No. 59

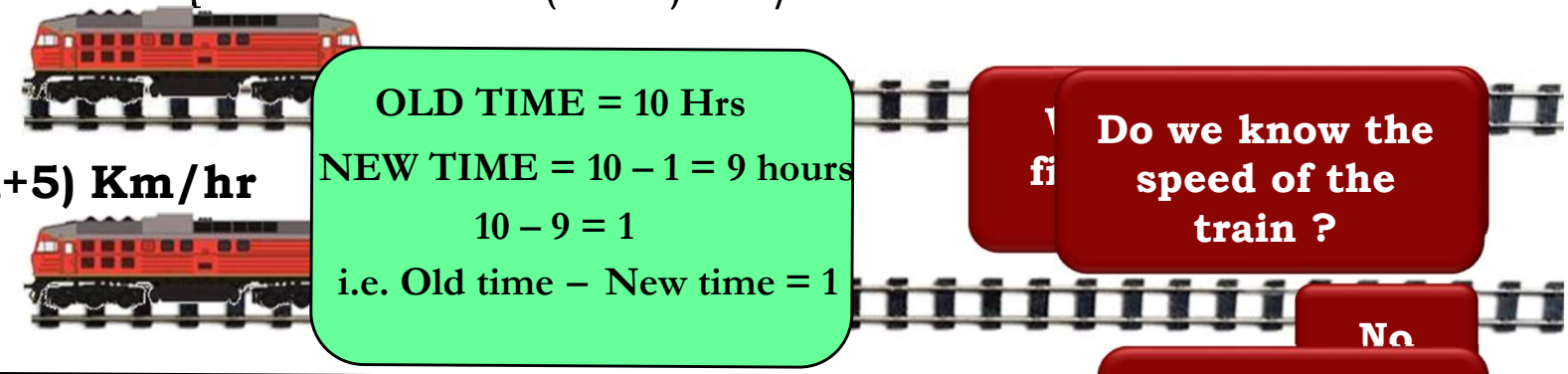
QUADRATIC EQUATIONS

- **SDT sum based on Train**

Q. A train travels 360 km at a uniform speed . If the speed is increased by 5 km/hr, it would have taken 1 hours less for the same journey. Find the speed of the train.

Sol : Let the speed of the train be x km/hr

∴ The new speed of train is (x + 5) km/ hr



	Old	New
SPEED	x Km/hr	(x+5) Km/hr
DISTANCE	360Km	360 Km
TIME = DISTANCE / SPEED	$\frac{360}{x}$ hrs	$\frac{360}{x+5}$ hrs

Q. A train travels 360 km at a uniform speed . If the speed is increased by 5 km/hr, it would have taken 1 hours less for the same journey. Find the speed of the train.

Sol : $\frac{360}{x} - \frac{360}{x+5} = 1$

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

$\therefore \quad \frac{x+5-x}{x(x+5)} = \frac{1}{360}$

$\therefore \quad \frac{5}{x^2+5x} = \frac{1}{360}$

$\therefore \quad 1800 = x^2 + 5x$

$\therefore \quad x^2 + 5x - 1800 = 0$

$\therefore \quad x^2 + 45x - 40x - 1800 = 0$

Calculation

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

$(x - 40) = 0$

$0 \quad \text{or} \quad x - 40 = 0$

$-45 \quad \text{or} \quad x = 40$

$45 - 40 = 5$

nnot be negative

Hence, $x = 40$

he Train is 40 km/hr.

1800

40

factors

such a

Since last sign is '-'

Give middle sign to the bigger factor

OLD TIME = 10 Hrs

NEW TIME = 10 – 1 = 9 hours

10 – 9 = 1

i.e. Old time – New time = 1

	Old	New
SPEED	x Km/hr	(x + 5) Km/hr
DISTANCE	360Km.	360 Km
TIME = DISTANCE / SPEED	$\frac{360}{x}$ hrs	$\frac{360}{x+5}$ hrs

