

Solution

QUADRATIC EQUATIONS WS 7

Class 10 - Mathematics

1. Let Ramu's present age be x years.

Age after 5 years ago = $(x - 5)$ years.

Age after 9 years later = $(x + 9)$ years.

According to question,

$$(x - 5)(x + 9) = 15$$

$$\Rightarrow x^2 + 4x - 60 = 0$$

$$\Rightarrow x^2 + 10x - 6x - 60 = 0$$

$$\Rightarrow (x + 10)(x - 6) = 0$$

$$\Rightarrow x = 6 \text{ or, } x = -10$$

$$x \neq -10. \text{ So, } x = 6.$$

Therefore, present age of Ramu is 6 years

2. Let the usual speed of aeroplane be x km/hr.

We know that, time taken to cover 'd' km with speed 's' km/hr is $\frac{d}{s}$

\therefore Time taken to cover 1200 km = $\frac{1200}{x}$ hrs.

&, Time taken to cover 1200 km when the speed is increased by 100 km/hr = $\frac{1200}{x+100}$ hrs.

According to the question

$$\frac{1200}{x} - \frac{1200}{x+100} = 1 \text{ (given time reduced by 1 hr with increase in speed)}$$

$$\Rightarrow \frac{1200x + 120000 - 1200x}{x^2 + 100x} = 1$$

$$\Rightarrow \frac{120000}{x^2 + 100x} = 1$$

$$\Rightarrow 120000 = x^2 + 100x$$

$$\Rightarrow x^2 + 100x - 120000 = 0$$

$$\Rightarrow x^2 + 400x - 300x - 120000 = 0$$

$$\Rightarrow x(x + 400) - 300(x + 400) = 0$$

$$\Rightarrow (x + 400)(x - 300) = 0$$

$$\Rightarrow x - 300 = 0 \text{ [} \because \text{ Speed can not be negative } \therefore x + 400 \neq 0]$$

$$\Rightarrow x = 300$$

Hence, the usual speed of aeroplane = x km/hr = 300 km/hr.

3. Assume number of toys = x

Therefore, Cost of one toy sold = $\frac{180}{x}$

Number of toys sold = $x - 1$

Selling price per toy = Rs. $(\frac{180}{x} + 1)$

Total SP = CP + profit

According to given situation we have,

$$(x - 1)(\frac{180}{x} + 1) = 180 + 10$$

$$\Rightarrow (x - 1)(\frac{180}{x} + 1) = 190$$

$$\Rightarrow x^2 - 179x - 180 = 190x$$

$$\Rightarrow x^2 - 11x - 180 = 0$$

After factorising above quadratic equation we get

$$(x - 20)(x + 9) = 0$$

$$\Rightarrow x = 20, -9$$

$$\Rightarrow x = 20 \text{ [negative value is Rejected i.e., } x = -9]$$

4. Let the actual age of Zeba be 'x' years. If her age is 5 years less than the actual, her age would be $(x-5)$ years. Clearly; $x \geq 5$(1)

According to the question, we have

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

$$\Rightarrow x^2 - 10x + 25 = 5x + 11$$

$$\Rightarrow x^2 - 15x + 14 = 0$$

$$\Rightarrow x^2 - 14x - x + 14 = 0$$

$$\Rightarrow (x - 14) - 1(x - 14) = 0$$

$$\Rightarrow (x - 14)(x - 1) = 0$$

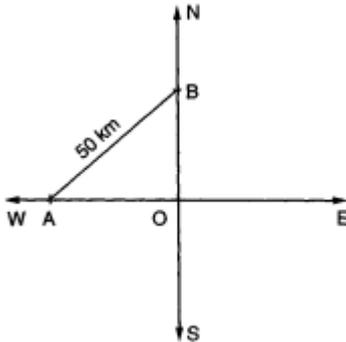
$$\Rightarrow x - 14 = 0 \text{ or } x - 1 = 0$$

$$\Rightarrow x = 14 \text{ or } x = 1$$

Since $x > 5$, we have $x = 14$

Thus, the present age of Zeba is 14 years.

5. Let speed of the second train be x km/hr. Then, the speed of the first train is $(x + 5)$ km/hr. Let O be the position of the railway station from which the two trains leave.



Distance traveled by the first train in 2 hours = $OA = \text{Speed} \times \text{Time} = 2(x + 5)$ km

Distance traveled by the second train in 2 hours = $OB = \text{Speed} \times \text{Time} = 2x$ km

By using pythagoras theorem, we have,

$$AB^2 = OA^2 + OB^2$$

$$\Rightarrow 50^2 = \{2(x + 5)\}^2 + (2x)^2$$

$$\Rightarrow 2500 = 4(x + 5)^2 + 4x^2$$

$$\Rightarrow 8x^2 + 40x - 2400 = 0$$

$$\Rightarrow x^2 + 5x - 300 = 0$$

$$\Rightarrow x^2 + 20x - 15x - 300 = 0$$

$$\Rightarrow x(x + 20) - 15(x + 20) = 0$$

$$\Rightarrow (x + 20)(x - 15) = 0$$

$$\Rightarrow x = -20 \text{ or, } x = 15$$

$$\Rightarrow x = 15 \text{ [because cannot be negative]}$$

Hence, the speed of the second train is 15 km/hr and, the speed of the first train is 20 km/hr.

6. According to question, two pipes are used to fill a swimming pool.

Pipe with larger diameter is used for 4 hours and pipe with smaller diameter is used for 9 hours.

Let x hours be the total time taken by the larger pipe to fill the tank

so in 1 hour it would fill $\frac{1}{x}$ part of the tank.

Similarly, y hours are needed for the smaller pipe,

then in 1 hour it would fill $\frac{1}{y}$ part.

So, $y = 10 + x$... (1)

$$\frac{4}{x} + \frac{9}{y} = 1/2$$

$$\text{using (1), } \frac{4}{x} + \frac{9}{10+x} = 1/2 \text{ ... (2)}$$

$$\Rightarrow x^2 - 16x - 80 = 0$$

$$\Rightarrow (x - 20)(x + 4) = 0$$

Since value of x cannot be negative

Therefore, $x = 20$ and $y = 30$

Hence, Larger diameter pipe fills in 20 hours, and Smaller diameter pipe fills in 30 hours.

7. Let the present age of the son be x years.

Since, the age of the father is twice the square of the son's age.

Hence, the present age of the father is $(2x^2)$ years.

Age of the son after 8 years = $(x + 8)$ years.

Age of the father after 8 years $= (2x^2 + 8)$ years.

According to the question ;

$$(2x^2 + 8) = 3(x + 8) + 4$$

$$\Rightarrow 2x^2 + 8 = 3x + 24 + 4$$

$$\Rightarrow 2x^2 - 3x + 8 - 28 = 0$$

$$\Rightarrow 2x^2 - 3x - 20 = 0.$$

$$\Rightarrow 2x^2 - 8x + 5x - 20 = 0$$

$$\Rightarrow 2x(x - 4) + 5(x - 4) = 0$$

$$\Rightarrow (x - 4)(2x + 5) = 0$$

$$\Rightarrow x - 4 = 0 \text{ or } 2x + 5 = 0$$

$$\Rightarrow x - 4 = 0 \text{ or } x = \frac{-5}{2}$$

$$\Rightarrow x = 4 \text{ [} \because \text{ age cannot be negative]}$$

\therefore son's present age = 4 years, and

Hence father's present age = (2×4^2) years = 32 years.

