UDAAN

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Quadratic Equation

Mathematics | **Lecture – 08**

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Topics

to be covered

Word Problems (Part - 04)

Questions based on Time and Work

Questions based on Miscellaneous Problems

A new way of solving Quadratic equation.

WORK HARD
DREAM BIG
NEVER GIVE UP !!

$\frac{75}{8}$ hr

#Q. Two water tap●s together can fill a tank in $9\frac{3}{8}$ hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the ~~tank~~ tank separately. Find the time in which each tap can separately fill the tank. **[NCERT]**

let smaller tap take x hours to completely fill the tank

x hr $= 1$ unit

1 hr $= \frac{1}{x}$ unit

$\boxed{\frac{75}{8} \text{ hr} = \frac{75}{8x} \text{ u}}$ (x)

let larger tap take $(x-10)$ hrs to completely fill the tank.

$(x-10)$ hr $= 1$ unit

1 hr $= \frac{1}{x-10}$ u

$\boxed{\frac{75}{8} \text{ hr} = \frac{75}{8(x-10)}}$ u

$(x-10)$

$$\frac{75}{8x} + \frac{75}{8(x-10)} = 1$$

$$\frac{75}{8}\left[\frac{1}{x} + \frac{1}{x-10}\right] = 1$$

$$\frac{1(x-10)+1(x)}{x(x-10)} = \frac{8}{75}$$

$$\frac{x-10+x}{x^2-10x} = \frac{8}{75}$$

$$\frac{2x-10}{x^2-10x} = \frac{8}{75}$$

$$150x - 750 = 8x^2 - 80x$$

$$0 = 8x^2 - 230x + 750$$

$$0 = 4x^2 - 115x + 375$$

(H.w)

P.T.O //

$4x^2 - 115x + 375 = 0$ → Solve by Quadratic Formula.

$x = 25, \quad x = 15/4$

Now,

Smaller tap

If $x = 25$ hours. , If $x = 15/4$

Larger tap

then, $x - 10 = 15$ hours. ,

then $x - 10 = \dfrac{15}{4} - 10$ → $-ve$ → not possible.

10 boriyan = 2 hours.

$$\frac{10}{2} \text{'B'} = 1 \text{ hr}$$

$$5 \text{'B'} = 1 \text{ hr}$$

$$\boxed{\frac{5}{2} \text{'B'} = \frac{1}{2} \text{ hr}}$$

Pura kaam
(whole work) = 1 unit

$\frac{100}{9}$ min

(P)(W)

#Q. Two pipes running together can fill a tank in $11\frac{1}{9}$ minutes. If one pipe takes 5 minutes more than the other to fill the tank separately, find the time in which each pipe would fill the tank separately.

[CBSE 2010]

Chota pipe

1 unit = (x+5) min

$\frac{1}{x+5}$ u = 1 min

$\frac{100}{9(x+5)}$ y = $\frac{100}{9}$ min

Bada pipe.

1 unit = x min

$\frac{1}{x}$ u = 1 min
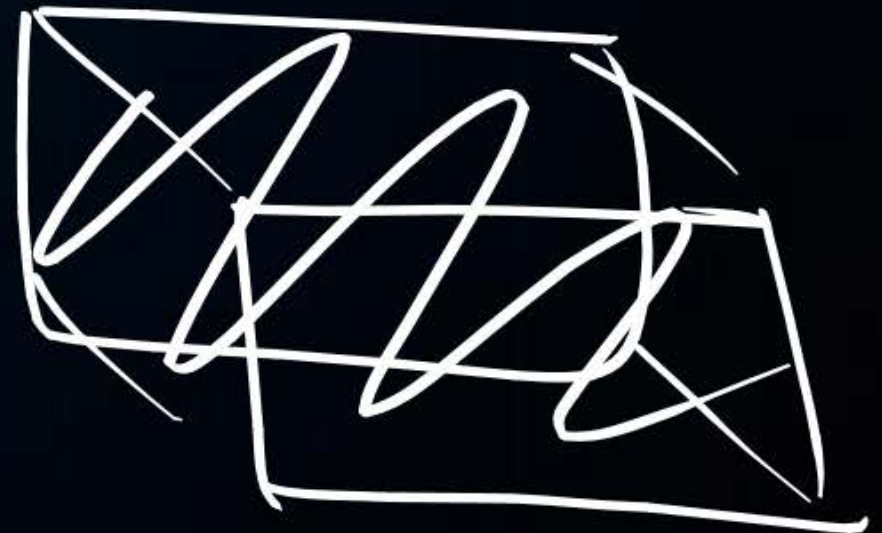
$\frac{100}{9x}$ y = $\frac{100}{9}$ min

x+5

x

$$\boxed{\frac{100}{9} \text{min} \longrightarrow 1 \text{unit}}$$

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

$$\frac{100}{9}\left[\frac{1}{x+5} + \frac{1}{x}\right] = 1 \qquad \underline{\text{H.w}}$$