Solving - 2

$\frac{360}{x} - \frac{360}{x+5} \times 1 = 1800$

No. 60

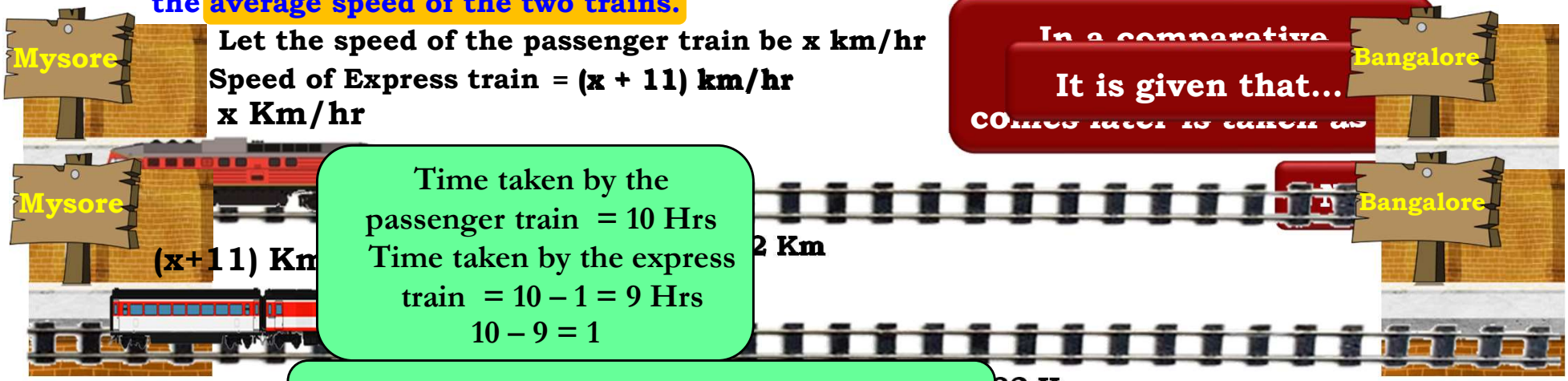
QUADRATIC EQUATIONS

- **SDT sum based on Train**

Q . An express train takes 1 hour less than a passenger train to travel 132 km between Mysore and Bangalore (without taking into consideration the time they stop at intermediate stations). If the average speed of express train is 11km/h more than that of the passenger train, find the average speed of the two trains.

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

Speed of Express train = (x + 11) km/hr



In a comparative ... comes later is taken as

It is given that...

Time taken by the passenger train = 10 Hrs

Time taken by the express train = 10 – 1 = 9 Hrs

10 – 9 = 1

Time taken by the passenger train – Time taken by the express train = 1

Let us tabulate the data

Speed		
Distance		
Time = $\frac{\text{Distance}}{\text{speed}}$	$\frac{132}{x}$ hrs	$\frac{132}{x+11}$ hrs

Q. **An express train takes 1 hour less than a passenger train to travel 132 km between Mysore and Bangalore (without taking into consideration the time they stop at intermediate stations). If the average speed of express train is 11km/h more than that of the passenger train, find the average speed of the two trains.**

Sol : Let the speed of the passenger train be x km/hr

∴ Speed of Express train = (x + 11) km/hr

	Passenger train	Express train
Speed	**x km/hr**	**(x + 11) km/hr**
Distance		**132 km**
Time = Distance / speed		

Time taken by the passenger train − Time taken by the express train = 1

According to

$$\frac{132}{x} - \frac{132}{x+11} = 1$$

$$\therefore \quad 132\left[\frac{1}{x} - \frac{1}{x+11}\right] = 1$$

$$\therefore \quad \frac{x+11-x}{x(x+11)} = \frac{1}{132}$$

$$\therefore \quad x^2 + 11x - 1452 = 0$$

$$\therefore \quad x^2 + 44x - 33x - 1452 = 0$$

$$\therefore \quad x(x+44) - 33(x+44) = 0$$

$$\therefore \quad (x+44)(x-33) = 0$$

$$\therefore \quad x = -44 \text{ or } x = 33$$

$$\therefore \quad x + 11 = 44$$

∴ The speed of the passenger train is 33 km/hr and speed of express train is 44 km/hr.

Calculation

2	1452
2	726
3	363
11	121
11	11
	1

1452

+ 44 **− 33**

Find two factors of 1452 in such a way that by subtracting the factors we get middle number.

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

No. 61

QUADRATIC EQUATIONS

- **SDT sum based on Bicycle**

A man riding on a bicycle covers a distance of 60 km in a direction of wind and comes back to his original position in 8 hours. If the speed of the wind is 10 km/hr. Find the speed of the bicycle.