8. We have,

Ashu's present age = x years,

Mrs Veena's present age = x^2 years

Five years hence, we have

Ashu's age = $(x + 5)$ years

Mrs Veena's age = $(x^2 + 5)$ years

It is given that five years hence Mrs Veena will be three times old as Ashu.

$$\therefore x^2 + 5 = 3(x + 5)$$

$$\Rightarrow x^2 + 5 = 3x + 15$$

$$\Rightarrow x^2 - 3x + 5 - 15 = 0$$

$$\Rightarrow x^2 - 3x - 10 = 0$$

$$\Rightarrow x^2 - 5x + 2x - 10 = 0$$

$$\Rightarrow x(x - 5) + 2(x - 5) = 0$$

$$\Rightarrow (x - 5)(x + 2) = 0$$

$$\Rightarrow x = 5 \text{ [} \because \text{ Age can never negative } \therefore x + 2 \neq 0]$$

Hence, Mrs Veena's present age = $x^2 = (5)^2 = 25$ years

And, Ashu's present age = 5 years.

9. Assume side of one square = x m and side of other square = y m, then we have

$$9x = 4y + 1$$

$$\Rightarrow \frac{9x-1}{4} = y \text{(i)}$$

According to given situation we have,

$$6y^2 = 29x^2 + 1$$

$$\Rightarrow 6\left(\frac{9x-1}{4}\right)^2 = 29x^2 + 1$$

$$\Rightarrow \frac{3(81x^2 - 18x + 1)}{8} = 29x^2 + 1$$

$$\Rightarrow 243x^2 - 54x + 3 = 232x^2 + 8$$

$$\Rightarrow 11x^2 - 54x - 5 = 0$$

Factorize above quadratic equation we get

$$\Rightarrow (x - 5)(11x + 1) = 0$$

$$\Rightarrow x = 5 \text{ or } x = \frac{-1}{11} \text{ (negative value is rejected)}$$

$$\therefore x = 5\text{m}$$

When $x = 5$, then $y = \frac{9 \times 5 - 1}{4} = 11\text{m}$ (From (i))

Hence sides of the square are 5m and 11m.

10. Let Shikha's present age be x .

Then,

Her age 5 years ago = $(x - 5)$ years,

Her age 8 years later = $(x + 8)$ years,

It is given that the product of these ages is 30.

$$\therefore (x - 5)(x + 8) = 30$$

$$\Rightarrow x^2 + 8x - 5x - 40 = 30$$

$$\Rightarrow x^2 + 3x - 40 - 30 = 0$$

$$\Rightarrow x^2 + 3x - 70 = 0$$

$$\Rightarrow x^2 + 10x - 7x - 70 = 0$$

$$\Rightarrow x(x + 10) - 7(x + 10) = 0$$

$$\Rightarrow (x - 7)(x + 10) = 0$$

$$\Rightarrow x - 7 = 0 \text{ [}\because \text{ age can never be negative } \therefore x + 10 \neq 0]$$

$$\Rightarrow x = 7 \text{ years}$$

Hence, Shikha's present age is 7 years.

11. Let the side of the smaller square be x cm and that of the larger square be y cm.

$$\text{Area of the smaller square} = x^2 \text{ cm}^2$$

$$\text{Area of the larger square} = y^2 \text{ cm}^2$$

$$\text{According to question, } y^2 - 2x^2 = 14 \text{ (i)}$$

$$\text{and, } 2y^2 + 3x^2 = 203 \text{ (ii)}$$

From (i),

$$y^2 = 14 + 2x^2$$

Now, substitute this value of y^2 in (ii),

$$2(14 + 2x^2) + 3x^2 = 203$$

$$\Rightarrow 28 + 4x^2 + 3x^2 = 203$$

$$\Rightarrow 7x^2 = 203 - 28$$

$$\Rightarrow 7x^2 = 175 \Rightarrow x^2 = 25 \Rightarrow x = 5 \text{ cm.}$$

Putting $x = 5$ in (i),

$$y^2 - 2 \times 5^2 = 14 \Rightarrow y^2 = 64 \Rightarrow y = 8$$

\therefore the side of smaller square is 5 cm and the side of larger square is 8 cm

12. Let the original speed of the bus be x km/hr

$$\text{Time taken to cover 75 km} = \frac{75}{x} \text{ hours.}$$

$$\text{New speed} = (x + 10) \text{ km/hr.}$$

$$\text{Time taken to cover 90 km with new speed} = \frac{90}{(x+10)} \text{ hours.}$$

$$\text{Total time taken to cover the whole journey} = 3 \text{ hours.}$$

$$\therefore \frac{75}{x} + \frac{90}{(x+10)} = 3$$

$$\Rightarrow \frac{75(x+10)+90x}{x(x+10)} = 3 \Rightarrow 165x + 750 = 3x^2 + 30x$$

$$\Rightarrow 3x^2 - 135x - 750 = 0 \Rightarrow x^2 - 45x - 250 = 0$$

$$\Rightarrow x^2 - 50x + 5x - 250 = 0 \Rightarrow x(x - 50) + 5(x - 50) = 0$$

$$\Rightarrow (x - 50)(x + 5) = 0 \Rightarrow x - 50 = 0 \text{ or } x + 5 = 0$$

$$\Rightarrow x = 50 \text{ or } x = -5 \Rightarrow x = 50 \text{ [}\because \text{ speed cannot be negative]}$$

Hence, the original speed of the bus was 50 km/hr

13. Suppose Arjun had x arrows.

$$\text{Number of arrows used to cut arrows of Bheeshm} = x/2$$

$$\text{Number of arrows used to kill the rath driver} = 6$$

$$\text{Number of other arrows used} = 3 \text{ (required to knock down rath, flag \& bow of bheem)}$$

$$\text{Remaining arrows} = 4\sqrt{x} + 1$$

According to the question;

$$\text{Total no. of arrows Arjuna had} = \frac{x}{2} + 6 + 3 + 4\sqrt{x} + 1$$

$$\therefore \frac{x}{2} + 6 + 3 + 4\sqrt{x} + 1 = x \Rightarrow \frac{x}{2} + 10 + 4\sqrt{x} = x$$

$$\Rightarrow x + 20 + 8\sqrt{x} = 2x$$

$$\Rightarrow x = 20 + 8\sqrt{x}$$

Putting $\sqrt{x} = y \Rightarrow y = x^2$, the above equation becomes

$$y^2 = 20 + 8y$$

$$\Rightarrow y^2 - 8y - 20 = 0$$

$$\Rightarrow y^2 - 10y + 2y - 20 = 0$$

$$\Rightarrow (y - 10)(y + 2) = 0$$

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

$$\Rightarrow y = 10 \text{ [}\because \text{y cannot be negative, as it is square root of x]}]$$

$$\Rightarrow x = y^2 \Rightarrow x = 100$$

Hence, the number of arrows which Arjun had is $x = 100$.

14. Let seven years ago Swati's age be x years.

As per given condition

Seven years ago Varun's age was five times the square of Swati's age.

