06

Linear Equation in One Variable

Equation

An equation is a statement of equality involving variables and it has an equality sign (=).

e.g. $3xy + 5x^2 = 6x$ is an equation.

Linear Equations in One Variable

The equations, in which the highest power of the variable appearing in the expression is 1, are called linear equations in one variable.

i.e. the linear equation is in the form of $ax + b = 0$, where $a \neq 0$.

☞ The graph of linear equation represents a straight line.

Properties of Linear Equation

(i) If same number is added or subtracted to both the sides of an equation, the equality remains the same.

(ii) If same number is multiplied to both the sides of the equation, the equality remains the same.

(iii) If both sides are divided by a same non-zero number, the equality remains the same.

☞ Any term can be taken to the other side with its sign changed, without affecting the equality.

Example 1 If $\frac{3}{7} + x = \frac{17}{7}$, then the value of x is

(a) 1 (b) 2 (c) 3 (d) 4

Sol. (b) We have, $\frac{3}{7} + x = \frac{17}{7} \Rightarrow x = \frac{17}{7} - \frac{3}{7}$

$\left[\text{transposing } \frac{3}{7} \text{ from LHS to RHS}\right]$

$\Rightarrow \quad x = \frac{17-3}{7} \Rightarrow x = \frac{14}{7} = 2$

Example 2 Solve the equation $2(x-3) - (5-3x) = 3(x+1) - 4(2+x)$.

(a) 2 (b) 1 (c) 3 (d) 4

Sol. (b) Given,

$$2(x-3) - (5-3x) = 3(x+1) - 4(2+x)$$

$$\Rightarrow \quad 2x - 6 - 5 + 3x = 3x + 3 - 8 - 4x$$

$$\Rightarrow \quad 5x - 11 = -x - 5$$

$$\Rightarrow \quad 6x = 6$$

$$\Rightarrow \quad x = 1$$

Example 3 If $\frac{17-3x}{5} - \frac{4x+2}{3} = 5 - 6x + \frac{7x+14}{3}$, then the value of x is

(a) $x = 9$ (b) $x = 8$
(c) $x = 4$ (d) $x = 7$

Sol. (c) We have,

$$\frac{17-3x}{5}-\frac{4x+2}{3}=5-6x+\frac{7x+14}{3}$$

The LCM of 5 and 3 is 15, so we multiplying both sides by 15.

$\therefore\ 3(17-3x)-5(4x+2)=15(5-6x)+5(7x+14)$

$\Rightarrow\ 51-9x-20x-10=75-90x+35x+70$

$\Rightarrow\ 41-29x=145-55x$

$\Rightarrow\ -29x+55x=145-41$

$\Rightarrow\ 26x=104 \Rightarrow \frac{26x}{26}=\frac{104}{26}$

$\Rightarrow\ x=4$ [dividing both sides by 26]

Hence, $x=4$ is the solution of the given equation.

Example 4 Find the value of x in the equation $\frac{2}{x-3}+\frac{3}{x-4}=\frac{5}{x}$, where $x\neq 0, 3, 4$.

(a) $1\frac{1}{3}$ (b) $3\frac{1}{4}$

(c) $3\frac{1}{3}$ (d) $2\frac{1}{3}$

Sol. (c) Given, $\frac{2}{x-3}+\frac{3}{x-4}=\frac{5}{x}$

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

$\Rightarrow\ [2(x-4)+3(x-3)]x=5[(x-3)(x-4)]$

$\Rightarrow\ (5x-17)x=5(x^2-7x+12)$

$\Rightarrow\ 5x^2-17x=5x^2-35x+60$

$\Rightarrow\ -17x+35x=60$

$\Rightarrow\ 18x=60$

$\Rightarrow\ x=\frac{10}{3}=3\frac{1}{3}$

Hence, $x=3\frac{1}{3}$ is a solution of the given equation.

