

Classwork $\rightarrow$ "✓" Marked questions
 Homework $\rightarrow$ "●" Bullet point questions.

Lecture-I

- ✓ Q. 1. The sum of two numbers is 9 and the sum of their squares is 41. Taking one number as x , form a quadratic equation in x and solve it to find the numbers.
- Q. 2. Find two consecutive even integers, the sum of whose squares is 164.
- ✓ Q. 3. The product of two consecutive integers is 20. Using quadratic equation find the integers.
- Q. 4. The sum of squares of two consecutive numbers is 313, find the numbers.
- ✓ Q. 5. A trader buys x articles for a total cost of Rs.600. (i) Write down the cost of one article in terms of x . If the cost per article were Rs.5 more, the number of articles that can be bought for Rs.600 would be four less. (ii) Write down the equation in x for the above situation and solve it to find x .
- Q. 6. A shopkeeper buys a certain number of books for Rs.720. If the cost per book was Rs.5 less, the number of books that could be bought for Rs.720 would be 2 more. Taking the original cost of each book to be Rs. x , write an equation in x and solve it.
- ✓ Q. 7. A trader bought a number of articles for Rs.1200. Ten were damaged and he sold each of the rest at Rs.2 more than what he paid for it, thus getting a profit of Rs.60 on the whole transaction. Taking the number of articles, he bought as x , from an equation in x and solve it.
- Q. 8. An express train makes a run of 240 km at a certain speed. Another train, whose speed is 12 km/hr less, takes an hour longer to make the same trip. Find the speed of the express train in km/hr.
- ✓ Q. 9. A train covers a distance of 90km at a uniform speed. Had the speed been 15 km/per hour more, it would have taken 30 minutes less for the journey. Find the original speed of the train.
- ✓ Q. 10. An aero plane traveled a distance of 400 km at an average speed of x km/hr, on the return the speed was increased by 40 km/hr. Write down an expression for the time taken for (i) The onward journey (ii) The return journey. If the return journey took 30 minutes less than the onward journey, write down an equation in x and find its value.
- Q. 11. A rectangle of area 105 cm^2 has its length equal to $x \text{ cm}$. Write down its breadth in terms of x . Given that its perimeter is 44cm, write down an equation in x and solve it to determine the dimensions of the rectangle.
- Q. 12. A rectangular garden 10m by 16m is to be surrounded by a concrete walk of uniform width. Given that the area of the walk is 120 square metres, assuming the width of the walk to be x , form an equation in x and solve it to find the value of x .
- ✓ Q. 13. The perimeter of a rectangular plot is 180m, and its area is 1800 m^2 . Take the length of the plot as $x \text{ 'm'}$. Use the perimeter 180m to write the value of the breadth in terms of ' x '. Use the value of length, breadth and the area to write an equation in ' x '. Solve the equation to calculate the length and breadth of the plot.

$$\bullet \quad 2(l+b)=180, \quad lb=1800 \rightarrow 2(x+b)=180 \text{ \& } xb=1800 \rightarrow \boxed{b=\frac{1800}{x}}$$

$$\# \quad x^2 - 90x + 1800 = 0$$

$$x^2 - 60x - 30x + 1800 = 0$$

$$x(x-60) - 30(x-60) = 0 \Rightarrow (x-60)(x-30) = 0 \Rightarrow x=60 \text{ or } x=30$$

$$\hookrightarrow x+b=90 \rightarrow x+\frac{1800}{x}=90 \xrightarrow{*x}$$

$$x^2 + 1800 = 90x$$

$$| \quad x=60 \rightarrow b=30 \text{ \& } \text{if } x=30 \rightarrow b=60 \rightarrow l=60, b=30 \text{ or } l=30, b=60$$

- Q. 7. A trader bought a number of articles for Rs. 1200. Ten were damaged and he sold each of the rest at Rs. 2 more than what he paid for it, thus getting a profit of Rs. 60 on the whole transaction. Taking the number of articles, he bought as x , from an equation in x and solve it.

Let the no. of articles be x & price of one article be y .