Then, seven years ago Varun's age was $5x^2$ years.

Therefore, Swati's present age = $(x + 7)$ years

And Varun's present age = $(5x^2 + 7)$ years

Three years hence Swati's age = $(x + 7 + 3)$ years = $(x + 10)$ years

And three years hence Varun's age = $(5x^2 + 7 + 3)$ years = $(5x^2 + 10)$ years

As per given condition

Three years hence Swati's age will be $\frac{2}{5}$ of Varun's age.

$$\text{Therefore, } x + 10 = \frac{2}{5}(5x^2 + 10)$$

$$\Rightarrow x + 10 = 2(x^2 + 2)$$

$$\Rightarrow x + 10 = 2x^2 + 4$$

$$\Rightarrow 2x^2 - x - 6 = 0$$

$$\Rightarrow 2x^2 - 4x + 3x - 6 = 0$$

$$\Rightarrow 2x(x - 2) + 3(x - 2) = 0$$

$$\Rightarrow (2x + 3)(x - 2) = 0$$

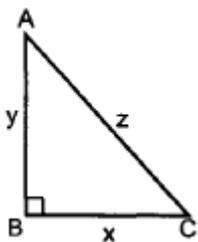
$$\Rightarrow x - 2 = 0 \text{ [}\because 2x + 3 \neq 0 \text{ as } x > 0\text{]}$$

$$\Rightarrow x = 2$$

Hence, Swati's present age = $(2 + 7)$ years = 9 years

Varun's present age = $(5 \times 2^2 + 7)$ years = 27 years

15. Let shortest side be x units and other side be y units



Hypotenuse = z units

As per given condition

The perimeter of right-angled triangle is five times the length of its shortest side.

$$\text{So, } x + y + z = 5x$$

$$\Rightarrow y + z = 4x$$

$$\Rightarrow z = 4x - y \dots(i)$$

The numerical value of the area of the triangle is 15 times the numerical value of the length of the shortest side.

So, area of the rectangle is = $15x$

$$\Rightarrow \frac{1}{2}x \cdot y = 15x$$

$$\Rightarrow y = 30 \dots(ii)$$

Using Pythagoras Theorem, we get

$$z^2 = x^2 + y^2$$

$$\Rightarrow (4x - y)^2 = x^2 + y^2 \text{ [from (i)]}$$

$$\Rightarrow (4x - 30)^2 = x^2 + (30)^2 \text{ [Using (ii)]}$$

$$\Rightarrow 16x^2 - 240x + 900 = x^2 + 900$$

$$\Rightarrow 15x^2 - 240x = 0$$

$$\Rightarrow 15x(x - 16) = 0$$

$$\Rightarrow x = 0 \text{ (rejecting) or } x = 16$$

$$\therefore x = 16$$

\therefore length of the shortest side = 16 units

length of other side = 30 units

length of hypotenuse $z = 4 \times 16 - 30 = 34$ units

16. Let the usual speed of the aeroplane be x km/hr. Then,

New speed = $(x + 250)$ km/hr

Time taken to cover 1250 km when the speed is x km/hr = $\frac{1250}{x}$ hrs.

Time taken to cover 1250 km when the speed is $(x + 250)$ km/hr = $\frac{1250}{x+250}$ hrs.

$$\therefore \frac{1250}{x} - \frac{1250}{x+250} = \frac{50}{60} \left[\because 50 \text{ minutes} = \frac{50}{60} \right]$$

$$\Rightarrow \frac{1250(x+250) - 1250x}{x(x+250)} = \frac{5}{6}$$

$$\Rightarrow \frac{1250x + 312500 - 1250x}{x^2 + 250x} = \frac{5}{6}$$

$$\Rightarrow \frac{312500}{x^2 + 250x} = \frac{5}{6}$$

$$\Rightarrow \frac{6}{5} \times 312500 = x^2 + 250x$$

$$\Rightarrow 6 \times 62500 = x^2 + 250x$$

$$\Rightarrow x^2 + 250x - 375000 = 0$$

$$\Rightarrow x^2 + 750x - 500x - 375000 = 0$$

$$\Rightarrow x(x + 750) - 500(x + 750) = 0$$

$$\Rightarrow (x + 750)(x - 500) = 0$$

$$\Rightarrow x = 500 \text{ [}\because \text{ Speed can not be negative } \therefore x + 750 \neq 0]$$

Hence, the usual speed of aeroplane is 500 km/hr.

17. Given, speed of boat in still water = 8 Km/hr. Let the speed of the stream be x km/hr. Then,

Speed of boat in downstream = $(8 + x)$ km/hr

Speed of boat in upstream = $(8 - x)$ km/hr

We know that time taken to cover 'd' km with speed 's' km/hr is $\frac{d}{s}$

So, Time taken by the boat to go 15 km upstream = $\frac{15}{8-x}$ hours.

&, Time taken by the boat to 22 km downstream = $\frac{22}{8+x}$ hours.

It is given that the total time taken by boat to go 15 km upstream & 22 km downstream is 5 hours.

$$\therefore \frac{15}{8-x} + \frac{22}{8+x} = 5$$

$$\Rightarrow \frac{15(8+x) + 22(8-x)}{(8-x)(8+x)} = 5$$

$$\Rightarrow \frac{120 + 15x + 176 - 22x}{8^2 - x^2} = 5$$

$$\Rightarrow \frac{-7x + 296}{64 - x^2} = 5$$

$$\Rightarrow -7x + 296 = 5(64 - x^2)$$

$$\Rightarrow -7x + 296 = 320 - 5x^2$$

$$\Rightarrow 5x^2 - 7x + 296 - 320 = 0$$

$$\Rightarrow 5x^2 - 7x - 24 = 0$$

$$\Rightarrow 5x^2 - 15x + 8x - 24 = 0$$

$$\Rightarrow 5x(x - 3) + 8(x - 3) = 0$$

$$\Rightarrow (5x + 8)(x - 3) = 0$$

$$\Rightarrow x - 3 = 0 \text{ [}\because \text{ Speed can not be negative } \therefore 5x + 8 \neq 0]$$

$$\Rightarrow x = 3$$

Hence, the speed of the stream is 3 km/hr.

18. Let the original speed of the aircraft be x km/hr.

Distance covered = 2800 km.

We know that, time taken to cover 'd' km with speed 's' km/hr is $\frac{d}{s}$ hr

So, Time taken to cover 2800 km = $\frac{2800}{x}$ hours.

Reduced speed = $(x - 100)$ km/hr.

Time taken to cover 2800 km at this speed = $\frac{2800}{(x-100)}$ hours.

Given time taken with reduced speed is 30 minutes i.e. $\frac{30}{60}$ hr

$$\therefore \frac{2800}{(x-100)} - \frac{2800}{x} = \frac{30}{60}$$

$$\Rightarrow \frac{1}{(x-100)} - \frac{1}{x} = \frac{1}{2 \times 2800} \Rightarrow \frac{x - (x-100)}{(x-100)x} = \frac{1}{5600}$$

$$\Rightarrow \frac{100}{(x^2 - 100x)} = \frac{1}{5600} \Rightarrow x^2 - 100x - 560000 = 0$$

$$\Rightarrow x^2 - 800x + 700x - 560000 = 0$$

$$\Rightarrow x(x-800) + 700(x-800) = 0$$

$$\Rightarrow (x-800)(x+700) = 0$$

$$\Rightarrow x - 800 = 0 \text{ or } x + 700 = 0$$

$$\Rightarrow x = 800 \text{ or } x = -700$$

$$\Rightarrow x = 800 \text{ [}\because \text{ speed cannot be negative]}$$

original speed of the aircraft = 800 km/hr

original duration of the flight = $\frac{2800}{800}$ hours = 3.5 hrs

= 3 hours 30 minutes.

