

Linear Equations and Inequalities In one Variable

EXERCISE: 12.1

1.

i. $5x - 3 = 3x - 5$

$$5x = 3x - 5 + 3$$

$$5x = 3x - 2$$

$$5x - 3x = -2$$

$$2x = -2$$

$$\boxed{x = -1}$$

ii) $3x - 7 = 3(5 - x)$

$$3x - 7 = 15 - 3x$$

$$3x = 15 + 7 - 3x$$

$$3x + 3x = 22$$

$$6x = 22$$

$$\boxed{x = \frac{22}{6}}$$

2

i) $4(2x + 1) = 3(x - 1) + 7$

$$8x + 4 = 3x - 3 + 7$$

$$8x = 3x - 3 + 7 - 4$$

$$8x - 3x = -3 + 3 = 0$$

$$5x = 0 \Rightarrow \boxed{x = 0}$$

$$\text{ii) } 3(2p-1) = 5-(3p-2)$$

$$6p-3 = 5-3p+2$$

$$6p = 5-3p+2+3$$

$$6p+3p = 10$$

$$9p = 10$$

$$p = \frac{10}{9} = 1\frac{1}{9}$$

3.

$$\text{i) } 5y - 2[y - 3(y-5)] = 6.$$

$$5y - 2y + 6(y-5) = 6$$

$$3y + 6y - 30 = 6$$

$$9y = 6 + 30 = 36$$

$$y = \frac{36}{9} = 4$$

$$\text{ii) } 0.3(6-x) = 0.4(x+8)$$

$$1.8 - 0.3x = 0.4x + 3.2$$

$$0.4x = 1.8 - 0.3x - 3.2$$

$$0.4x + 0.3x = -1.4$$

$$0.7x = -1.4$$

$$x = \frac{-1.4}{0.7} = -2$$

4

$$i) \frac{x-1}{3} = \frac{x+2}{6} + 3$$

Multiply and divide 2 on L.H.S

$$\frac{2(x-1)}{2 \times 3} = \frac{x+2}{6} + 3$$

$$\frac{2x-1}{6} - \frac{x+2}{6} = 3$$

$$\frac{2x-1-x-2}{6} = 3$$

$$\frac{x-3}{6} = 3$$

$$x-3 = 3 \times 6$$

$$x-3 = 18$$

$$x = 18 + 3$$

$$\boxed{x = 21}$$

$$ii) \frac{x+7}{3} = 1 + \frac{3x-2}{5}$$

$$\frac{x+7}{3} = \frac{5}{5} + \frac{3x-2}{5}$$

$$\frac{x+7}{3} = \frac{5+3x-2}{5}$$

$$\frac{x+7}{3} = \frac{3x+3}{5}$$

Cross multiplying

$$5(x+7) = 3(3x+3)$$

$$5x+35 = 9x+9$$

$$9x = 5x+35-9$$

$$9x-5x = 26$$

$$4x = 26$$

$$x = \frac{26}{4} = \frac{13}{2} = 6\frac{1}{2}$$

5. i)

$$\frac{y+1}{3} - \frac{y-1}{2} = \frac{1+2y}{3}$$

Multiplying both sides by 6 i.e LCM of 3,2,3 we get

$$2(y+1) - 3(y-1) = 2(1+2y)$$

$$2y+2 - 3y+3 = 2+4y$$

$$5-y = 4y+2$$

$$4y+y = 5-2$$

$$5y = 3$$

$$y = \frac{3}{5}$$

ii)