Total Cost =

(No. of Articles) (Price per Article)

$$xy = 1200 \rightarrow y = \frac{1200}{x}$$

$$(x-10)(y+2) = 1260 \rightarrow (x-10)\left(\frac{1200}{x} + 2\right) = 1260$$

$$\Rightarrow (x-10)(1200+2x) = 1260x \rightarrow 1200x - 12000 + 2x^2 - 20x = 1260x$$

$$\Rightarrow 2x^2 - 8x - 12000 = 0 \rightarrow \boxed{x^2 - 40x - 6000 = 0} \Rightarrow x^2 - 100x + 60x - 6000 = 0$$

$$(x-100)(x+60) = 0 \Rightarrow \boxed{x=100} \checkmark \text{ or } \boxed{x=-60} \text{ (discarded)}$$

- Q. 5. A trader buys x articles for a total cost of Rs. 600. (i) Write down the cost of one article in terms of x . If the cost per article were Rs. 5 more, the number of articles that can be bought for Rs. 600 would be four less. (ii) Write down the equation in x for the above situation and solve it to find x .

(C-I)

Sol: $\left. \begin{array}{l} \text{No. of Article} = x \\ \text{Price per Article} = y \end{array} \right\} \begin{array}{l} xy = 600 \rightarrow \\ \text{i) } y = \frac{600}{x} \end{array}$

(C-II)

$$\left. \begin{array}{l} \text{No. of Articles} = (x-4) \\ \text{Price} = (y+5) \end{array} \right\} \begin{array}{l} (x-4)(y+5) = 600 \Rightarrow (x-4)\left(\frac{600}{x} + 5\right) = 600 \\ \Rightarrow (x-4)(600+5x) = 600x \end{array}$$

$$\Rightarrow 600x - 2400 + 5x^2 - 20x = 600x \Rightarrow 5x^2 - 20x - 2400 = 0$$

$$\Rightarrow x^2 - 4x - 480 = 0 \rightarrow x^2 - 24x + 20x - 480 = 0 \Rightarrow (x-24)(x+20) = 0$$

$$\Rightarrow \boxed{x=24} \text{ or } x=-20$$

✓ Q. 10. An aero plane traveled a distance of 400 km at an average speed of x km/hr, on the return the speed was increased by 40 km/hr. Write down an expression for the time taken for (i) The onward journey (ii) The return journey. If the return journey took 30 minutes less than the onward journey, write down an equation in x and find its value.

↳ $\frac{1}{2}$ hr.

Sol:

onward journey. $\rightarrow$
Speed = x km/hr & distance = 400 km $\rightarrow T_1 = \frac{400}{x}$ hr.

Return journey. $\leftarrow$
Speed = $(x+40)$ km/hr & distance = 400 km $\rightarrow T_2 = \frac{400}{x+40}$ hr.

$$T_1 = T_2 + \frac{1}{2} \quad \text{or} \quad T_1 - T_2 = \frac{1}{2}$$

$$(T_1 > T_2)$$

$$\frac{400}{x} - \frac{400}{x+40} = \frac{1}{2} \Rightarrow 400 \left(\frac{1}{x} - \frac{1}{x+40} \right) = \frac{1}{2} \Rightarrow 800 \left(\frac{x+40-x}{x(x+40)} \right) = 1$$

$$\Rightarrow 32000 = x^2 + 40x \Rightarrow x^2 + 40x - 32000 = 0 \rightarrow x^2 + 200x - (60x - 32000) = 0$$

$$x(x+200) - 60(x+200) = 0 \rightarrow (x+200)(x-60) = 0 \Rightarrow x \neq -200 \quad \text{or} \quad x = 60$$

✓ Q. 9. A train covers a distance of 90 km at a uniform speed. Had the speed been 15 km per hour more, it would have taken 30 minutes less for the journey. Find the original speed of the train.

Let the original speed of the train be x km/hr.

$$\text{Case-I} \rightarrow D = 90 \text{ km, Speed} = x \text{ km/hr} \rightarrow T_1 = \frac{90}{x}$$

$$\text{Case-II} \rightarrow D = 90 \text{ km, Speed} = (x+15) \text{ km/hr} \rightarrow T_2 = \frac{90}{x+15}$$

$$\text{Here: } T_2 = T_1 + \frac{1}{2} \rightarrow T_2 - T_1 = \frac{1}{2}$$

$$(T_1 > T_2)$$

$$\rightarrow \frac{90}{x} - \frac{90}{x+15} = \frac{1}{2} \Rightarrow 90 \left(\frac{1}{x} - \frac{1}{x+15} \right) = \frac{1}{2}$$

$$\Rightarrow 180 \left(\frac{x+15-x}{x(x+15)} \right) = 1 \Rightarrow (180)(15) = x^2 + 15x \Rightarrow x^2 + 15x - (180)(15) = 0$$

$$(180)(15)$$

$$\rightarrow x^2 + 60x - 45x - (60)(45) = 0 \rightarrow x(x+60) - 45(x+60) = 0$$

$$\rightarrow (x+60)(x-45) = 0 \Rightarrow x = -60 \quad \text{or} \quad x = 45$$

✗

original speed = 45 km/hr.

