12. Equations in one variable

1. A shopkeeper purchased 60 books of same publication $\frac{2}{3}$ of those books were sold at Rs. 24 per book more than cost price. All the remaining books were sold for Rs. 1440 to another shopkeeper. The transaction resulted in 20 % profit, then what is the original cost price of each book ?

Solution: Let the original cost price of each book be Rs. x

$\therefore$ **Purchase price of 60 books** $= x \times 60 =$ **Rs.** $60x$

$\frac{2}{3}$ **books of 60 books** $= 60 \times \frac{2}{3} = 40$ **books.**

40 books were sold by taking Rs. 24 per book more than cost price.

$\therefore x + 24$

Remaining books $= 60 - 40 = 20$

Remaining 20 books were sold to another shopkeeper for Rs. 1440.

$\therefore$ **Total selling price** $= 40\ (x + 24) + 1440$

20 % profit is obtained on cost price of Rs. $60x$

$$\therefore 60x \times \frac{20}{100} = 12x$$

$\therefore$ **Selling price of books** $= 60x + 12x =$ **Rs.** $72x$

From the given conditions,

$$\therefore 40(x + 24) + 1440 = 72x$$

$$\therefore 40x + 960 + 1440 = 72x$$

$$\therefore 40x + 2400 = 72x$$

$$\therefore 72x - 40x = 2400$$

$$\therefore 32x = 2400$$

$$\therefore x = \frac{2400}{32}$$

$$= \frac{300}{4}$$

$$\therefore x = 75$$

$\therefore$ **Original cost price of each book is Rs. 75.**

2. On Republic day, some funds were approved by organization for 1000 students in lower K.G. of a school. Later it was decided to share sweets form same fund to 800 students of upper K. G. Therefore each student in lower K.G. got 150 paise less sweets than before. What was the total amount approved by the organization ?

Solution : Let the amount approved for sweets be Rs. x

Total students in lower K.G. in the school = 1000

∴ Price of sweets received by each of the students in lower K.G. in the school $= \text{Rs.}\frac{x}{1000}$

But 1000 students of lower K.G. and 800 students of upper K.G. that means there are 1800 total students. So sweets are distributed to 1800 students.

Hence each student got sweets of $= \text{Rs.}\frac{x}{1800}$

Now, 150 Paise $= \text{Rs.}\frac{150}{100}$

From given condition,

$$\therefore \frac{x}{1000} - \frac{x}{1800} = \frac{150}{100}$$

Let us multiply both sides by 100.

$$\frac{x}{1000} \times 100 - \frac{x}{1800} \times 100 = \frac{150}{100} \times 100$$

$$\therefore \frac{x}{10} - \frac{x}{18} = 150$$

LCM of 10 and 18 is 90.

$$\therefore \frac{9x - 5x}{90} = 150$$

$$\therefore 9x - 5x = 150 \times 90$$

$$\therefore 4x = 13500$$

$$\therefore x = \frac{13500}{4}$$

$$\therefore x = 3375$$

∴ Amount approved for sweets by on organization is Rs. 3375.

3. Dinkarrao purchased two varieties of wheat at the rate of Rs. 28 and Rs. 30. He purchased total 270 kg wheat. The total amount spend for purchasing is Rs. 7860. How much wheat he purchased of each variety.

Solution : Let us assume the wheat purchased at the rate of Rs. 28 be x kg and wheat purchased at the rate of

Rs. 30 = $(270 - x)$ kg

Dinkarrao purchased total 270 kg wheat of two varieties at rate of Rs. 28 and Rs. 30 for Rs. 7860.

By given condition,

$$\therefore 28x + 30(270 - x) = 7860$$

$$\therefore 28x + 8100 - 30x = 7860$$

$$28x - 30 = 7860 - 8100$$

$$\therefore -2x = -240$$

Let us multiply both sides by minus sign.

$$\therefore 2x = 240$$

$$\therefore x = \frac{240}{2}$$

$$\therefore x = 120$$

∴ 120 kg of wheat of rate Rs. 28 was purchased.

Wheat purchased at rate of Rs. 30 = $(270 - x)$ kg

$= 270 - 120$

$= 150$ kg

∴ Dinkarrao purchased 120 kg wheat of rate Rs. 28 and 150 kg wheat of rate Rs. 30.

4. In a library, there are as many books in Marathi as there are $\frac{1}{5}$ Hindi, $\frac{1}{7}$ Sanskrit and thrice English books. There are total 5320 books in library so what is the number of each book in library ?

Solution : Let the number of Marathi books in library be x

∴ Number of Hindi books $= \frac{1}{5}x$

∴ Number of Sanskrit books $= \frac{1}{7}x$

∴ Number of English books $= 3x$

Total number of books is 5320.

According to given condition,

$$\therefore x + \frac{1}{5}x + \frac{1}{7}x + 3x = 5320$$

LCM of 5 and 7 is 35.

