ans 45 years, 13 years)

6. अहिले बाबुको उमेर छोराको उमेरको 3 गुणा छ । 10 वर्ष पछिको छोराको उमेर र 20 वर्ष अधिको बाबुको उमेर बराबर भए उनीहरूको हालको उमेर पत्ता लगाउनुहोस् ।

The present age of father is 3 times the age of his son. If the age of son after 10 years is equal to the age of the father before 20 years. Find present ages of father and son.  
(Ans. 45 yrs, 15 yrs)

7. तिन वर्ष पहिले A र B को उमेरको अनुपात  $4:3$  थियो । 3 वर्षपछि उनीहरूको अनुपात  $11:9$  भए A र B को हालको उमेर पत्ता लगाउनुहोस् ।

Three years ago, the ratio of ages of A and B was  $4:3$ . Three years hence, the ratio of their ages will  $11:9$  find their present ages.

(Ans. 8 yrs 64 yrs)

8. एउटा भिन्नको अंशमा 3 जोड्दा भिन्ननको मान । हुन्छ । उक्त भिन्नको हरमा 3 जोड्दा भिन्नको मान  $\frac{1}{4}$  हुन्छ । सो भिन्नको मान कति हुन्छ । पत्ता लगाउनुहोस् ।

If 3 is added to the numerator of a fraction the value of the fraction becomes 1. When 3 is added to the denominator of the fraction, the value of the fraction becomes  $\frac{1}{4}$ . What is the value of fraction. Find it.

(Ans:  $\frac{2}{5}$ )

9. 5 वटा पुस्तक र 4 वटा कपिको संयुक्त मूल्य रु 1900 छ । यदि 3 कपि र 1 पुस्तकको मूल्य बराबर भए 3 वटा कपि र 2 वटा पुस्तकको संयुक्त मूल्य निकाल्नुहोस् ।

The cost of 5 books and 4 copies is Rs 1900. If the cost of 3 copies is same as the cost of 1 book. Find the combined cost of 3 copies and 2 books.

(Ans. 900)

10. एउटा आयतको परिमिति 82 m, र यसको क्षेत्रफल  $400 \text{ m}^2$  भए आयतको लम्बाई र चौडाइ पत्ता लगाउनुहोस् । The perimeter of a rectangle is 82 m and its area is  $400 \text{ m}^2$ . Find the length and breadth of the rectangle.

(Ans: 32m, 16m)

11. दुई अंकले बनेको संख्या यसका अङ्गहरू उल्याउदा बन्ने संख्या भन्दा 36 ले कम हुन्छ । एक स्थानमा भएको अडक दश स्थानमा भएको अडकको दोब्बर भन्दा 1 ले बढि छ भने त्यो संख्या पत्ता लगाउनुहोस् ।

A number of two digits is 36 less the number will the digits reversed if the units digit exceeds twice the tens digit by 1, find the number.

(Ans: 37)

12. दुई अंकको एउटा संख्या र त्यसको विपरित संख्याको अनुपात  $3:8$  यदि अडकहरूको अन्तर 5 भए उक्त संख्या पत्ता लगाउनुहोस् ।

The ratio of a two digits number and its reverse number is  $3:8$ . If the difference of its two digits is 5, find the number.

(Ans. 27)

13. 10 र 100 को बिचमा पर्ने एउटा संख्यामा त्यसका अंकहरूको स्थान परिवर्तन गरि 17 जोड्दा त्यो संख्याको दोब्बर हुन्छ । यदि त्यो संख्यामा 5 जोडियो भने त्यसका अडकहरूको योगको 5 गुणा हुन्छ । उक्त संख्या पत्ता लगाउनुहोस् ।

In a number lying between 10 and 100 when the places of its are inter changed and 17 is added it becomes two times of the number. If 5 is added to this number it becomes five times of the sum of its digits find the number.

(Ans. 35)

14. बाबु र छोराको उमेरको योगफल 36 वर्ष छ । जब अहिलेको बाबुको उमेर बराबर छोराको उमेर हुन्छ तर बाबु र छोराको उमेरको योगफल 84 वर्ष हुन्छ । उनीहरूको हालको उमेर कति होला । पत्ता लगाउनुहोस् ।

The sum of ages of a father and his son is 36 yrs. When the sum becomes as old as his father now. The sum of their age will be 84 yrs. Find the present age of father.  
(Ans. 30,6)

15. एउटा निश्चित रकम कैहि निश्चित मानिसहरूलाई बिचमा बांडनु पर्ने छ । यदि 3 जना मानिस कम भयो भने पत्येक मानिसले 150 बढि पाउँछ । तर यदि 6 जना मानिस बढि भयो भने प्रत्येक मानिसले रु 120 कम पाउँछ मानीसलको संख्या र प्रत्येक मानिसको रकम पत्ता लगाउनुहोस् ।

A certain sum of money is to be divided among certain number of men. If there were 3 men less, each man would have Rs 150 more. But if the 6 men more each man would have Rs 120 less. Find the number of men and total sum of money.

(Ans: Rs 2700, 9)

16. रामले श्यामलाई भन्यो "यदि तिमीले तिमी संग भएको रूपैयाका आधा मलाई दियो भने म संग रु 100 हुनेछ । श्यामले "उत्तर दियो" म संग रु 100 हुनेछ यदि तिमिले मलाई तिमी संग भएको रूपैयाको एक तिहाई दियो भने प्रत्येक संग कर्ति रूपैया रहेछ ।

Ram said to Shyam "I will give you one half of yours money I shall have Rs 100 with me. Shyam replied I shall have Rs 100 with me If you gave money only one third of your money find the money of each. (Ans: 60, Rs 80)

17. बाबुको उमेर दुई अंकले बनेको संख्या र छोराको उमेर अंकहरू उल्टएर बन्दछ । यदि बाबु छोरा भन्दा 27 वर्ष जेठो छ र प्रयोग भएका अंकहरूको योग 7 छ भने तिनीहरूको हालको उमेर कर्ति होला ? पत्ता लगाउनुहोस् ।

A father's age formed by reversing the two digits of son age. If the father is 27 yrs older than his son and sum of the digits used is 7. Find the present age. (Ans: 52, 25)

18. A र B को मासिक आमदानीको अनुपात 3:2 छ । तिनीहरूको खर्चको अनुपात 5:3 छ । यदि प्रत्येक को प्रति महिना रु 10,000 बचाउछ भने तिनीहरूको प्रति महिनाको आमदानी कर्ति रहेछ ? पत्ता लगाउनुहोस् ।

The monthly income of A and B are in the ratio of 3:2. There expenses are in the ratio of 5:3. If each of them saves rs 10,000 in a month find their monthly income. (Ans: Rs 60,000, Rs 40,000)

19. 3 वर्ष पछिदिको उमेर भाइको उमेरको 4 गुणा हुनेछ । 3 वर्ष अघि दिकीको उमेर भाईको अब 4 वर्ष पछि हुने उमेरको दुई गुणा थियो । उनीहरूको हालको उमेर कर्ति होला ?

3 years later a sister will be 4 times as old as her brother 3 years ago, the sister's age was two times her brother's age will be 4 year hence what are their present ages?