Q. 1. The sum of two numbers is 9 and the sum of their squares is 41. Taking one number as x , form a quadratic equation in x and solve it to find the numbers.

Solⁿ: Let the numbers be x & $9-x$.

$$\begin{aligned}\therefore x^2 + (9-x)^2 &= 41 \Rightarrow x^2 + 81 + x^2 - 18x = 41 \\ &\Rightarrow 2x^2 - 18x + 40 = 0 \\ &\Rightarrow x^2 - 9x + 20 = 0 \\ &\Rightarrow x^2 - 4x - 5x + 20 = 0 \\ &\Rightarrow x(x-4) - 5(x-4) = 0 \\ &\Rightarrow (x-4)(x-5) = 0 \\ &\Rightarrow x = 4 \text{ or } x = 5 \quad \underline{\text{Ans.}}\end{aligned}$$

Q. 3. The product of two consecutive integers is 20. Using quadratic equation find the integers.

Solⁿ: Let the no:s be x & $x+1$

$$\begin{aligned}\therefore (x)(x+1) &= 20 \Rightarrow x^2 + x = 20 \Rightarrow x^2 + x - 20 = 0 \\ &\Rightarrow x^2 + 5x - 4x - 20 = 0 \\ &\Rightarrow x(x+5) - 4(x+5) = 0 \Rightarrow (x+5)(x-4) = 0 \\ &\Rightarrow x = -5 \text{ or } x = 4\end{aligned}$$

* If $x = -5$ then $-5+1 = -4$

-5 & -4 / Ans

* If $x = 4$ then $4+1 = 5$

4 & 5

Q. 5. A trader buys x articles for a total cost of Rs.600. (i) Write down the cost of one article in terms of x . If the cost per article were Rs.5 more, the number of articles that can be bought for Rs.600 would be four less. (ii) Write down the equation in x for the above situation and solve it to find x .

Sol:

i) Cost of one article = $\frac{600}{x}$.

ii) Cost of one article now = $\left(\frac{600}{x} + 5\right)$

No. of article bought = $x-4$.

$$\left(\frac{600}{x} + 5\right)(x-4) = 600$$

$$\Rightarrow \frac{(600 + 5x)(x-4)}{x} = 600 \Rightarrow 600x - 2400 + 5x^2 - 20x = 600x$$

$$\Rightarrow 5x^2 - 20x - 2400 = 0 \Rightarrow x^2 - 4x - 480 = 0$$

$$\Rightarrow x^2 - 24x + 20x - 480 = 0 \Rightarrow x(x-24) + 20(x-24) = 0 \quad \text{Ans}$$

$$\Rightarrow (x-24)(x+20) = 0 \Rightarrow \boxed{x=24} \text{ or } x=-20$$

Q. 7. A trader bought a number of articles for Rs.1200. Ten were damaged and he sold each of the rest at Rs.2 more than what he paid for it, thus getting a profit of Rs.60 on the whole transaction. Taking the number of articles, he bought as x , from an equation in x and solve it.

Sol: Let the number of articles bought be x .

$$\text{Total cost} = \text{Rs.} 1200$$

$$\text{Cost of one article} = \frac{1200}{x}$$

Now; No. of articles left = $x-10$.

$$\text{S.P of one article} = \frac{1200}{x} + 2$$

Here: $(x-10)\left(\frac{1200}{x} + 2\right) = 1260$

$$(x-10)\left(\frac{1200+2x}{x}\right) = 1260 \Rightarrow (x-10)(1200+2x) = 1260x$$

$$\Rightarrow 1200x + 2x^2 - 12000 - 20x = 1260x$$

$$\Rightarrow 2x^2 - 60x - 20x - 12000 = 0$$

$$\Rightarrow \boxed{x^2 - 40x - 6000 = 0} \Rightarrow x^2 - 100x + 60x - 6000 = 0$$

$$\Rightarrow x(x-100) + 60(x-100) = 0$$

$$\Rightarrow (x-100)(x+60) = 0$$

$$\Rightarrow \boxed{x=100} \text{ or } x = -60$$

Ans

Q. 9. A train covers a distance of 90km at a uniform speed. Had the speed been 15 km/per hour more, it would have taken 30 minutes less for the journey. Find the original speed of the train.