$$\frac{p}{3} + \frac{p}{4} = 55 - \frac{p+40}{5}$$

$$\frac{4p+3p}{12} = \frac{55 \times 5}{5} - \frac{p+40}{5}$$

$$\frac{7p}{12} = \frac{275 - p - 40}{5}$$

$$\frac{7p}{12} = \frac{235-p}{5}$$

Cross multiplication

$$7p \times 5 = 12(235-p)$$

$$35p = 12 \times 235 - 12p$$

$$35p + 12p = 12 \times 235$$

$$47p = 12 \times 235$$

$$p = \frac{12 \times 235}{47}$$

$$p = 60$$

6. i) $n - \frac{n-1}{2} = 1 - \frac{n-2}{3}$

$$\frac{2n - (n-1)}{2} = \frac{3 - (n-2)}{3}$$

$$\frac{2n - n + 1}{2} = \frac{3 - n + 2}{3}$$

$$\frac{n+1}{2} = \frac{5-n}{3}$$

Cross multiplication

$$3 \times (n+1) = 2(5-n)$$

$$3n + 3 = 10 - 2n$$

$$3n + 2n = 10 - 3$$

$$5\eta = 7$$

$$\boxed{\eta = 7/5}$$

$$\text{ii) } \frac{3t-2}{3} + \frac{2t+3}{2} = t + \frac{7}{6}$$

$$\frac{3t-2}{3} + \frac{2t+3}{2} = \frac{6t+7}{6}$$

Multiplying 6 on both sides

$$2(3t-2) + 3(2t+3) = 1(6t+7)$$

$$6t-4 + 6t+9 = 6t+7$$

$$6t+5 = 7$$

$$6t = 7-5 = 2$$

$$\boxed{t = 2/6 = 1/3}$$

7

$$\text{i) } 4(3x+2) - 5(6x-1) = 2(x-8) - 6(7x-4)$$

$$12x+8 - 30x+5 = 2x-16 - 42x+24$$

$$13 - 18x = 8 - 40x$$

$$40x - 18x + 13 = 8$$

$$22x = 8 - 13 = -5$$

$$\boxed{x = \frac{-5}{22}}$$

$$\text{ii. } 3(5x+7) + 5(2x-11) = 3(8x-5) - 15$$

$$15x + 21 + 10x - 55 = 24x - 15 - 15$$

$$25x - 34 = 24x - 30$$

$$25x - 24x = 34 - 30$$

$$x = 4$$

8.

$$\text{i) } \frac{3-2x}{2x+5} = -\frac{3}{11}$$

Cross Multiplying both sides

$$-11(3-2x) = 3(2x+5)$$

$$22x - 33 = 6x + 15$$

$$22x - 6x = 33 + 15$$

$$16x = 48$$

$$\boxed{x=3}$$

$$\text{ii) } \frac{5p+2}{8-2p} = \frac{7}{6}$$

Cross Multiplying on both sides

$$6(5p+2) = 7(8-2p)$$

$$30p + 12 = 56 - 14p$$

$$30p + 14p = 56 - 12$$

$$44p = 44 \Rightarrow \boxed{p=1}$$

9

$$i) \frac{5}{x} = \frac{7}{x-4}$$

Cross multiplying on both sides

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

$$7x = 5x - 20$$

$$2x = -20$$

$$\boxed{x = -10}$$

$$ii) \frac{4}{2x+3} = \frac{5}{x+4}$$

Cross multiplication on both sides

$$5(2x+3) = 4(x+4)$$

$$10x + 15 = 4x + 16$$

$$10x - 4x = 16 - 15$$

$$6x = 1 \Rightarrow \boxed{x = \frac{1}{6}}$$

10

$$i) \frac{2x+5}{2} - \frac{5x}{x-1} = x$$

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

$$2x^2 - 2x + 5x - 5 - 10x = 2x(x-1)$$

$$2x^2 + 3x - 5 - 10x = 2x^2 - 2x$$

$$-7x - 5 = -2x$$

$$-5 = 7x - 2x$$

$$5x = -5$$

$$\boxed{x = -1}$$

$$\text{ii) } \frac{1}{5} \left(\frac{1}{3x} - 5 \right) = \frac{1}{3} \left(3 - \frac{1}{x} \right)$$

$$\frac{1}{5} \left(\frac{1-15x}{3x} \right) = \left(\frac{3x-1}{3x} \right)$$

$$1-15x = 5(3x-1)$$

$$1-15x = 15x-5$$

$$15x+15x = 1+5$$

$$30x = 6$$

$$\boxed{x = \frac{6}{30} = \frac{1}{5}}$$

$$\text{ii) } \frac{2x-3}{2x-1} = \frac{3x-1}{3x+1}$$

Subtracting "1" on both sides

$$\frac{2x-3}{2x-1} - 1 = \frac{3x-1}{3x+1} - 1$$

$$\frac{2x-3-2x+1}{2x-1} = \frac{3x-1-3x-1}{3x+1}$$

$$\frac{-2}{2x-1} = \frac{-2}{3x+1}$$

$$3x+1 = 2x-1$$

$$3x-2x = -1-1$$

$$\boxed{x = -2}$$

ii)