(13 yrs, 1 yrs)

20. दुईओटा अंकले बनेको संख्या धनात्मक संख्यामा भएका अंकहरू मध्ये एक स्थानको अंकलाई दश स्थानको अंकले भाग गर्दा भागफल 3 हुन्छ । त्यो संख्या 36 जोड्ने हो भने त्यो खियाको स्थिति संख्या हन्छ । भने त्यो संख्या 36 जोड्ने हो भन त्यो संख्याको स्थिति संख्या हन्छ । भने त्यो संख्या पत्ता लगाउनुहोस् ।

A positive number consists of two digits where digit in the unit place is divided by the digit in the tenth place then the quotient is 3 of 36 is added to the number then digits of the number are reversed . Find the number .

21. दुई अङ्कले बनेको एउटा संख्यामा अङ्कहरूको योगफल 7 छ । यदि सो संख्याबाट पद घटाइयो भने शुरूको संख्या पत्ता लगाउनुहोस् । The sum of the digits in two digits number is 7. If 45 is subtracted from the number the place of the digit are interchanged . Find the intral number. (Ans: 61)

21. यदि 3 अघि बाबु र छोराको उमेरको 48 वर्ष थियो । अब 3 वर्ष पछि , बाबु र छोराको उमेरको अनुपात 3:1 हुन्छ भने छोरा भन्दा बाबु कर्ति वर्षले जेठो रहेछ पत्ता लगाउनुहोस् । 3 yrs ago the sum of age of father and son was 48 yrs.. After three yrs, the ratio of the ages of the father and son will be 3: 1, Then how much older is the father from his son? Find it (Ans : 3 yrs)

## 12.2 वर्ग समिकरणहरू शालिक समस्याहरू

### Verbal Problems on Quadratic Equation

#### Short Questions:

##### Model 1

यदि एउटा प्राकृतिक संख्याको वर्गबाट 17 घटाउदा परिणाम 152 हुन्छ भने सो संख्या पत्ता लगाउनुहोस् ।

If 17 is subtracted from the square of natural number the result is 152. Find the number.

##### Solution:

Let the natural number be  $x$

Its square number =  $x^2$

According to the question

$$\begin{aligned}
 x^2 - 17 &= 152 \\
 \text{or, } x^2 &= 152 + 17 \\
 \text{or, } x^2 &= 169 \\
 \text{or, } x^2 &= 13^2 \\
 \therefore x &= 13 \\
 \therefore \text{The required natural number is } 13
 \end{aligned}$$

### Model 2

यदि एउटा संख्याको वर्गमा 6 जोड्दा 31 हुन्छ भने त्यो संख्या पत्ता लगाउनुहोस् ।  
If 6 is added to the square of a number the result is 31, find the number.

**Solution:**

$$\begin{aligned}
 \text{Let the required number be } x \\
 \text{Its square} &= x^2 \\
 \text{According to the question} \\
 \text{or, } x^2 + 6 &= 31 \\
 \text{or, } x^2 &= 31 - 6 \\
 \text{or, } x^2 &= 25 \\
 \text{or, } x^2 &= 5^2 \\
 \therefore x &= \pm 15 \\
 \text{The required number is } &\pm 15.
 \end{aligned}$$

### Model 3

यदि एउटा घनात्मक संख्याको वर्गको 7 गुणा 10 जोड्दर योगफल 352 हुन्छ भने उक्त संख्या निकाल्नुहोस् ।  
If 10 is added to the number that is 7 times of the square of a positive number the result is 353. Find the number.

**Solution:**

$$\begin{aligned}
 \text{Let the positive number be } x \\
 \text{Its square} &= x^2 \\
 \text{According to the question} \\
 x^2 + 7 + 10 &= 353 \\
 \text{or, } 7x^2 &= 353 - 10 \\
 \text{or, } 7x^2 &= 343 \\
 \text{or, } x^2 &= 7^2 \\
 \therefore x &= 7 \\
 \text{The required positive number is } &7.
 \end{aligned}$$

### Model 4

यदि एउटा प्राकृतिक संख्याको वर्गको एक तिहाईमा 3 जोड्दा योगफल 30 हुन्छ भने सो संख्या पत्ता लगाउनुहोस् ।  
If 3 is added to one third of the square of positive number, the sum is 30. Find the number.

**Solution:**

$$\begin{aligned}
 \text{Let the natural number be } x \\
 \text{Its square number} &= x^2 \\
 \text{According to the question} \\
 \text{or, } \frac{1}{3} \text{ of } x^2 + 3 &= 30 \\
 \text{or, } \frac{x^2}{3} &= 30 - 3 \\
 \text{or, } x^2 &= 27 \times 3 \\
 \text{or, } x^2 &= 81 \\
 \text{or, } x^2 &= 9^2 \\
 \therefore x &= 9 \\
 \text{The required natural number is } &9.
 \end{aligned}$$

**20 लाई दुई भागमा विभाजन गर्नुहोस् । ताकी तिनीहरको गुणनफल 16 होस् ।**

Divide 20 into two parts so that their product will be 16.

**Solution:**

Let the required two numbers are  $x$  and  $(20 - x)$

According to the question

$$x \times (20 - x) = 96$$

$$\text{or, } 20x - x^2 - 16 = 0$$

$$\text{or, } -x^2 + 20x - 16 = 0$$

$$\text{or, } -(x^2 - 20x + 16) = 0$$

$$\text{or, } x^2 - 20x + 16 = 0$$

$$\text{or, } x^2 - 24x + 4x + 16 = 0$$

$$\text{or, } x(x - 24) - 4(x - 24) = 0$$

$$\therefore (x - 24)(x - 4) = 0$$

$$\text{either } x - 24 = 0$$

$$\therefore x = 24$$

$$\text{or, } x - 4 = 0$$

$$\therefore x = 4$$

The required two numbers are 24, 6 or 6, 24.

### **Model 6**

एउटा घनात्मक संख्या र सो संख्याको व्युतकमान पातिकको 48 गुणाको योग 19 छ । सो संख्या पत्ता लगाउनुहोस् ।

The sum of a positive number and 48 times of its reciprocal is 19. Find the number.

**Solution:**

Let the positive number be  $x$

$$\text{Its reciprocal number} = \frac{1}{x}$$

According to the question

$$x + \frac{1}{x} \times 48 = 19$$

$$\text{or, } \frac{x^2 + 48}{x} = 19$$

$$\text{or, } x^2 + 48 = 19x$$

$$\text{or, } x^2 - 19x + 48 = 0$$

$$\text{or, } x^2 - (16 + 3)x + 48 = 0$$

$$\text{or, } x^2 - 16x - 3x + 48 = 0$$

$$\text{or, } x(x - 16) - 3(x - 16) = 0$$

$$\therefore (x - 16)(x - 3) = 0$$

$$\text{either } x - 16 = 0$$

$$\therefore x = 16$$

$$\text{or, } x - 3 = 0$$

$$\therefore x = 3$$

The required positive numbers are 16 and 3.

### **Model 7**

तीनबाटा लगातार आउने जोर संख्याको योगफल 28 भन्दा 2 ले बढि हुन्छ, भने उक्त संख्याहरू पत्ता लगाउनुहोस् ।

The sum of the three consecutive even numbers is 2 more than 28. Find the numbers.

**Solution:**

Let the consecutive even numbers are  $x$ ,  $x + 2$  and  $x + 4$

According to the question

$$x + x + 2 + x + 4 = 28 + 2$$

$$\text{or, } 3x + 6 = 30$$

$$\text{or, } 3x = 30 - 6$$

$$\text{or, } 3x = 24$$

$$\therefore x = 8$$

The required numbers are 8, 10 and 12.