∴ Let us multiply both sides by 35.

$$\therefore 35x + 7x + 5x + 105x = 5320 \times 35$$

$$\therefore 152x = 186200$$

$$\therefore x = \frac{186200}{152}$$

$$\therefore x = \frac{5320 \times 35}{152}$$

$$= \frac{2660 \times 35}{76}$$

$$= \frac{665 \times 35}{19}$$

$$= 35 \times 35$$

$$\therefore x = 1225$$

∴ Number of Hindi books $= \frac{1}{5}x$

$$= \frac{1}{5} \times 1225$$

$$= 245$$

∴ Number of Sanskrit books $= \frac{1}{7}x$

$$= \frac{1}{7} \times 1225$$

$$= 175$$

∴ Number of English books $= 3x$

$$= 3 \times 1225$$

$$= 3675$$

∴ 1225 Marathi books, 245 Hindi books, 175 Sanskrit books and 3675 English books in library.

5. Numerator of a fraction is 5 more than its denominator. If 3 is added to numerator and denominator, the fraction obtained is $\frac{4}{3}$. Find the fraction.

Solution : Let the denominator of the fraction be x.

∴ Numerator of the fraction is 5 more than denominator.

∴ Numerator of fraction $= x + 5$

If 3 is added to both numerator and denominator then the obtained fraction is $\frac{4}{3}$.

$$\therefore \frac{x+5+3}{x+3} = \frac{4}{3}$$

$$\therefore \frac{x+8}{x+3} = \frac{4}{3}$$

$$\therefore 3(x+8) = 4(x+3)$$

$$\therefore 3x + 24 = 4x + 12$$

$\therefore 24 - 12 = 4x - 3x$

$\therefore x = 12$

∴ denominator of fraction = 12

and numerator of fraction $= x + 5 = 12 + 5 = 17$

∴ The fraction $= \frac{17}{12}$

6. The present average age of Shree, Raj and Om is 20 years. The present age of Raj is 18 years old. Five years ago, the sum of ages of Raj and Shree was $\frac{5}{4}$ times the age of Om at that time. Then find present age of Om ?

Solution : The present average age of Raj, Shree and Om is 20 years.

∴ Sum of present age of three $= (3 \times 20) = 60$ years

Today's age of Raj is 15 years.

∴ Sum of present age of Shree and Om is

$60 - 15 = 45$ years

Suppose the present age of Shree be x years.

∴ Today's age of Om will be $(45 - x)$

Five years's ago, age of Raj $= 15 - 5 = 10$ years.

Age of Shree will be $(x-5)$ years and age of Om will be $(45-x-5)$ years.

Five years ago, sum of ages of Raj and Shree was $\frac{5}{4}$ times the age of Om at that time.

$$\therefore 10+(x-5)=\frac{5}{4}(45-x-5)$$

$$\therefore 10+x-5=\frac{5}{4}(40-x)$$

$$\therefore 4\,(5+x)=5(40-x)$$

$$\therefore 20+4x=200-5x$$

Let us add $5x$ on both the sides,

$$\therefore 20+4x+5x=200-5x+5x$$

$$\therefore 20+9x=200$$

Let us subtract 20 from both the sides,

$$\therefore 20+9x-20=200-20$$

$$\therefore 9x=180$$

$$\therefore x=\frac{180}{9}$$

$$\therefore x=20$$

$$\therefore \text{Present age of Om}=45-x=45-20=25$$

$\therefore$ Present age of Om is 25 years.

7. In a two digit number, digit at ten's place is twice the digit at unit's place. The number obtained by interchanging the digits is $\frac{5}{6}$ times of the original number. Find the number.

Solution : Let digit at ten's place of two digit number be x.

$\therefore$ **Digit at unit's place of that number** $= x - 1$

$\therefore$ **That two digit number** $= 10x + (x - 1)$

Number obtained by interchanging the digits

$= 10(x - 1) + x$

$\therefore$ **According to given condition,**

$$10(x - 1) + x = \frac{5}{6}[10x + (x - 1)]$$

$$\therefore 10x - 10 + x = \frac{5}{6}[10x + x - 1]$$

$$\therefore 11x - 10 = \frac{5}{6}(11x - 1)$$

$$\therefore 6(11x - 10) = 5(11x - 1)$$

$$\therefore 66x - 60 = 55x - 5$$

$$\therefore 66x - 55x = 60 - 5$$

$$\therefore 11x = 55$$

$$\therefore x = \frac{55}{11}$$

$\therefore x = 5$

$\therefore x - 1 = 5 - 1 = 4$

∴ Digit at ten's place is 5 and digit at unit's place is 4.

∴ Two digit number is 54.

8. Father's age is 20 years more than son's age. Find son's today's age if after 3 years ratio of son's age to father's age will be $\frac{19}{39}$.

Solution : Let today's age of son be x years.

∴ Today's age of father $= (x + 20)$ years.

After 3 years son's age $= (x + 3)$ years.

After 3 years father's age $= (x + 20 + 3)$ years.

After 3 years ratio of son's age to father's age $= \frac{x+3}{x+23}$

But it is given that after 3 years ratio of son's age to father's age will be $\frac{19}{39}$.

