

No. **65**



# QUADRATIC EQUATIONS

- **Sum based on Work**

**Q.** A cottage industry produces a certain number of pottery articles in a day. It was observed on a particular day that the cost of production of each article (in rupees) was 3 more than twice the number of articles produced on that day. If the total cost of production on that day was Rs.90, find the number of articles produced and the cost of each article.

**Sol.** Let the number of articles produced be  $x$ .  
 $\therefore$  Cost of production of each article =  $2x + 3$

Total cost of production = Number of articles  $\times$  Cost of production of each article

$$90 = x(2x + 3)$$

$$90 = 2x^2 + 3x$$

$$0 = 2x^2 + 3x - 90$$

$$\therefore 2x^2 + 3x - 90 = 0$$

$$\therefore 2x^2 + 15x - 12x - 90 = 0$$

$$\therefore x(2x + 15) - 6(2x + 15) = 0$$

$$\therefore (2x + 15)(x - 6) = 0$$

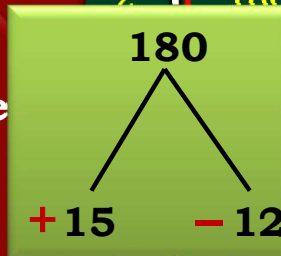
$$\therefore 2x + 15 = 0 \quad \text{or} \quad x - 6 = 0$$

Find two factors of 180 in such a way that their sum is 15.

Since last sign is '-', Give middle sign to the bigger factor & opposite sign to the smaller factor.

$$90 \times 2 = 180$$

Calculation



$$= 15$$

**$\therefore$  6 articles are produced each day and cost of production of each article is Rs.15.**

No. **66**



# QUADRATIC EQUATIONS

- **Sum based on two taps**

**Q.** Two water taps 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 separately. Find the time in which each can fill the tank.

**Sol :** Let the time taken to fill the tank by smaller tap be  $x$  hrs  
 $\therefore$  The time taken to fill the tank by larger tap be  $(x - 10)$  hrs

Portion of the tank filled by smaller tap in 1 hr =  $\frac{1}{x}$

Portion of the tank filled by larger tap in 1 hr =  $\frac{1}{x-10}$

Time taken by both the taps together to fill the same tank  
 $= 9\frac{3}{8}$  hours  $= \frac{75}{8}$  hours

Portion of the tank filled in 1 hour by both taps =  $\left(\frac{1}{x} + \frac{1}{x-10}\right) = \left(\frac{8}{75}\right)$   
 As per the given condition,

$$\begin{aligned} \frac{1}{x} + \frac{1}{x-10} &= \frac{8}{75} \\ \therefore \frac{x-10+x}{x(x-10)} &= \frac{8}{75} \\ \therefore \frac{2x-10}{x^2-10x} &= \frac{8}{75} \\ \therefore 75(2x-10) &= 8(x^2-10x) \\ \therefore 150x-750 &= 8x^2-80x \end{aligned}$$

Find two factors of 1500 in such a way that by adding factors we get middle number.

Tank	Time required to fill a tank	Portion of tank filled in 1 hour
1	2 hrs	$\frac{1}{2}$
1	3 hrs	$\frac{1}{3}$
1	$x$ hrs	$\frac{1}{x}$ Smaller tap
1	$x - 10$ hrs	$\frac{1}{x-10}$ Larger tap
1	$9\frac{3}{8} = \frac{75}{8}$	$\frac{1}{\frac{75}{8}} = \frac{8}{75}$ Both taps

If  $x = 4$  then  $x - 10 = -6$  not acceptable as time  
 If  $x = 10$  then  $x - 10 = 0$  not acceptable as time  
 If  $x = 15$  then  $x - 10 = 5$  acceptable  
 $\therefore x - 10 = 5 \Rightarrow x = 15 + 10 = 25$   
 $\therefore x - 10 = 25 - 10 = 15$

**Time taken by larger tap alone is 15 hours and by smaller tap alone is 25 hours**

No. **67**



# QUADRATIC EQUATIONS

- **Word Problem based on work**



Q)

For doing some work Ganesh takes 10 days more than John. If both work together they complete the work in 12 days. Find the number of days if Ganesh worked alone?