19. Let the present age of Nisha be x years.

Then, as per given condition

Asha's age (in years) is 2 more than the square of her daughter Nisha's age.

$$\text{So, Asha's age} = x^2 + 2$$

$$\text{Difference in their ages} = x^2 + 2 - x$$

$$\text{And, Asha's age when Nisha's age will be } (x^2 + 2) \text{ years} = (x^2 + 2) + (x^2 + 2 - x)$$

$$\text{If Asha's age is one year less than 10 times the present age of Nisha} = 10x - 1$$

So, As per given condition

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

$$\Rightarrow 2x^2 - x + 4 = 10x - 1$$

$$\Rightarrow 2x^2 - 11x + 5 = 0$$

$$\Rightarrow 2x^2 - 10x - x + 5 = 0$$

$$\Rightarrow 2x(x-5) - 1(x-5) = 0$$

$$\Rightarrow (x-5)(2x-1) = 0$$

$$\Rightarrow x - 5 = 0 \text{ or } 2x - 1 = 0$$

$$\Rightarrow x = 5 \text{ or } x = \frac{1}{2}$$

$$\Rightarrow x = 5 \text{ [as age can't be a fraction]}$$

$$\Rightarrow x^2 + 2 = 5^2 + 2 = 27$$

Hence, Nisha's age is 5 years and Asha's age is 27 years.

20. Let the total number of swans be x .

$$\therefore \text{Number of swans playing on the shore of the tank} = \frac{7}{2}\sqrt{x}$$

It is given that there are two remaining swans playing in the water. Hence, total no. of swans = $\frac{7}{2}\sqrt{x} + 2$, which is equal to x .

$$\text{Clearly; } x = \frac{7}{2}\sqrt{x} + 2$$

$$\Rightarrow x - \frac{7}{2}\sqrt{x} - 2 = 0$$

$$\Rightarrow y^2 - \frac{7}{2}y - 2 = 0, \text{ where } y = \sqrt{x} \Rightarrow y^2 = x$$

$$\Rightarrow 2y^2 - 7y - 4 = 0$$

$$\Rightarrow 2y^2 - 8y + y - 4 = 0$$

$$\Rightarrow 2y(y-4) + (y-4) = 0$$

$$\Rightarrow (y-4)(2y+1) = 0$$

$$\Rightarrow y = 4 \text{ or, } y = -\frac{1}{2}$$

$$\Rightarrow y = 4 \text{ [} \because y = -\frac{1}{2} \text{ is not possible as } y \text{ is square root of } x \text{]}$$

$$\Rightarrow x = y^2 \Rightarrow x = 4^2 = 16$$

Hence, the total number of swans = $x = 16$.

21. Let the present age of son be x years. It is given that age of his father is $3\frac{1}{2}$ times than that of son.

$$\therefore \text{ age of his father} = 3\frac{1}{2}x = \frac{7}{2}x$$

According to the question,

$$\Rightarrow x^2 + \left(\frac{7}{2}x\right)^2 = 1325$$

$$\Rightarrow x^2 + \frac{49}{4}x^2 = 1325$$

$$\Rightarrow \frac{4x^2 + 49x^2}{4} = 1325$$

$$\Rightarrow 53x^2 = 1325 \times 4$$

$$\Rightarrow x^2 = \frac{1325 \times 4}{53} = 100$$

$$\Rightarrow x = \sqrt{100} = 10$$

Son's Age, $x = 10$ years

$$\text{and father's age} = \frac{7}{2} \times x = \frac{7}{2} \times 10 = 35 \text{ years.}$$

22. Assume number of tourists = x and it is given that charges for the room is Rs. 1200.

$$\text{Therefore, share per person} = \text{Rs. } \frac{1200}{x}$$

$$\text{Number of tourist paid the charge} = \text{Rs. } (x - 3)$$

$$\text{Therefore, Share per person} = \text{Rs. } \frac{1200}{x-3}$$

According to given situation we have,

$$\frac{1200}{x-3} - \frac{1200}{x} = 20$$

$$\Rightarrow \frac{1200x - 1200(x-3)}{(x-3)x} = 20$$

$$\Rightarrow 3600 = 20(x^2 - 3x)$$

$$\Rightarrow x^2 - 3x - 180 = 0$$

$$\Rightarrow (x - 15)(x + 12) = 0$$

$$\Rightarrow x = 15, x = -12 \text{ (rejecting)}$$

Therefore, $x = 15$

Hence, there were 15 tourists in the party.

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

$$\text{We know that, } \text{time} = \frac{\text{distance}}{\text{speed}}$$

$$\text{So, Time taken to cover 180 km with speed } x \text{ km/hr} = \frac{180}{x} \text{ hours.}$$

$$\text{Now, Time taken to cover 180 km when the speed is increased by 9 km/hr} = \frac{180}{x+9} \text{ hours}$$

According to the question ;

$$\therefore \frac{180}{x} - \frac{180}{x+9} = 1$$

$$\Rightarrow \frac{180x + 1620 - 180x}{x^2 + 9x} = 1$$

$$\Rightarrow 1620 = x^2 + 9x$$

$$\Rightarrow x^2 + 9x - 1620 = 0$$

$$\Rightarrow x^2 + 45x - 36x - 1620$$

$$\Rightarrow x(x + 45) - 36(x + 45) = 0$$

$$\Rightarrow x = -45 \text{ or } x = 36$$

Since the speed cannot be negative, $x \neq -45$

$$\Rightarrow x = 36$$

Thus, the speed of the train is 36 km/hr.

24. Let the number of students be x

Total budget for food = Rs. 480/-

$$\text{Then, cost of food for each student} = \text{Rs } \frac{480}{x}$$

But eight students failed to go

Then, the numbers of students going to picnic = $(x - 8)$.

$$\therefore \text{New cost of food for each member} = \text{Rs} \frac{480}{x-8}$$

According to the question ;

$$\frac{480}{x-8} - \frac{480}{x} = 10$$

$$\Rightarrow \frac{480x - 480(x-8)}{x(x-8)} = 10$$

$$\Rightarrow \frac{480x - 480x + 3840}{x^2 - 8x} = 10$$

$$\Rightarrow 3840 = 10(x^2 - 8x)$$

$$\Rightarrow x^2 - 8x = \frac{3840}{10}$$

$$\Rightarrow x^2 - 8x - 384 = 0$$

$$\Rightarrow x^2 - 24x + 16x - 384 = 0$$

$$\Rightarrow x(x - 24) + 16(x - 24) = 0$$

$$\Rightarrow (x - 24)(x + 16) = 0$$

$$\Rightarrow x - 24 = 0 \quad [\because \text{Number of student cannot be negative. } \therefore x + 16 \neq 0]$$

$$\Rightarrow x = 24$$

So, the total no. of students initially is $x = 24$.