$\therefore \frac{x+3}{x+23} = \frac{19}{39}$

$\therefore 39(x + 3) = 19(x + 23)$

$\therefore 39x + 117 = 19x + 437$

By subtracting 117 from both the sides,

$$39x + 117 - 117 = 19x + 437 - 117$$

$$\therefore 39x = 19x + 320$$

Subtracting $19x$ from both the sides,

$$\therefore 39x - 19x = 19x + 320 - 19x$$

$$\therefore 20x = 320$$

Dividing both the sides by 20,

$$\therefore \frac{20x}{20} = \frac{320}{20}$$

$$\therefore x = 16$$

∴ Today's age of son is 16 years.

9. First number is less than second number by 7. The ratio of first number to second number is $\frac{4}{5}$. Find the numbers.

Solution : Let second number be x.

∴ First number $= x - 7$

∴ The ratio of first number to second number $= \frac{x-7}{x}$

But it is given that ratio of first number to second number is $\frac{4}{5}$.

$$\therefore \frac{x-7}{x} = \frac{4}{5}$$

$\therefore 5(x-7) = 4x$

$\therefore 5x - 35 = 4x$

Subtracting $4x$ from both the sides,

$\therefore 5x - 35 - 4x = 4x - 4x$

$\therefore x - 35 = 0$

$\therefore x = 35$

$\therefore$ Second number $= 35$

$\therefore$ First number $= x - 7 = 35 - 7 = 28$

$\therefore$ The numbers are 28 and 35.

10. The difference between today's age of two sisters is 4 years. 5 years ago, ratio of their ages was $\frac{5}{7}$. Find their present ages.

Solution : Let the today's age of younger sister be x.

$\therefore$ Today's age of elder sister $= (x + 4)$ years.

5 years ago, age of younger sister $= (x - 5)$ years.

5 years ago, age of elder sister $= (x + 4) - 5 = (x - 1)$ years

5 years ago, ratio of their ages $= \frac{x-5}{x-1}$

But the ratio of their ages was $\frac{5}{7}$ which is given.

$\therefore \frac{x-5}{x-1} = \frac{5}{7}$

$\therefore 7(x-5) = 5(x-1)$

$\therefore 7x - 35 = 5x - 5$

Subtracting $5x$ from both the sides,

$\therefore 7x - 35 - 5x = 5x - 5 - 5x$

$2x - 35 = -5$

Adding 5 on both the sides,

$2x - 35 + 5 = -5 + 5$

$\therefore 2x - 30 = 0$

$\therefore 2x = 30$

Dividing both the sides by 2,

$\therefore \frac{2x}{2} = \frac{30}{2}$

$\therefore x = 15$

$\therefore$ Today's age of younger sister is 15 years.

$\therefore$ Today's age of elder sister $= x + 4 = 15 + 4 = 19$ years

$\therefore$ Today's age of younger sister is 15 years and today's age of elder sister is 19 years.

11. If the sum of three consecutive whole numbers is 291, then what are the numbers ?

Solution : Let first consecutive natural odd number be x.

$\therefore$ The three consecutive natural odd numbers are

$$x, x+2, x+4.$$

The sum of three consecutive natural odd numbers is 291.

$$\therefore x + x + 2 + x + 4 = 291$$

$$\therefore 3x + 6 = 291$$

Subtracting 6 from both the sides,

$$\therefore 3x + 6 - 6 = 291 - 6$$

$$\therefore 3x = 285$$

$$\therefore x = \frac{285}{3}$$

$$\therefore x = 95$$

$$\therefore \text{First number} = 95$$

$$\text{Second number} = x + 2 = 95 + 2 = 97$$

$$\text{Third number} = x + 4 = 95 + 4 = 99$$

$\therefore$ The numbers are 95, 97 and 99.

12. The difference between two numbers is 12. The 12 times of smallest number is as the ten times of largest number. Find the numbers.

Solution : Let the smaller number be x.

$\therefore$ Second number $= (x + 12)$

12 times of smaller number is as the ten times of larger number.

$$\therefore 12x = 10(x + 12)$$

$$\therefore 12x = 10x + 120$$

Subtracting $10x$ from both the sides,

$$\therefore 12x - 10x = 10x + 120 - 10x$$

$$\therefore 2x = 120$$

$$\therefore x = 60$$

$\therefore$ First number $x = 60$

$\therefore$ Second number $= x + 12 = 60 + 12 = 72$

$\therefore$ The two numbers are 60 and 72.

13. The sum of present ages of Mira and her mother is 60 years. 5 years ago, Mira's mothers age was 4 times the age of Mira at that time. Find their present ages.

Solution : Let present age of Mira be x.

