Solution

QUADRATIC EQUATIONS WS 6

Class 10 - Mathematics

Section A

1.

(c) 2 km/hr

Explanation: Let the speed of the stream be x km/hr

Speed of the boat upstream = (5 - x)km/hr

Speed of the boat downstream = (5 + x)km/hr

Time taken for going 5.25 km upstream = $\frac{5.25}{5-x}$,hours

Time taken for going 5.25 km downstream = $\frac{5.25}{5+x}$ hours

Obviously, time taken for going 5.25 km upstream is more than the time taken for going 5.25 km, downstream

It is given that the time taken for going 5.25 km, upstream is 1 hour more than the time taken for going 5.25 downstream

$\therefore \frac{5.25}{5-x} - \frac{5.25}{5+x} = 1$

$\Rightarrow 5.25\left\{\frac{1}{5-x} - \frac{1}{5+x}\right\} = 1 \Rightarrow \frac{21}{4}\left(\frac{5+x-5+x}{(5-x)(5+x)}\right) = 1$

$\Rightarrow \frac{21}{4} \times \frac{2x}{25-x^2} = 1 \Rightarrow \frac{21}{2} \times \frac{x}{25-x^2} = 1$

$\Rightarrow 2x^2 + 21x - 50 = 0$

$\Rightarrow x(2x + 25) - 2(2x + 25) = 0 \Rightarrow (2x + 25)(x - 2) = 0$

$\Rightarrow x - 2 = 0, 2x + 25 = 0$

$\Rightarrow x = 2\left[\because x = \frac{-25}{2}\right]$

$\therefore$ speed of the stream = 2km/hr

2.

(d) 50

Explanation: Let x be the number of persons and y be the amount received by each person.

According to the question, xy = 6500 ...(i)

Also, (x + 15)(y - 30) = 6500 ...(ii)

$\Rightarrow$xy - 30x + 15y - 450 = 6500

$\Rightarrow$6500 - 30x + 15y - 450 = 6500 [From (i)]

$\Rightarrow$2x - y + 30 = 0

$\Rightarrow$2x - $\frac{6500}{x}$ + 30 = 0 [From (i)]

$\Rightarrow 2x^2 - 6500 + 30x = 0$

$\Rightarrow x^2 + 15x - 3250 = 0$

$\Rightarrow$(x - 50)(x + 65) = 0

$\Rightarrow$x = 50 or x = -65

Since, number of persons cannot be negative. Hence, number of persons = 50

3. **(a)** 100

Explanation: Let Arjun had x arrows.

According to question,

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

$\Rightarrow$ 10 + $4\sqrt{x}$ = $\frac{x}{2}$

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

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

$\Rightarrow$ $64x = x^2 - 40x + 400$

$\Rightarrow$ $x^2 - 104x + 400 = 0$

$\Rightarrow$ $x^2 - 100x - 4x + 400 = 0$

$\Rightarrow$ x(x - 100) - 4(x - 100) = 0

$\Rightarrow$ (x - 100)(x - 4) = 0

$\Rightarrow$ x - 100 = 0 and x - 4 = 0

$\Rightarrow$ x = 100 and x = 4 [which is not possible]

Therefore, Arjun had 100 arrows.

4.

(c) 999

Explanation: Let the number of bangles in a side of square = x

According to the question,

x^2 + 38 = Total no. of bangles ...(i)

Also, $(x + 1)^2$ - 25 = Total no. of bangles ...(ii)

From (i) and (ii), we have

$x^2 + 38 = (x + 1)^2 - 25$

$\Rightarrow$ 38 + 24 = 2x $\Rightarrow$ x = 31

$\therefore$ Total no. of bangles = $(31)^2$ + 38 = 999

5.

(b) 7 years

Explanation: Let Rohan's present age be x years.

Then Rohan's mother age will be (x + 26) years.

And after 3 years their ages will be (x + 3) and (x + 29) years. According to question,

(x + 3)(x + 29) = 360

$\Rightarrow x^2 + 29x + 3x + 87 = 360$

$\Rightarrow x^2 + 32x - 273 = 0$

$\Rightarrow x^2 + 39x + 7x - 273 = 0$

$\Rightarrow$ x(x + 39) -7(x + 39) = 0

$\Rightarrow$ (x - 7)(x + 39) = 0

$\Rightarrow$ (x - 7) = 0 and x + 39 = 0

$\Rightarrow$ x = 7 and x = -39 [x = -39 is not possible]

Therefore, Rohan's present is 7 years

6.

(c) 30 days

Explanation: Let B takes x days to do the work,

then A takes (x - 10) days to do it.

$\therefore$ Work done by B in 1 day = $\frac{1}{x}$ and work done by A in $\frac{1}{x-10}$

According to question, $\frac{1}{x} + \frac{1}{x-10} = \frac{1}{12}$

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

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

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

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

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

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

$\Rightarrow$ x - 30 = 0 and x - 4 = 0

$\Rightarrow$ x = 30 and x = 4 [x = 4 is not possible]

Therefore, B can finish the work in 30 days.

7. **(a)** Rs.8

Explanation: Let the original price of 1 kg sugar = Rs. x

$\therefore$ In Re. 1, the weight of sugar can be bought = $\frac{1}{x}$ kg

$\therefore$ In Rs. 56, the weight of sugar can be bought = $\frac{56}{x}$ kg

New price = Rs. (x - 1)

$\therefore$ In Rs. 56, the weight of sugar can be bought = $\frac{56}{x-1}$ kg

According to question, $\frac{56}{x-1} - \frac{56}{x} = 1$

$\Rightarrow \frac{56x-56x+56}{x(x-1)}$ = 1

$\Rightarrow \frac{56}{x^2-x}$ = 1

$\Rightarrow x^2 - x - 56 = 0$

$\Rightarrow x^2 - 8x + 7x - 56 = 0$

$\Rightarrow x(x - 8) + 7(x - 8) = 0$

$\Rightarrow (x + 7)(x - 8) = 0$

$\Rightarrow x + 7 = 0$ and $x - 8 = 0$

$\Rightarrow x = -7$ and $x = 8$ [x = -7 is not possible]

Therefore, the original price of 1 kg of sugar is Rs. 8

8.

(d) 100

Explanation: Let the number of students be x

∴ Each student would get = $\frac{500}{x}$ bananas

∴ If there were 25 more students, then each student would get = $\frac{500}{x+25}$ bananas

According to question, $\frac{500}{x} - \frac{500}{x+25}$ = 1

$\Rightarrow \frac{500x+12500-500x}{x(x+25)}$ = 1

$\Rightarrow \frac{12500}{x^2+25x}$ = 1

$\Rightarrow x^2 + 25x - 12500 = 0$

$\Rightarrow x^2 + 125x - 100x - 12500 = 0$

$\Rightarrow x(x + 125) - 100(x + 125) = 0$

$\Rightarrow (x + 125)(x - 100) = 0$

$\Rightarrow x + 125 = 0$ and $x - 100 = 0$

$\Rightarrow x = -125$ and $x = 100$ [x = -125 is not possible]

Therefore, the number of students is 100

9. **(a)** 7 years

Explanation: Let Sharma's present age be x years

then, his age 3 years ago is (x - 3) years and 5 years from now is (x + 5) years. According to question,

$\frac{1}{x-3} + \frac{1}{x+5} = \frac{1}{3}$

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

$\Rightarrow \frac{2x+2}{x^2+5x-3x-15} = \frac{1}{3}$

$\Rightarrow 6x + 6 = x^2 + 2x - 15$

$\Rightarrow x^2 - 4x - 21 = 0$

$\Rightarrow x^2 - 7x + 3x - 21 = 0$

$\Rightarrow x(x - 7) + 3(x - 7) = 0$

$\Rightarrow (x + 3)(x - 7) = 0$

$\Rightarrow x + 3 = 0$ and $x - 7 = 0$

$\Rightarrow x = -3$ and $x = 7$

But x = -3 does not satisfy the given condition.