Sol. Let the speed of bicycle be x km/hr

Total time taken = 8 hours

wind = (x – 10) km/hr

What we have to find in this sum ?

x km/hr

		of wind
DISTANCE		60 km
SPEED	(x + 10) km/hr	(x – 10) km/hr
TIME = DISTANCE / SPEED	60 / x + 10	60 / x – 10

As per the given condition

$$\frac{60}{x+10} + \frac{60}{x-10} = 8$$

A man riding on a bicycle cover a distance of 60 km in a direction of wind and comes back to his original position in 8 hours. If the speed of the wind is 10 km/hr. Find the speed of the bicycle.

Sol. Let the speed of bicycle be x km/hr

As per the given condition

$$\frac{60}{x+10} + \frac{60}{x-10} = 8$$

$$\therefore \quad 60\left[\frac{1}{x+10} + \frac{1}{x-10}\right] = 8$$

$$\therefore \quad \frac{x - 10 + x + 10}{(x+10)(x-10)} = \frac{8}{60} \; \frac{2}{15}$$

$$\therefore \quad \frac{2x}{x^2 - 100} = \frac{2}{15}$$

Dividing throughout by 2 we get,

$$\frac{x}{x^2 - 100} = \frac{1}{15}$$

$$x^2 - 100 = 15x$$

$$\therefore \quad 1x^2 - 15x - 100 = 0$$

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

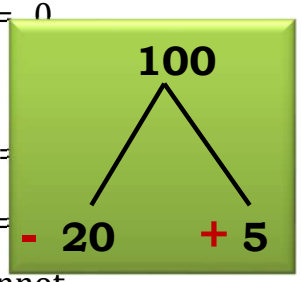
$$\therefore \quad x^2 - 20x + 5x - 100 = 0$$

$$\therefore \quad x(x-20) + 5(x-20) = 0$$

$$\therefore \quad (x-20)(x+5) = 0$$

$$\therefore \quad x - 20 = 0 \quad \text{or} \quad x + 5 =$$

$$\therefore \quad x = 20 \quad \text{or} \quad x =$$



$\therefore$ The speed of the bicycle cannot be negative

of 100 in
hat by
rs we get
ber.