**Sol.** Let the number of days required by John alone to complete the work be  $x$  days.

$\therefore$  No. of days taken by Ganesh alone is  $(x + 10)$  days.  $\therefore \frac{1}{x} + \frac{1}{x+10} = \frac{1}{12}$

Also number of days required by both to complete the same work is 12 days

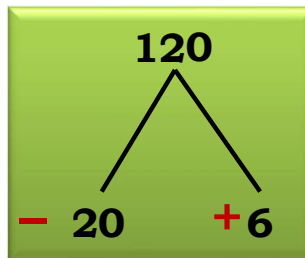
$\therefore$  Work done by John in 1 day =  $\frac{1}{x}$

It is given that... find ?

In a comparative statement whatever sign comes later is taken as  $x$  the opposite sign to the smaller factor

in such a way that by subtracting factors we get middle no. 14

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



No. of days	Work done in 1 day
$x$	$\frac{1}{x}$
$x + 10$	$\frac{1}{x+10}$
12	$\frac{1}{12}$

$\therefore x \neq -6$  Hence,  $x = 20$

$\therefore x + 10 = 20 + 10 = 30$

**Ganesh alone worked for 30 days.**

No. **68**



# QUADRATIC EQUATIONS

- **Word Problem based on work**

**Q)** Tinu takes 9 days more than his father to do a certain piece of work. Together they can do the work in 6 days. How many days will Tinu take to do that work.

**Sol.** Let the number of days required by father alone to do a certain piece of work be  $x$  days.

$\therefore$  No. of days taken by Tinu alone is  $(x + 9)$  days.

Also number of days required by both to complete the same work is 6 days

$\therefore$  Work done by Father in 1 day =  $\frac{1}{x}$

$\therefore$  Work done by Tinu in 1 day =  $\frac{1}{x + 9}$

**In a comparative statement whatever comes later is taken as  $x$**

$$\frac{1}{x} + \frac{1}{x + 9} = \frac{1}{6}$$

$$\therefore \frac{x + 9 + x}{x(x + 9)} = \frac{1}{6}$$

$$\therefore \frac{2x + 9}{x^2 + 9x} = \frac{1}{6}$$

**It is given that ... find ?**

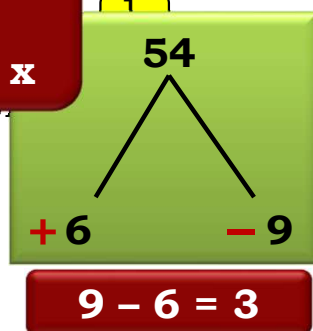
$$\therefore \frac{x^2 - 9x + 6x - 54}{x(x - 9) + 6(x - 9)} = 0$$

**Since we are subtracting the factors give middle term sign to the bigger factor and the opposite sign to the smaller factor**

be negative

$$\therefore x + 9 = 9 + 9 = 18$$

**Tinu alone requires 18 days to complete the work.**



No. **69**



# QUADRATIC EQUATIONS

- **Word Problem based on work**

Q) One tank can be filled up by two taps in 6 hours. The smaller tap alone takes 5 hours more than the bigger tap alone. Find the time required by each tap to fill the tank separately.

Sol. Let the time taken to fill a tank by a bigger tap alone

∴ The time taken by smaller tap alone is  $(x + 5)$  hrs.

Time taken by both the taps together to fill the same tank is 6 hrs.

What do we have to find ?

ment  
e will

Portion of the tank filled in 1 hr by bigger tap =  $\left(\frac{1}{x}\right)$  capacity

Portion of the Tank filled in 1 hr by smaller tap

=  $\left(\frac{1}{x + 5}\right)$  capacity

Tank filled in 1 hr by both taps together =  $\left(\frac{1}{6}\right)$  capacity

As per the given condition,

$$\left(\frac{1}{x}\right) + \left(\frac{1}{x + 5}\right) = \left(\frac{1}{6}\right)$$

Tank	Time required to fill a tank	Portion of tank filled in 1 hour
1	2 hrs	$\frac{1}{2}$
1	3 hrs	$\frac{1}{3}$
1	x hrs	$\frac{1}{x}$
1	x + 5 hrs	$\frac{1}{x + 5}$
1	6 hrs	$\frac{1}{6}$

**Q. One tank can be filled up by two taps in 6 hours. The smaller tap alone takes 5 hours more than the bigger tap alone. Find the time required by each tap to fill the tank separately.**