The number of students actually attended the picnic = $x - 8 = 24 - 8 = 16$.

25. Let the length of the piece be x metres.

Total cost of the piece = Rs. 35,

Then, rate per metre = Rs. $\frac{35}{x}$

New length = $(x + 4)$ metres

Since the cost remains same.

$$\therefore \text{New rate per metre} = \text{Rs} \frac{35}{x+4}$$

According to the question ;

$$\frac{35}{x} - \frac{35}{x+4} = 1$$

$$\Rightarrow \frac{35(x+4) - 35x}{x(x+4)} = 1$$

$$\Rightarrow \frac{35x + 140 - 35x}{x(x+4)} = 1$$

$$\Rightarrow 140 = x(x + 4)$$

$$\Rightarrow 140 = x^2 + 4x$$

$$\Rightarrow x^2 + 4x - 140 = 0$$

$$\Rightarrow x^2 + 14x - 10x - 140 = 0$$

$$\Rightarrow x(x + 14) - 10(x + 14) = 0$$

$$\Rightarrow (x + 14)(x - 10) = 0$$

$$\Rightarrow x - 10 = 0 \quad [\because \text{Length cannot be negative } \therefore x + 14 \neq 0]$$

$$\Rightarrow x = 10$$

Hence, the length of the piece of cloth is 10 m.

26. Let the bookseller bought total ' x ' books for ₹ 1760

Hence, cost of one book = ₹ $\frac{1760}{x}$

If he had bought 4 more books i.e. total $(x + 4)$ books for ₹ 1760

\Rightarrow cost of $(x + 4)$ books = ₹ 1760.

$$\therefore \text{cost of one book} = \text{₹} \frac{1760}{(x+4)}$$

According to the question ;

$$\frac{1760}{x} - \frac{1760}{(x+4)} = 22 \quad (\text{Since, new price is ₹ 22 less than the old price})$$

$$\Rightarrow \frac{1}{x} - \frac{1}{(x+4)} = \frac{22}{1760} \Rightarrow \frac{(x+4) - x}{x(x+4)} = \frac{1}{80}$$

$$\Rightarrow \frac{4}{(x^2+4x)} = \frac{1}{80} \Rightarrow x^2 + 4x = 320$$

$$\Rightarrow x^2 + 4x - 320 = 0 \Rightarrow x^2 + 20x - 16x - 320 = 0$$

$$\Rightarrow x(x + 20) - 16(x + 20) = 0 \Rightarrow (x + 20)(x - 16) = 0$$

$$\Rightarrow x + 20 = 0 \text{ or } x - 16 = 0 \Rightarrow x = -20 \text{ or } x = 16$$

$$\Rightarrow x = 16 \quad [\because \text{number of books cannot be negative}]$$

Hence, the bookseller bought 16 books.

27. Let the length of one side be x metres and other side be y metres.

$$\text{Then, } x + y + x = 30 \implies y = 30 - 2x$$

$$\therefore \text{Area of the garden} = 100 \text{ m}^2$$

$$\implies xy = 100$$

$$\implies x(30-2x) = 100$$

$$\implies 2x^2 - 30x + 100 = 0$$

$$\implies 2(x^2 - 15x + 50) = 0 \text{ or } x^2 - 15x + 50 = 0$$

$$\implies x^2 - 10x - 5x + 50 = 0$$

$$\implies x(x-10) - 5(x-10) = 0$$

$$\implies (x-10)(x-5) = 0$$

Either $x-10 = 0$ or $x-5 = 0$

$$\implies x = 10, 5$$

$$\therefore y = 30 - 20 = 10 \text{ or } 30 - 10 = 20$$

Hence, the dimensions of the vegetable garden are $5\text{m} \times 20\text{m}$ or $10\text{m} \times 10\text{m}$.

28. Let the speed of the Deccan Queen = x kmph

The speed of another train = $(x - 20)$ kmph

The distance between Mumbai and Pune is 192 km.

Then, the time is taken by Deccan Queen = $\left(\frac{192}{x}\right)$ hours

Time is taken by another train = $\left(\frac{192}{x-20}\right)$ hours

The difference of time taken by two trains is $\frac{48}{60} = \frac{4}{5}$ hours.

$$\frac{192}{x-20} - \frac{192}{x} = \frac{4}{5}$$

$$\Rightarrow \frac{1}{x-20} - \frac{1}{x} = \frac{1}{240}$$

$$\Rightarrow \frac{x-x+20}{x^2-20x} = \frac{1}{240}$$

$$\Rightarrow x^2 - 20x - 4800 = 0$$

$$\Rightarrow x^2 - 80x + 60x - 4800 = 0$$

$$\Rightarrow x(x-80) + 60(x-80) = 0$$

$$\Rightarrow (x-80)(x+60) = 0$$

$$\Rightarrow x = 80 \text{ or } x = -60$$

$x = 80$ [\because speed cannot be negative]

Hence, speed of Deccan Queen = 80 km/h

29. Let usual speed = x km/hr

New speed = $(x + 250)$ km/hr

Total distance = 1500 km

Time taken by usual speed = $\frac{1500}{x}$ hr

Time taken by new speed = $\frac{1500}{x+250}$ hr

According to question,

$$\frac{1500}{x} - \frac{1500}{x+250} = \frac{1}{2}$$

$$\Rightarrow \frac{1500x + 1500 \times 250 - 1500x}{x^2 + 250x} = \frac{1}{2}$$

$$\Rightarrow x^2 + 250x = 750000$$

$$\Rightarrow x^2 + 250x - 750000 = 0$$

$$\Rightarrow x^2 + 1000x - 750x - 750000 = 0$$

$$\Rightarrow x(x + 1000) - 750(x + 1000) = 0$$

$$\Rightarrow x = 750 \text{ or } x = -1000$$

Therefore, usual speed is 750 km/hr, -1000 is neglected.

30. Let the total number of camels be x . Then,

Number of camels seen in the forest = $\frac{x}{4}$

Number of camels gone to mountains = $2\sqrt{x}$

Number of camels on the bank of river = 15

Total number of camels = $\frac{x}{4} + 2\sqrt{x} + 15$

By hypothesis, we have,

$$\frac{x}{4} + 2\sqrt{x} + 15 = x$$

$$\Rightarrow \frac{x}{4} - x + 2\sqrt{x} + 15 = 0$$

$$\Rightarrow -3x + 8\sqrt{x} + 60 = 0$$

$$\Rightarrow 3x - 8\sqrt{x} - 60 = 0$$

$$\Rightarrow 3y^2 - 8y - 60 = 0, \text{ where } x = y^2$$

$$\Rightarrow 3y^2 - 18y + 10y - 60 = 0$$

$$\Rightarrow 3y(y - 6) + 10(y - 6) = 0$$

$$\Rightarrow (3y + 10)(y - 6) = 0$$

$$\Rightarrow \text{either } (y - 6) = 0$$

$$\text{or } (3y + 10) = 0$$

$$\Rightarrow y = 6 \text{ or } y = -\frac{10}{3}$$

$$\text{Now, } y = -\frac{10}{3} \Rightarrow x = \left(-\frac{10}{3}\right)^2 = \frac{100}{9} \quad [\because x = y^2]$$