### Model 8

एउटा कोठाको लम्बाई यसको चौडाइको दोब्बर छ । यदि कोठाको क्षेत्रफल  $128 \text{ m}^2$  छ भने कोठाको चौडाई पता लगाउनुहोस् ।

The length of a room is twice of its breath. If the area of the room is  $128\text{m}^2$  find its breath.

**Solution:**

Let the breath of room be  $x$

Then its length of room =  $2x$

According to the question

$$2x \times x = 128$$

$$\text{or, } 2x^2 = 128$$

$$\text{or, } x^2 = 64$$

$$\text{or, } x^2 = 8^2$$

$$\therefore x = 8$$

Breadth of room is 8m.

### Model 9 दुई ओटा संख्याहरूको योग 10 र गुणन फल 21 छ । ती संख्याहरू पता लगाउनुहोस् ।

The sum of two number is 10 and their product is 21. Find the numbers.

**Solution:** Let the one number be  $x$ , the other number is  $(10 - x)$

According to the questions

$$x(10 - x) = 21$$

$$\text{or, } 10x - x^2 - 21 = 0$$

$$\text{or, } -x^2 + 10x - 21 = 0$$

$$\text{or, } -(x^2 - 10x + 21) = 0$$

$$\text{or, } x^2 - 10x + 21 = 0$$

$$\text{or, } x^2 - (7 + 3) + 21 = 0$$

$$\text{or, } x^2 - 7x - 3x + 21 = 0$$

$$\text{or, } x(x - 7) - 3(x - 7) = 0$$

$$\therefore (x - 7)(x - 3) = 0$$

$$\text{either } x - 7 = 0 \quad \therefore x = 7$$

$$\text{or, } x - 3 = 0 \quad \therefore x = 3$$

The required number are 7 and 3

### Model 10 हरि भन्दा राम 3 वर्ष कान्छो र राम भन्दा श्याम 5 वर्ष जेठो छ । यदि हरि र श्यामको उमेरको गुणनफल 48 वर्ष छ भने राम बति वर्षको छ ।

Hari is 3 yrs younger than Ram and Shyam is 5 yrs older than Ram. If the product of the present age of Hari and shyam is 48 yrs how old is Ram.

**Solution:**

Let age of Hari be  $x$

Then age of Ram =  $x - 3$  and the age of Shyam  $(x - 3) + 5 = x + 2$

According to the questions

$$x \times (x + 2) = 48$$

$$\text{or, } x^2 + 2x - 48 = 0$$

$$\text{or, } x^2 + 8x - 6x - 48 = 0$$

$$\text{or, } x(x + 8) - 6(x + 8) = 0$$

$$\therefore (x + 8)(x - 6) = 0$$

$$\text{Either } x + 8 = 0 \quad \therefore x = -8$$

$$\text{or, } x - 6 = 0 \quad x = 6$$

$\therefore$  Age of Ram is 6 yrs

**Model 11**

आमा र छोराको हालको उमेर कमश 37 वर्ष र 8 वर्षका छ । कति वर्ष अघि उनीहरुको उमेरको गुणनफलज्ञाट थियो ।

The present age of the mother abd his son are 37 and 8 yrs respectively. How many yrs ago was the product of their age 96 yrs.

**Solution:**

Let the required time be  $x$  yrs ago

According to the question

$$\text{or, } (37 - x)(8 - x) = 96$$

$$\text{or, } x^2 - 45x + 200 = 0$$

$$\text{or, } x^2 - 40x - 5x - 200 = 0$$

$$\text{or, } x(x - 40) - 5(x - 40) = 0$$

$$\therefore (x - 40)(x - 5) = 0$$

$$\text{Either } x - 40 = 0$$

$$\therefore x = 40 \text{ (impossible)}$$

$$\text{or, } x - 5 = 0$$

$$\therefore x = 5$$

The required time is 5 yrs ago.

**Model 12**

एकजना मानिसको उमेर भन्दा 10 वर्ष अघि र 10 वर्ष पछिको उमेरको गुणनफल 300 हुन्छ भने उसको हालको उमेर निकालनुहोस् ।

The product of the ages of a man 10 yrs before and 10 yrs hence is 300. Find the present age of the man.

**Solution:**

Let the present age of man be  $x$

$$10 \text{ yrs ago a man's age} = x - 10$$

$$10 \text{ yrs hence a man's age} = x + 10$$

According to the questions

$$(x - 10) \times (x + 10) = 300$$

$$\text{or, } x^2 - 100 = 300$$

$$\text{or, } x^2 = 400$$

$$\text{or, } x^2 = 20^2$$

$$\therefore x = 20$$

The age of man is 20 yrs.

**Model 14**

यदि दुई ओटा लगातार आउने जोर संख्याहरुको वर्गहरुको फरक 20 भए ती संख्याहरु पत्ता लगाउनुहोस् ।

If the difference of square of two consecutive even number is 20 find the numbers.

**Solution:**

Let the consecutive even number be  $x, x + 2$

Its square are  $(x)^2$  and  $(x + 2)^2$

According to the question

$$\text{or, } (x + 2)^2 - x^2 = 20$$

$$\text{or, } x^2 + 4x + 4 - x^2 = 20$$

$$\text{or, } 4x + 4 = 20$$

$$\text{or, } 4x = 20 - 4$$

$$\text{or, } 4x = 16$$

$$\therefore x = 4$$

The required even consecutive number are 4 and 6.

**प्र० १०।** यदि ती संख्याका वर्गका योगफल 29 छ भने संख्याहरु पत्ता लगाउनुहोस् ।

The sum of the square of three consecutive integers is 29. Find the numbers.