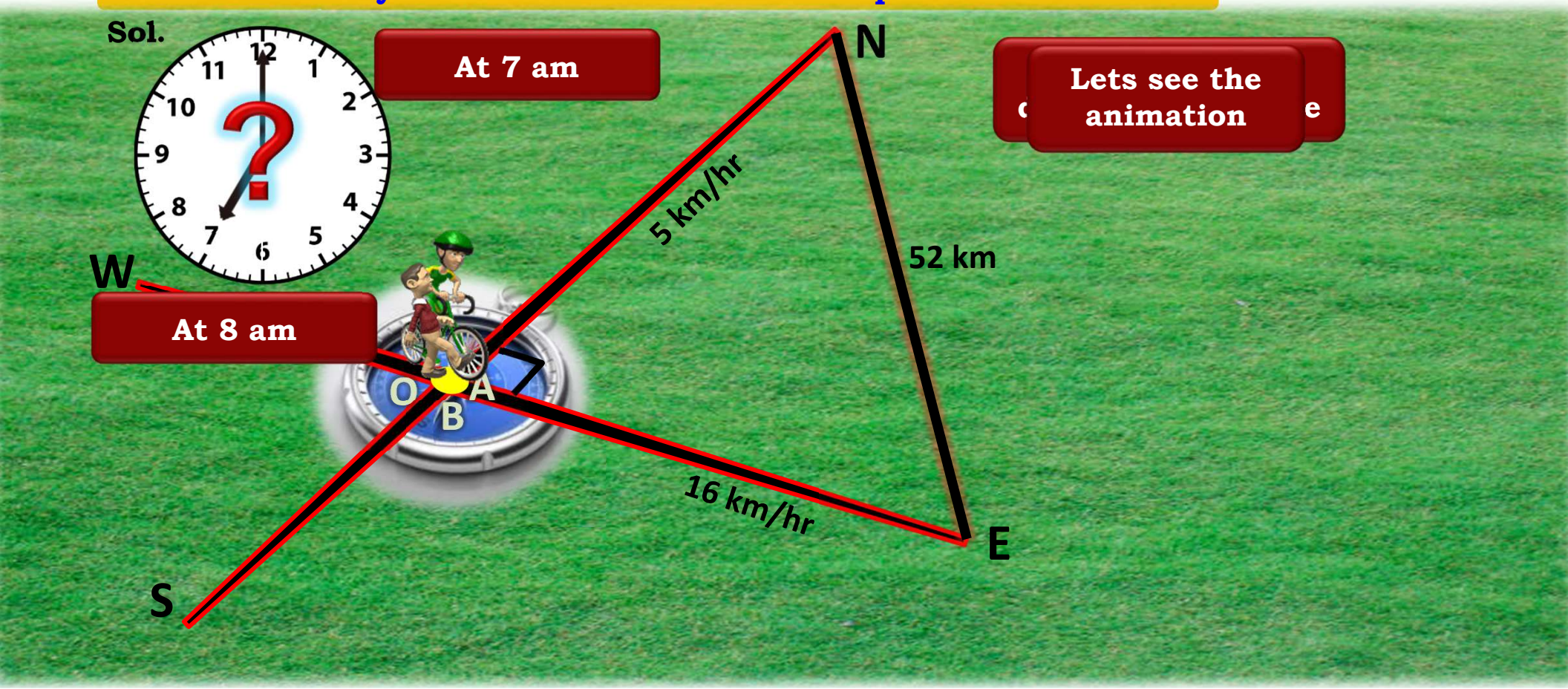
km/hr

No. 62

QUADRATIC EQUATIONS

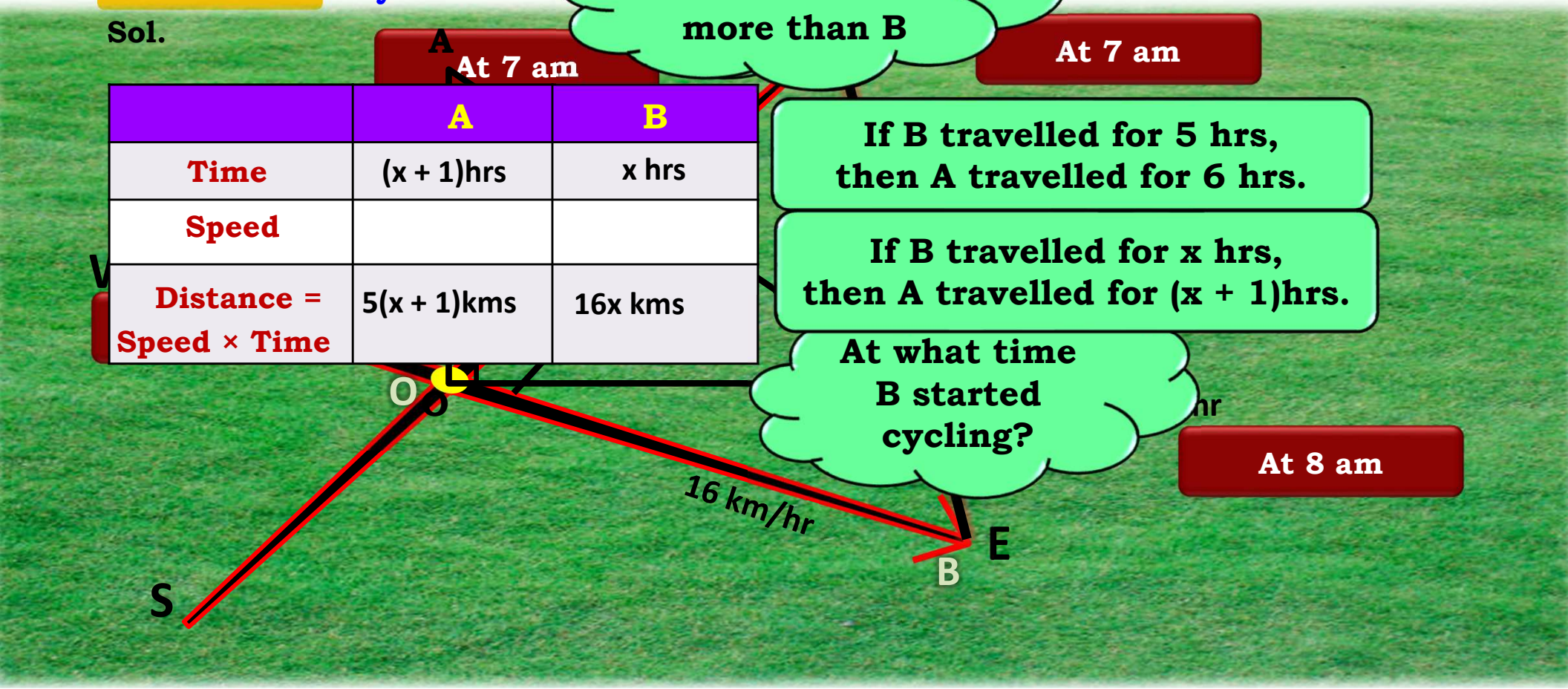
- **SDT sum based on walking and cycling**

From the same place at 7 am 'A' started walking in the north at the speed of 5 km/hr. After 1 hour B started cycling in the east at a speed of 16 km/hr. At what time they will be at distance of 52 km apart from each other.