$\therefore$ Present age of Mother $= (60 - x)$ years

5 years ago, Mira's age $= (x - 5)$ years

5 years ago, Mother's age $= (60 - x - 5)$ years

5 years ago, Mira's mothers age was four times the age of Mira's age at that time.

$$\therefore 60 - x - 5 = 4(x - 5)$$

$$\therefore 55 - x = 4x - 20$$

Subtracting $4x$ from both the sides,

$$\therefore 55 - x - 4x = 4x - 20 - 4x$$

$$\therefore 55 - 5x = -20$$

Subtracting 55 from both the sides,

$$55 - 5x - 55 = -20 - 55$$

$$\therefore -5x = -75$$

$$\therefore 5x = 75$$

$$\therefore x = \frac{75}{5}$$

$$\therefore x = 15$$

$\therefore$ Present age of Mira's mother $= 60 - 15 = 45$

∴ **Present age of Mira is 15 years and present age of Mira's mother is 45 years.**

14. The breadth of a rectangle is 0.75 times the length and area is 4332 sq.m. Find the perimeter of the rectangle.

Solution : Let the length of a rectangle be x.

Breadth of a rectangle is 0.75 times of its length.

∴ **Breadth of a rectangle** $= 0.75 \times x$

Area of a rectangle $= 4332$ **sq.m**

Area of a rectangle = length × breadth

$$4332 = x \times (0.75 \times x)$$

$$\therefore \frac{4332}{0.75} = x^2$$

$$\therefore \frac{433200}{75} = x^2 \ldots\ldots \left[\frac{4332 \times 100}{0.75 \times 100} = \frac{433200}{75}\right]$$

$$\therefore \frac{86640}{15} = x^2$$

$$\therefore x^2 = 5776$$

Taking square root of both sides,

$$\therefore x = 76$$

∴ **Length of a rectangle** $= x = 76$**m and**

Breadth of a rectangle $= 0.75 \times x = 0.75 \times 76 = 57$**m**

Perimeter of a rectangle = 2 (Length + Breadth)

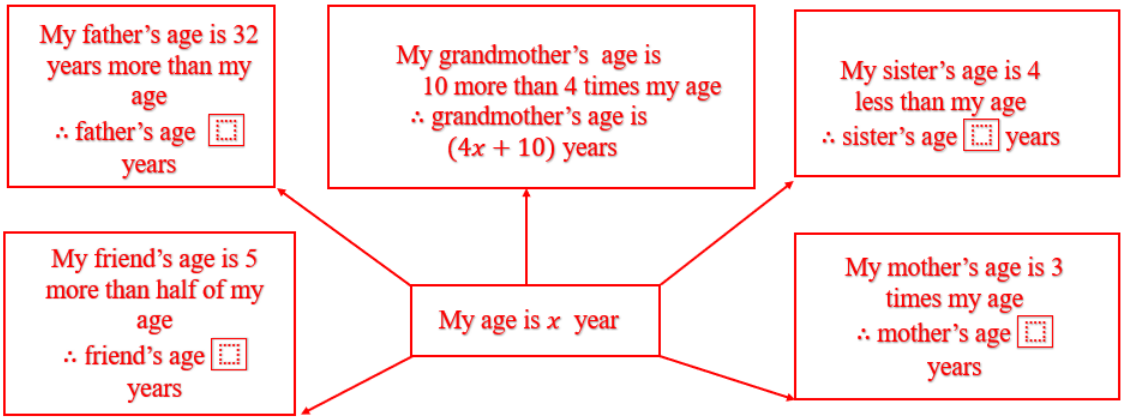
$$= 2(76 + 57)$$

$$= 2(133)$$

$$= 266\text{m}$$

∴ Perimeter of a rectangle is 266m.

15. Complete the activity given below. Find the ages of other persons from the given information.



(i) If my father's age is 48 years then what will be my age ?

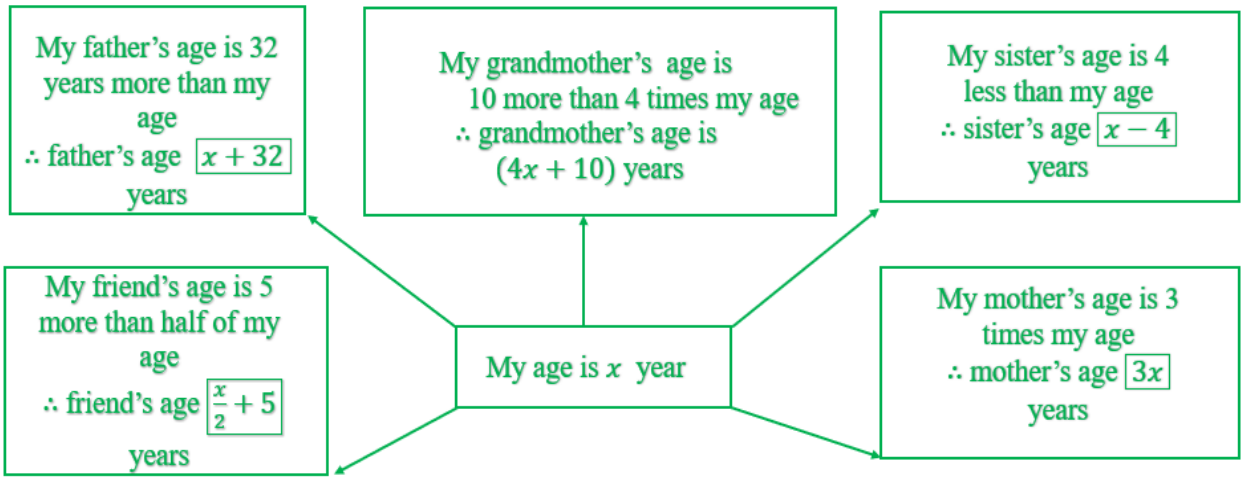
(ii) If my grandmother's age is 78 years then what will be my age ?