**Sol.**  $\frac{1}{x} + \frac{1}{x+5} = \frac{1}{6}$

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

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

$$\therefore 1(x^2+5x) = 6(2x+5)$$

$$\therefore x^2+5x = 12x+30$$

$$\therefore x^2+5x-12x-30=0$$

$$\therefore x^2-7x-30=0$$

$$\therefore x^2+3x-10x-30=0$$

$$\therefore x(x+3)-10(x+3)=0$$

$$\therefore (x+3)(x-10)=0$$

$\therefore x = 10$

$\therefore x+5 = 10+5 = 15$

$\therefore$

**Time taken by bigger tap alone is 10 hrs and smaller tap alone is 15 hrs.**

Since we are subtracting the factors give middle term sign to the bigger factor and the opposite sign to the smaller factor



No. **70**



# QUADRATIC EQUATIONS

- **Word Problem based on cost**

(Q) The cost of bananas is increased by Re. 1 per dozen, one can get 2 dozen less for Rs. 840. Find the original cost of one dozen of banana.

Sol. Let the cost of banana per dozen be Rs.  $x$ .

Amount for which bananas are bought = Rs. 840

$$\frac{840}{x}$$

Old no. of dozens

Total Amount  
Cost per dozen

Since we are subtracting the factors give middle term sign to the bigger factor and the opposite sign to the smaller factor

If I have Rs. 100 the dozens will I be able to buy

If cost per dozen increases one will get less no. of dozens

As per given condition,

Amount	Cost per dozen	No. of dozens
100	10	100

Old no. of dozens

Find two factors of 420 in such a way that by subtracting factors we get middle no. 1

Old no. of dozens

$$\therefore x - 20 = 0 \text{ or } x + 21 = 0$$

$$\therefore \frac{100}{20} = 5 \text{ or } x = -21$$

bananas cannot be negative.

$$\therefore x \neq -21$$

Hence  $x = 20$

The original cost of one dozen of banana is Rs. 20.

No. **71**



# QUADRATIC EQUATIONS

- **Word Problem based on cost  
(Businessman)**

**Q.** A businessman bought some items for Rs. 600, keeping 10 items for himself he sold the remaining items at a profit of Rs. 5 per item. From the amount received in this deal he could buy 15 more items. Find the original price of each item.

**Sol.** Let original price of each item be Rs.  $x$

CP of 1 item	Rs. $x$
Total CP	Rs. 600
How many items did he sell?	$\frac{600}{x}$
No. of items sold	$(\frac{600}{x} - 10)$
SP of 1 item	Rs. $(x + 5)$
Total SP	Rs. $(\frac{600}{x} - 10)(x + 5)$

But how many items did he purchase?

Am

With the profit amount he could buy 15 more items

$$\text{Total SP} - \text{Total CP} = \text{Profit}$$

SP of 1 item =

CP of 1 item + Profit per item

$$(\frac{600}{x} - 10)(x + 5) - 600 = 15x$$



**Q.** A businessman bought some items for Rs. 600, keeping 10 items for himself he sold the remaining items at a profit of Rs. 5 per item. From the amount received in this deal he could buy 15 more items. Find the original price of each item.

**Sol.** As per the given condition

$$\left(\frac{600}{x} - 10\right)(x + 5) - 600 = 15x$$

$$\frac{600}{x}(x + 5) - 10(x + 5) - 600 = 15x$$

$$\therefore \cancel{600} + \frac{3000}{x} - 10x - 50 - \cancel{600} = 15x$$

Multiplying 'x' on both sides, we get

$$\therefore 3000 - 10x^2 - 50x = 15x^2$$

$$\therefore 0 = 15x^2 + 10x^2 + 50x - 3000$$

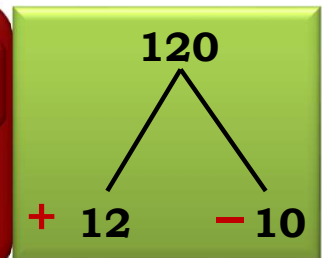
$$\therefore 25x^2 + 50x - 3000 = 0$$

Dividing throughout by 25, we get

$$\therefore 1x^2 + 2x - 120 = 0$$

Since we are subtracting the

Lets remove x from denominator and the smaller factor



$x = -12$  is not acceptable because cost cannot be negative.

$$\therefore x = 10$$

$\therefore$  Original price of each item is Rs.10.

**Thank You**