**Solution:**

Let the three consecutive numbers be  $x, x + 1$  and  $x + 2$

According to the question

$$x^2 + (x + 1)^2 + (x + 2)^2 = 29$$

$$\text{or, } x^2 + x^2 + 2x + 1 + x^2 + 4x + 4 = 29$$

$$\text{or, } 3x^2 + 6x + 5 - 29 = 0$$

$$\text{or, } 3x^2 + 6x - 24 = 0$$

$$\text{or, } 3(x^2 + 2x - 8) = 0$$

$$\text{or, } x^2 + 2x - 8 = 0$$

$$\text{or, } x^2 + 4x - 2x - 8 = 0$$

$$\text{or, } x(x - 4) - 2(x + 4) = 0$$

$$\therefore (x - 2)(x + 4) = 0$$

Either  $x - 2 = 0$

$$\therefore x = 2$$

$$\text{or, } x + 4 = 0$$

$$\therefore x = -4$$

Three consecutive positive numbers are required 2, 3, and 4

### Practice Yourself

1. यदि दुई अनुवर्ती विजेता संख्याहरुको गुणनफल 195 भए ती संख्याहरु के के हुन ।  
What are the consecutive odd numbers whose product is 195. (Ans: 13, 15)
2. दुई वटा अनुवर्ती पूर्णाङ्क संख्याहरु पत्ता लगाउनुहोस् । जहाँ ठूलो संख्याको वर्ग ती संख्याहरुको गुणनफलसँग बराबर छ ।  
Find the two consecutive integers such that the square of the bigger number is equal to the product of the numbers. (Ans: -1, 0)
3. यदि एउटा संख्याको वर्गमा 11 जोड्दा योगफल 75 हुन्छ भने त्यो संख्या पत्ता लगाउनुहोस् ।  
If 11 added to the square of a number then the sum is 75, find the number. (Ans: ± 8)
4. यदि एउटा घनात्मक संख्याको वर्गको दोब्बर बाट 17 घटाउदा परिणाम 111 हुन्छ भने त्यो संख्या पत्ता लगाउनुहोस् ।  
If 17 is subtracted from the choice of the square of a positive number, the result is 111. Find the number. (Ans: 8)
5. यदि घनात्मक संख्याको वर्गको आधा बाट 15 बाट 15 घटाउदा परिणाम 35 हुन्छ भने त्यो संख्या पत्ता लगाउनुहोस् ।  
If 15 is subtracted from the twice of the square of a positive number, the result is 35. Find the number. (Ans: 10)
6. 11 लाई दुई भागमा विभाजन गर्नुहोस् । ताकी तिनीहरुको गुणनफल 24 होस् ।  
Divide 11 into two parts so that their product will be 24. (Ans: 8, 3)
7. एउटा घनात्मक संख्या र उक्त संख्याको वर्गको योगफल 56 भए सो संख्या पत्ता लगाउनुहोस् ।  
If the sum of a positive number and its square is equal to 56, find the number. (Ans: 7)
8. यदि एउटा संख्या र त्यसै संख्याको व्युतक्रमको 25 गुणा योगफल 10 भए उक्त संख्या पत्ता लगाउनुहोस् ।  
If the sum of a number and 25 times of its reciprocal is 10. Find the number. (Ans: 5)
9. 2:3 को अनुपातमा भएका दुई ओटा घनात्मक संख्याहरुको गुणनफल 96 छ भने ती संख्याहरु पत्ता लगाउनुहोस् ।  
The product of two positive numbers which are in the ratio 2:3 is 96, find the numbers. (Ans: 8, 12)
10. राम र श्याम भन्दा 4 वर्ष जोठो छ । उनीहरुको उमेरको गुणनफल 12 वर्ष भए रामको उमेर पत्ता लगाउनुहोस् ।  
Ram is 4 years older than Shyam. If the product of their ages is 12, find the age of Ram. (Ans: 6 yrs)
11. दुई वटा संख्याहरुको वर्गको योगफल 233 छ । एउटा संख्या अर्को संख्याको दुई गुणनफल 3 ले कम छ । उक्त संख्याहरु पत्ता लगाउनुहोस् ।

- The sum of the square of two number is 233 are of the number is 3 less than twice the other number find the number. (Ans: 8, 13)
12. तीन बटा अनुवर्ती पूणाडकहरु वर्गहरुको योगफल 110 भए ती संख्याहरु पत्ता लगाउनुहोस् ।  
The sum of square pf three consecutive integers is 110, find the these numbers. (Ans: 15, 16, 17)
14. दुई ओटा घनात्मक संख्याहरुको गुणनफल 162 छ। यदि एउटा संख्या अर्को संख्याको दोब्बर छ भने संख्याहरु पत्ता लगाउनुहोस्। The product of two positive numbers is 162. If one number is double of other numbers find the numbers . (Ans: 9 and 18)
15. एउटा मानिसको 20 वर्ष पछि र 20 वर्ष अघिको उमेरको गणनफल 500 हुन्छ भने उसको हालको उमेर पत्ता लगाउनुहोस्। The product of the age a man 20 yrs hence and 20 years before is 500, find the present age of the man. (Ans: 30 yrs.)

### Long Questions

#### **Model 1**

दुईजना दाजु भाईको अहिलेको उमेर कमश 22 वर्ष र 15 वर्ष छ। कति वर्ष पछि तिनीहरुको उमेरको गुणनफल 408 वर्ष हुन्छ ? पत्ता लगाउनुहोस् ।

The present age of two brother are respectively 22 yrs and 15 yrs. After how many yrs the product of their age will be 408 yrs?

**Solution:**

$$\begin{aligned}
 &\text{The present age of elder brother} = 22 \text{ yrs} \\
 &\text{and the present age of youngest brother} = 15 \text{ yrs} \\
 &\text{Let the required time be after } x \text{ yrs} \\
 &\text{According to the questions} \\
 &\text{After } x \text{ yrs age of elder brother} = 22 + x \\
 &\text{and age of younger brother} = 15 + x \\
 &\therefore (22 + x)(15 + x) = 408 \\
 &\text{or, } 330 + 22x + 15x + x^2 = 408 \\
 &\text{or, } x^2 + 37x + 330 - 408 = 0 \\
 &\text{or, } x^2 + 37x - 78 = 0 \\
 &\text{or, } x^2 + (39 - 2)x - 78 = 0 \\
 &\text{or, } x^2 + 39x - 2x - 78 = 0 \\
 &\text{or, } x(x + 39) - 2(x + 39) = 0 \\
 &\therefore (x + 39)(x - 2) = 0 \\
 &\text{either } x + 39 = 0 \\
 &\therefore x = -39 \text{ (impossible)} \\
 &\text{or, } x - 2 = 0 \\
 &\therefore x = 2
 \end{aligned}$$

The required time is after 2 yrs

#### **Model 2**

दाजु र भाईको उमेरको अन्तर 4 वर्ष र गुणनफल 221 हुन्छ भने ती दुई भाईको उमेर पत्ता लगाउनुहोस् ।

The difference of the of two brothers is 4 yrs and product their ages is 221 determine the age of the two brothers.

**Solution:**

$$\begin{aligned}
 &\text{Let the age of elder brother be } x, \text{ age of younger brother} = x - 4 \\
 &\text{According to the questions} \\
 &\text{Now } x(x - 4) = 221 \\
 &\text{or, } x^2 - 4x - 221 = 0 \\
 &\text{or, } x^2 - (17 - 13)x - 221 = 0 \\
 &\text{or, } x^2 - 17x + 13x - 221 = 0 \\
 &\text{or, } x(x - 17) + 13(x - 17) = 0
 \end{aligned}$$

$$\therefore (x - 17)(x + 13) = 0$$

$$\text{Either } x - 17 = 0$$

$$\therefore x = 17$$

$$\text{Again or } x + 13 = 0$$

$$\therefore x = -13 \text{ (Impossible)}$$

The age of two brothers are 17 years and 13 years

### Model 3

दाजु र बहिनीको उमेरको अन्तर 5 वर्ष छ । तिनीहरूको उमेरको गुणनको संख्यात्मक मान उमेरको योगफलको 6 गुणा हुन्छ भने दिदि र भाईको हालको उमेर पता लगाउनुहोस् ।

The difference of the present age of brother and his younger sister 5 yrs the product of age of numerical value of is equal to 6 times the same of there age. Find the present age of the brother and his sister.