Therefore, Sharma's present age is 7 years.

10.

(c) 40 km/hr

Explanation: Let the actual speed of the train be x km/hr

Time taken to cover 360 km at this speed = $\frac{360}{x}$ hrs.

Time taken to cover 360 km at the increased speed = $\frac{360}{x+5}$ hrs.

According to condition, $\frac{360}{x} - \frac{360}{x+5} = 1$

$\Rightarrow 360\left[\frac{1}{x} - \frac{1}{x+5}\right]$ = 1

$\Rightarrow 360\left[\frac{x+5-x}{x(x+5)}\right]$ = 1

$\Rightarrow 360\left[\frac{5}{x(x+5)}\right]$ = 1

$\Rightarrow x^2 + 5x - 1800 = 0$

$\Rightarrow x^2 + 45x - 40x - 1800$

$\Rightarrow x(x + 45) - 40(x + 45) = 0$

$\Rightarrow (x - 40)(x + 45) = 0$

$\Rightarrow x - 40 = 0$ and $x + 45 = 0$

$\Rightarrow x = 40$ km/hr and $x = -45$ km/hr [But $x = -45$ is not possible]

Therefore, the actual speed of the train is 40 km/hr.

11.

(c) 3 km/hr

Explanation: Let the rate of my walking be x km/h

$\therefore$ Time taken to cover 2 km at the rate of x km/h = $\frac{2}{x}$ hrs

New rate = (x + 1) km/h

$\therefore$ Time taken to cover 2 km at new rate = $\frac{2}{x+1}$ hrs

According to question, $\frac{2}{x} - \frac{2}{x+1} = \frac{10}{60}$

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

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

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

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

$\Rightarrow x^2 + 4x - 3x - 12 = 0$

$\Rightarrow x(x + 4) -3(x + 4) = 0$

$\Rightarrow (x + 4)(x - 3) = 0$

$\Rightarrow (x + 4) = 0$ and $x - 3 = 0$

$\Rightarrow x = -4$ [not possible] and $x = 3$

Therefore, the rate of my walking is 3 km/h.

12.

(b) 20 km/hr

Explanation: Let the original speed be x km/h

$\therefore$ Time taken to cover 200 km at the rate of x km/h = $\frac{200}{x}$ hrs

New rate = (x + 5) km/h

$\therefore$ Time taken to cover 200 km at new rate = $\frac{200}{x+5}$ hrs

According to question, $\frac{200}{x} - \frac{200}{x+5} = 2$

$\Rightarrow 200\left[\frac{1}{x} - \frac{1}{x+5}\right] = 2$

$\Rightarrow 200\left[\frac{x+5-x}{x(x+5)}\right] = 2$

$\Rightarrow \frac{1000}{x^2+5x} = 2$

$\Rightarrow x^2 + 5x - 500 = 0$

$\Rightarrow x^2 + 25x - 20x - 500 = 0$

$\Rightarrow x(x + 25) -20(x + 25) = 0$

$\Rightarrow x(x + 25)(x - 20) = 0$

$\Rightarrow x + 25$ and $x - 20 = 0$

$\Rightarrow x = -25$ and $x = 20$

Therefore, the original speed is 20 km/h.

13. Let the number of John's marbles be *x*.

Therefore, number of Jivanti's marble = $45 - x$

After losing 5 marbles,

Number of John's marbles = $x - 5$

Number of Jivanti's marbles = $45 - x - 5 = 40 - x$

Given that the product of their marbles is 124.

$\therefore (x - 5)(40 - x) = 124$

$\Rightarrow x^2 - 45x + 324 = 0$

Section B

14. Original Area of land = Length $\times$ Width = 500 m $\times$ 400 m = 2,00,000 m^2

    Width of the school area = Width - 2x

    Length of the school area = Length - 2x

    Area Left for School = (Length - 2x) $\times$ (Width - 2x)

    = (500 - 2x) $\times$ (400 - 2x)

    Area of grass and flower

    = original area of land - Area Left for School

    1,18,400 = 2,00,000 - (500 - 2x) $\times$ (400 - 2x)

    1,18,400 = 2,00,000 - (2,00,000 - 800x - 1000x + $4x^2$)

    1,18,400 = 2,00,000 - $4x^2$ + 1800x - 2,00,000

    $4x^2$ - 1800x + 1,18,400 = 0

    x^2 - 450x + 29,600 = 0

    $x = \frac{-(-450) \pm \sqrt{(-450)^2 - 4(1)(29600)}}{2(1)}$

    $x = \frac{450 \pm \sqrt{202500 - 118400}}{2}$

    $x = \frac{450 \pm \sqrt{84100}}{2}$

    $x = \frac{450 \pm 290}{2}$

    x = 370 or 80

    but, x = 370 is not possible.

    Length of PQ = 500 - 2x

    = 500 - 2(80)

    = 340 m

    Length of QR = 400 - 2x

    = 400 - 2(80)

    = 400 - 160

    = 240 m

15. Perimeter of PQRS

    = 2 (PQ + QR)

    = 2 (340 + 240)

    = 2 $\times$ 580

    = 1160 m

    hence, the perimeter of Rectangle PQRS = 1160 m

16. 7

    Explanation:

    Let the present age of Rehman be x years.

    Then,

    3 years ago, Rehman's age = (x - 3) years

    5 years from now, Rehman's age = (x + 5) years

    It is given that

    $\frac{1}{x-3} + \frac{1}{x+5} = \frac{1}{3}$

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

    $\Rightarrow \frac{2x+2}{x^2+2x-15} = \frac{1}{3}$

    $\Rightarrow$ 6x + 6 = x^2 + 2x - 15

    $\Rightarrow$ x^2 - 4x - 21 = 0

    $\Rightarrow$ x^2 - 7x + 3x - 21 = 0

    $\Rightarrow$ x(x - 7) + 3(x - 7) = 0

    $\Rightarrow$ x - 7 = 0 or x + 3 = 0

    Since age cannot be negative, x $\neq$ -3

    $\Rightarrow$ x = 7

    Hence, Rehman's present age is 7 years.

17. 12

Explanation:

Ram and Bhagat together do the work m 4 days

∴ Ram and Bhagat will do in one days = $\frac{1}{4}$ work

Let Bhagat alone does the same work in x days.