Solving Word Problem by using Linear Equation

- Denote the unknown quantity by some letters, say x, y, z, etc.
- Translate the statements of the problem into mathematical statements.
- Using the conditions given in the problem, form the equation.
- Solve the equation for the unknown.

Example 5 A man is 30 yr older than his son. After 12 yr, the man will be twice as old as his son. Find their present ages.

(a) 17 yr, 47 yr (b) 18 yr, 48 yr

(c) 19 yr, 49 yr (d) None of these

Sol. (b) Let age of son be x yr.

Then, mathematical statement are

Age of man $=(x+30)$ yr

Age of son $=x+12$

Age of man $=x+30+12$

According to the given condition,

$x+30+12=2(x+12)$

$\Rightarrow\ x+42=2x+24$

After simplification, we get

$x=18$ yr

So, age of son $=18$ yr

and age of man $=30+18=48$ yr

Example 6 A number when added to its two-third is equal to 35. Find the number.

(a) 21 (b) 20

(c) 22 (d) 23

Sol. (a) Let the number be x.

Then, according to the given condition,

$$x+\frac{2}{3}x=35$$

$$\Rightarrow\ \frac{3x+2x}{3}=35$$

$$\Rightarrow\ \frac{5x}{3}=35$$

$$\Rightarrow\ x=\frac{35\times 3}{5}$$

$$\Rightarrow\ x=21$$

Hence, the required number is 21.

Example 7 The digit in the ten's place of a two-digit number is 3 more than the digit in the unit's place. Let the digit at unit's place be b. Then, the number is

(a) $11b+30$ (b) $10b+30$

(c) $11b+3$ (d) $10b+3$

Sol. (a) Let digit at unit's place be b.

Then, digit at ten's place $=(3+b)$

$\therefore$ Number $=10(3+b)+b$

$=30+10b+b$

$=11b+30$

Example 8 The sum of three consecutive even natural numbers is 48. Find the greatest of these numbers.

(a) 17 (b) 18 (c) 19 (d) 20

Sol. (*b*) Let the three consecutive even natural numbers be $x, (x + 2)$ and $(x + 4)$.

According to the question,

$x + (x + 2) + (x + 4) = 48$ [given]

$\Rightarrow \quad 3x + 6 = 48$

$\Rightarrow \quad 3x = 48 - 6$

$\Rightarrow \quad 3x = 42$

$\Rightarrow \quad x = \frac{42}{3}$

$\therefore \quad x = 14$

Hence, the three consecutive even natural numbers are 14, (14 + 2) and (14 + 4), i.e.14,16 and 18.

Therefore, the greatest number is 18.

Example 9 The volume of water in a tank is twice of that in the other. If we draw out 25 litres from the first and add it to the other, the volumes of the water in each tank will be the same. Find the volumes of water in each tank.

(a) 100 L (b) 102 L (c) 110 L (d) 98 L

Sol. (*a*) Let volume of water in one tank be x L.

Then, volume of the water in another tank = $2x$ L.