**Solution:**

Let age of brother be  $x$

According to the question

Then age of younger sister  $= x - 5$

Again

According to questions

$$x \times (x - 5) = 6(x + x - 5)$$

$$\text{or, } x^2 - 5x = 6(2x - 5)$$

$$\text{or, } x^2 - 5x = 12x - 30$$

$$\text{or, } x^2 - 5x - 12x + 30 = 0$$

$$\text{or, } x^2 - 17x + 30 = 0$$

$$\text{or, } x^2 - (15 + 2)x + 30 = 0$$

$$\text{or, } x^2 - 15x - 2x + 30 = 0$$

$$\text{or, } x(x - 15) - 2(x - 15) = 0$$

$$\therefore (x - 15)(x - 2) = 0$$

$$\text{either } x - 15 = 0$$

$$\therefore x = 15$$

$$\text{again } x - 2 = 0$$

$$\therefore x = 2 \text{ (impossible)}$$

$$\text{Age of brother (x)} = 15 \text{ yrs age of younger sister} = (15 - 5) \text{ yrs} = 10 \text{ yrs.}$$

### Model 4

दुई दिदि बहिनीको हालको उमेरको गुणनफल 150 छ । 5 वर्ष अघि दिदिको उमेर बहिनीको उमेरको दोब्बर भए तिमीहरूको हालको उमेर पता लगाउनुहोस् ।

The product of the present age of the two sister is 150, 5 yrs ago elder sister was twice as old as her younger sister find the their present ages.

**Solution:**

Let the age of elder sister be  $x$

then, according to the questions

$$\text{age of younger sister} = \frac{150}{x} \text{ (how ?)}$$

$$\text{Now, 5 yrs ago age of elder sister} = x - 5$$

$$\text{and 5 yrs ago age of younger sister} = \left(\frac{150}{x} - 5\right)$$

From the condition

$$(x - 5) = \left(\frac{150}{x} - 5\right) \times 2$$

$$\begin{aligned}
 \text{or, } x - 5 &= \frac{300}{x} - 10 \\
 \text{or, } x - 5 &= \frac{300 - 10x}{x} \\
 \text{or, } x^2 - 5x &= 300 - 10x \\
 \text{or, } x^2 - 5x + 10x &- 300 = 0 \\
 \text{or, } x^2 + 5x - 300 &= 0 \\
 \text{or, } x^2 + (20 - 15)x - 300 &= 0 \\
 \text{or, } x^2 + 20x - 15x - 300 &= 0 \\
 \text{or, } x(x + 20) - 15(x + 20) &= 0 \\
 \therefore (x + 20)(x - 15) &= 0
 \end{aligned}$$

Either  $x + 20 = 0$

$$x = -20 \text{ (impossible)}$$

$$\text{or, } x - 15 = 0$$

$$\therefore x = 15$$

Age of brother ( $x$ ) = 25 yrs and age of younger sister

$$= \frac{150}{x} = \frac{150}{15} = 10 \text{ yrs}$$

### Model 5

एउटा समकोण त्रिभुजको समकोण बनाउने भुजाहरू त्यसको कर्ण भुजा भन्दा 2cm र 4cm ले कमश कम हुने गरि भने त्रिभुजका भुजाहरूको नाप पत्ता लगाउनुहोस् ।

The sides of a right angled triangle containing the right angle are less than hypotenuse by 2cm and 4cm respectively find the lengths of the sides of triangle.

**Solution:**

In the right angled triangle

let the side of hypotenuse be  $x$

then according to the question

other sides are  $x - 2$  cm and  $x - 4$  cm respectively

Pythagoras, theorem

$$h^2 = p^2 + b^2$$

$$\text{or, } x^2 - (x - 2)^2 + (x - 4)^2$$

$$\text{or, } x^2 = x^2 - 4x + 4 = x^2 - 8x + 16$$

$$\text{or, } 0 = x^2 - 12x + 20$$

$$\text{or, } x^2 - (10 - 2)x + 20 = 0$$

$$\text{or, } x^2 - 10x - 2x + 20 = 0$$

$$\text{or, } x(x - 10) - 2(x - 10) = 0$$

$$\text{or, } (x - 2)(x - 10) = 0$$

$$\text{either } x - 2 = 0$$

$$\therefore x = 2 \text{ (impossible)}$$

$$\text{or, } x - 10 = 0$$

$$\therefore x = 10$$

The length of sides are 10cm, 8cm and 6cm respectively.

### Model 6

एउटा आयतकार कोठाको क्षेत्रफल  $45\text{m}^2$  छ । यदि कोठाको लम्बाई  $3\text{m}$  चौडाई  $1\text{m}$  बढि भएको भए कोठा वर्गाकार हुने थियो भने सो कोठा को लम्बाई र चौडाई पत्ता लगाउनुहोस् ।

The area of rectangular room is  $45\text{m}^2$ . If the length has been  $3\text{m}$  less and the breath  $1\text{ m}$  more then would have been a square. Find the length and breadth.

**Solution:**

Let the length of room be  $x$

According to the question then breadth of room =  $\frac{45}{x}$

Again length of room =  $(x - 3)$  and breadth of room =  $\left(\frac{45}{x} + 1\right)$

According to the questions

$$\therefore x - 3 = \frac{45}{x} + 1$$

$$\text{or, } x - 3 = \frac{45 + x}{x}$$

$$\text{or, } x^2 - 3x = 45 + x$$

$$\text{or, } x^2 - 3x - x - 45 = 0$$

$$\text{or, } x^2 - 4x - 45 = 0$$

$$\text{or, } x^2 - (9 - 5)x - 45 = 0$$

$$\text{or, } x^2 - 9x + 5x - 45 = 0$$

$$\text{or, } x(x - 9) + 5(x - 9) = 0$$

$$\therefore (x - 9)(x + 5) = 0$$

$$\text{Either } x - 9 = 0$$

$$\therefore x = 9 \quad x = 5 = 0$$

$$x = -5 \text{ (impossible)}$$

Hence, the length and breadth of rooms are 9cm and 5m.

### Model 7

एउटा आयतकार चोकको क्षेत्रफल  $63 \text{ m}^2$  र परिमिती  $32 \text{ m}$  छ भने लम्बाई र चौडाई पता लगाउनुहोस् ।

The area of a rectangle court yard is  $63 \text{ m}^2$  and perimeter is  $32 \text{ m}$ , find the length and breadth of rectangular court yard.

Solution:

Let the length of rectangle court yard be  $x$

Then, according to the question

$$\text{breadth court yard} = \frac{63}{x}$$

Now, From the condition

$$2 \left( x + \frac{63}{x} \right) = 32$$

$$\text{or, } \frac{x^2 + 63}{x} = \frac{32}{2}$$

$$\text{or, } \frac{x^2 + 63}{x} = 16$$

$$\text{or, } x^2 + 63 = 16x$$

$$\text{or, } x - 16x + 63 = 0$$

$$\text{or, } x^2 - (9 + 7) + 63 = 0$$

$$\text{or, } x^2 - 9x - 7x + 63 = 0$$

$$\text{or, } x^2(x - 9) - 7(x - 9) = 0$$

$$\therefore (x - 9)(x - 7) = 0$$

$$\text{Either } x - 9 = 0$$

$$\therefore x = 9$$

$$\text{or, } x - 7 = 0$$

$$\therefore x = 7 \text{ (impossible)}$$

Length of Rectangular Court yard =  $9 \text{ m}$

Its breadth =  $\frac{63}{9} \text{ m} = 7 \text{ m}$

**Model 8**

कविता को छोरा जन्मदा उनी 23 वर्ष की थिएन तर अहिले उनको र छोराको उमेरको गुणनफल 174 छ भने आमा र छोराको उमेर पत्ता लगाउनुहोस् ।

Kabita was 23 yrs when her son was born but the product of their age now is 174 find the present ages of mother and her son.