$$\frac{2y+3}{3y+2} = \frac{4y+5}{6y+7}$$

Cross multiplication

$$(2y+3)(6y+7) = (3y+2)(4y+5)$$

$$12y^2 + 14y + 18y + 21 = 12y^2 + 15y + 8y + 10$$

$$32y + 21 = 23y + 10$$

$$32y - 23y = 10 - 21$$

$$9y = -11$$

$$\boxed{y = -\frac{11}{9}}$$

$$12. \quad x = p + 1$$

$$\frac{5x-30}{2} - \frac{7p+1}{3} = \frac{1}{4}$$

Multiplying 12 on both sides

$$6(5x-30) - 4(7p+1) = 3$$

$$30x - 180 - 28p - 4 = 3$$

$$30(p+1) - 180 - 28p - 4 - 3 = 0$$

$$30p + 30 - 180 - 28p - 7 = 0$$

$$2p - 157 = 0$$

$$\boxed{p = \frac{157}{2}}$$

$$13. \quad \frac{x+3}{3} - \frac{x-2}{2} = 1 \quad \text{if } \frac{1}{x} + p = 1$$

Multiplying 6 on both sides

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

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

$$\boxed{x = 6}$$

$$\frac{1}{x} + p = 1 \Rightarrow p = 1 - \frac{1}{x} = 1 - \frac{1}{6}$$

$$\boxed{p = \frac{5}{6}}$$

EXERCISE: 12.2

1.

Let the number be 'x'

Three more than twice a number is

$$= 2x + 3 \text{ --- ①}$$

Four less than the number = $x - 4$ --- ②

$$\text{①} = \text{②}$$

$$2x + 3 = x - 4$$

$$2x - x = -4 - 3$$

$$\boxed{x = -7}$$

The number is "-7"

2

Let the four consecutive integers are $x+1, x+2, x+3, x+4$.

Given sum of them = 46

$$x+1 + x+2 + x+3 + x+4 = 46$$

$$4x + 10 = 46$$

$$4x = 46 - 10 = 36$$

$$\boxed{x = 9}$$

The integers are $9+1, 9+2, 9+3, 9+4$.

$$= 10, 11, 12, 13.$$

3.

Let the number be "x"

Manjula subtracts $\frac{7}{3}$ from it = $x - \frac{7}{3}$.

The above result is multiplied by 6 i.e. $6(x - \frac{7}{3})$

Now it is equal 2 less than twice the number 'x'

$$\text{i.e. } 6(x - \frac{7}{3}) = 2x - 2$$

$$6x - 14 = 2x - 2$$

$$6x - 2x = 14 - 2$$

$$4x = 12$$

$$\boxed{x = 3}$$

4.

Let the numbers be x, 7x

15 is added to both numbers, then

it becomes $x+15$, $7x+15$

Then one new number becomes $\frac{5}{2}$ times the other new number.

$$7x + 15 = \frac{5}{2}(x + 15)$$

$$2(7x + 15) = 5(x + 15)$$

$$14x + 30 = 5x + 75$$

$$14x - 5x = 75 - 30$$

$$9x = 45$$

$$\boxed{x = 5}$$

Therefore the numbers are 5, 35.

5. Let the three consecutive even integers are $x, x+2, x+4$

$$\text{Given, Sum} = 0.$$

$$x + x + 2 + x + 4 = 0.$$

$$3x + 6 = 0$$

$$3x = -6$$

$$\boxed{x = -2}$$

$$\begin{aligned} \therefore \text{The integers are } & -2, -2+2, -2+4 \\ & = -2, 0, 2 \end{aligned}$$

6. Let the two consecutive odd integers are $x+1, x+3$.

Given two-fifths of smaller exceeds two-ninth of greater by 4.

$$\frac{2}{5}(x+1) + 4 = \frac{2}{9}(x+3)$$

$$\frac{2x+2+20}{5} = \frac{2x+6}{9}$$

Cross multiplication.

$$(2x+22)9 = 5(2x+6)$$

$$18x + 198 = 10x + 30$$

$$18x - 10x = 30 - 198$$

$$8x = -168$$

$$\boxed{x = -21}$$

$$x+1 = -21+1 = -20$$

$$x+3 = -21+3 = -18$$

The consecutive odd integers are $-20, -18$

7. Given the denominator of a fraction is 1 more than twice its numerator.

It is written as $\frac{x}{2x+1}$

Given Numerator and Denominator are both increased by 5
it becomes $\frac{3}{5}$.

$$\text{i.e. } \frac{x+5}{2x+1+5} = \frac{3}{5}$$

$$\frac{x+5}{2x+6} = \frac{3}{5}$$

Cross multiplication.

$$5(x+5) = 3(2x+6)$$

$$5x + 25 = 6x + 18$$

$$6x - 5x = 25 - 18 \quad \therefore \frac{x}{2x+1} = \frac{7}{2(7)+1} = \frac{7}{14+1}$$

$$\boxed{x = 7} \quad = \frac{7}{15}$$

Therefore the original fraction is $\frac{7}{15}$.