According to the question,

Volume of the water in first tank + 25

= Volume of the water in another tank – 25

$\Rightarrow \quad x + 25 = 2x - 25 \Rightarrow 2x - x = 25 + 25$

$\therefore \quad x = 50$

Hence, volume of water in one tank = 50 L

and volume of the water in another tank

$= 2 \times 50 = 100$ L

Practice Exercise

1. Linear equation in one variable has
   (a) only one variable with any power
   (b) only one term with a variable
   (c) only one variable with power 1
   (d) only constant term
2. A linear equation in one variable has
   (a) only one solution
   (b) two solutions
   (c) more than two solutions
   (d) no solution
3. If $8x - 3 = 25 + 17x$, then x is a/an
   (a) fraction (b) integer
   (c) rational number (d) Cannot be solved
4. The value of x, for which the expressions $3x - 4$ and $2x + 1$ become equal, is
   (a) -3 (b) 0 (c) 5 (d) 1
5. On subtracting 8 from x, the result is 2. The value of x is
   (a) 10 (b) 11 (c) 9 (d) 8
6. If $\frac{x}{2} - \frac{1}{5} = \frac{x}{3} + \frac{1}{4}$, then the value of x is
   (a) 29/10 (b) 27/10
   (c) 23/10 (d) None of these
7. If $x = 4/5\,(x + 10)$, find the value of x.
   (a) 39 (b) 40
   (c) 41 (d) None of these
8. If $\frac{0.2x + 5}{3.5x - 3} = \frac{2}{5}$, then find the value of x.
   (a) 29/6 (b) 31/6
   (c) 23/6 (d) None of these
9. If $\frac{5x}{3} - 4 = \frac{2x}{5}$, then the numerical value of $2x - 7$ is
   (a) $\frac{19}{13}$ (b) $-\frac{13}{19}$ (c) 0 (d) $\frac{13}{19}$
10. If $\frac{3t - 2}{3} + \frac{2t + 3}{2} = t + \frac{7}{6}$, then find the value of t.
    (a) $\frac{1}{3}$ (b) $\frac{2}{3}$
    (c) $\frac{1}{5}$ (d) $\frac{1}{7}$
11. If the sum of the two numbers is 11 and their product is 30, then the numbers are
    (a) 8, 3 (b) 9, 2
    (c) 7, 4 (d) 6, 5

12. If one number is thrice the other and their sum is 20, then the numbers are
(a) 5, 15 (b) 4, 12
(c) 3, 9 (d) None of these

13. One of the angle of a triangle is equal to the sum of the other two angles. If the ratio of the other two angles is 4 : 5, then the angles of triangle are
(a) 90°, 40°, 50° (b) 15°, 60°, 105°
(c) 30°, 60°, 90° (d) 30°, 40°, 110°

14. The ages of two persons differ by 20 yr. If 5 yr ago, the elder one is 5 times as old as the younger one, their present ages are
(a) 50 yr, 30 yr (b) 28 yr, 5 yr
(c) 20 yr, 10 yr (d) 30 yr, 10 yr

15. The sum of the ages of a father and son is 45 yr. Five years ago, the product of their ages was 4 times the father's age at that time. The present ages of the father and son respectively are
(a) 25 yr, 10 yr (b) 36 yr, 9 yr
(c) 39 yr, 6 yr (d) None of these

16. The sum of three consecutive multiples of 7 is 357. Find the smallest multiple.
(a) 112 (b) 126
(c) 119 (d) 116

17. Two numbers differ by 40. When each number is increased by 8, the bigger becomes thrice the lesser number. If one number is x, then the other number is (40 − x).
(a) 5 (b) 6
(c) 7 (d) 8

18. Half of herd of deer are grazing in the field and three-fourth of the remaining are playing nearby. The rest 9 are drinking water from the pond. Find the number of deer in the herd.
(a) 70 (b) 72
(c) 73 (d) 74

19. Sum of the digits of a two-digit number is 9. When we interchange the digits, it is found that the resulting new number is greater than the original number by 27. What is the two-digits number?
(a) 35 (b) 36 (c) 37 (d) 38

20. In a class, $\frac{3}{5}$ of the students are girls and rest are boys. If $\frac{2}{9}$ of the girls and $\frac{1}{4}$ of the boys are absent. What part of the total number of students are present?
(a) $\frac{23}{30}$ (b) $\frac{23}{36}$
(c) $\frac{18}{49}$ (d) $\frac{17}{25}$

21. Baichung's father is 26 yr younger than Baichung's grandfather and 29 yr older than Baichung. The sum of the ages of all the three is 135 yr. What is the age of each one of them?
(a) 18 yr, 46 yr, 72 yr (b) 17 yr, 46 yr, 72 yr
(c) 17 yr, 46 yr, 75 yr (d) None of these