**Solution:**

Let the present age of Kabita be  $x$

Then age of her son =  $x - 23$

Now, From the condition

$$x \times (x - 23) = 174$$

$$\text{or, } x^2 - 23x = 174 = 0$$

$$\text{or, } x^2 - (29 - 6)x - 174 = 0$$

$$\text{or, } x^2 - 29x + 6x - 174 = 0$$

$$\text{or, } x(x - 29) + 6(x - 29) = 0$$

$$\therefore (x - 29)(x + 6) = 0$$

$$\text{Either } x - 29 = 0$$

$$\therefore x = 29$$

$$x + 6 = 0$$

$$\therefore x = -6 \text{ (impossible)}$$

Hence age of Kabita = 29 yrs

Age of her son = 6 yrs

**Model 9**

यदि एउटा केटाको र उसको बाबुको उमेरको योग 32 वर्ष छ । उनिहरुको गुणनफलको  $\frac{1}{8}$  भाग केटाको उमेर भन्दा 10 ले धेरै छ भने उनिहरु कति कति वर्षका थिए पत्ता लगाउनुहोस् ।

If a boy is age and his father is age amount together is 32 yrs and the one eighth part of the product of their ages exceeds the boys age by 10 yrs. Find the old ther are.

**Solution:**

Let the age of father be  $x$ , Then

According to the questions

Age of son =  $(32 - x)$

Now, From the condition

$$\frac{1}{8} \text{ of } [x \times (32 - x)] = (32 - x) + 10$$

$$\text{or, } \frac{1}{8} [32x - x^2] = 32 - x + 10$$

$$\text{or, } 32x - x^2 = 256 - 8x + 80$$

$$\text{or, } 32x - x^2 - 256 + 8x - 80 = 0$$

$$\text{or, } -x^2 + 40x - 336 = 0$$

$$\text{or, } x^2 - 40x + 336 = 0$$

$$\text{or, } x^2 - (28 + 12)x + 336 = 0$$

$$\text{or, } x^2 - 28x - 12x + 336 = 0$$

$$\text{or, } x(x - 28) - 12(x - 28) = 0$$

$$\therefore (x - 28)(x - 12) = 0$$

$$\text{Either } x - 28 = 0$$

$$\therefore x = 28$$

$$\text{Again } x - 12 = 0$$

$$\therefore x = 12 \text{ (Impossible)}$$

Hence

Age of father = 28 yrs age of son = 49 yrs

**Model 10**

एक वर्ष अगाडि बाबूको उमेर छोराको उमेरको 8 गुणा थियो । हाल बाबूको उमेर छोराको छोराको उमेरको वर्गसंग बराबर छ । उनिहरूको हालको उमेर पता लगाउनुहोस् ।

A year ago the father was 8 times as old as his son. How his age in the square of the son's age find the present their age ?

**Solution:**

Let the age of father and son be  $x$  and  $y$  respectively.

From the 1<sup>st</sup> condition

$$x - 1 = 8(y - 1)$$

$$\text{or, } x - 1 = 8y - 8$$

$$\text{or, } x = 8y - 7 \dots\dots\dots (i)$$

Again from the 2<sup>nd</sup> condition

$$x = y^2 \dots\dots\dots (ii)$$

From equation (i) and (ii)

$$\text{or, } y^2 = 8y - 7$$

$$\text{or, } y^2 - 8y + 7 = 0$$

$$\text{or, } y^2 - 7y - y + 7 = 0$$

$$\text{or, } y(y - 7) - 1(y - 7) = 0$$

$$\text{or, } (y - 7)(y - 1) = 0$$

$$\text{either } y - 7 = 0 \quad \therefore y = 7$$

$$y - 1 = 0 \quad \therefore y = 1 \text{ (impossible)}$$

Hence age of son = 7 yrs and age of father = 49 yrs

**Model 11**

एउटा दुई अंकको संख्या त्यसका अडकहरूको योगको 4 गुणा र गुणनफलको तीन गुणा छ भने त्यो संख्या पता लगाउनुहोस् ।

A two digit number is four times the sum and three times product of its digit. Find the number.

**Solution:**

Let the two digits number be  $x$  and  $y$  respectively.

Two digits number =  $10x + y$

From the 1<sup>st</sup> condition

$$10x + y = 4(x + y)$$

$$\text{or, } 10x + y = 4x + 4y$$

$$\text{or, } 10x + 4x = 4y - y$$

$$\text{or, } 6x = 3y$$

$$\therefore y = 2x \dots\dots\dots (i)$$

From the 2<sup>nd</sup> condition

$$10x + y = 3(xy)$$

$$\text{or, } 10x + 2x = 3(x \times 2y) x$$

$$\text{or, } 12x = 6x^2$$

$$\text{or, } 6x^2 - 12x = 0$$

$$\text{or, } 6x(x - 2) = 0$$

$$\text{either } 6x = 0$$

$$\therefore x = 0$$

$$\text{Again } x - 20 = 0$$

$$\therefore x = 2$$

Again putting the value of  $x$  in equation (i)

$$y = 2x$$

$$\text{or, } y = 2 \times 2$$

$$\therefore y = 4 \text{ number of}$$

$$\text{The required two digits number} = 10x + y = 10 \times 2 + 4 = 24$$

**Model 12**

बन भोज कार्यक्रम के लिए मानिसों द्वारा बस भाड़ा बराबर तिर्दा 3600 पर्दा। यदि 5 जना बढ़ि भए भए प्रत्येक मानिस द्वारा रु 60 कम तिनु पर्दा भने जस्ता मानिसको संख्या र प्रत्येक मानिस द्वारा तिनुपर्ने रकम पत्ता लगाउनुहोस्।

In a picnic program a total bus fare of the Rs 3600 is to be equally paid by the number of men. If there were 5 men more each man would have paid Rs 60 less. Find the number of men and the fare to be paid by each man.

**Solution:**

Let the total number of men be  $x$

Total fare of bus is Rs 3600

According to the question

$$\text{Bus fare of each man} = \frac{\text{Rs } 3600}{x}$$

Again If no. of men  $x + 5$

$$\text{Bus fare of each man} = \frac{\text{Rs } 3600}{x + 5}$$

According to the question

$$\frac{3600}{x} - \frac{3600}{x + 5} = 60$$

$$\text{or, } \frac{3600x + 18000 - 3600x}{x(x + 5)} = 60$$

$$\text{or, } 18000 = 60x^2 + 300x$$

$$\text{or, } 60x^2 + 300x - 18000 = 0$$

$$\text{or, } x^2 + 5x - 300 = 0$$

$$\text{or, } x^2 + 20x - 15x - 300 = 0$$

$$\text{or, } x(x + 20) - 15(x + 20) = 0$$

$$\text{or, } (x + 20)(x - 15) = 0$$

Either  $x + 20 = 0$

$$\therefore x = -20$$

$$\text{or, } x - 15 = 0$$

$$\therefore x = 15$$

The number of men = 15

$$\text{Bus fare each man} = \frac{\text{Rs } 3600}{15} = \text{Rs } 240$$

**Model 13**

यदि दुइआठ संख्याहरू  $x$  र  $x + 2$  का व्युत्क्रम हरको योगफल  $\frac{5}{12}$  छ भने ती संख्याहरू पत्ता लगाउनुहोस्।

If the sum of reciprocal of the numbers  $x$  and  $x + 2$  is  $\frac{5}{12}$ , find the number.