8.

Let the two numbers are $2x$, $5x$

Given their difference is 15

$$\text{i.e. } 5x - 2x = 15$$

$$3x = 15$$

$$x = 15/3 = 5$$

$$\boxed{x = 5}$$

Therefore the two positive numbers are 10, 25

9.

Let the number added to each be 'x'

on adding 'x' to each of the numbers, it becomes

$$12+x, 22+x, 42+x, 72+x$$

For the numbers to be in proportion

$$\frac{12+x}{22+x} = \frac{42+x}{72+x}$$

Cross Multiplication.

$$(x+12)(x+72) = (x+22)(x+42)$$

$$x^2 + 72x + 12x + 864 = x^2 + 22x + 42x + 924$$

$$84x + 864 = 64x + 924$$

$$84x - 64x = 924 - 864$$

$$20x = 60$$

$$\boxed{x=3}$$

So the number that must be added is $x=3$

10.

Let the unit's digit be x .

As the difference of both digits is 3, the ten's digit is

$$x+3$$

\therefore The number is $10x(x+3) + x$

On reversing the digits, we have ten's digit ' x ' and

$(x+3)$ at unit's place.

The new number = $10x + (x+3)$

By adding both number, we get 143.

$$10(x+3) + x + 10x + (x+3) = 143$$

$$10x + 30 + x + 10x + x + 3 = 143$$

$$22x + 33 = 143$$

$$22x = 143 - 33$$

$$22x = 110$$

$$\boxed{x = 5}$$

$$\begin{aligned}\therefore 10(x+3) + x &= 10(5+3) + 5 \\ &= 80 + 5 = 85\end{aligned}$$

\therefore The two digit number is 85

12

Let the Raju's present age be x years.

Then, Ritu's present age be $4x$ years.

In four times, Ritu's age will be twice of Raju's age.

$$\text{i.e. } 4x + 4 = 2(x + 4)$$

$$4x + 4 = 2x + 8$$

$$4x - 2x = 8 - 4$$

$$2x = 4$$

$$\boxed{x = 2}$$

\therefore The present ages of Raju, Ritu are 2, 8 years.

11. Let the unit's digit be "x"

Then, the ten's digit number be "11-x"

$$\text{The two digit number} = 10(11-x) + x.$$

When we interchange the digits, the resulting new number is greater than original number by 63.

$$\text{ie } 10(x) + (11-x) = 10(11-x) + x + 63.$$

$$10x + 11 - x = 110 - 10x + x + 63.$$

$$9x + 11 = 173 - 9x$$

$$9x + 9x = 173 - 11$$

$$18x = 162$$

$$\boxed{x = 9}$$

$$\begin{aligned} \therefore 10(11-x) + x &= 10(11-9) + 9 \\ &= 10(2) + 9 = 20 + 9 = 29. \end{aligned}$$

\therefore The two digit number is 29.

13. Let the son's age be "x" years.

Then the father age be "7x" years.

Two years ago, father was 13 times as old as his son.

$$7x - 2 = 13(x - 2)$$

$$7x - 2 = 13x - 26$$

$$13x - 7x = 26 - 2$$

$$6x = 24$$

$$\boxed{x = 4}$$

Their present age of son, father are 4, 28.

14. Let the ages of sona and sonali are $5x$, $3x$.

Five years hence, the ratio of their ages were 10:7

$$\text{i.e. } \frac{5x+5}{3x+5} = \frac{10}{7}$$

Cross Multiplication

$$7(5x+5) = 10(3x+5)$$

$$35x + 35 = 30x + 50$$

$$35x - 30x = 50 - 35$$

$$5x = 15$$

$$\boxed{x = 3}$$

Therefore their present ages are 15, 9.

15. An employee works on a contract of 30 days for that he will receive ₹ 200 for each day and he will be fined ₹ 20 for each day he is absent.

Let the number he remains absent be 'x' days

then the no of days he worked are '30-x' days.

$$\therefore 200(30-x) - 20x = 3,800$$

$$6,000 - 200x - 20x = 3,800$$

$$220x = 6,000 - 3,800$$

$$220x = 2,200$$

$$\boxed{x = 10}$$

\therefore The no. of days he remained absent are 10 days

16. Let the no of ₹ 5 coins be x.

no of ₹ 2 coins be 3x

no of ₹ 1 coins be 160-4x.