22. Lakshmi is a cashier in a bank. She has currency notes of denominations ₹ 100, ₹ 50 and ₹ 10, respectively. The ratio of the number of these notes is 2 : 3 : 5. The total cash with Lakshmi is ₹ 400000. How many notes of each denomination does she have?
(a) 2000, 3000, 5000 (b) 1500, 3000, 4500
(c) 2000, 3000, 4000 (d) None of these

23. The base of an isosceles triangle is $\frac{4}{3}$ cm. The perimeter of the triangle is $4\frac{2}{15}$ cm. What is the length of the remaining equal sides?
(a) $1\frac{2}{5}$ (b) $2\frac{2}{5}$
(c) $3\frac{2}{5}$ (d) None of these

24. A steamer goes downstream from one point to another in 7 h. It covers the same distance upstream in 8 h. If the speed of stream is 2 km/h, find the speed of the steamer in still water and the distance between the ports.
(a) 30 km/h, 224 km/h
(b) 40 km/h, 225 km/h
(c) 32 km/h, 228 km/h
(d) None of these

Answers

1	(c)	2	(a)	3	(c)	4	(c)	5	(a)	6	(b)	7	(b)	8	(b)	9	(b)	10	(a)
11	(d)	12	(a)	13	(a)	14	(d)	15	(b)	16	(a)	17	(b)	18	(b)	19	(b)	20	(a)
21	(b)	22	(a)	23	(a)	24	(b)												

Hints & Solutions

1. (c) Linear equation in one variable has only one variable with power 1.

e.g. $3x + 1 = 0$, $2y - 3 = 7$ and $z + 9 = -2$ are the linear equations in one variable.

2. (a) A linear equation in one variable has only one solution.

e.g. Solution of the linear equation $ax + b = 0$ is unique, i.e. $x = -\frac{b}{a}$.

3. (c) Given, $8x - 3 = 25 + 17x$

$\Rightarrow \quad 8x - 17x = 25 + 3$

[transposing $17x$ to LHS and -3 to RHS]

$\Rightarrow \quad -9x = 28$

$\therefore \quad x = \frac{-28}{9}$ [dividing both sides by -9]

Hence, x is a rational number.

4. (c) Given expressions $3x - 4$ and $2x + 1$ are equal.

Then, $3x - 4 = 2x + 1 \Rightarrow 3x - 2x = 1 + 4$

[transposing $2x$ to LHS and -4 to RHS]

$\therefore \quad x = 5$

Hence, the value of x is 5.

5. (a) Given, $x - 8 = 2$

$\Rightarrow \quad x = 8 + 2$ [transposing -8 to RHS]

$\therefore \quad x = 10$

Hence, the value of x is 10.

6. (b) We have, $\frac{x}{2} - \frac{1}{5} = \frac{x}{3} + \frac{1}{4}$

The denominators on both sides are 2, 5, 3 and 4. Their LCM is 60.

Multiplying both sides of the given equation by 60, then we get $60\left(\frac{x}{2} - \frac{1}{5}\right) = 60\left(\frac{x}{3} + \frac{1}{4}\right)$

$\Rightarrow \quad 60 \times \frac{x}{2} - 60 \times \frac{1}{5} = 60 \times \frac{x}{3} + 60 \times \frac{1}{4}$

$\Rightarrow \quad 30x - 12 = 20x + 15$

$\Rightarrow \quad 30x - 20x = 15 + 12$

[transposing $20x$ to LHS and -12 to RHS]

$\Rightarrow \quad 10x = 27$

$\therefore \quad x = \frac{27}{10}$

[dividing both sides by 10]

Hence, $x = \frac{27}{10}$ is the solution of the given equation.

7. (b) We have, $x = \frac{4}{5}(x + 10)$

$\Rightarrow \quad 5x = 4(x + 10)$

[multiplying both sides by 5]

$\Rightarrow \quad 5x = 4x + 40$

$\Rightarrow \quad 5x - 4x = 40$ [transposing $4x$ to LHS]

$\therefore$ $x = 40$, which is the required solution.