∴ Ram will take = (x - 6) days

∴ $\frac{1}{x} + \frac{1}{x-6} = \frac{1}{4}$

$\Rightarrow \quad \frac{x-6+x}{x(x-6)} = \frac{1}{4}$

4x - 24 + 4x = x^2 - 6x

$\Rightarrow x^2$ - 6x - 8x + 24 = 0

$\Rightarrow x^2$ - 14x + 24 = 0

$\Rightarrow x^2$ - (12 + 2)x + 24 = 0

$\Rightarrow x^2$ - 12x - 2x + 24 = 0

$\Rightarrow x^2$ - 12x - 2x + 24 = 0

$\Rightarrow$ x(x - 12) - 2(x - 12) = 0

$\Rightarrow$ x = 12, x = 2

∴ If Bhagat complete the work in 2 days

Ram will take = 2 - 6 = -4 days (impossible)

Hence, Bhagat can finish in 12 days

18. 3

Explanation:

Let the usual speed of the man be x km/hr.

Time taken to cover 3 km at usual speed = $\frac{3}{x}$ hours.

Actual speed of the man = (x + 1) km/hr.

Time taken to cover 3 km at actual speed = $\frac{3}{(x+1)}$ hours.

∴ $\frac{3}{x} - \frac{3}{(x+1)} = \frac{15}{60}$

$\Rightarrow \frac{3}{x} - \frac{3}{(x+1)} = \frac{1}{4}$

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

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

$\Rightarrow \frac{1}{(x^2+x)} = \frac{1}{12}$

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

$\Rightarrow x^2$ + 4x - 3x - 12 = 0

$\Rightarrow$ x(x + 4) - 3(x + 4) = 0

$\Rightarrow$ (x + 4)(x - 3) = 0

$\Rightarrow$ x + 4 = 0 or x - 3 = 0

$\Rightarrow$ x = - 4 or x = 3

$\Rightarrow$ x = 3 [∵ speed cannot be negative]

Hence, the usual speed of the man is 3 km/hr.

19. 5

Explanation:

Let the speed of the Stream be x km/hr.

∴ Speed of boat up stream = 15 - x

and speed of boat down stream = 15 + x

Now according to the question

$\frac{30}{15-x} + \frac{30}{15+x} = 4\frac{1}{2}$

$\frac{30(15+x)+30(15-x)}{15^2-x^2} = \frac{9}{2}$

900 $\times$ 2 = 9 (15^2 - x^2)

$9x^2$ = 2025 - 1800

$x^2 = \frac{225}{9}$

$x^2 = 25 = \pm 5$

x = 5

Hence, the speed of the stream = 5 km/hr.

20. 6

Explanation:

According to the question,A motorboat whose speed in still water is 18 km/h, takes 1 hour more to go 24 km upstream than to return downstream to the same spot.

Let the speed of stream be x km/h

Then the speed of boat upstream = (18 - x) km/h

Speed of boat downstream = (18 + x) km/h

According to the question,

$\frac{24}{18-x} - \frac{24}{18+x} = 1$

$\frac{24(18+x)-24(18-x)}{(18-x)(18+x)} = 1$

$\frac{24(18+x)-24(18-x)}{18^2-x^2} = 1$

$432 + 24x - 432 + 24x = 324 - x^2$

$48x = 324 - x^2$

$x^2 + 48x - 324 = 0$

x(x + 54) - 6(x + 54) = 0

(x + 54) (x - 6) = 0

x + 54 = 0, x - 6 = 0

x = - 54, x = 6

Since speed cannot be negative

The speed of steam x = 6 km/h.

21. Let the total number of camels be x

According to the question,

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

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

let $\sqrt{x} = y$, then

$3y^2 - 8y - 60 = 0$

or, $3y^2 - 18y + 10y - 60 = 0$

or, $3y(y - 6) + 10(y - 6) = 0$

or, $(3y + 10)(y - 6) = 0$

or, $y = 6$ or $y = -\frac{10}{3}$ (not possible)

So, $y = 6$ or, $y^2 = 36$

$x = y^2 = 36$

Hence the number of camels = 36.

22. One year ago, a man was 8 times as old as his son. Now his age is equal to the square of his son's age.

we have to find their present age's.

Suppose, one year ago, son's age be x years.

Then, man's age one year ago = 8x years.

Therefore present age of son = (x +1) years and, Present age of man = (8x +1) years.

Therefore $8x + 1 = (x + 1)^2$ [Given]

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

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

$\Rightarrow x = 0$ or x = 6 [$\because$ Son's age cannot be 0]

So, Present age of son = (x + 1) years = 7 years,

and, Present age of man = (8x + 1) years = 49 years

23. Let the present age of Varun be x years.

Then,

3 years ago, Varun's age = (x - 3) years

5 years from now, Varun's age = (x + 5) years

It is given that

$\frac{1}{x-3}+\frac{1}{x+5}=\frac{1}{3}$

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

$\Rightarrow \frac{2x+2}{x^2+2x-15}=\frac{1}{3}$

$\Rightarrow$ 6x + 6 = x^2 + 2x - 15

$\Rightarrow$ x^2 - 4x - 21 = 0

$\Rightarrow$ x^2 - 7x + 3x - 21 = 0

$\Rightarrow$ x(x - 7) + 3(x - 7) = 0

$\Rightarrow$ x - 7 = 0 or x + 3 = 0

Since age cannot be negative, x $\neq$ -3

$\Rightarrow$ x = 7

Hence, Varun's present age is 7 years.

24. (x - 5)(x + 7) = 2x + 1

x^2 + 2x - 35 = 2x + 1

x^2 - 36 = 0

x^2 = 36

x = $\pm$6

Present age = 6 years

25. Let the usual speed of the train be x km/h

Reduced speed of the train = (x – 8) km/h

Distance of journey = 480km

Time taken to reach destination at usual speed = $\frac{480}{x}h$

Time taken to reach destination at reduced speed = $\frac{480}{x-8}h$

According to given question

$\frac{480}{x-8}=\frac{480}{x}+3$

$\Rightarrow \frac{480}{x-8}-\frac{480}{x}=3$

$\Rightarrow \frac{480x-480x+3840}{x(x-8)}=3$

$\Rightarrow \frac{3840}{x(x-8)}=3$

$\Rightarrow$ x^2 - 8x = 1280

$\Rightarrow$ x^2 - 8x - 1280 = 0

$\Rightarrow$ x^2 - 40x + 32x - 1280 = 0

$\Rightarrow$ x(x - 40) + 32(x - 40) = 0

$\Rightarrow$ (x - 40) (x + 32) = 0

$\Rightarrow$ x = 40 or x = -32

$\Rightarrow$ x = 40 (speed cannot be negative)

Hence the usual speed of the train is 40 km/h

26. Let the speed of the fast train be x km/hr. Then, speed of slow train= (x - 10) km/hr.

Since, fast train takes one hour less than a slow train to cover 200. Therefore,

$\frac{200}{x-10}-\frac{200}{x}=1$

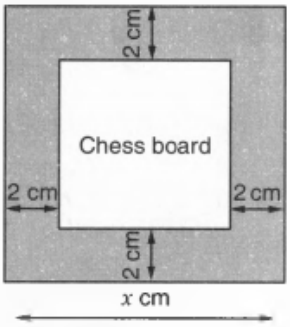
$x^2-10x-2000=0$

$\Longrightarrow (x+40)(x-50)=0$

$\Rightarrow$ x=-40 or x=50

$\Rightarrow$ 50 [as x is speed and it can't be negative]

Therefore, speed of fast train= 50 km/hr and speed of slow train = 50-10 =40km/hr.