But, the number of camels cannot be a fraction.

$$\therefore y = 6 \Rightarrow x = 6^2 = 36 \quad [\text{because } x = y^2]$$

Hence, the number of camels = 36. Therefore total number of camels seen in the forest is equal to 36. Hence proved

31. Given that first distance = 54 km.

Let x be the first speed of the train.

$$\text{We know that } \frac{\text{Distance}}{\text{Speed}} = \text{Time} = \frac{54}{x} \text{ hours}$$

When 63 km cover at an average speed of 6 km/hr more than the first speed.

$$\text{then Time} = \frac{63}{x+6} \text{ hours}$$

As per given condition

$$\frac{54}{x} + \frac{63}{x+6} = 3 \text{ hours}$$

$$\Rightarrow \frac{54(x+6) + 63x}{x(x+6)} = 3$$

$$\Rightarrow 54(x+6) + 63x = 3x(x+6)$$

$$\Rightarrow 54x + 324 + 63x = 3x^2 + 18x$$

$$\Rightarrow 117x + 324 = 3x^2 + 18x$$

$$\Rightarrow 3x^2 - 117x - 324 + 18x = 0$$

$$\Rightarrow 3x^2 - 99x - 324 = 0$$

$$\Rightarrow x^2 - 33x - 108 = 0$$

$$\Rightarrow x^2 - 36x + 3x - 108 = 0$$

$$\Rightarrow x(x - 36) + 3(x - 36) = 0$$

$$\Rightarrow x + 3 = 0 \text{ or } x - 36 = 0$$

$$\Rightarrow x = -3 \text{ or } x = 36$$

Speed cannot be negative and hence initial speed of the train is 36 km/hour.

32. Let the length of the hypotenuse be x cm.

Since, length of the hypotenuse is 2 cm & 4cm greater than the base & the altitude respectively.

Hence, Base = (x - 2) cm and Altitude = (x - 4) cm

Clearly ; $x \geq 4$ (1)

According to the Pythagoras theorem, we have

$$(\text{Base})^2 + (\text{Altitude})^2 = (\text{Hypotenuse})^2$$

$$\Rightarrow (x - 2)^2 + (x - 4)^2 = x^2$$

$$\Rightarrow x^2 - 4x + 4 + x^2 - 8x + 16 = x^2$$

$$\Rightarrow x^2 - 12x + 20 = 0$$

$$\Rightarrow x^2 - 10x - 2x + 20 = 0$$

$$\Rightarrow x(x - 10) - 2(x - 10) = 0$$

$$\Rightarrow (x - 10)(x - 2) = 0$$

$$\Rightarrow x = 2, \text{ or } x = 10 \Rightarrow x = 10 \quad [\text{but } x \neq 2 \text{ as } x \geq 4 \text{ from (1)}]$$

Hence, the length of the rods are 8 cm, 6 cm and 10 cm.

33. Suppose two years ago, son's age be x years.

Then, man's age two years ago = $3x^2$ years

∴ Present age of son = $(x + 2)$ years

And, present age of father = $(3x^2 + 2)$ years

Three years hence, we have

son's age = $(x + 2 + 3) = (x + 5)$ years

father's age = $(3x^2 + 2 + 3) = (3x^2 + 5)$ years

It is given that

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

$$\Rightarrow 3x^2 + 5 = 4x + 20$$

$$\Rightarrow 3x^2 - 4x - 15 = 0$$

$$\Rightarrow 3x^2 - 9x + 5x - 15 = 0$$

$$\Rightarrow 3x(x - 3) + 5(x - 3) = 0$$

$$\Rightarrow x - 3 = 0 \text{ or } 3x + 5 = 0$$

$$\Rightarrow x = 3 \text{ or } x = -\frac{5}{3}$$

Since, age cannot be in fraction, $x \neq -\frac{5}{3}$

$$\Rightarrow x = 3$$

Thus, present age of son = $x + 2 = 5$ years

and present age of father = $3x^2 + 2 = 3(3)^2 + 2 = 29$ years.

34. Let x students planned the picnic.

Then, $(x - 8)$ students attended the picnic.

Total bus charges = ₹ 1440

$$\therefore \frac{1440}{(x-8)} - \frac{1440}{x} = 30$$

$$\Rightarrow \frac{1}{(x-8)} - \frac{1}{x} = \frac{30}{1440} \Rightarrow \frac{x-(x-8)}{(x-8)x} = \frac{1}{48}$$

$$\Rightarrow \frac{8}{(x^2-8x)} = \frac{1}{48} \Rightarrow x^2 - 8x = 384 \text{ [by cross multiplication]}$$

$$\Rightarrow x^2 - 8x - 384 = 0 \Rightarrow x^2 - 24x + 16x - 384 = 0$$

$$\Rightarrow x(x - 24) + 16(x - 24) = 0 \Rightarrow (x - 24)(x + 16) = 0$$

$$\Rightarrow x - 24 = 0 \text{ or } x + 16 = 0 \Rightarrow x = 24 \text{ or } x = -16$$

$$\Rightarrow x = 24 \text{ [∵ number of students cannot be negative]}$$

Thus, 24 students planned the picnic.

i. Number of students who attended the picnic = $(24 - 8) = 16$

ii. Share of 24 students = ₹ 1440

$$\text{Share of 8 students} = ₹ \left(\frac{1440}{24} \times 8 \right) = ₹ 480$$

∴ money paid towards the fee = ₹ 480

The value reflected in the given question is 'charity'.

35. Since, there are 60 minutes gap between 2 PM & 3 PM.

Time needed by minutes hand after t minutes past 2 PM to show 3 PM = $(60 - t)$ minutes

According to the question ;

$$60 - t = \frac{t^2}{4} - 3$$

$$\Rightarrow 63 = \frac{t^2}{4} + t$$

$$\Rightarrow 63 = \frac{t^2 + 4t}{4}$$

$$\Rightarrow 252 = t^2 + 4t$$

$$\Rightarrow t^2 + 4t - 252 = 0$$

$$\Rightarrow t^2 + 18t - 14t - 252 = 0$$

$$\Rightarrow t(t + 18) - 14(t + 8) = 0$$

$$\Rightarrow (t + 18)(t - 14) = 0$$

$$\Rightarrow t + 18 = 0 \text{ or } t - 14 = 0$$

$$\Rightarrow t = -18 \text{ or } t = 14$$

Since time cannot be negative, $t \neq -18$

Hence, $t = 14$ minutes.

36. Let the usual speed of the plane be x km/hr. Then,

New speed = $(x + 400)$ km/hr.

Time taken to cover 1600 km when the speed is x km/hr = $\frac{1600}{x}$ hrs.