8. (b) Given, $\frac{0.2x + 5}{3.5x - 3} = \frac{2}{5}$

$\Rightarrow \quad 5(0.2x + 5) = 2(3.5x - 3)$

[by cross-multiplication]

$\Rightarrow \quad x + 25 = 7x - 6$

$\Rightarrow \quad x - 7x = -6 - 25$

[transposing $7x$ to LHS and 25 to RHS]

$\Rightarrow \quad -6x = -31$

$\Rightarrow \quad \frac{-6x}{-6} = \frac{-31}{-6}$

[dividing both sides by -6]

$\therefore \quad x = \frac{31}{6}$

9. (b) Given, $\frac{5x}{3} - 4 = \frac{2x}{5}$

$\Rightarrow \quad \frac{5x}{3} - \frac{2x}{5} = 4$

$\left[\text{transposing } \frac{2x}{5} \text{ to LHS and } -4 \text{ to RHS}\right]$

$\Rightarrow \quad \frac{25x - 6x}{15} = 4 \qquad$ [taking LCM in LHS]

$\Rightarrow \quad 19x = 60$

$\Rightarrow \quad \frac{19x}{19} = \frac{60}{19}$ [dividing both sides by 19]

$\therefore \quad x = \frac{60}{19}$

Now, $2x - 7 = 2 \times \frac{60}{19} - 7$ [putting the value of x]

$= \frac{120 - 133}{19} = -\frac{13}{19} \qquad$ [taking LCM]

Hence, the numerical value of $2x - 7$ is $-\frac{13}{19}$.

10. (a) Given, $\frac{3t - 2}{3} + \frac{2t + 3}{2} = t + \frac{7}{6}$

$\Rightarrow \quad \frac{2(3t - 2) + 3(2t + 3)}{6} = \frac{6t + 7}{6}$

$\Rightarrow \quad 6t - 4 + 6t + 9 = 6t + 7$

$\Rightarrow \quad 12t + 5 = 6t + 7$

$\Rightarrow \quad 12t - 6t = 7 - 5$

[transposing 6t to LHS and 5 to RHS]

$\Rightarrow \quad 6t = 2$

$\Rightarrow \quad \frac{6t}{6} = \frac{2}{6} \qquad$ [dividing both sides by 6]

$\therefore \quad t = \frac{1}{3}$

11. (d) Let numbers be x and $11 - x$.

Since, $x(11 - x) = 30 \qquad$ [given]

$\Rightarrow \quad x^2 - 11x + 30 = 0$

$\Rightarrow \quad (x - 5)(x - 6) = 0$

$\Rightarrow \quad x = 5, 6$

12. (a) Let the number be x.

According to the given condition,

$x + 3x = 20$

$\Rightarrow \quad x = 5$

Other number is $(3x) = 3 \times 5 = 15$

13. (a) Let the two angles be 4x and 5x respectively.

Then, third angle will be $4x + 5x = 9x$

Since, $4x + 5x + 9x = 180°$

$\Rightarrow \quad 18x = 180°$

$\Rightarrow \quad x = 10°$

$\therefore$ Angles are $4x = 4 \times 10 = 40°$

$5x = 5 \times 10 = 50°$ and $9x = 9 \times 10 = 90°$

14. (d) Let their ages be x and $(x - 20)$ yr.

5 yr ago, their ages are $(x - 5)$

and $(x - 20 - 5)$ yr.

According to the given condition,

$5(x - 20 - 5) = (x - 5)$

$\Rightarrow \quad 5x - 125 = x - 5$

$\Rightarrow \quad 4x = 120$

$\Rightarrow \quad x = 30$

Hence, their present ages are 30 yr and 10 yr respectively.

15. (b) Let son's age be x, then father's age be $(45 - x)$.