$\hookrightarrow \frac{1}{2} \text{ hr.}$

Solⁿ: Let the original speed of the train be $x \text{ km/hr.}$

$$\Rightarrow \text{time taken } (t_1) = \frac{90}{x} \quad \left\{ \begin{array}{l} \text{Time} = \frac{\text{Distance}}{\text{speed}} \end{array} \right.$$

Now, Speed = $(x+15) \text{ km/hr}$ then time taken $(t_2) = \frac{90}{x+15}$

Here:- $t_1 = t_2 + \frac{1}{2} \Rightarrow \frac{90}{x} = \frac{90}{x+15} + \frac{1}{2}$

$$\Rightarrow \frac{90}{x} - \frac{90}{x+15} = \frac{1}{2} \Rightarrow 90 \left[\frac{1}{x} - \frac{1}{x+15} \right] = \frac{1}{2}$$

$$\Rightarrow 90 \left[\frac{x+15-x}{x(x+15)} \right] = \frac{1}{2} \Rightarrow 90 \times 15 \times 2 = x(x+15)$$

$$\Rightarrow 2700 = x^2 + 15x$$

$$\Rightarrow x^2 + 15x - 2700 = 0$$

$$x^2 + 60x - 45x - 2700 = 0 \Rightarrow x(x+60) - 45(x+60) = 0$$

$$\Rightarrow (x+60)(x-45) = 0 \Rightarrow x = -60 \text{ or } \boxed{x=45}$$

$\Rightarrow$ original speed of the train = 45 km/hr.

Q. 11. A rectangle of area 105 cm² has its length equal to x cm. Write down its breadth in terms of x . Given that its perimeter is 44 cm, write down an equation in x and solve it to determine the dimensions of the rectangle.

Solⁿ:- Here, $\text{length } (l) = x \text{ cm}$ $\therefore$ Area of rectangle = 105 cm²
 $\therefore l \times b = 105$
 $2 \times b = 105$
 $b = \frac{105}{x}$

$\therefore$ perimeter = 44 cm
 $2(l+b) = 44$ ~~22~~
 $x + \frac{105}{x} = 22 \Rightarrow x^2 + 105 = 22x$
 $\Rightarrow$ $x^2 - 22x + 105 = 0$
 $\hookrightarrow x^2 - 15x - 7x + 105 = 0$
 $x(x-15) - 7(x-15) = 0 \Rightarrow (x-15)(x-7) = 0$
 $\Rightarrow x = 15 \text{ or } x = 7.$

If $x = 15 \Rightarrow l = 15 \text{ cm} \& b = 7 \text{ cm}$
If $x = 7 \Rightarrow l = 7 \text{ cm} \& b = 15 \text{ cm}$ } Ans.

Q. 13. The perimeter of a rectangular plot is 180m, and its area is 1800m^2 . Take the length of the plot as x 'm'. Use the perimeter 180m to write the value of the breadth in terms of ' x '. Use the value of length, breadth and the area to write an equation in ' x '. Solve the equation to calculate the length and breadth of the plot.

Sol: $\therefore \text{Perimeter} = 180\text{m} \text{ \& Area} = 1800\text{m}^2$.

Here $l = x\text{m}$ $\rightarrow 2(l+b) = 180 \Rightarrow x+b=90 \Rightarrow b=90-x$

$$A = 1800 \Rightarrow x(90-x) = 1800 \Rightarrow 90x - x^2 = 1800$$

$$\Rightarrow x^2 - 90x + 1800 = 0 \Rightarrow x^2 - 60x - 30x + 1800 = 0$$

$$\Rightarrow x(x-60) - 30(x-60) = 0 \Rightarrow (x-60)(x-30) = 0$$

$$\Rightarrow x = 60 \text{ or } x = 30.$$

$$\Rightarrow l = 60\text{m} \text{ \& } b = 30\text{m} \\ \text{or} \\ l = 30\text{m} \text{ \& } b = 60\text{m}.$$

Q. 12. A rectangular garden 10m by 16m is to be surrounded by a concrete walk of uniform width. Given that the area of the walk is 120 square metres, assuming the width of the walk to be x , form an equation in x and solve it to find the value of x .

Sol:

Area of walk = area of PQRS - area of ABCD.