27. 

Let the length of the side of the chess board be x cm. Then,

Area of 64 squares = $(x - 4)^2$

$\therefore (x - 4)^2 = 64 \times 6.25$

$\Rightarrow x^2 - 8x + 16 = 400$

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

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

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

$\Rightarrow x = 24$ cm

28. Let the number of books bought be x.

$\therefore \quad \frac{1200}{x} - \frac{1200}{x+10} = 20$ (divide throughout by 20 we get)

or, $x^2 + 10x - 600 = 0$

$x^2 + 30x - 20x - 600 = 0$

x(x + 30) - 20(x+ 30) = 0

or, (x + 30)(x - 20) = 0

$\Longrightarrow$ x+30 = 0 or x- 20 = 0

or, x = - 30 or x = 20

Since number of books cannot be negative,

$\therefore$ x=20

$\therefore$ Number of books bought = 20

29. Let breadth of the field = x m

$\therefore$ Length = (x + 30) m and diagonal = (x + 60) m

$\therefore$ By Pythagoras theorem

$(30 + x)^2 + x^2 = (60 + x)^2$

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

$\Rightarrow (x - 90)(x + 30) = 0$

$\Rightarrow x = 90$ (Rejecting x = -30)

$\therefore$ Length = 120 m and breadth = 90m

30. Let the sides of the two squares be x and x + 6.

A.T.Q. $x^2 + (x + 6)^2 = 468$

$\Rightarrow 2x^2 + 12x - 432 = 0$ or $x^2 + 6x - 216 = 0$

$\Rightarrow (x + 18)(x - 12) = 0$

$\Rightarrow x = 12$ or x = -18 (rejecting)

Sides of two squares are 12 m and 18 m.

31. Let age of the son be x years

$\therefore$Father's age is $(x)^2$

Also $x^2 + 5x = 66$

$\Rightarrow x^2 + 5x - 66 = 0$

$\Rightarrow (x + 11)(x - 6) = 0$

$\Rightarrow x = -11, x = 6$

$\therefore$ Age of son = 6 years and age of father = $(6)^2$ = 36 years.

32. Let the time taken by the tap of smaller diameter to fill the tank separately be 'x' hours and the time taken by the tap of larger diameter to fill the tank separately be (x - 5) hours.

A.T.Q.

$\frac{1}{x} + \frac{1}{x-5} = \frac{3}{10}$

$\Rightarrow 3x^2 - 35x + 50 = 0$

$\Rightarrow (x - 10)(3x - 5) = 0$

$\Rightarrow x = 10$ or $x = \frac{5}{3}$

But $x = \frac{5}{3}$ is not possible, so $x = 10$

$\therefore$ time taken by the tap of smaller diameter to fill the tank separately is 10 hours

and time taken by the tap of larger diameter to fill the tank separately is 10 - 5 = 5 hours.

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

Then, new speed = (x- 200) km/hr.

Duration of flight at original speed = $\frac{600}{x}$hrs

Duration of flight at reduced speed = $\frac{600}{x-200}$hrs

According to the question

$\frac{600}{x-200} - \frac{600}{x} = \frac{1}{2}$

$\Rightarrow \frac{600x-600x+120000}{x(x-200)} = \frac{1}{2}$

$\Rightarrow \frac{120000}{x^2-200x} = \frac{1}{2}$

$\Rightarrow x^2 - 200x - 240000 = 0$

$\Rightarrow x^2 - 600 x + 400 x - 240000 = 0$

$\Rightarrow x (x - 600) + 400 (x - 600) = 0$

$\Rightarrow (x- 600) (x + 400) = 0$

Either x - 600 =0 or x + 400 = 0

$\Rightarrow x = 600, -400$

since Speed cannot be negative. So x = 600

So, original speed of the aircraft was 600 km/hr.

Hence, duration of flight = $\frac{600}{x}$hrs $= \frac{600}{600}$hrs = 1 hr

34. A + B finish the work in 6 days.

$\therefore$ They will finish in one day = $\frac{1}{6}$ work

Let B alone does the same work in x days

$\therefore$ A alone will finish it in (x - 5) days

Now, $\frac{1}{x-5} + \frac{1}{x} = \frac{1}{6}$

$\Rightarrow \frac{x+x-5}{x(x-5)} = \frac{1}{6}$

$\frac{2x - 5}{x^2 - 5} = \frac{1}{6}$

$\Rightarrow 12x - 30 = x^2 - 5x$

$\Rightarrow x^2 - 17x + 30 = 0$

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

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

$\Rightarrow x(x - 15) - 2(x - 15) = 0$

$\Rightarrow (x - 15) (x - 2) = 0$

x = 15, x = 2(rejectable)

Hence, B finishes the work in 15 days

35. Let her actual marks be x

Therefore, $9 (x +10) = x^2$

i.e., $x^2 - 9x - 90 = 0$

i.e., $x^2 - 15x + 6x - 90 = 0$

i.e., $x(x - 15) + 6(x -15) = 0$

i.e., $(x + 6) (x -15) = 0$

Therefore, x = -6 or x = 15

Since x is the marks obtained, $x \neq$ -6. Therefore, x = 15.

So, Ajita got 15 marks in her mathematics test.

36. Let the speed while going be x km/h

∴Speed while returning = (x + 10) km/h

According to question,

$\frac{150}{x} - \frac{150}{x+10} = \frac{5}{2}$

$\frac{150(x+10)-150(x)}{x(x+10)} = \frac{5}{2}$

$\frac{1500}{x(x+10)} = \frac{5}{2}$

$\frac{300}{x(x+10)} = \frac{1}{2}$

$x^2 + 10x = 600$

$x^2 + 10x - 600 = 0$

$x^2 + 30x - 20x - 600 = 0$

(x + 30) (x - 20) = 0

x = - 30 or x = 20

But speed is never negative, so x = 20.

∴ Speed while going = 20 km/h and Speed while returning = 20 + 10 = 30 km/h

37. Let Raveena got marks in English be x.

∴ She got the marks in Mathematics = (30 - x)

If she got marks in English = (x - 3)

and in Mathematics = (32 - x)

According to problem

(x - 3) (32 - x) =210

$32x - x^2 - 96 - 3x = 210$

$\Rightarrow \quad 35x - 96 - x^2 = 210$

$\Rightarrow \quad x^2 - 35x + 306 = 0$

$\Rightarrow x^2 - 18x - 17x + 306 = 0$

$\Rightarrow$ x(x-18) -17(x-18) = 0

$\Rightarrow$ (x - 18)(x -17) = 0

x=18,17

Hence, ∴ If she got marks in English = 18, then in Mathematics = 17

If she got marks in English = 17 then

she got marks in Mathematics = 18

38. Let the age of father be x years

and age of son be y years

∴ x + y = 35 and xy = 150

or y =35 - x

Putting the value of y,

x(35 - x) = 150

or, $x^2 - 35x + 150 = 0$

$x^2 - 30x - 5x + 150 = 0$

$x(x - 30) - 5(x - 30) = 0$

or, (x-30)(x-5) = 0

or, x = 30, x = 5 (rejected as age of father is always more than the son)

Now, x=30,gives y=35-30=5

Hence the age of father = 30 years and the age of son= 5 years

39. Two tap running together fill the tank in $3\frac{1}{13}$ hr.

$= \frac{40}{13}$ hours

If first tap alone fills the tank in x hrs.