According to the given condition,

$(x - 5)(45 - x - 5) = 4(45 - x - 5)$

$\Rightarrow \quad (x - 5) = 4$

$\Rightarrow \quad x = 9$

$\therefore$ Father's age now = 36 yr and son's age = 9 yr

16. (a) Let the three consecutive multiples of 7 be $7x$, $(7x + 7)$, $(7x + 14)$, where x is a natural number.

According to the question,

$7x + (7x + 7) + (7x + 14) = 357$

$\Rightarrow \quad 21x + 21 = 357$

$\Rightarrow \quad 21(x + 1) = 357$

$\Rightarrow \quad \frac{21(x + 1)}{21} = \frac{357}{21}$

[dividing both sides by 21]

$\Rightarrow \quad x + 1 = 17$

$\Rightarrow \quad x = 17 - 1$

[transposing 1 to RHS]

$\therefore \quad x = 16$

Hence, the smallest multiple of 7 is 7×16, i.e. 112.

17. (b) Given, one number = x

and other number = $40 - x$

Let $(40 - x) > x$

Then, according to the question,

$40 - x + 8 = 3(x + 8)$

$\Rightarrow \quad 48 - x = 3x + 24$

$\Rightarrow \quad -x - 3x = 24 - 48$

[transposing 3x to LHS and 48 to RHS]

$\Rightarrow \quad -4x = -24$

$\Rightarrow \quad x = -24 \times \left(-\frac{1}{4}\right)$

$\therefore \quad x = 6$

Hence, one number = x = 6

and other number = $40 - x = 40 - 6 = 34$

Now, difference between numbers

$= 34 - 6 = 28 \neq 40$

which does not satisfy the condition given in question.

18. (b) Let the number of deer in the herd be *x*.

Then, number of deer grazing in the field = $\frac{x}{2}$

$\therefore$ Number of remaining deer = $x - \frac{x}{2}$

Number of deer playing nearby = $\frac{3}{4} \times \frac{x}{2} = \frac{3x}{8}$

The rest number of deer, drinking water = 9

According to the question,

$$\frac{x}{2} + \frac{3x}{8} + \frac{9}{1} = x$$

$$\Rightarrow \quad \frac{4x + 3x + 72}{8} = x$$

[$\because$ LCM of 2, 8 and 1 = 8]

$$\Rightarrow \quad \frac{7x + 72}{8} = \frac{x}{1}$$

$\Rightarrow \quad 8x = 7x + 72$

[by cross-multiplication]

$\Rightarrow \quad 8x - 7x = 72$

[transposing 7*x* to LHS]

$\Rightarrow \quad x = 72$

Hence, the number of deer in the herd is 72.

19. (b) Let unit's place digit = x, then ten's place digit = $9 - x$

So, original number = $10(9 - x) + x$

$= 90 - 10x + x = 90 - 9x$

After interchanging the digits,

New number = $10x + (9 - x) = 10x + 9 - x$

$= 9x + 9$

According to the question,

New number = Original number + 27

$\Rightarrow \quad 9x + 9 = (90 - 9x) + 27$

$\Rightarrow \quad 9x + 9 = 90 - 9x + 27$

$\Rightarrow \quad 9x + 9 = 117 - 9x$

$\Rightarrow 9x + 9x = 117 - 9$

[transposing $-9x$ to LHS and 9 to RHS]

$\Rightarrow 18x = 108 \Rightarrow x = \frac{108}{18} = 6$

[dividing both sides by 18]

Hence, the original number = $90 - 9x$

$= 90 - 9 \times 6 = 90 - 54 = 36$

20. (a) Let the number of students be x. Then,

Number of girls = $\frac{3}{5}x$ and number of boys = $\frac{2}{5}x$

Number of girls present = $\frac{7}{9} \times \frac{3}{5}x = \frac{7x}{15}$ and

Number of boys present = $\frac{3}{4} \times \frac{2}{5}x = \frac{3x}{10}$

$\therefore$ Total students present = $x\left(\frac{7}{15} + \frac{3}{10}\right)$

$= \frac{23}{30}x$

Hence, $\frac{23}{30}$ part of the total number of students are present.