(iii) What will be my age if my sister's age is 22 years ?

(iv) What will be my age if my friend's age is 16 years ?

(v) What will be my age if my mother's age is 39 years ?

Solution:



(i) According to the given information in the activity.

My age $= x$ years.

∴ Father's age $= (x + 32)$ years.

But father's age is 48 years. ……. (given)

∴ $x + 32 = 48$

Subtracting 32 from both the sides,

$$x + 32 - 32 = 48 - 32$$

$$\therefore x = 16$$

∴ My age is 16 years.

(ii) According to the given information in the activity.

My age $= x$ years.

$\therefore$ **Grandmother's age** $= (4x + 10)$ **years**

But grandmother's age is 78 years. ……. (given)

$$\therefore 4x + 10 = 78$$

Subtracting 10 from both the sides,

$$4x + 10 - 10 = 78 - 10$$

$$\therefore 4x = 68$$

$$\therefore x = \frac{68}{4}$$

$$\therefore x = 17$$

$\therefore$ **My age is 17 years.**

(iii) According to the given information in the activity.

My age $= x$ **years.**

$\therefore$ **Sister's age** $= (x - 4)$ **years.**

But sister's age is 22 years. ……. (given)

$$\therefore x - 4 = 22$$

Adding 4 on both the sides,

$$\therefore x - 4 + 4 = 22 + 4$$

$$\therefore x = 26$$

$\therefore$ **My age is 26 years.**

(iv) According to the given information in the activity.

My age $= x$ years.

$\therefore$ friend's age $= \frac{x}{2} + 5$ years.

But friend's age is 16 years. ……. (given)

$$\therefore \frac{x}{2} + 5 = 16$$

$$\therefore x + 10 = 32$$

$$\therefore x = 32 - 10$$

$$\therefore x = 22$$

$\therefore$ My age is 22 years.

(v) According to the given information in the activity.

My age $= x$ years.

$\therefore$ Mother's age $= 3x$ years.

But mother's age is 39 years. ……. (given)

$$\therefore 3x = 39$$

$$\therefore x = \frac{39}{3}$$

$$\therefore x = 13$$

$\therefore$ My age is 13 years.

16. Sum of three numbers is 196. First number is $\frac{2}{5}$ times of second and second number is $\frac{5}{7}$ times of third number. Find third number is how many times of the first number. Complete the following activity.

Let the third number be x.

Second number is $\frac{5}{7}$ times of third number.

$\therefore$ Second number $=$ $\square$ $\times$ third number $=$ $\square$

First number is $\frac{2}{5}$ times of second number.

$\therefore$ First number $=$ $\square$ $\times$ second number $=$ $\square$ $\times$ $\square$

$=$ $\square$

Sum of three numbers is 196.

First number + Second number + Third number = 196

$\therefore$ $\square + \square + \square = 196$

$\therefore \left(\frac{2+5+7}{7}\right) x = \square$

$\therefore \square\, x = \square$

$\therefore 2x = \square$

$\therefore x = \square$

$\therefore$ **Third number** $= x =$ $\square$

$\therefore$ **First number** $=$ $\square$ $=$ $\square$ $\times 98 =$ $\square$

Third number is greater than first number.

$\therefore$ **Third number – first number** $=$ $\square$ $-$ $\square$ $=$ $\square$

$\therefore$ **Third number is greater than first number by** $\square$

Solution: Let the third number be x**.**

Second number is $\frac{5}{7}$ **times of third number.**

$\therefore$ **Second number** $= \boxed{\frac{5}{7}} \times$ **third number** $= \boxed{\frac{5}{7}\ x}$

First number is $\frac{2}{5}$ **times of second number.**

$\therefore$ **First number** $= \boxed{\frac{2}{5}} \times$ **Second number** $= \boxed{\frac{2}{5}} \times \boxed{\frac{5}{7}\ x} = \boxed{\frac{2}{7}x}$

Sum of three numbers is 196.

First number $+$ **Second number** $+$ **Third number** $= 196$

$\therefore \boxed{\frac{2}{7}x} + \boxed{\frac{5}{7}x} + \boxed{x} = 196$

$\therefore \left(\frac{2+5+7}{7}\right)x = \boxed{196}$

$\therefore \boxed{\frac{14}{7}}\ x = \boxed{196}$

$$\therefore\ 2x = \boxed{196}$$

$$\therefore\ x = \boxed{98}$$

$\therefore$ Third number $= x = \boxed{98}$

$\therefore$ First number $= \boxed{\frac{2}{7}x} = \boxed{\frac{2}{7}} \times 98 = \boxed{28}$

Third number is greater than first number.

$\therefore$ Third number – First number $= \boxed{98} - \boxed{28} = \boxed{70}$

$\therefore$ Third number is greater than first number by $\boxed{70}$.