Time taken to cover 1600 km when the speed is $(x + 400)$ km/hr = $\frac{1600}{x+400}$ hrs.

$$\therefore \frac{1600}{x} - \frac{1600}{x+400} = \frac{40}{60} \left[\because 40 \text{ minutes} = \frac{10}{60} \text{ hr} \right]$$

$$\Rightarrow \frac{1600(x+400) - 1600x}{x(x+400)} = \frac{2}{3}$$

$$\Rightarrow \frac{1600x + 640000 - 1600x}{x^2 + 400x} = \frac{2}{3}$$

$$\Rightarrow \frac{640000}{x^2 + 400x} = \frac{2}{3}$$

$$\Rightarrow 1920000 = 2(x^2 + 400x)$$

$$\Rightarrow \frac{1920000}{2} = x^2 + 400x$$

$$\Rightarrow 960000 = x^2 + 400x$$

$$\Rightarrow x^2 + 400x - 960000 = 0$$

$$\Rightarrow x^2 + 1200x - 800x - 960000 = 0$$

$$\Rightarrow x(x + 1200) - 800(x + 1200) = 0$$

$$\Rightarrow (x + 1200)(x - 800) = 0$$

$$\Rightarrow x - 800 = 0 \left[\because \text{Speed can not be negative } \therefore x + 1200 \neq 0 \right]$$

$$\Rightarrow x = 800$$

Hence, the usual speed of the plane is 800 km/hr.

37. Let the usual speed of the train be x km/hr. We know that time taken to cover 'd' km with speed 's' km/hr is $\frac{d}{s}$

\therefore Time taken to cover 150 km = $\frac{150}{x}$ hrs.

And, Time taken to cover 150 km when the speed is increased by 5 km/hr = $\frac{150}{x+5}$ hrs.

According to the question ;

$$\therefore \frac{150}{x} - \frac{150}{x+5} = 1$$

$$\Rightarrow \frac{150(x+5) - 150x}{x(x+5)} = 1$$

$$\Rightarrow \frac{150x + 750 - 150x}{x^2 + 5x} = 1$$

$$\Rightarrow 750 = x^2 + 5x$$

$$\Rightarrow x^2 + 5x - 750 = 0$$

$$\Rightarrow x^2 + 30x - 25x - 750 = 0$$

$$\Rightarrow x(x + 30) - 25(x + 30) = 0$$

$$\Rightarrow (x + 30)(x - 25) = 0$$

$$\Rightarrow x - 25 = 0 \left[\because \text{Speed can not be negative } \therefore x + 30 \neq 0 \right]$$

$$\Rightarrow x = 25$$

\therefore The usual speed of the train = x km/hr = 25 km/hr.

38. Let the cost price of an article be ₹ x . It is given that percentage gain is equal to cost price of the article.

Hence, percentage gain = $x\%$

$S \cdot P = C \cdot P \left(1 + \frac{\text{percentage gain}}{100} \right)$ [S.P is selling price]

$$\therefore \text{S.P.} = x \left(1 + \frac{x}{100} \right) = x + \frac{x^2}{100}$$

Given, S.P. = ₹ 75

$$\Rightarrow x + \frac{x^2}{100} = 75$$

$$\Rightarrow 100x + x^2 = 7500$$

$$\Rightarrow x^2 + 100x - 7500 = 0$$

$$\Rightarrow x^2 + 150x - 50x - 7500 = 0$$

$$\Rightarrow x(x + 150) - 50(x + 150) = 0$$

$$\Rightarrow (x + 150)(x - 50) = 0$$

$$\Rightarrow x + 150 = 0 \text{ or } x - 50 = 0$$

Since the price cannot be negative, $x \neq -150$

$$\Rightarrow x = 50$$

Thus, the cost price of an article = ₹ x = ₹ 50

39. Let the present age of girl's sister be 'x' years.

So, girl's present age = 2x years.

After 4 years;

Girl's age = (2x+4) years.

Sister's age = (x+4) years.

According to the question ;

$(x + 4)(2x + 4) = 160$ (\because product of their ages 4 years hence is 160)

$$\Rightarrow 2x^2 + 12x - 144 = 0 \Rightarrow x^2 + 6x - 72 = 0$$

$$\Rightarrow x^2 + 12x - 6x - 72 = 0 \Rightarrow x(x + 12) - 6(x + 12) = 0$$

$$\Rightarrow (x + 12)(x - 6) = 0 \Rightarrow x + 12 = 0 \text{ or } x - 6 = 0$$

$$\Rightarrow x = -12 \text{ or } x = 6$$

$$\Rightarrow x = 6 \text{ [}\because \text{ age cannot be negative]}$$

Hence, sister's present age = x = 6 years and girl's present age = 2x = 12 years

40. Let the actual marks be x

According to the question,

$$7(x + 8) = x^2 - 4$$

$$\Rightarrow 7x + 56 = x^2 - 4$$

$$\Rightarrow x^2 - 7x - 60 = 0$$

$$\Rightarrow x^2 - 12x + 5x - 60 = 0$$

$$\Rightarrow x(x - 12) + 5(x - 12) = 0$$

$$\Rightarrow (x - 12)(x + 5) = 0$$

$$\Rightarrow x - 12 = 0 \text{ or } x + 5 = 0$$

$$\Rightarrow x = 12 \text{ or } x = -5$$

$$\Rightarrow x = 12 \dots \text{ [}\because \text{ Marks can't be negative]}$$

Hence, Aarush scored 12 marks in Mathematics test.

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

We know that time taken to cover 'd' km with speed 's' km/h = $\frac{d}{s}$ \therefore time taken to cover 90 km = $\frac{90}{x}$ hours

&, Time taken to cover 90 km when the speed is increased by 15 km/hr = $\frac{90}{x+15}$ hours

According to the question ;

$$\frac{90}{x} - \frac{90}{x+15} = \frac{30}{60} \text{ (time reduced by 30 minutes with increased speed)}$$

$$\Rightarrow \frac{90}{x} - \frac{90}{x+15} = \frac{1}{2}$$

$$\Rightarrow \frac{90x + 1350 - 90x}{x^2 + 15x} = \frac{1}{2}$$

$$\Rightarrow \frac{1350}{x^2 + 15x} = \frac{1}{2}$$

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

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

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

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

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

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

$$\Rightarrow x = -60 \text{ or } x = 45$$

Since the speed cannot be negative, $x \neq -60$.

$$\Rightarrow x = 45$$

Thus, the original speed of the train is 45 km/hr.

42. Let the original list price of the toy be Rs. x.

\therefore Number of toys can be bought for Rs 360 = $\frac{360}{x}$ toys

Now, Reduced list price of the toy = Rs(x - 2)

\therefore Number of toys can be bought with new reduced list price for Rs 360 = $\frac{360}{x-2}$ toys

According to the question:

$$\frac{360}{x-2} = 2 + \frac{360}{x} \text{ (2 extra toys can be bought if price reduces by 2 rupees)}$$

$$\therefore \frac{360}{x-2} - \frac{360}{x} = 2$$

$$\begin{aligned}
\Rightarrow \frac{360x - 360(x-2)}{x(x-2)} &= 2 \\
\Rightarrow \frac{360x - 360x + 720}{x^2 - 2x} &= 2 \\
\Rightarrow 720 &= 2(x^2 - 2x) \\
\Rightarrow x^2 - 2x &= \frac{720}{2} \\
\Rightarrow x^2 - 2x &= 360 \\
\Rightarrow x^2 - 2x - 360 &= 0 \\
\Rightarrow x^2 - 20x + 18x - 360 &= 0 \\
\Rightarrow x(x - 20) + 18(x - 20) &= 0 \\
\Rightarrow (x - 20)(x + 18) &= 0 \\
\Rightarrow x - 20 = 0 \text{ [Since, Cost cannot be negative. } \therefore x + 18 \neq 0 \text{]} \\
\Rightarrow x &= 20
\end{aligned}$$

Hence, the original list price of the toy is $x = \text{Rs } 20$.