21. (b) Let the age of Baichung be x yr.

Then, age of Baichung's father = (x + 29) yr

and age of Baichung's grandfather

= (x + 29) + 26 = (x + 55) yr

According to the question,

$x + (x + 29) + (x + 55) = 135$

$\Rightarrow \quad x + x + 29 + x + 55 = 135$

$\Rightarrow \quad 3x + 84 = 135$

$\Rightarrow \quad 3x = 135 - 84$

[transposing 84 to RHS]

$\Rightarrow \quad 3x = 51$

$\Rightarrow \quad x = \frac{51}{3} = 17$

[dividing both sides by 3]

$\therefore$ Age of Baichung = x = 17 yr

Age of Baichung's father = (x + 29)
= (17 + 29) = 46 yr
and age of Baichung's grandfather = (x + 55)
= (17 + 55) = 72 yr

22. (a) Let the number of currency notes of denominations ₹ 100, ₹ 50 and ₹ 10 be 2x, 3x and 5x, respectively.

∴ The amount she has from ₹ 100 notes
$= 2x \times 100 = 200x$

The amount she has from ₹ 50 notes
$= 3x \times 50 = 150x$

The amount she has from ₹ 10 notes
$= 5x \times 10 = 50x$

According to the question,

Total amount = 400000

$\Rightarrow 200x + 150x + 50x = 400000$

$\Rightarrow \quad 400x = 400000$

$\Rightarrow \quad x = \frac{400000}{400} = 1000$

[dividing both sides by 400]

∴ Number of ₹ 100 notes = $2x = 2 \times 1000 = 2000$

Number of ₹ 50 notes = $3x = 3 \times 1000 = 3000$

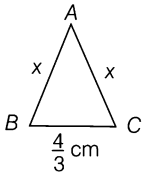
and number of ₹ 10 notes = $5x = 5 \times 1000$
$= 5000$

Hence, she has 2000, 3000 and 5000 notes of denominations ₹ 100, ₹ 50 and ₹ 10, respectively.

23. (a) Given, length of AB = length of AC,

base = $\frac{4}{3}$ cm and perimeter of a triangle = $4\frac{2}{15}$ cm

Let *ABC* be a triangle and length of the equal sides be x.



∴ Perimeter of the triangle = AB + AC + BC

$\Rightarrow \quad AB + AC + BC = 4\frac{2}{15}$

$\Rightarrow \quad x + x + \frac{4}{3} = \frac{62}{15}$

$\Rightarrow \quad 2x + \frac{4}{3} = \frac{62}{15}$

$\Rightarrow \quad 2x = \frac{62}{15} - \frac{4}{3}$

[transposing $\frac{4}{3}$ to RHS]

$\Rightarrow \quad 2x = \frac{62 - 20}{15}$ [∵ LCM of 15 and 3 = 15]

$\Rightarrow \quad 2x = \frac{42}{15} \Rightarrow x = \frac{42}{2 \times 15}$

[dividing both sides by 2]

$\Rightarrow \quad x = \frac{21}{15} = \frac{7}{5} = 1\frac{2}{5}$ cm

Hence, the length of the remaining equal sides is $1\frac{2}{5}$ cm.

24. (b) Given, speed of stream = 2 km/h

Let speed of steamer in still water be *x* km/h.

Then, speed of downstream = (x + 2) km/h

and speed of upstream = (x − 2) km/h

∴ Distance covered in 7 h while downstream
$= 7(x + 2)$

and distance covered in 8 h while upstream
$= 8(x - 2)$

According to the question,

$7(x + 2) = 8(x - 2)$

$\Rightarrow \quad 7x + 14 = 8x - 16 \Rightarrow x = 30$ km/h

∴ Total distance = 7(x + 2) km = 7(30 + 2) km
$= 7 \times 32$ km = 224 km

Hence, speed of the steamer in still water is 30 km/h and the distance between the ports is 224 km.