17. Solve the following equations.

(1) $\frac{7x-16}{5x+6} = \frac{-1}{8}$

Solution : $\frac{7x-16}{5x+6} = \frac{-1}{8}$

$\therefore\ 8(7x-16) = -1(5x+6)$

$\therefore\ 56x - 128 = -5x - 6$

Adding $5x$ on both the sides,

$\therefore\ 56x - 128 + 5x = -5x - 6 + 5x$

$\therefore\ 61x - 128 = -6$

Adding 128 on both the sides,

$\therefore\ 61x - 128 + 128 = -6 + 128$

$$\therefore 61x = 122$$

Dividing both the sides by 61,

$$\therefore \frac{61x}{61} = \frac{122}{61}$$

$$\therefore x = 2$$

(2) $\frac{2x-5}{3x+1} = \frac{5}{16}$

Solution : $\frac{2x-5}{3x+1} = \frac{5}{16}$

$$\therefore 16(2x-5) = 5(3x+1)$$

$$\therefore 32x = 80 = 15x + 5$$

Subtracting $15x$ from both the sides,

$$\therefore 32x - 80 - 15x = 15x + 5 - 15x$$

$$\therefore 17x - 80 = 5$$

Adding 80 on both the sides,

$$\therefore 17x - 80 + 80 = 5 + 80$$

$$\therefore 17x = 85$$

Dividing both the sides by 17,

$$\therefore \frac{17x}{17} = \frac{85}{17}$$

$$\therefore x = 5$$

(3) $\frac{5x-4}{2x} = 2$

Solution : $\frac{5x-4}{2x} = 2$

$$\therefore \frac{5x-4}{2x} = \frac{2}{1}$$

$$\therefore 1(5x-4) = 2(2x)$$

$$\therefore 5x - 4 = 4x$$

Subtracting $4x$ from both the sides,

$$\therefore 5x - 4 - 4x = 4x - 4x$$

$$\therefore x - 4 = 0$$

Adding 4 on both the sides,

$$\therefore x - 4 + 4 = 0 + 4$$

$$\therefore x = 4$$

(4) $\frac{m}{3} + 2 = \frac{4m}{3} - 1$

Solution : $\frac{m}{3} + 2 = \frac{4m}{3} - 1$

Multiplying each term by 3,

$$\left(\frac{m}{3} \times 3\right) + (2 \times 3) = \left(\frac{4m}{3} \times 3\right) - (1 \times 3)$$

$$\therefore m + 6 = 4m - 3$$

Subtracting 4m from both the sides,

$$\therefore m + 6 - 4m = 4m - 3 - 4m$$

$$\therefore -3m + 6 = -3$$

Subtracting 6 from both the sides,

$$\therefore -3m + 6 - 6 = -3 - 6$$

$$\therefore -3m = -9$$

$$\therefore 3m = 9$$

Dividing both the sides by 3,

$$\therefore \frac{3m}{3} = \frac{9}{3}$$

$$\therefore m = 3$$

(5) $\frac{17 - 3x}{5} + 9 = x + \frac{2 + 4x}{3}$

Solution : $\frac{17 - 3x}{5} + 9 = x + \frac{2 + 4x}{3}$

LCM of denominators 3 and 5 is 15.

Let us multiply both the sides of given equations by 15.

$$\therefore 15 \times \frac{17 - 3x}{5} + 9 \times 15 = x \times 15 + \frac{2 + 4x}{3} \times 15$$