Then second tap alone fills it in (x + 3) hr

Now $\frac{1}{x} + \frac{1}{x+3} = \frac{13}{40}$

$\frac{x+3+x}{x(x+3)} = \frac{13}{40}$

$\frac{2x+3}{x^2+3x} = \frac{13}{40}$

$80x + 120 = 13x^2 + 39x$

or, $13x^2 - 41x - 120 = 0$

$13x^2 - (65 - 24)x + 120 = 0$

(x - 5)(13x + 24) = 0

$x = 5, x = -\frac{24}{13}$

time can't be negative

Hence, 1st tap takes 5 hours and Ilnd tap

takes = 5 + 3 = 8 hours

Section C

40. (18 + x) (12 + x) = 2(18 $\times$ 12)

41. x^2 + 30x - 216 = 0

42. Solving : x^2 + 30x - 216 = 0

$\Rightarrow$ (x + 36)(x - 6) = 0

x $\neq$ -36 $\therefore \Rightarrow$ x = 6.

new dimensions are 24 cm $\times$ 18 cm

43. If (18 + x)(12 + x) = 220

then x^2 + 30x - 4 = 0

Here D = 900 + 16 = 916 which is not a perfect square.

Thus we can't have any such rational value of x.

Section D

44. Let the original price of the book = ₹ x

$\therefore$ Number of books bought for ₹ 600 = $\frac{600}{x}$

Reduced price of the book = ₹ (x - 5)

$\therefore$ Number of books bought for ₹ 600 = $\frac{600}{x-5}$

It is given that

$\frac{600}{x-5} - \frac{600}{x} = 4$

$\Rightarrow \frac{600x-600x+3000}{x^2-5x}$ = 4

$\Rightarrow$ 3000 = $4x^2$ - 20x

$\Rightarrow 4x^2$ - 20x - 3000 = 0

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

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

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

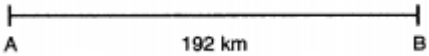
$\Rightarrow$ x - 30 = 0 or x + 25 = 0

$\Rightarrow$ x = 30 or x = -25

Since the price of a book cannot be negative, x $\neq$ -25

$\Rightarrow$ x = 30

Hence, the original price of a book is ₹ 30

45. 

Let speed of passenger train be x km/h

$\therefore$ speed of superfast train = (x + 16) km/h

By question, $T_{\text{passenger}} = \frac{192}{x}$ and $T_{\text{superfast}} = \frac{192}{(x+16)}$

or, $\frac{192}{x} - \frac{192}{x+16} = 2$

or, $192(x + 16) - 192x = 2\left(x^2 + 16x\right)$

or, $192x + 192 \times 16 - 192x = 2\left(x^2 + 16x\right)$

$192x + 3072 - 192x = 2\left(x^2 + 16x\right)$ (divide throughout by 2, we get,

$96x + 1536 - 96x = \left(x^2 + 16x\right)$

or x(x + 48) - 32(x + 48) = 0

or, (x - 32) (x + 48) = 0

or, x = 32 or - 48

Since speed can't be negative, therefore - 48 is not possible.

$\therefore$ Speed of passenger train = 32 km/h and Speed of fast train = 48 km/h

46. Let the average speed of truck be x km/h.

$\frac{150}{x} + \frac{200}{x+20} = 5$

or, 150x + 3000 + 200x = 5x(x + 20)

or, $x^2 - 50x - 600 = 0$

or, $x^2 - 60x + 10x - 600 = 0$

or, $x(x - 60) + 10(x - 60) = 0$

or, (x-60)(x + 10) = 0

or, x = 60 ; or x = -10

as, speed cannot be negative

Therefore, x=60 km/h

Hence, first speed of the truck = 60 km/h

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

Time taken to cover 63 km $= \frac{63}{x}$ hours

Time taken to cover 72 km when the speed is increased by 6 km/hr $= \frac{72}{x+6}$ hours

By the question,we have,

$\frac{63}{x} + \frac{72}{x+6} = 3$

$\Rightarrow \frac{21}{x} + \frac{24}{x+6} = 1$

$\Rightarrow \frac{21x+126+24x}{x^2+6x} = 1$

$\Rightarrow$ 45x + 126 = x^2 + 6x

$\Rightarrow$ x^2 - 39x - 126 = 0

$\Rightarrow$ x^2 - 42x + 3x - 126 = 0

$\Rightarrow$ x(x - 42) + 3(x - 42) = 0

$\Rightarrow$ (x - 42)(x + 3) = 0

$\Rightarrow$ x - 42 = 0 or x + 3 = 0

$\Rightarrow$ x = 42 or x = -3

Since the speed cannot be negative, $x \neq -3$.

Thus, the original average speed of the train is 42 km/hr.

48. Let the present age of father be x years.

Son's present age = (45 - x) years.

Five years ago:

Father's age = (x - 5) years

Son's age = (45 - x - 5) years = (40 - x) years.

According to question,

$\therefore$ (x - 5) (40 - x) = 124

$\Rightarrow$ 40x - x^2 - 200 + 5x = 124

$\Rightarrow$ x^2 - 45x + 324 = 0

Spilting the middle term,

$\Rightarrow$ x^2 - 36x - 9 x + 324 = 0

$\Rightarrow$ x(x - 36) - 9(x - 36) = 0

$\Rightarrow$ (x - 9)(x - 36) = 0

$\Rightarrow$ x = 9, or 36

We can't take father age as 9 years

So, x = 36, we have

Father's present age = 36 years

Son's present age = 9 years

Hence, Father's present age = 36 years and Son's present age = 9 years.

49. Let number of books the shopkeeper buys = x

Price of each book = Rs $\frac{1200}{x}$

cost of each book when x +10 books are bought = RS $\frac{1200}{x+10}$

According to given question,

$\frac{1200}{x} - \frac{1200}{x+10}$= 20

$1200(\frac{1}{x} - \frac{1}{x+10}) = 20$

$(\frac{1}{x} - \frac{1}{x+10}) = \frac{20}{1200}$

$\frac{(x+10)-x}{x(x+10)} = \frac{1}{60}$

x +10- x = $\frac{x^2+10x}{60}$

600 = x^2 + 10x

x^2+ 10x - 600 = 0

Here, it is quadratic equation

x^2 + 30x - 20x - 600 = 0

x(x+30) -20(x+30) = 0

(x+30) (x-20) = 0

either

(x+30) =0 or (x-20) = 0

x = -30 or x= 20

x= -30, is not possible because the number of books can't be negative.

so, number of books = x = 20.

50. Given that a train travelling at a uniform speed for 360 km

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

Time taken $= \frac{\text{Distance}}{\text{Speed}} = \frac{360}{x}$

Time taken at increased speed $= \frac{360}{x+5}$ hours.