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

$$\frac{2x + 5}{x^2 + 5x} = \frac{9}{100}$$

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

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

$$\cancel{x = -25/9} , \quad x = 20$$

Ans: Faster pipe = 20 minutes
Slower pipe = 25 minutes

#Q. A takes 6 days less than the time taken by B to finish a piece of work. If both A and B together can finish it in 4 days, find the times taken by B to finish the work.

[CBSE 2017]

let B takes x days to finish the work.

x days = 1 unit

1 day = $\dfrac{1}{x}$ unit

4 days = $\dfrac{4}{x}$ unit

and let A takes $(x-6)$ days to finish the work.

$(x-6)$ days = 1 unit

1 day = $\dfrac{1}{x-6}$ unit

4 days = $\dfrac{4}{x-6}$ unit

4 days $\longrightarrow$ 1 unit

$$\dfrac{4}{x} + \dfrac{4}{x-6} = 1$$

H·W

P·T·O

$$4\left[\frac{1}{x} + \frac{1}{x-6}\right] = 1$$

$$\frac{x-6+x}{x^2-6x} = \frac{1}{4}$$

$$\frac{2x-6}{x^2-6x} = \frac{1}{4}$$

$$8x - 24 = x^2 - 6x$$

$$0 = x^2 - 14x - 24$$

$$x = 12, \quad x = 2 \text{ — not possible. (Think)}$$

Ans//

#Q. A takes 10 days less than the time taken by B to finish a piece of work. If both A and B together can finish the work in 12 days, find the time taken by B to finish the work.

$$A \longrightarrow (x-10) \text{ days}$$

$$1 \text{ unit} = (x-10) \text{ days}$$

$$\frac{1}{x-10} \text{ unit} = 1 \text{ day}$$

$$\boxed{\frac{12}{x-10} u = 12 \text{ days}}$$

$$B \longrightarrow x \text{ days}$$

$$1 \text{ unit} = x \text{ days}$$

$$\frac{1}{x} \text{ unit} = 1 \text{ day}$$

$$\boxed{\frac{12}{x} \text{ unit} = 12 \text{ days}}$$

$$12 \text{ days} \rightarrow 1 \text{ unit}$$

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

Next page

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

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

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

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

$$\boxed{0=x^2-34x+120}$$

$$x=30,\ \boxed{x=4}\ \rightarrow \text{not possible. Think}!$$

$$\boxed{\text{Ans: B takes 30 days.}}$$

Total money = 10000

Total Babuas = 500

Money each Babua have = $\dfrac{10000}{500}$

= $\boxed{20\ Rs}$

Formula :-

Money each person has = $\dfrac{\text{Total money}}{\text{no. of persons.}}$

#Q. Rs. 6500 were divided equally among a certain number of persons. Had there been 15 more persons, each would have got Rs. 30 less. Find the original number of persons.

let total no. of persons
$$= x$$
let each person get y Rs.

Money each person have $= \dfrac{\text{Total money}}{\text{Total persons}}$

Total Money $= 6500$
no. of persons $= x$

Total money $= 6500$
Total persons $= x+15$

$$y = \dfrac{6500}{x}$$

$$y - 30 = \dfrac{6500}{x+15}$$

$$\dfrac{6500}{x} - 30 = \dfrac{6500}{x+15}$$

$$\dfrac{6500}{x} - \dfrac{6500}{x+15} = 30$$

H.w//

→ Next page

$$\frac{6500}{x} - \frac{6500}{x+15} = 30$$

$$6500 \left[\frac{1}{x} - \frac{1}{x+15} \right] = 30$$

$$\frac{\cancel{x+15} - \cancel{x}}{x(x+15)} = \frac{\cancel{30}}{6500\cancel{0}}$$

$$\frac{15}{x^2 + 15x} = \frac{3}{650}$$

$$9750 = 3x^2 + 45x$$

$$\boxed{0 = 3x^2 + 45x - 9750}$$

$$\rightarrow 3\left[x^2 + 15x - 3250 \right] = 0$$

$$\searrow x = -65, x = 50$$

Ans: 50 persons

#Q. Rs. 9000 were divided equally among a certain number of persons. Had there been 20 more persons, each would have got Rs. 160 less. Find the original number of persons.

let Original no. of persons $= x$.

let, each get $= y$ Rs.