$$\therefore 3(17 - 3x) + 135 = 15x + 5(2 + 4x)$$

$$\therefore 51 - 9x + 135 = 15x + 10 + 20x$$

$$-9x + 186 = 35x + 10$$

Subtracting $35x$ from both sides,

$$\therefore\ -9x + 186 - 35x = 35x + 10 - 35x$$

$$\therefore 186 - 44x = 10$$

Subtracting 186 from both the sides,

$$\therefore 186 - 44x - 186 = 10 - 186$$

$$\therefore -44x = -176$$

$$\therefore 44x = 176$$

$$\therefore x = \frac{176}{44}$$

$$= \frac{44}{11}$$

$$\therefore x = 4$$

(6) $(3x + 2)(x + 2) = x\,(3x + 10)$

Solution : $(3x + 2)(x + 2) = x\,(3x + 10)$

$$\therefore 3x^2 + 6x + 2x + 4 = 3x^2 + 10x$$

Subtracting $3x^2$ **from both the sides,**

$$\therefore 3x^2 + 8x + 4 - 3x^2 = 3x^2 + 10x - 3x^2$$

$$8x + 4 = 10x$$

Subtracting $10x$ from both the sides,

$$\therefore 8x + 4 - 10x = 10x - 10x$$

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

Subtracting 4 from both the sides,

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

$$\therefore -2x = -4$$

$$\therefore 2x = 4$$

Dividing both the sides by 2,

$$\therefore \frac{2x}{2} = \frac{4}{2}$$

$$\therefore x = 2$$

(7) $4(x + 9) - 5 = 5x + 3(2 - x) + 13$

Solution : $4(x + 9) - 5 = 5x + 3(2 - x) + 13$

$$\therefore 4x + 36 - 5 = 5x + 6 - 3x + 13$$

$$\therefore 4x + 31 = 2x + 19$$

Subtracting $2x$ from both the sides,

$$\therefore 4x + 31 - 2x = 2x + 19 - 2x$$

$$\therefore 2x + 31 = 19$$

Subtracting 19 from both the sides,

$$\therefore 2x + 31 - 19 = 19 - 19$$

$$\therefore 2x + 12 = 0$$

Subtracting 12 from both the sides,

$$\therefore 2x + 12 - 12 = 0 - 12$$

$$\therefore 2x = -12$$

Dividing both the sides by 2,

$$\therefore \frac{2x}{2} = \frac{-12}{2}$$

$$\therefore x = -6$$

(8) $7n + 14 = 2n + 6$

Solution : $7n + 14 = 2n + 6$

Subtracting 2n from both the sides,

$$\therefore 7n + 14 - 2n = 2n + 6 - 2n$$

$$5n + 14 = 6$$

Subtracting 6 from both the sides,

$$\therefore 5n + 14 - 6 = 6 - 6$$

$$\therefore 5n + 8 = 0$$

Subtracting 8 from both the sides,

$$\therefore 5n + 8 - 8 = 0 - 8$$

$$\therefore 5n = -8$$

Dividing both the sides by 5,

$$\therefore \frac{5n}{5} = \frac{-8}{5}$$

$$\therefore n = \frac{-8}{5}$$

(9) $5 - 2p + 50 = 9p$

Solution : $5 - 2p + 50 = 9p$

Adding 2p on both the sides,

$$5 - 2p + 50 + 2p = 9p + 2p$$

$$\therefore 55 = 11p$$

Dividing both the sides by 11.

$$\therefore \frac{55}{11} = \frac{11p}{11}$$

$$\therefore p = 5$$

(10) $17(y + 4) + 8\,(y + 6) = 11(y + 5) + 15\,(y + 3)$

Solution : $17(y + 4) + 8\,(y + 6) = 11(y + 5) + 15\,(y + 3)$

$$\therefore 17y + 68 + 8y + 48 = 11y + 55 + 15y + 45$$

$$\therefore 25y + 116 = 26y + 100$$

Subtracting 26y from both the sides,

$$\therefore 25y + 116 - 26y = 26y + 100 - 26y$$

$$\therefore 116 - y = 100$$

$$-y = 100 - 116$$

$$\therefore -y = -16$$

$$\therefore y = 16$$

18. Complete the following activity :-

$$x - 2 = \frac{3 - x}{4}$$

Multiplying both the sides by $\square$,

$$\therefore \square \times (x - 2) = \frac{3 - x}{4} \times \square$$

$$\therefore \square \times (x - 2) = \square$$

$$\therefore \square x - \square = \square$$

Adding $\square$ on both the sides,

$$\therefore \square x - \square + \square = \square - \square + \square$$

$$\therefore \square x - \square = \square$$

$$\therefore \square x = \square + \square$$

$$\therefore \square\, x = \square$$

$$\therefore x = \square$$

Solution :

$$x - 2 = \frac{3 - x}{4}$$

Multiplying both the sides by $\boxed{4}$,

$$\therefore \boxed{4} \times (x - 2) = \frac{3 - x}{4} \times \boxed{4}$$

$$\therefore \boxed{4} \times (x - 2) = \boxed{3 - x}$$

$$\therefore \boxed{4}\, x - \boxed{8} = \boxed{3 - x}$$

Adding $\boxed{x}$ on both the sides,

$$\therefore \boxed{4}\, x - \boxed{8} + \boxed{x} = \boxed{3} - \boxed{x} + \boxed{x}$$

$$\therefore \boxed{5}\, x - \boxed{8} = \boxed{3}$$

$$\therefore \boxed{5}\, x = \boxed{3} + \boxed{8}$$

$$\therefore \boxed{5}\, x = \boxed{11}$$

$$\therefore x = \boxed{\frac{11}{5}}$$

19. Each equation is followed by the values of the variable. Decide whether these values are solutions of that equation or not.

1. $3x - 6 = x + 2, \qquad x = -2, 4, 3$

Solution : $3x - 6 = x + 2$

(i) Let us put $x = -2$ **in the given equation ,**

$$\therefore 3(-2) - 6 = -2 + 2$$

$$-6 - 6 = 0$$

$$-12 = 0$$

But $-12 \neq 0$

$\therefore$ **LHS** $\neq$ **RHS**

$\therefore x = -2$ **is not the solution of the given equation.**

(ii) Let us put $x = 4$ **in the given equation,**

$$3x - 6 = x + 2$$

$$\therefore 3(4) - 6 = 4 + 2$$

$$\therefore 12 - 6 = 6$$

$$\therefore 6 = 6$$

$\therefore x = 4$ **is the solution of the given equation.**

(iii)

Let us put $x = 3$ **in the given equation,**

$$3x - 6 = x + 2$$

$\therefore 3(3) - 6 = 3 + 2$

$\therefore 9 - 6 = 5$

$\therefore 3 = 5$

But $3 \neq 5$

$\therefore$ LHS $\neq$ RHS

$\therefore x = 3$ is not the solution of the given equation.