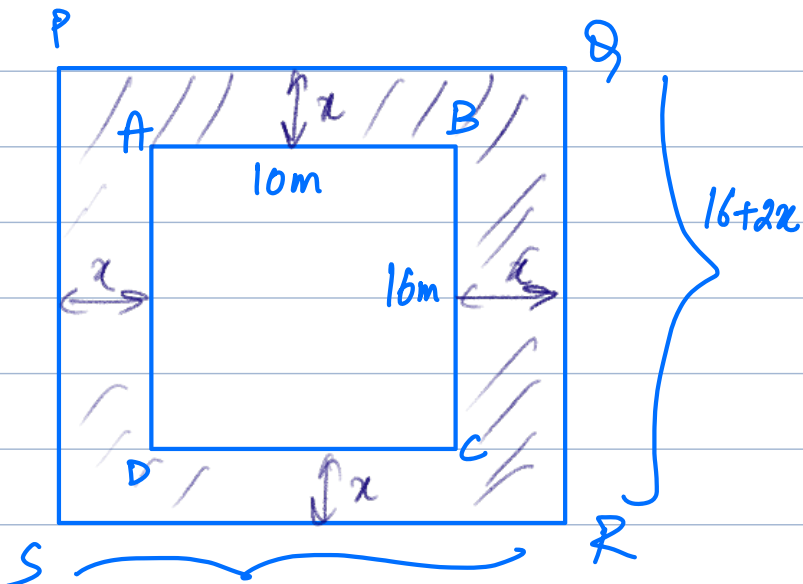
$$120 = (16+2x)(10+2x) - (10)(16)$$

$$\Rightarrow 120 = 160 + 32x + 20x + 4x^2 - 160$$

$$\Rightarrow 0 = 4x^2 + 52x - 120$$

$$\Rightarrow x^2 + 13x - 30 = 0 \Rightarrow x^2 + 15x - 2x - 30 = 0$$

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



$$\Rightarrow \text{width} = 2\text{m}.$$

Q. 10. An aero plane traveled a distance of 400 km at an average speed of x km/hr, on the return the speed was increased by 40 km/hr. Write down an expression for the time taken for (i) The onward journey
(ii) The return journey. If the return journey took 30 minutes less than the onward journey, write down an equation in x and find its value.

Solⁿ:

$$\text{onward journey (time} = t_1) \Rightarrow t_1 = \frac{400}{x} \text{ hr.}$$

$$\text{Return journey (time} = t_2) \Rightarrow t_2 = \frac{400}{x+40} \text{ hr.}$$

$$\therefore t_1 = t_2 + \frac{1}{2} \quad \therefore t_1 - t_2 = \frac{1}{2}$$

$$\frac{400}{x} - \frac{400}{x+40} = \frac{1}{2} \Rightarrow 400 \left[\frac{1}{x} - \frac{1}{x+40} \right] = \frac{1}{2}$$

$$\Rightarrow 400 \left[\frac{x+40-x}{x(x+40)} \right] = \frac{1}{2} \Rightarrow 32000 = x^2 + 40x$$

$$\Rightarrow x^2 + 40x - 32000 = 0.$$

$$\Rightarrow x^2 + 200x - 160x - 32000 = 0$$

$$\Rightarrow x(x+200) - 160(x+200) = 0$$

$$\Rightarrow (x+200)(x-160) = 0 \Rightarrow x = -200$$

$$\boxed{x = 160} \quad \checkmark$$

$$\Rightarrow \text{Speed} = 160 \text{ km/hr.}$$

Q. 8. An express train makes a run of 240 km at a certain speed. Another train, whose speed is 12 km/hr less, takes an hour longer to make the same trip. Find the speed of the express train in km/hr.

Sol: Let the speed of express train = x km/hr
then the speed of another train = $(x-12)$ km/hr.

Let t_1 be the time taken by express train $\therefore t_1 = \frac{240}{x}$
Let t_2 ———) ——— another train $\therefore t_2 = \frac{240}{x-12}$

$$\text{Here: } t_2 - t_1 = 1 \Rightarrow \frac{240}{x-12} - \frac{240}{x} = 1$$

$$\Rightarrow 240 \left[\frac{1}{x-12} - \frac{1}{x} \right] = 1 \Rightarrow 240 \left[\frac{x - (x-12)}{(x-12)x} \right] = 1$$

$$\Rightarrow 240 \times 12 = x^2 - 12x \Rightarrow \boxed{x^2 - 12x - 2880 = 0}$$

$$\Rightarrow x^2 - 60x + 48x - 2880 \Rightarrow x(x-60) + 48(x-60) = 0$$

$$\Rightarrow (x-60)(x+48) = 0 \Rightarrow \boxed{x = 60} \text{ or } x = \cancel{48}$$

$$\Rightarrow \text{Speed} = 60 \text{ km/hr.}$$

Lecture-II

$\rightarrow$ Homework discussion.