Case-I

$$y = \frac{9000}{x}$$

Case-II

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

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

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

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

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

$$180000 = 160x^2 + 3200x$$

$160x^2 + 328x - 180000 = 0$

$160[x^2 + 20x - 1125] = 0$

$$\boxed{x^2 + 20x - 1125 = 0}$$

Ans: 25 persons

#Q. If the price of a book is reduced by Rs. 5, a person can buy 5 more books for Rs. 300. Find the original list price of the book.

let cost of each book $= x$ RS.

let no. of book $= y$.

Total money $= 300$.

Total cost $=$ no. of books $\times$ cost of each book

Case-I

$300 = xy$

$$\boxed{\dfrac{300}{x} = y}$$

Case-II

$300 = (x-5)(y+5)$

$$\boxed{\dfrac{300}{x-5} = y+5}$$

$$\boxed{\dfrac{300}{x-5} = \dfrac{300}{x} + 5}$$

$\Rightarrow$ Next page --

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

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

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

$$0 = 5x^2 - 25x - 1500$$

$$\boxed{0 = x^2 - 5x - 300}$$

$$(x = 20, \ x = -15 \times$$

Ans: 20 RS

#Q. If the list price of a toy is reduced by Rs. 2, a person can buy 2 toys more for Rs. 360. Find the original price of the toy.   [CBSE 2002 C]

H.W

Ans: Rs 20

Q $x^2 + 5x + 6 = 0$

$S = -5, \quad P = 6$

$\boxed{-2, 3}$

Q $x^2 - 8x + 13 = 0$

$S = 8, \quad P = 13$

$\boxed{4 + p, \quad 4 - p}$

$(4 + 5_3), (4 - 5_3)$

$(4 + p)(4 - p) = 13$

$4^2 - p^2 = 13$

$16 - 13 = p^2$

$\boxed{\pm \sqrt{3} = p}$

#Q. Solve for x : $\frac{1}{x} - \frac{1}{x-2} = 3, x \neq 0,2$

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

$$3x^2 - 6x + 2 = 0$$

$$ax^2 + bx + c = 0$$

$$x = \frac{-(-6) \pm \sqrt{12}}{2(3)}$$

$$a = 3, b = -6, c = 2$$

$$D = b^2 - 4ac$$

$$D = (-6)^2 - 4(3)(2)$$

$$x = \frac{6 \pm \sqrt{2 \times 2 \times 3}}{6}$$

$$D = 36 - 24$$

$$x = \frac{6 \pm 2\sqrt{3}}{6}$$

$$D = 12$$

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

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

$$\frac{x - 2 - x}{x^2 - 2x} = 3$$

$$-2 = 3(x^2 - 2x)$$

$$-2 = 3x^2 - 6x$$

$$x = \frac{6 \pm 2\sqrt{3}}{6}$$

$$x = \frac{\cancel{2}(3 \pm \sqrt{3})}{\cancel{6}_3}$$

$$\boxed{x = \frac{3 \pm \sqrt{3}}{3}}$$

$$x = \frac{3 + \sqrt{3}}{3}, \frac{3 - \sqrt{3}}{3}$$

$$\frac{3x^2}{3} - \frac{6x}{3} + \frac{2}{3} = \frac{0}{3}$$

$$x^2 - 2x + \frac{2}{3} = 0$$

$$\boxed{S = 2, \, P = \frac{2}{3}}$$

$$\boxed{(1+p), (1-p)}$$

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

$$1^2 - p^2 = \frac{2}{3}$$

$$1 - \frac{2}{3} = p^2$$

$$\frac{1}{3} = p^2$$

$$P = \pm \frac{1}{\sqrt{3}}$$

$$\left(1 + \frac{1}{\sqrt{3}}\right), \left(1 - \frac{1}{\sqrt{3}}\right)$$

$$\frac{\sqrt{3}+1}{\sqrt{3}}, \frac{\sqrt{3}-1}{\sqrt{3}}$$

$$\frac{3+\sqrt{3}}{3}, \frac{3-\sqrt{3}}{3}$$

#Q. $x - \dfrac{1}{x} = 3, x \neq 0$ [NCERT, CBSE 2010]