According to the question

$\frac{360}{x} - \frac{360}{x+5} = \frac{48}{60}$

$360\left[\frac{1}{x} - \frac{1}{x+5}\right] = \frac{4}{5}$

$or, \frac{360(x+5-x)}{x^2+5x} = \frac{4}{5}$

$or, \frac{1800}{x^2+5x} = \frac{4}{5}$

$\Rightarrow \quad x^2 + 5x - 2250 = 0$

$\Rightarrow \quad x^2 + (50 - 45)x - 2250 = 0$

$\Rightarrow \quad x^2 + 50x - 45x - 2250 = 0$

$\Rightarrow \quad (x + 50)(x - 45) = 0$

Either x = - 50 or x = 45

As speed cannot be negative

∴ Original speed of train = 45 km/hr.

51. Let the length of piece be x m

Then , rate = $\frac{200}{x}$ per m

Now , new length = (x + 5)m

Since, the cost remains same .

∴ New rate = $\frac{200}{x+5}$ per m .

Then, $\frac{200}{x+5} = \frac{200}{x} - 2$

$\frac{200}{x+5} = \frac{200-2x}{x}$

⇒ 200x = (x + 5) (200 - 2x)

⇒ 200x = 200x - 2x^2 + 1000 - 10x

⇒ 2x^2 + 10x - 1000 = 0

⇒ x^2 + 5x - 500 = 0

⇒ x^2 + 25x – 20x – 500 =0

⇒ x(x + 25) – 20(x +2 5) = 0

⇒ (x – 20) (x + 25) = 0

Therefore, x = 20 or x = -25

But length cannot be negative, therefore x = 20 m

Therefore , length of the piece = 20m

52. Let the usual speed of train be x km/hr

$\frac{300}{x} - \frac{300}{x+5} = 2$

300 (x+5 - x) = 2x(x+5)

150(5) = x^2 + 5x

750 = x^2 + 5x

or, $x^2 + 5x - 750 = 0$

or, $x^2 + 30x - 25x - 750 = 0$

or, (x + 30) (x - 25) = 0

or, x = - 30 or x = 25

Since, speed cannot be negative.

$\therefore \quad x \neq -30, x = 25\text{km/hr}$

∴ Speed of train = 25 km/hr

53. Total time taken by minute hand from 2 p.m. to 3 p.m. is 60 min.

According to question,

$t + \left(\frac{t^2}{4} - 3\right) = 60$

⇒ 4t + t^2 – 12 = 240

⇒ t^2 + 4t – 252 = 0

⇒ t^2 + 18t – 14t – 252 = 0

⇒ t(t + 18) – 14(t +18) = 0

⇒ (t + 18) (t – 14) = 0

⇒ t + 18 = 0 or t – 14 = 0

⇒ t = –18 or t = 14 min.

As time can't be negative.

Therefore, t = 14 min.

54. Let the number of John's marbles be *x*.

Therefore, number of Jivanti's marble = 45 − *x*

After losing 5 marbles,

Number of John's marbles = *x* − 5

Number of Jivanti's marbles = 45 − *x* − 5 = 40 − *x*

Given that the product of their marbles is 124.

∴ (x – 5) (40 – x) = 124

⇒ x^2 – 45x +324 = 0

Now, to factorize this equation, we need to take numbers such that their product is 324 and sum is 45

⇒ x^2 – 36x – 9x + 324 = 0

⇒ x(x – 36) – 9 (x – 36) = 0

⇒ (x – 36) (x – 9) = 0

Either x – 36 = 0 or *x* − 9 = 0

i.e.,

x = 36 or *x* = 9

If the number of John's marbles = 36,

Then, number of Jivanti's marbles = 45 − 36 = 9

If number of John's marbles = 9

Then, number of Jivanti's marbles = 45 − 9 = 36

55. Let the usual speed of the plane be x km/hr.

Then, time taken to cover 1500 km with the usual speed = $\frac{Distance}{Speed} = \frac{1500}{x} hrs$

Increased speed be (x + 250) km/hr

Time taken to cover 1500 km with the increased speed = $\frac{1500}{x+250} hrs$

According to the question

$\frac{1500}{x} - \frac{1500}{x+250} = 30min = \frac{1}{2}$

$\Rightarrow \frac{1500x+1500\times250-1500x}{x(x+250)} = \frac{1}{2}$

$\Rightarrow \frac{1500\times250}{x^2+250x} = \frac{1}{2}$

⇒ x^2 + 250x - 750000 = 0

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

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

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

Either $x + 1000 = 0$ or $x - 750 = 0$

$\Rightarrow x = -1000, 750$

But speed of the plane cannot be negative. So, x = 750.

Hence, the usual speed of the plane is 750 km/hr.

56. If the present age of sister be x,then ,by the first condition of the question,we have,

present age of the girl = 2x

By the second condition of the question,we have,

$(2x + 4)(x + 4) = 160$

$2x^2 + 8x + 4x + 16 = 160$

$2x^2 + 12x -144 = 0$

$2x^2 + (24 - 12)x - 144 = 0$

$2x(x + 12) - 12(x + 12) = 0$

$(2x - 12)(x +12) = 0$

$\therefore x = 6; x = -12$

Since age can't be negative,therefore

x=6

So, Age of sister = 6 and Age of girl = 2(6)=12

57. According to question a dealer sells a toy for Rs. 24 and gains as much per cent as the cost price of the toy.

Let the cost price of the toy be Rs. x.

Then, Gain = x%

$\Rightarrow$ Gain = Rs. $\left(x \times \frac{x}{100}\right)$ = Rs. $\frac{x^2}{100}$.

Therefore, S.P. = C.P. + Gain = $x + \frac{x^2}{100}$.

But, S.P. =Rs. 24.

$\therefore \quad x + \frac{x^2}{100} = 24$ [Given]

$\Rightarrow 100x + x^2 = 2400$

$\Rightarrow x^2 + 100x - 2400 = 0$

$\Rightarrow x^2 + 120x -20x -2400 = 0$

$\Rightarrow \quad x(x + 120) - 20(x + 120) = 0$

$\Rightarrow (x + 120) (x - 20) = 0$

$\Rightarrow x = 20, -120$

$\Rightarrow x = 20$ [because $x > 0$]

Hence, the cost price of the toy is Rs. 20.

58. Given:-

Speed of boat =18 km/hr

Distance = 24 km

Let x be the speed of stream.

Let t_1 and t_2 be the time for upstream and downstream As we know that,

speed = $\frac{\text{distance}}{\text{time}}$

$\Rightarrow$ time = $\frac{\text{distance}}{\text{speed}}$

For upstream, Speed = (18 - x) km/hr

Distance =24 km

Time = t_1

Therefore,

$t_1 = \frac{24}{18-x}$

For downstream,

Speed = (18 + x) km/hr

Distance = 24 km

Time = t_2

Therefore,

$t_2 = \frac{24}{18+x}$

Now according to the question-

$t_1 = t_2 + 1$

$\frac{24}{18-x} = \frac{24}{18+x} + 1$

$\Rightarrow \frac{1}{18-x} - \frac{1}{18+x} = \frac{1}{24}$

$\Rightarrow \frac{(18+x)-(18-x)}{(18-x)(18+x)} = \frac{1}{24}$

$\Rightarrow 48x = (18 - x)(18 + x)$

$\Rightarrow 48x = 324 + 18x - 18x - x^2$

$\Rightarrow x^2 + 48x - 324 = 0$

$\Rightarrow x^2 + 54x - 6x - 324 = 0$

$\Rightarrow x(x + 54) -6(x + 54) = 0$

$\Rightarrow (x + 54)(x - 6) = 0$

$\Rightarrow x = -54$ or $x = 6$

Since speed cannot be negative.