Total ₹ 300 in coins of denomination

$$\therefore 5x(1) + 2(3x) + 1(160-4x) = 300.$$

$$5x + 6x + 160 - 4x = 300.$$

$$7x = 300 - 160$$

$$7x = 140$$

$$\boxed{x = 20}$$

Coins of each denomination are

$$₹ 5 \text{ Coins} = 20$$

$$₹ 2 \text{ Coins} = 60$$

$$₹ 1 \text{ Coins} = 80$$

17 Let the no. of passengers with ₹ 5 tickets be 'x'

The No. of passengers with ₹ 7.5 tickets be '40-x'

Total receipts from passengers is ₹ 230

$$\text{i.e. } 5x + 7.5(40-x) = 230$$

$$5x + 300 - 7.5x = 230$$

$$7.5x - 5x = 300 - 230$$

$$2.5x = 70$$

$$x = \frac{70}{2.5}$$

$$x = 28$$

∴ Number of passengers with ₹ 5 tickets are 28

18. Let the no. of students in the group be 'x'

They paid equally for use of a full boat and

pay ₹ 10 each i.e. = $10 \times x = 10x$ — ①

If there are 3 more students in group, each would have

paid ₹ 2 less i.e. ₹ 8 i.e. = $8 \times (x+3)$ — ②

$$\text{①} = \text{②}$$

$$10x = 8(x+3)$$

$$10x = 8x + 24$$

$$2x = 24$$

$$\boxed{x = 12}$$

∴ No. of students in group are 12

19. Let the number of deer in the herd be 'x'

Half of a herd of deer are grazing in field i.e. = $\frac{1}{2}x$

Three fourths of remaining are playing i.e. = $\frac{3}{4}(\frac{1}{2}x)$
= $\frac{3}{8}x$

The rest 9 are drinking water

$$\text{i.e. } x - \left\{ \frac{x}{2} + \frac{3x}{8} \right\} = 9$$

$$x - \frac{4x + 3x}{8} = 9$$

$$\frac{8x - 7x}{8} = 9$$

$$\frac{x}{8} = 9$$

$$\boxed{x = 72}$$

Number of deer in the herd are 72

20. Let the no. of flower in the beginning be "x"

$$\text{At 1st temple she offers} = \frac{1}{2} \times x = \frac{x}{2}$$

$$\text{2nd temple she offer} = \frac{1}{2} \times \frac{x}{2} = \frac{x}{4}$$

$$\text{3rd temple she offer} = \frac{1}{2} \times \frac{x}{4} = \frac{x}{8}$$

Now she is left with 6 flowers at end

$$\text{i.e. } x - \left\{ \frac{x}{2} + \frac{x}{4} + \frac{x}{8} \right\} = 6$$

$$x - \frac{4x + 2x + x}{8} = 6$$

$$\frac{8x - 7x}{8} = 6$$

$$\frac{x}{8} = 6$$

$$\boxed{x = 48}$$

∴ No. of flowers in the beginning are 48.

21. Let the two supplementary angles be x , $90-x$

These angles differ by 50° .

$$\text{i.e. } 90 - x - x = 50$$

$$90 - 2x = 50$$

$$2x = 90 - 50$$

$$2x = 40$$

$$\boxed{x = 20^\circ}$$

\therefore The two supplementary angles are $20^\circ, 70^\circ$.

22. Let the angles of triangle are $5x, 6x, 7x$.

Sum of angles of Triangle = 180°

$$\text{i.e. } 5x + 6x + 7x = 180$$

$$18x = 180$$

$$\boxed{x = 10}$$

\therefore The angles of triangle are $50^\circ, 60^\circ, 70^\circ$.

23. Two equal sides of an isosceles triangle are $3x-1, 2x+2$

$$\text{i.e. } 3x - 1 = 2x + 2$$

$$3x - 2x = 2 + 1$$

$$\boxed{x=3}$$

The third side is $2x = 2 \times 3 = 6$ Units.

The two sides are $3x-1 = 3 \times 3 - 1 = 9-1 = 8$ Units

$$2x+2 = 2 \times 3 + 2 = 6+2 = 8 \text{ Units}$$

$$\therefore \text{Perimeter of triangle} = 6+8+8 = 22 \text{ Units}$$

24.

Let the perimeter of given triangle be x cm.