(A) $\dfrac{3 \pm \sqrt{13}}{2}$ ✓

(B) $\dfrac{2 \pm \sqrt{13}}{2}$

(C) $1, 2$

(D) $\dfrac{3 \pm \sqrt{15}}{2}$

$$D = b^2 - 4ac$$
$$D = (-3)^2 - 4(1)(-1)$$
$$= 9 + 4$$
$$\boxed{D = 13}$$

$$\boxed{x = \dfrac{-b + \sqrt{D}}{2a}}$$

$$x = \dfrac{-(-3) \pm \sqrt{13}}{2(1)}$$

$$x = \dfrac{3 \pm \sqrt{13}}{2}$$

$$\dfrac{x}{1} - \dfrac{1}{x} = 3$$

$$\dfrac{x^2 - 1}{x} = 3$$

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

$$\boxed{x^2 - 3x - 1 = 0}$$

$$ax^2 + bx + c = 0$$

$$\boxed{a = 1, b = -3, c = -1}$$

#Q. Find the roots of the quadratic equation:

$$3x^2 + 2\sqrt{5}x - 5 = 0$$

$$ax^2 + bx + c = 0$$

$$\boxed{a = 3,\ b = 2\sqrt{5},\ c = -5}$$

$$D = b^2 - 4ac$$
$$= (2\sqrt{5})^2 - 4(3)(-5)$$
$$= 20 + 60$$

$$\boxed{D = 80}$$

$$\begin{array}{c|c}
2 & 80 \\
2 & 40 \\
2 & 20 \\
2 & 10 \\
2 & 5 \\
5 & 1
\end{array}$$

$$\sqrt{80} = \sqrt{2\times2\times2\times2\times5}$$
$$= 2\times2\sqrt{5}$$

$$\boxed{\sqrt{80} = 4\sqrt{5}}$$

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

$$x = \frac{-2\sqrt{5} \pm \sqrt{80}}{2(3)}$$

$$x = \frac{-2\sqrt{5} \pm 4\sqrt{5}}{6}$$

$$x = \frac{-2\sqrt{5} + 4\sqrt{5}}{6} \quad,\quad x = \frac{-2\sqrt{5} - 4\sqrt{5}}{6}$$

$$x = \frac{2\sqrt{5}}{6}_3 \quad,\quad x = \frac{-8\sqrt{5}}{6}$$

$$\boxed{x = \frac{\sqrt{5}}{3}} \quad,\quad \boxed{x = -\sqrt{5}}$$

$$\frac{3x^2}{3} + \frac{2\sqrt{5}x}{3} - \frac{5}{3} = \frac{0}{3}$$

$$\boxed{x^2 + \frac{2\sqrt{5}}{3}x - \frac{5}{3} = 0}$$

$$S = \frac{-2\sqrt{5}}{3}, \quad P = \frac{-5}{3}$$

$$\left(\frac{-\sqrt{5}}{3} + P, \frac{-\sqrt{5}}{3} - P \right)$$

$$\frac{-\sqrt{5}}{3} + \frac{2\sqrt{5}}{3}, \quad \frac{-\sqrt{5}}{3} - \frac{2\sqrt{5}}{3}$$

$$\frac{\sqrt{5}}{3}, \quad -\sqrt{5}$$

$$\left(\frac{-\sqrt{5}}{3} + P \right)\left(\frac{-\sqrt{5}}{3} - P \right) = \frac{-5}{3}$$

$$\left(\frac{-\sqrt{5}}{3} \right)^2 - (P)^2 = \frac{-5}{3}$$

$$\frac{5}{9} - P^2 = \frac{-5}{3}$$

$$\frac{5}{9} + \frac{5}{3} = P^2$$

$$\frac{5 + 15}{9} = P^2$$

$$\frac{20}{9} = P^2$$

$$P = \pm \frac{2\sqrt{5}}{3}$$

Homework

① Revision .

② Jo bhi DPP's key Question
   nahi bane, usko phir se karo.

③ ye method sikhao - - //