$\Rightarrow x \neq -54$

$\therefore x = 6$

Thus the speed of stream is 6 km/hr.

Total time of Journey = $t_1 + t_2$

$= \frac{24}{18-x} + \frac{24}{18+x}$

$= \frac{24}{12} + \frac{24}{24} = 2 + 1 = 3$ hrs.

59. Let the speed of the stream be x km/hr.

Speed of boat upstream = (5 - x) km/hr.

Speed of boat downstream = (5 + x) km/hr.

Time taken to go upstream = $\frac{5.25}{5-x}$ hours.

Time taken to go downstream = $\frac{5.25}{5+x}$ hours.

According to question,

$\therefore \quad \frac{5.25}{5-x} - \frac{5.25}{5+x} = 1$

$\Rightarrow \quad 5.25[\frac{1}{5-x} - \frac{1}{5+x}] = 1$

$\Rightarrow \quad \frac{21}{4}[\frac{5+x-5+x}{(5-x)(5+x)}] = 1$

$\Rightarrow \quad \frac{21}{4} \times \frac{2x}{25-x^2} = 1$

$\Rightarrow \quad 21x = 50 - 2x^2$

$\Rightarrow 2x^2 + 21x - 50 = 0$

$\Rightarrow 2x^2 + 25x - 4x - 50 = 0$

$\Rightarrow \quad x(2x + 25) - 2(2x + 25) = 0$

$\Rightarrow (2x + 25) (x - 2) = 0$

$\Rightarrow x - 2 = 0, 2x + 25 = 0$

$\Rightarrow x = 2 \left[\because x \neq -\frac{25}{2} \text{ as } x > 0\right]$

Hence, the speed of the stream is 2 km/hr.

60. Let time taken by pipe A be x minutes, and time taken by pipe B be x + 5 minutes.

In one minute pipe A will fill $\frac{1}{x}$ tank

In one minute pipe B will fill $\frac{1}{x+5}$ tank

pipes A + B will fill in one minute = $\frac{1}{x} + \frac{1}{x+5}$ tank

Now according to the question.

$\frac{1}{x} + \frac{1}{x+5} = \frac{9}{100}$

or, $\frac{x+5+x}{x(x+5)} = \frac{9}{100}$

or, $100(2x + 5) = 9x(x + 5)$

or, $200x + 500 = 9x^2 + 45x$

or, $9x^2 - 155x - 500 = 0$

or, $9x^2 - 180x + 25x - 500 = 0$

or,9x(x - 20) + 25(x - 20) = 0

or, (x-20)(9x + 25) = 0

or, $x = 20, \frac{-25}{9}$

rejecting negative value, x = 20 minutes

and x + 5 = 25 minutes

Hence pipe A will fill the tank in 20 minutes and pipe B will fill it in 25 minutes.

61. Let the original list price be Rs x

$\therefore$ No. of books bought for Rs 300 = $\frac{300}{x}$

Reduced list price of the book = Rs (x - 5)

No. of books bought for Rs 300 = $\frac{300}{x-5}$

According to question,

$\frac{300}{x-5} - \frac{300}{x} = 5$

$\Rightarrow \frac{300x-300x+1500}{x^2-5x} = 5$

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

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

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

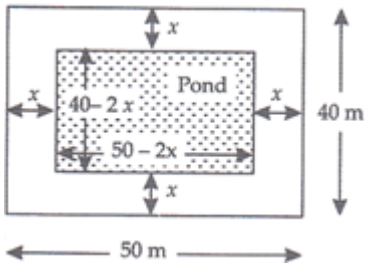
$\Rightarrow x = 20 \quad$ or $\quad x = -15$

$\Rightarrow x = 20$

The negative sign is rejected.

Therefore x = 20

Therefore the original price list is Rs. 20

62. 

Let width of the pond be x m. Then,

The length of pond = $(50 - 2x)m$ and the breadth of pond = $(40 - 2x)m$

Area of grass around the pond = 1184 m^2

$\Rightarrow$ Area of Lawn - Area of Pond = 1184

$\Rightarrow 50 \times 40 - (50 - 2x)(40 - 2x) = 1184$

$\Rightarrow 2000 - (2000 - 100x - 80x + 4x^2) - 1184 = 0$

$\Rightarrow 2000 - (2000 - 180x + 4x^2) - 1184 = 0$

$\Rightarrow$ 2000 - 2000 + 180x - $4x^2$ - 1184 = 0

$\Rightarrow$ $4x^2$ - 180x + 1184 = 0

$\Rightarrow 4(x^2 - 45x + 296) = 0$

$\Rightarrow$ x^2 - 45x + 296 = 0

Factorise now,

$\Rightarrow$ x^2 - 37x - 8x + 296 = 0

$\Rightarrow$ x(x - 37) - 8(x - 37) = 0

$\Rightarrow$ (x - 37) (x - 8) = 0

$\Rightarrow$ x - 37 = 0 or x - 8 = 0

$\Rightarrow$ x = 37 or x = 8

When x = 37, then

The length of pond = 50 - 2 $\times$ 37

= 50 - 74

= -24 m (Length cannot be negative)

When x = 8, then

The length of pond = 50 – 2x

= 50 - 2 × 8

= 50 - 16

= 34 m

And the breadth of the pond

= 40 - 2x

= 40 - 2 × 8

= 40 - 16

= 24 m

Therefore, the length and breadth of the pond are 34 m and 24 m respectively.

63. Let the speed of the train be x km/hr for first 54 km and for next 63 km, speed is (x + 6) km/hr.

According to the question

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

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

or, 54x + 324 + 63x = 3x(x + 6)

or, $117x + 324 = 3x^2 + 18x$

or, $3x^2 - 99x - 324 = 0$

or, $x^2 - 33x - 108 = 0$

or, $x^2 - 36x + 3x - 108 = 0$

or, x(x - 36) + 3(x - 36) = 0

(x - 36)(x + 3) = 0

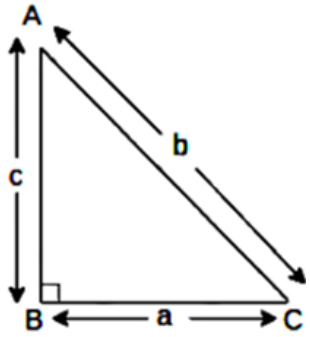
x = 36

x = - 3 rejected.