As each side is increased by 4 cm, so the perimeter is increased by $3 \times 4 = 12$ cm

According to given information.

$$\frac{x+12}{x} = \frac{7}{5}$$

(Cross Multiplication)

$$7x = 5(x+12)$$

$$7x = 5x + 60$$

$$7x - 5x = 60$$

$$2x = 60$$

$$\boxed{x=30}$$

\therefore perimeter of given triangle = 30 cm

25. Length of a rectangle is 5cm less than twice its breadth

$$\text{i.e. } l = 2b - 5 \Rightarrow 2b = l + 5 \text{ --- (1)}$$

Length is decreased by 3cm i.e. $(l-3)$ cm

breadth is increased by 2cm i.e. $(b+2)$ cm

Resulting perimeter of rectangle is 72 cm

$$2(l-3+b+2) = 72$$

$$2l + 2b - 2 = 72$$

From eq (1) we get

$$2l + l + 5 - 2 = 72$$

$$3l + 3 = 72$$

$$3l = 72 - 3$$

$$3l = 69$$

$$l = 23 \text{ cm}$$

\therefore Length of Rectangle = 23 cm

$$\text{From eq (1) } 2b = l + 5 = 23 + 5$$

$$2b = 28 \Rightarrow b = 14 \text{ cm}$$

\therefore breadth of Rectangle = 14 cm

$$\therefore \text{Area of Rectangle} = l \times b = 23 \times 14 = 322 \text{ cm}^2$$

26.

Length of rectangle $l = 10 \text{ cm}$ breadth of rectangle $b = 8 \text{ cm}$

Each side of rectangle is increased by $x \text{ cm}$, its perimeter is doubled.

$$\begin{aligned} \text{Perimeter of rectangle} &= 2(10+8) = 2 \times 18 \\ &= 36 \text{ cm.} \end{aligned}$$

$$\text{i.e. } 2[(10+x) + (8+x)] = 2 \times 36 \quad [\because \text{perimeter is doubled}]$$

$$18 + 2x = 36 \quad \text{--- (1)}$$

$$2x = 36 - 18 = 18$$

$$x = 18/2 = 9$$

$$\boxed{x = 9 \text{ cm}}$$

$$\begin{aligned} \text{Area of new rectangle} &\text{ is } (10+9) \times (8+9) \\ &= 19 \times 17 = 323 \text{ cm}^2. \end{aligned}$$

27.

Let the speed of streamer in still water be $x \text{ km/h}$

Given the speed of stream = 5 km/h .

The speed of streamer downstream = $(x+5) \text{ km/h}$.

Speed of streamer upward stream = $(x-5) \text{ km/h}$.

Both upstream and down stream takes same time

Time Taken by Streamer for down stream is $\frac{90}{x+5}$ hrs

Time taken by streamer for up stream is $\frac{60}{x-5}$ hrs

$$\text{i.e. } \frac{90}{x+5} = \frac{60}{x-5}$$

Cross Multiplication

$$3(x-5) = 2(x+5)$$

$$3x - 15 = 2x + 10$$

$$3x - 2x = 10 + 15$$

$$\boxed{x = 25}$$

\therefore Speed of streamer in still water = 25 km/h

28

Let the speed of streamer in still water be " x "

Given, the speed of stream = 1 km/h

Speed of streamer down stream = $(x+1)$ km/h

Speed of streamer up stream = $(x-1)$ km/h

Distance Covered by streamer, downstream = $5(x+1)$ km

Distance covered by streamer, up stream = $6(x-1)$ km

According to given information

$$5(x+1) = 6(x-1)$$

$$5x+5 = 6x-6$$

$$6x-5x = 5+6$$

$$\boxed{x = 11}$$

∴ Speed of Streamer in still water is 11 km/h

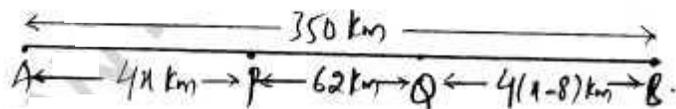
$$\begin{aligned} \text{Distance between two ports} &= 5(x+1) = 5(11+1) \\ &= 60 \text{ km} \end{aligned}$$

29. Let the speed of faster car be x km/h.

Then the speed of other car be $(x-8)$ km/h

Let the faster car starts from place A and the slower car starts from place B.