**Solution:**

The given numbers are  $x$  and  $x + 2$

then its reciprocal  $\frac{1}{x}$  and  $\frac{1}{x+2}$  respectively.

$$\text{Now, } \frac{1}{x} + \frac{1}{x+2} = \frac{5}{12}$$

$$\text{or, } \frac{x+2+x}{x(x+2)} = \frac{5}{12}$$

$$\text{or, } \frac{2x+2}{x^2+2x} = \frac{5}{12}$$

$$\text{or, } 5x^2 + 10x = 24x + 24$$

$$\text{or, } 5x^2 + 10x - 24x - 24 = 0$$

$$\begin{aligned}
 \text{or, } & 5x^2 - 14x - 24 = 0 \\
 \text{or, } & 5x - 20x + 6x - 24 = 0 \\
 \text{or, } & 5x(x-4) + 6(x-4) = 0 \\
 \therefore & (x-5)(5x+6) = 0 \\
 \text{either } & x-4 = 0 \\
 \therefore & x = 4 \\
 \text{or, } & 5x+6 = 0 \\
 \therefore & x = \frac{-6}{5} \text{ (impossible)}
 \end{aligned}$$

The required numbers are 4 and 6 respectively.

#### Model 14

हाल बाबू र छोराको उमेरको गुणनफल 800 छ । हालको उमेर बराबर छोराको उमेर पुग्ने बेलामा तिनीहरूको योगफल 100 हुनेछ । तिनीहरूको हालको उमेर निकाल्नुहोस् ।

The product of the present age of father and son is 800. When the son becomes as old as father at present, the sum of their age will be 100. Find the their present ages.

**Solution:**

Let the present age of father be  $x$   
Then, according to the questions

$$\text{Age of son} = \frac{800}{x}$$

$$\text{Difference age of father and son} = \left( x - \frac{800}{x} \right)$$

$$\text{Now, } x + \left( x - \frac{800}{x} \right) + x = 100$$

$$\text{or, } 2x + \frac{x^2 - 800}{x} = 100$$

$$\text{or, } \frac{2x^2 + x^2 - 800}{x} = 100$$

$$\text{or, } 3x^2 - 800 = 100x$$

$$\text{or, } 3x^2 - 100x - 800 = 0$$

$$\text{or, } 3x^2 - 120x + 20x - 800 = 0$$

$$\text{or, } 3x(x-40) + 20(x-40) = 0$$

$$\therefore (x-40)(3x+20) = 0$$

$$\text{either } x-40 = 0$$

$$\therefore x = 40$$

$$\text{or, } 3x+20 = 0$$

$$\therefore x = \frac{-20}{3} \text{ (impossible)}$$

Hence age of father = 40 yrs and age of son = 20 yrs.

#### Next Method

Let the age of father and son be  $x$  and  $y$  respectively.

From the first condition

$$xy = 800 \dots\dots\dots (i)$$

Again from the 2<sup>nd</sup> condition

difference age of father and son =  $x - y$

$$x + x - y + x = 100$$

$$\text{or, } 3x - y = 100$$

$$\therefore 3x - 100 = y \dots\dots\dots (ii)$$

Putting the value of  $y$  in equation (i), we get

$$\begin{aligned}
 & x \times (3x - 100) = 800 \\
 \text{or, } & 3x^2 - 100x - 800 = 0 \\
 \text{or, } & 3x^2 - (120 - 20)x - 800 = 0 \\
 \text{or, } & 3x^2 - 120x + 20x - 800 = 0 \\
 \text{or, } & 3x(x - 40) + 20(x - 40) = 0 \\
 \therefore & (x - 40)(3x + 20) = 0 \\
 \text{either } & x - 40 = 0 \quad \therefore x = 40 \\
 \text{or, } & 3x + 20 = 0 \quad \therefore x = -\frac{2}{3}
 \end{aligned}$$

Hence age of father is = 40 yrs and Son's age = 20 yrs

### Model 15

सुजनको रु 90 मा केहि कलमहरु किन्यो । यदि उसले प्रत्येकाका रु 1 घटि तिरेको भए 3 ओटा कलम बढि आउद्यो भने उसले कति ओटा कलम किनेको रहेछ ।

Sujan brought some pens for Rs 90. if he per paid Rs 1 less for each, he would have 3 more pens how many pens did he buy?

**Solution:**

Let the number of pens be  $x$

Total price of pens = Rs 90

$$\text{each price of pen} = \frac{\text{Rs } 90}{x}$$

According to the questions

$$\text{number of pens} = x + 3$$

$$\text{Again each price of pen} = \frac{\text{Rs } 90}{x + 3}$$

From the condition

$$\begin{aligned}
 & \frac{90}{x} - \frac{90}{x+3} = 1 \\
 \text{or, } & \frac{90(x+3) - 90x}{x(x+3)} = 1 \\
 \text{or, } & 90x + 270 - 90x = x^2 + 3x \\
 \text{or, } & x^2 + 3x - 270 = 0 \\
 \text{or, } & x^2 + 18x - 15x(x+18) = 0 \\
 \text{or, } & x(x+18) - 15(x+18) = 0 \\
 \therefore & (x+18)(x-15) = 0 \\
 \text{either } & x+18 = 0 \quad \therefore x = -18 \\
 \text{or, } & x-15 = 0 \quad \therefore x = 15
 \end{aligned}$$

The required number of pen = 15

### Model 16

एक जना कामदारको काम गरेको दिनमा रु 300 ज्याला पाउँछ र गएल भएको दिनमा रु 60 जरीवाना तिर्नु पर्दै । यदि एक महिनाको अन्त्यमा रु 7560 पाउँछ भने सो महिनाको कति दिन काम गर्यो होला ।

A workers ways is Rs 300 for each day he works and he fined Rs 60 the every days when he is absent id he gets Rs 7560 at the ends of a month, how many days did he work?

**Solution:**

In a month 30 days

Let the working days be  $x$

Wage of working days = Rs  $300x$

Absent day =  $(30 - x)$

Fined amount =  $(30 - x) \times \text{Rs } 60 = \text{Rs } 1800 - 60x$

Now, according to the questions

$$\text{or, } \text{Rs } 300x - (\text{Rs } 1800 - \text{Rs } 60x) = \text{Rs } 7560$$



Again 2<sup>nd</sup> condition

$$x^2 + y^2 = 5^2$$

$$\therefore x^2 + y^2 = 25 \dots\dots\dots (ii)$$

from the equation (ii)

$$x^2 + y^2 = 25$$

$$(x^2 + y)^2 - 2xy = 25$$

$$\text{or, } (x+y)^2 - 2 \times 12 = 25$$

$$\text{or, } (x + y)^2 = 25 + 24$$

$$\text{or, } (x + y)^2 = 49$$

$$(x + y)^2 = 7^2$$

$$\therefore x + y = 7 \dots\dots\dots (ii)$$

Again, we know

$$x - y = \sqrt{(x + y)^2 - 4xy}$$

$$\text{or, } x - y = \sqrt{7^2 - 4 \times 24}$$

$$\text{or } x - y = \sqrt{49 - 48}$$

$$\therefore x = y \equiv 1 \quad (\text{iv})$$

From equation (iii) are (iv)

$$x + y = 7$$

$$x + y = r$$

$$\frac{2x}{2} = \frac{8}{2}$$

$$x = 4$$

#### Putting th

$$x + y = 7$$

$$4 + y = 7$$

$$\therefore v = 3$$

Hence length and breadth are 4m and 3m respectively of play ground.