43. Let the number of books bought by shopkeeper be x .

Given, Cost of x books = Rs. 80.

\therefore Cost of one book = Rs. $\frac{80}{x}$

If the number of books bought in Rs. 80/- was $(x + 4)$,

then Cost of one book = Rs. $\frac{80}{x+4}$

According to the question ;

$$\therefore \frac{80}{x} - \frac{80}{x+4} = 1$$

$$\Rightarrow 80 \left(\frac{1}{x} - \frac{1}{x+4} \right) = 1$$

$$\Rightarrow 80 \left\{ \frac{x+4-x}{x(x+4)} \right\} = 1$$

$$\Rightarrow \frac{320}{x^2+4x} = 1$$

$$\Rightarrow x^2 + 4x = 320$$

$$\Rightarrow x^2 + 4x - 320 = 0$$

$$\Rightarrow x^2 + 20x - 16x - 320 = 0$$

$$\Rightarrow x(x + 20) - 16(x + 20) = 0$$

$$\Rightarrow (x + 20)(x - 16) = 0$$

$$\Rightarrow x = -20 \text{ or, } x = 16 \Rightarrow x = 16 \text{ [} \because x \text{ is no. of books, hence } x \text{ cannot be negative]}$$

Hence, the number of books originally bought is $x = 16$

44. Let, B alone takes x days to finish the work.

Then, A alone can finish it in $(x - 10)$ days

Clearly ; $x \geq 10$(1)

Since B takes x days to complete the work.

So in 1 day B will do $\frac{1}{x}$ work.

Similarly, A's one day work = $\frac{1}{x-10}$ work.

Now, (A's one day's work) + (B's one day's work)

$$\frac{1}{x-10} + \frac{1}{x}$$

$$\text{And, (A + B)'s one day's work} = \frac{1}{12}$$

$$\therefore \frac{1}{x-10} + \frac{1}{x} = \frac{1}{12}$$

$$\Rightarrow \frac{x+x-10}{x(x-10)} = \frac{1}{12}$$

$$\Rightarrow 12(2x - 10) = x(x - 10)$$

$$\Rightarrow 24x - 120 = x^2 - 10x$$

$$\Rightarrow x^2 - 10x - 24x + 120 = 0$$

$$\Rightarrow x^2 - 34x + 120 = 0$$

$$\Rightarrow x^2 - 30x - 4x + 120 = 0$$

$$\Rightarrow x(x - 30) - 4(x - 30) = 0$$

$$\Rightarrow (x - 30)(x - 4) = 0$$

$$\Rightarrow x - 30 = 0 \text{ [} \because x \geq 10 \text{ from (1) } \therefore x - 4 \neq 0 \text{]}$$

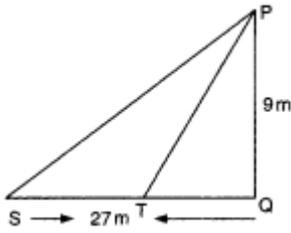
$$\Rightarrow x = 30$$

Hence, B alone can finish the work in 30 days.

45. Let PQ be the pole and the peacock is sitting at the top P of the pole.

Let the hole be at Q.

Initially, the snake is at point S when the peacock notices the snake such that QS = 27 m.



Given, speed of the peacock and the snake are equal.

Therefore, Distance covered by peacock = Distance covered by snake.

i.e., PT = ST = x (say)

Thus, in right triangle PQT, we have

$$QT = 27 - x, PT = x \text{ and } PQ = 9$$

Using Pythagoras theorem, we have

$$PT^2 = PQ^2 + QT^2$$

$$\Rightarrow x^2 = 9^2 + (27 - x)^2$$

$$\Rightarrow x^2 = 81 + 729 - 54x + x^2$$

$$\Rightarrow 810 - 54x = 0$$

$$\Rightarrow 54x = 810$$

$$\Rightarrow x = 15$$

Therefore, QT = SQ - ST = (27 - 15) m = 12 m

Hence, the snake is caught at a distance of 12 m from the hole.

46. Let, the slower pipe takes x hours to fill the reservoir.

Hence, the faster pipe will take (x - 10) hours to fill the reservoir.

Since, the slower pipe takes x hours to fill the reservoir.

$$\therefore \text{Portion of the reservoir filled by the slower pipe in 1 hour} = \frac{1}{x}$$

$$\therefore \text{Portion of the reservoir filled by the slower pipe in 12 hours} = \frac{1}{x} \times 12 = \frac{12}{x}$$

$$\text{Now, portion of the reservoir filled by the faster pipe in 1 hr} = \frac{1}{x-10}$$

$$\therefore \text{Portion of the reservoir filled by faster pipe in 12 hours} = \frac{1}{x-10} \times 12 = \frac{12}{x-10}$$

It is given that the reservoir is completely filled in 12 hours by simultaneously operating both pipes.

$$\therefore \frac{12}{x} + \frac{12}{x-10} = 1$$

$$\Rightarrow \frac{12(x-10)+12x}{x(x-10)} = 1$$

$$\Rightarrow \frac{12x-120+12x}{x^2-10x} = 1$$

$$\Rightarrow x^2 - 10x = 24x - 120$$

$$\Rightarrow x^2 - 10x - 24x + 120 = 0$$

$$\Rightarrow x^2 - 34x + 120 = 0$$

$$\Rightarrow x^2 - 30x - 4x + 120 = 0$$

$$\Rightarrow x(x - 30) - 4(x - 30) = 0$$

$$\Rightarrow (x - 30)(x - 4) = 0$$

$$\Rightarrow x - 30 = 0. [\because x - 4 \neq 0, \text{ otherwise } (x-10) \text{ i.e. time taken by faster pipe will become } -6 \text{ hr i.e. negative, which is not possible}]$$

$$\Rightarrow x = 30$$

Hence, the second pipe take 30 hours to fill the reservoir.

47. Let speed of the stream be x km/h .

Speed of the boat in still water = 11 km/h (Given)

\therefore Upstream speed of boat = (11 - x) km/h

and, downstream speed be (11 + x) km/h

Distance = 12 km

Also we know that, time taken to cover 'd' km with speed 's' km/h is = $\frac{d}{s}$

Time taken by boat to cover 12 km downstream = $\frac{12}{11+x}$ hours

Time taken by boat to cover 12 km upstream = $\frac{12}{11-x}$ hours

$$\text{ATQ } \frac{12}{11+x} + \frac{12}{11-x} = 2\frac{3}{4} \Rightarrow \frac{12(11-x)+12(11+x)}{(11+x)(11-x)} = \frac{11}{4}$$

$$\Rightarrow \frac{132+132}{121-x^2} = \frac{11}{4} \Rightarrow 4 \times 264 = 11(121 - x^2)$$

$$\Rightarrow \frac{4 \times 264}{11} = 121 - x^2 \Rightarrow 4 \times 24 = 121 - x^2$$

$$\Rightarrow x^2 = 25 \Rightarrow x = \pm 5$$

Hence, speed of the stream is $x = 5$ km/h