Let P and Q be their position after 4 hours



$$AP = 4x \text{ km}, BQ = 4(x-8) \text{ km}, PQ = 62 \text{ km}$$

According to the given pb.

$$AP + PQ + BQ = 350$$

$$4x + 62 + 4(x-8) = 350$$

$$4x + 62 + 4x - 32 = 350$$

$$8x + 30 = 350$$

$$8x = 350 - 30 = 320$$

$$x = 320/8$$

$$\boxed{x = 40 \text{ km/hr}}$$

\therefore Speed of faster car is 40 km/hr. and the speed of slower car is $(40 - 8)$ i.e. 32 km/hr.

EXERCISE : 12.3.

i) $x > -2$

Solution set = $\{-1, 0, 1, 3\}$

ii) $x < -2$

Solution set = $\{-7, -5, -3\}$

iii) $x > 2$

Solution set = $\{3\}$

iv) $-5 < x \leq 5$

Solution set = $\{-3, -1, 0, 1, 3\}$

v) $-8 < x < 1$

Solution set = $\{-7, -5, -3, -1, 0\}$

vi) $0 \leq x \leq 4$

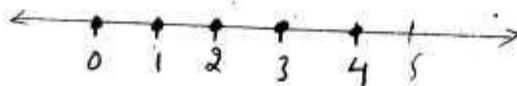
Solution set = $\{0, 1, 3\}$

2. It is shown by tick dots on number line.

i) $x \leq 4, x \in \mathbb{N}$



ii) $x < 5, x \in \mathbb{W}$

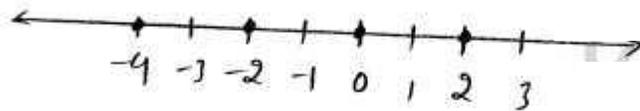


iii) $-3 \leq x < 3, x \in \mathbb{I}$



3. Replacement set = $\{-6, -4, -2, 0, 2, 4, 6\}$

$$-4 \leq x < 4$$



4.

i) $\{1, 2, 3, \dots, 10\}$



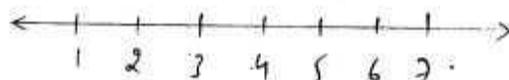
ii) $\{-1, 0, 1, 2, 5, 8\}$



iii) $\{-5, 10\}$



iv) $\{5, 6, 7, 8, 9, 10\}$



Solution set = Φ .