(as speed is never negative)

Hence First speed of train = 36 km/h

64. Let △ABC be the right angle triangle, right angled at B, as shown in figure.



Also, let AB = c cm, BC = a cm and AC = b cm

Then, according to the given information, we have

b = 6 + 2a ...(i) (Let a be the shortest side)

and c = 3a - 6

We know that, $b^2 = c^2 + a^2$

$\Rightarrow (6 + 2a)^2 = (3a - 6)^2 + a^2$ ...[Using (i) and (ii)]

$\Rightarrow 36 + 4a^2 + 24a = 9a^2 + 36 - 36a + a^2$

$\Rightarrow 60a = 6a^2$

$\Rightarrow$ 6a=60 ...[$\because$ a cannot be zero]

$\Rightarrow$ a = 10 cm

Now, from equation (i),

b = 6 + 2 × 10 = 26

and from equation (ii),

c = 3 × 10 - 6 = 24

Thus, the dimensions of the triangle are 10 cm, 24 cm and 26 cm.

65. Let the numbers are x and (x > y)

$x^2 - y^2 = 204$ …(i)

$y^2 = 10x - 4$ …(ii)

By (i) and (ii)

$x^2 - 10x + 4 - 204 = 0$

$x^2 - 10x + 200 = 0$

$(x - 20)(x + 10) = 0$

$x = 20, x = -10$ (rejected)

$y = 14$

66. Let the age of father = x years

age of son = (45 - x) years

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

On Solving

$x = 36$

Age of father = 36 years

Age of son = 9 years

67. Let sides of two square x m and y m ($x > y$)

$x^2 + y^2 = 452$ …(i)

$4x - 4y = 8$ …(ii)

$\Rightarrow x - y = 2$

By (i) & (ii)

$x^2 + (x - 2)^2 = 452$

$\Rightarrow x^2 - 2x - 224 = 0$

$x^2 - 16x + 14x - 224 = 0$

$(x - 16)(x + 14) = 0$

$x = 16, x = -14$ (rejected)

$y = 14$

Sides are 16 m and 14 m

68. Let cost of production of each article be Rs x

We are given total cost of production on that particular day = Rs 90

Therefore, total number of articles produced that day = 90/x

According to the given conditions,

$x = 2\left(\frac{90}{x}\right) + 3$

$\Rightarrow x = \frac{180}{x} + 3$

$\Rightarrow x = \frac{180+3x}{x}$

$\Rightarrow x^2 = 180 + 3x$

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

$\Rightarrow x^2 - 15x + 12x - 180 = 0$

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

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

Cost cannot be in negative, therefore, we discard $x = -12$

Therefore, $x = Rs\ 15$ which is the cost of production of each article.

Number of articles produced on that particular day = $\frac{90}{15} = 6$

69. Let the number of books bought be x.

$\frac{1800}{x} - \frac{1800}{x+10} = 30$

$\therefore x^2 + 10x - 600 = 0$

$(x + 30)(x - 20) = 0$

$x = -30$ (Rejected), 20

$\therefore$ Number of books bought = 20

70. Let the present age of Roohi be x years.

Then,

3 years ago, Roohi's age = (x - 3) years

5 years from now, Roohi's age = (x + 5) years

It is given that

$\frac{1}{x-3} + \frac{1}{x+5} = \frac{1}{3}$

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

$\Rightarrow \frac{2x+2}{x^2+2x-15} = \frac{1}{3}$

$\Rightarrow 6x + 6 = x^2 + 2x - 15$

$\Rightarrow x^2 - 4x - 21 = 0$

$\Rightarrow x^2 - 7x + 3x - 21 = 0$

$\Rightarrow x(x - 7) + 3(x - 7) = 0$

$\Rightarrow x - 7 = 0$ or $x + 3 = 0$

Since age cannot be negative, $x \neq -3$

$\Rightarrow x = 7$

Hence, Roohi's present age is 7 years.

71. Let the number of days taken by B be x days.

$\therefore$ number of days taken by A = (x - 16) days

$\frac{1}{x} + \frac{1}{x-16} = \frac{1}{15}$

$\therefore x^2 - 46x + 240 = 0$

(x - 40) (x - 6) = 0

x = 40, 6 Rejected ($\because$ 6 - 16 is -ve)

$\therefore$ Number of days taken by B = 40 days

72. Let the original number of persons be x.

Total amount to be divided among all people = Rs. 9000/-

So, Share of each person = Rs. $\frac{9000}{x}$

If the number of persons is increased by 20. Then,

New share of each person = Rs. $\frac{9000}{x+20}$

According to the question ;

$\frac{9000}{x} - \frac{9000}{x+20} = 160$

$\Rightarrow \frac{9000(x+20)-9000x}{x(x+20)} = 160$

$\Rightarrow \frac{9000x+180000-9000x}{x^2+20} = 160$

$\Rightarrow \frac{180000}{x^2+20} = 160$

$\Rightarrow \frac{180000}{160} = x^2 + 20$

$\Rightarrow 1125 = x^2 + 20x$

$\Rightarrow x^2 + 20x - 1125 = 0$

$\Rightarrow x^2 + 45x - 25x - 1125 = 0$

$\Rightarrow x(x + 45) - 25(x + 45) = 0$

$\Rightarrow (x + 45)(x - 25) = 0$

$\Rightarrow x - 25 = 0$ [$\because$ The number of persons cannot be negative. $\therefore x + 45 \neq 0$]

$\Rightarrow x = 25$

Hence, the original number of persons is 25.

73. Let the number of toys produced be *x*.

$\therefore$ Cost of production of each toy = Rs (55 − *x*)

It is given that, total production of the toys = Rs 750

$\therefore x(55 – x) = 750$

$\Rightarrow x^2 – 55x + 750 = 0$

Now to factorize this equation we have to find two numbers such that their product is 750 and sum is 55

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

$\Rightarrow x(x – 25) – 30(x – 25) = 0$

$\Rightarrow (x – 25)(x – 30) = 0$

Either $x – 25 = 0$ or $x - 30 = 0$

i.e., $x = 25$ or $x = 30$

Hence, the number of toys will be either 25 or 30.

74. Let the original duration of the tour be x days.

Total expenses of the tour = ₹ 4200

So, expense of one day = ₹ $\frac{4200}{x}$

If tour extends for 3 more days, total duration = (x + 3) days

Hence, expense of one day = $\frac{4200}{x+3}$

Now, according to the question ;

$\frac{4200}{x} - \frac{4200}{(x+3)} = 70$

$\Rightarrow 4200 \times \left[\frac{1}{x} - \frac{1}{(x+3)}\right] = 70 \Rightarrow \frac{(x+3)-x}{x(x+3)} = \frac{70}{4200}$

$\Rightarrow$ x(x +3) = 180 $\Rightarrow$ x^2 + 3x - 180 = 0

$\Rightarrow$ x^2 + 15x - 12x - 180 = 0 $\Rightarrow$ x(x + 15) - 12(x + 15) = 0

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

$\Rightarrow$ x = -15 or x = 12

$\Rightarrow$ x = 12 [$\because$ number of days cannot be negative.]

$\therefore$ original duration of the tour is 12 days.

75. Let the present age of Tanay be x years

By the question,

(x - 5)(x + 10) = 16

or, $x^2 + 5x - 50 = 16$

or, $x^2 + 5x - 66 = 0$

or, $x^2 + 11x - 6x - 66 = -66$

x(x + 1)-16(x - l11) = 0

(x + 11) (x -6) = 0

=-11, 6

Rejecting x = - 11, as age cannot be negative.

$\therefore$ Present age of Tanay is 6 years.