2. $3x + 5 = 14$, $x = 3, -3, 1$

Solution : (i) $3x + 5 - 14$

Let us put $x = 3$ in the given equation ,

$\therefore 3(3) + 5 = 14$

$\therefore 9 + 5 = 14$

$\therefore 14 = 14$

$\therefore$ LHS = RHS

$\therefore x = 3$ is the solution of the given equation.

(ii) $3x + 5 = 14$

Let us put $x = -3$ in the given equation,

$\therefore 3(-3) + 5 = 14$

$\therefore -9 + 5 = 14$

$\therefore\ -4 = 14$

But $-4 \neq 14$

$\therefore$ LHS $\neq$ RHS

$\therefore\ x = -3$ is not solution of the given equation.

(iii) $3x + 5 = 4$

Let us put $x = 1$ in the equation,

$\therefore\ 3(1) + 5 = 14$

$\therefore\ 3 + 5 = 14$

$\therefore\ 8 = 14$

But $8 \neq 14$

$\therefore$ LHS $\neq$ RHS

$\therefore\ x = 1$ is not solution of the given equation.

3. $7x = 56, \quad x = 4, -4, 8$

Solution : (i) $7x = 56$

Let us put $x = 4$ in the given equation

$\therefore\ 7(4) = 56$

$\therefore\ 28 = 56$

But $28 \neq 56$

$\therefore$ **LHS $\neq$ RHS**

$\therefore x = 4$ **is not solution of the given equation.**

(ii) $7x = 56$

Let us put $x = -4$ **in the given equation**

$\therefore 7(-4) = 56$

$\therefore -28 = 56$

But $-28 \neq 56$

$\therefore$ **LHS $\neq$ RHS**

$\therefore x = -4$ **is not solution of the given equation.**

(iii) $7x = 56$

Let us put $x = 8$ **in the given equation.**

$\therefore 7(8) = 56$

$\therefore 56 = 56$

$\therefore$ **LHS = RHS**

$\therefore x = 8$ **is the solution of the given equation.**

4. $\frac{3}{p} + 1 = 4$, $p = -1, 1, 2$

Solution : (i) $\frac{3}{p} + 1 = 4$

Let us put p = -1 **in the given equation,**

$\therefore \frac{3}{-1} + 1 = 4$

$\therefore -3 + 1 = 4$

$\therefore -2 = 4$

But $-2 \neq 4$

$\therefore$ **LHS** $\neq$ **RHS**

$\therefore p = -1$ **is not solution of the given equation.**

(ii) $\frac{3}{p} + 1 = 4$

Let us put p =1 in the given equation,

$\therefore \frac{3}{1} + 1 = 4$

$\therefore 3 + 1 = 4$

$\therefore 4 = 4$

$\therefore$ **LHS = RHS**

$\therefore$ **P = 1 is the solution of the given equation.**

(iii) $\frac{3}{p} + 1 = 4$

Let us put p = 2 in the given equation,

$\therefore \frac{3}{2} + 1 = 4$

$\therefore \frac{3+2}{2} = 4$

$\therefore 3 + 2 = 4 \times 2$

$\therefore 5 = 8$

But $5 \neq 8$

$\therefore$ **LHS** $\neq$ **RHS**

$\therefore x = 2$ **is not solution of the given equation.**

20. Write the mathematical statements of the following statements.

1) By how much is the number 15 greater than x **?**

Ans : $15 - x$

2) Which is the number if 3 is added to three times x **?**

Ans : $3x + 3$

3) Which is the number if m is less than 10 ?

Ans : $10 - m$

4) Which is the number if a **is greater than 7 ?**

Ans : $a + 7$

5) Which is the number if 20 is greater than x.

Ans : $20 + x$

21. Write equations from the following statements :-

1) The sum of half of x and 5 is 13 .

Ans : $\frac{x}{2} + 5 = 13$

2) Nine times of m is 54.

Ans : $9m = 54$

3) The sum of $\frac{1}{4}$ times of a and a is 35.

Ans : $\frac{1}{4}\ a + a = 35$

4) If the sum of y and 6, divided by 9 is 2.

Ans : $\frac{y + 6}{9} = 2$

5) The sum of twice p and 4 is 24.

Ans : $2p + 4 = 24$

22. Write the following statements in mathematical form using variable x.

1) The sum of the three consecutive natural numbers is 156.

Ans : $x + (x + 1) + (x + 2) = 156$

2) Five times of the number is greater than 5, we get 20.

Ans : $5x + 5 = 20$

3) When 10 is added to $\frac{2}{3}$ times a number then result is 26.

Ans : $\frac{2}{3}\ x + 10 = 26$

4) Sum of 4 times number and three times of the same number is 63.

Ans : $4x + 3x = 63$

5) Sum of the number and its half of the number is 450.

Ans : $\frac{x}{2} + x = 450$

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