5 i) $2x - 3 > 7$

$$2x > 7 + 3$$

$$2x > 10$$

$$x > 5$$

$$\text{Solution set} = \{6, 9, 12\}$$

ii) $3x + 8 \leq 2$

$$3x \leq 2 - 8$$

$$3x \leq -6$$

$$x \leq -2$$

$$\text{Solution set} = \{-6, -3\}$$

iii) $-3 < 1 - 2x$

$$3 > 2x - 1$$

$$2x - 1 < 3$$

$$2x < 3 + 1$$

$$2x < 4$$

$$x < 2$$

$$\text{Solution set} = \{-6, -3, 0\}$$

6. i) $4x+1 < 17, x \in \mathbb{N}$

$$4x < 17-1$$

$$4x < 16$$

$$x < 4, x \in \mathbb{N}$$

As $x \in \mathbb{N}$, the solution set is $\{1, 2, 3\}$

ii) $4x+1 \leq 17, x \in \mathbb{W}$

$$4x \leq 17-1$$

$$4x \leq 16$$

$$x \leq 4$$

As $x \in \mathbb{W}$, the solution set is $\{0, 1, 2, 3, 4\}$

iii) $4 > 3x-11, x \in \mathbb{N}$

$$3x-11 < 4$$

$$3x < 4+11$$

$$3x < 15$$

$$x < 5$$

As $x \in \mathbb{N}$, the solution set is $\{1, 2, 3, 4\}$

iv) $-17 \leq 9x-8, x \in \mathbb{Z}$

$$9x-8 \geq -17$$

$$9x \geq -17+8$$

$$9x \geq -9$$

$$x \geq -1$$

As $x \in \mathbb{Z}$, the solution set is $\{-1, 0, 1, 2, 3, \dots\}$

$$7. i) \frac{2y-1}{5} \leq 2, y \in \mathbb{N}$$

$$2y-1 \leq 10$$

$$2y \leq 10+1$$

$$2y \leq 11$$

$$y \leq \frac{11}{2}$$

As $y \in \mathbb{N}$, the solution set is $\{1, 2, 3, 4, 5\}$

$$ii) \frac{2y+1}{3} + 1 \leq 3, y \in \mathbb{W}$$

$$\frac{2y+1}{3} \leq 3-1$$

$$\frac{2y+1}{3} \leq 2$$

$$2y+1 \leq 6$$

$$2y \leq 6-1$$

$$2y \leq 5$$

$$y \leq \frac{5}{2}$$

As $y \in \mathbb{W}$, the solution set is $\{0, 1, 2\}$

$$iii) \frac{2}{3}p + 5 < 9, p \in \mathbb{W}$$

$$\frac{2}{3}p < 9-5$$

$$\frac{2}{3}p < 4$$

$$2p < 12$$

$$p < 6$$

As $p \in \mathbb{W}$, the solution set is $\{0, 1, 2, 3, 4, 5\}$

iv. $-2(p+3) > 5 \quad p \in \mathbb{I}$

Multiplying '-' on both sides

$$2(p+3) < -5$$

$$2p+6 < -5$$

$$2p < -5-6$$

$$2p < -11$$

$$p < -\frac{11}{2}$$

As $p \in \mathbb{I}$, the solution set is $\{-9, -8, -7, -6\}$

8.

i) $2x-3 < x+2, \quad x \in \mathbb{N}$

$$2x < x+2+3$$

$$2x-x < 5$$

$$x < 5$$

As $x \in \mathbb{N}$, the solution set is $\{1, 2, 3, 4\}$

ii) $3-x \leq 5-3x, \quad x \in \mathbb{W}$

$$3-x+3x \leq 5$$

$$2x + 3 \leq 5$$

$$2x \leq 5 - 3$$

$$2x \leq 2$$

$$x \leq 1$$

As $x \in \mathbb{N}$, the solution set is $\{0, 1\}$

iv. $\frac{3}{2} - \frac{x}{2} > -1, x \in \mathbb{N}$

$$\frac{3-x}{2} > -1$$

$$3-x > -2$$

Multiplying with "-" on both sides

$$x-3 < 2$$

$$x < 2+3$$

$$x < 5$$

As $x \in \mathbb{N}$, the solution set is $\{1, 2, 3, 4\}$

9. $\{-3, -2, -1, 0, 1, 2, 3\}$

$$\frac{3x-1}{2} < 2$$

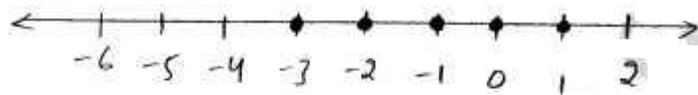
$$3x-1 < 4$$

$$3x < 4+1$$

$$3x < 5$$

$$x < 5/3.$$

As x should be in replacement set, the solution set is $\{-3, -2, -1, 0, 1\}$.



10.

$$\frac{x}{3} + \frac{1}{4} < \frac{x}{6} + \frac{1}{2}, x \in \mathbb{W}$$

$$\frac{x}{3} - \frac{x}{6} + \frac{1}{4} < \frac{1}{2}$$

$$\frac{x}{3} - \frac{x}{6} < \frac{1}{2} - \frac{1}{4}$$

$$\frac{2x - x}{6} < \frac{2 - 1}{4}$$

$$\frac{x}{6} < \frac{1}{4}$$

$$x < \frac{6}{4}$$

$$x < \frac{3}{2}$$

As $x \in \mathbb{W}$, the solution set is $\{0, 1\}$

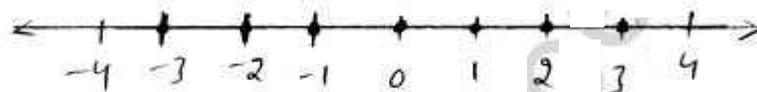
$$\text{ii) } -4 \leq 4x < 14, \quad x \in \mathbb{N}$$

$$4x \geq -4 \quad ; \quad 4x < 14$$

$$x \geq -1 \quad ; \quad x < \frac{14}{4}$$

$$x < \frac{7}{2}$$

As $x \in \mathbb{N}$, the solution set is $\{-1, 0, 1, 2, 3\}$



$$\text{ii) } -1 < \frac{x}{2} + 1 \leq 3, \quad x \in \mathbb{I}$$

$$\frac{x}{2} + 1 > -1 \quad ; \quad \frac{x}{2} + 1 \leq 3$$

$$\frac{x}{2} > -1 - 1 \quad ; \quad \frac{x}{2} \leq 3 - 1$$

$$\frac{x}{2} > -2 \quad ; \quad \frac{x}{2} \leq 2$$

$$x > -4 \quad ; \quad x \leq 4$$

$$\text{i.e. } -4 < x \leq 4$$

As $x \in \mathbb{I}$, the solution set is $\{-3, -2, -1, 0, 1, 2, 3, 4\}$