### **Practice Yourself**

- आमा र छोरीको हालको उमेर कम्श 30 वर्ष । 14 वर्ष छ । कति वर्ष अधि तिमीहरुको उमेरको गुणनफल 192 थियो पत्ता लगाउनुहोस् ।  
The present ages of a mother and daughter are 30 yrs and 14 yrs respectively. Find the how many yrs ago the product of their age was 192 ? (Ans: 6 yrs)
  - छोरीको उमेर छोराको उमेर भन्दा 4 वर्षले जेठो छ । 2 वर्ष अधि उनिहरुका उमेरको गुणनफल 32 थियो भने उनीहरुको हालको उमेर पत्ता लगाउनुहोस् ।  
The daughter's age 4 yrs more than son's age. 2 yrs ago the product of their ages was 32 yrs. Find the their present ages. (Ans: 5 yrs)
  - दिदि र भाईको हालको उमेरको अन्तर 6 वर्ष छ । तिनीहरुको उमेरको गुणनपको संख्यात्मक मान उमेरको योगफलको 4 गणा छ भने दिदि र भाईको उमेर पत्ता लगाउनुहोस् । (Ans: 12 yrs, 6 yrs)  
The difference of the present age sister and her younger brother is 4 yrs. the product of age of numerical value is equal to 4 times the sum of them ages. Find the present age of the sister and her brother.
  - 6 वर्ष अधि एउटा मानिसको उमेर उमको छोराको उमेर भन्दा 6 गुणा बढि थियो । हालको तिनीहरुको उमेरको गुणन 396 छ । हालको उमेर पत्ता लगाउनुहोस् ।  
6 yrs ago a man's was 6 times the age of his son. the product of their age is 396, find the present ages. (Ans: 36 yrs, 11yrs)
  - दुई ओटा संख्याहरुको योग 16 छ र ति संख्याहरुको योग 130 छ भने संख्याहरु निकाल्नुहोस् ।  
The sum of the numbers is 16 and the sum of their square is 130. Find the numbers. (Ans: (7,9)
  - दुई अंडकको एउटा संख्यामा अडकहरुको गुणनफल 8 छ । त्यस संख्यामा 18 जोड्दा सौ संख्यामा अडकहरुको स्थान बदलिन्छ भने त्यो संख्या पत्ता लगाउनुहोस् । (Ans: 24)

- A two digits number the product of two digits is 8. When 18 added to the number the digits inter change them place. Find the number.
7. दुई अंकको संख्या त्यसका अंकहरूको योगफलको 4 गुणा र गुणनफलको 3 गुणा छ भने त्यो संख्या पत्ता लगाउनुहोस् ।
- A two digit number is four times the sum and three times the product of its digits. Find the number.  
(Ans: 24)
8. एउटा आयतकार चउरको क्षेत्रफल  $28m^2$  र यसको परिमिती 22 m छ भने लम्बाई र चौडाई पत्ता लगाउनुहोस् ।  
A rectangular widow has an area of  $28m^2$  and its perimeter 22m. Find the length and breadth.  
(Ans: 7m, 4m)
9. एउटा आयतकार ट्याङ्कीको उचाई 2m छ । यसको लम्बाई चौडाई भन्दा 3m ले बढि छ । ट्याङ्कीमा  $80m^2$  पानी अटाउछ भने उक्त ट्याङ्कीको लम्बाई र चौडाई पत्ता लगाउनुहोस् । The height of a tank is 2m and its length is 3m more than its breath. If  $80 m^2$  of water can be stored in tank, find the length and breath of the tank.  
(Ans: 8m, 5m)
10. कमला चौधरी आफ्नो छोरा जन्मदा 25 वर्षका थिइन । अहिले तिनीहरूको उमेरको गुणनफल 600 छ भने आमा र छोराको उमेर पत्ता लगाउनुहोस् ।  
Kamala Chaudhary was 25 yrs old when her son was born. If the product of their ages how is 600 find the age of mother and son.  
(Ans: 40 yrs 15 yrs)
11. बाबुको उमेर छोराको उमेरको वर्ग भन्दा 4 वर्ष बढि छ । यदि बाबुको उमेर र छोराको उमेरको 4 गुणाको योगफल 64 वर्ष भए तिनीहरूको उमेर पत्ता लगाउनुहोस् ।  
The age of father exceeds to the square of the age of his son by 4 yrs. the sum of the age of father and four times the age of his son in 64 yrs. Find the their ages. (Ans: 6 yrs 40 yrs)
12. दाजु र भाइको उमेरको अनुपात  $3:4$  छ । छ वर्ष अधि उनिहरूको उमेरको वर्गको अनुपात  $4:9$  थियो भने उनीहरूको अनिहरूको अहिलेको उमेर पत्ता लगाउनुहोस् ।  
The ratio of present age of brother is  $3:4$  the ratio of the square of their age before 5 yrs was  $4:9$  find their present ages.
13. एउटा आयतकार कोठाको क्षेत्रफल  $70m^2$  छ । यदि कोठाको लम्बाई 1m घटाउने र चौडाई 2m बढाउने हो भने कोठाको वर्गकार हुने थियो । सो कोठाको लम्बाई र चौडाई पत्ता लगाउनुहोस् ।  
The area of a room is  $70m^2$  if the length of the room was 1m less and its breath was 2m more than it would be in shape of square. Find the length and breath of room.(Ans: 10m, 7m)
14. एउटा समकोण त्रिभुजको कर्ण त्यसको आधार भन्दा 2cm बढि छ र उचाईको दोब्बर भन्दा 1cm बढि छ भने त्रिभुजको प्रत्येक भुजाको लम्बाई पत्ता लगाउनुहोस् ।  
The length of the hypotenuse of a right angled triangle exceeds for length of base by 2cm and exceeds for length of altitude 1cm, find the length of each side of triangle.  
(Ans: 8 15, 17)
15. यदि दुई ओटधा संख्याहरूको योगफल 15 र तिनीहरूको व्युत्कक्षमको योगफल  $\frac{3}{10}$  छ भने ती संख्याहरू पत्ता लगाउनुहोस् ।  
If the sum of two numbers 15 and sum of their reciprocal is  $\frac{3}{10}$  find the numbers.  
(Ans: 5, 10)
16. एउटा आयतका खेत 16m लम्बाई र 10m चौडाई छ । उक्त खेतको वरिपरि चारैतिर  $120m^2$  क्षेत्रफल र समान र चौडा भएको बाटो छ । बाटोको चौडा पत्ता लगाउनुहोस् ।  
Area tangular field is 16m long and 10 m wide. There is a path com form width around from the out sides if having an area of  $120m^2$ . Find the width of the path.  
(Ans: 2m)
17. रु. 1000 केहि मानिसहरूलाई बराबर हुने गरी बाँडियो । यदि 5 जना मानिसहरू बढि भएको भए प्रत्येकले रु. 10 कम पाउने थिए कंति जना मानिसहरूलाई सो रकम बाँडिएको थियो पत्ता लगाउनुहोस् । Rs. 1000 was distributed equally among a certain number of people. If there were 5 people more each would have received Rs. 10 less Amon how many people was the amount distributed ? Find.  
(Ans: 20)