From the same place at 7 am 'A' ... orth at the speed of 5 km/hr. After 1 hour ... at a speed of 16 km/hr. At what time they will be at ... ch other.

Sol.



	A	B
Time	(x + 1)hrs	x hrs
Speed		
Distance = Speed × Time	5(x + 1)kms	16x kms

From the same place at 7 am 'A' started walking in the north at the speed of 5 km/hr. After 1 hour B started cycling in the east at a speed of 16 km/hr. At what time they will be at distance of 52 km apart from each other.

Sol. In right angled Δ AOB,

By Pythagoras theorem,

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

$$\therefore [5(x+1)]^2 + (16x)^2 = (52)^2$$

$$\therefore [5x+5]^2 + (16x)^2 = (52)^2$$

$$\therefore 25x^2 + 50x + 25 + 256x^2 = 2704$$

$$\therefore 281x^2 + 50x + 25 - 2704 = 0$$

$$\therefore 281x^2 + 50x - 2679 = 0$$

$$\therefore 281x^2 - 843x + 893x - 2679 = 0$$

$$\therefore 281x(x-3) + 893(x-3) = 0$$

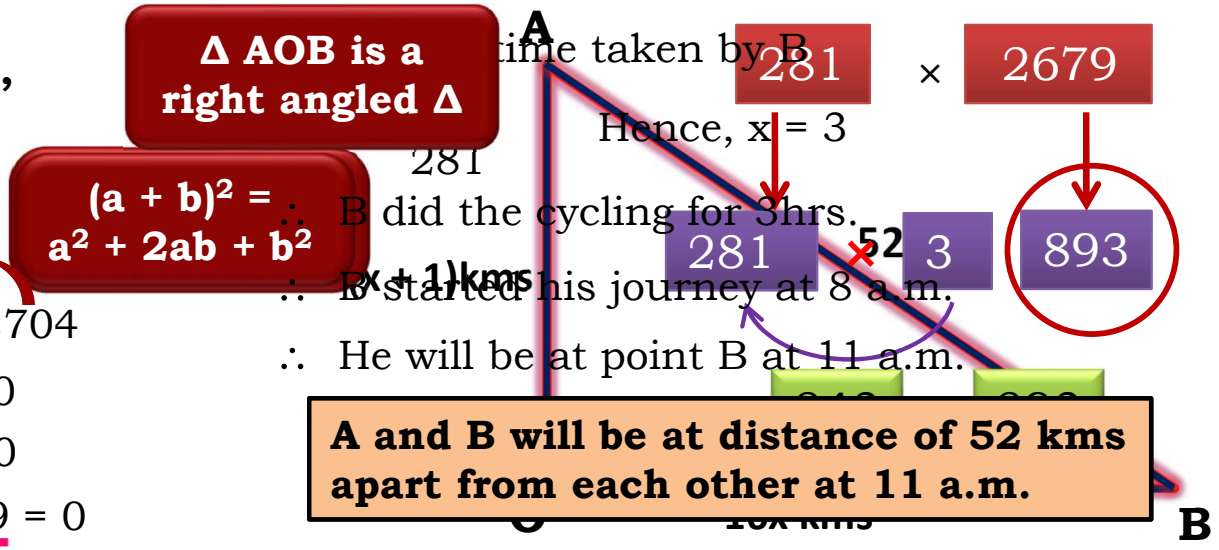
$$\therefore (x-3)(281x+893) = 0$$

$$\therefore x - 3 = 0 \quad \text{or} \quad 281x + 893 = 0$$

$$\therefore x = 3 \quad \text{or} \quad x = -\frac{893}{281}$$

Δ AOB is a right angled Δ

$(a+b)^2 = a^2 + 2ab + b^2$



time taken by B

Hence, x = 3

∴ B did the cycling for 3hrs.

∴ B started his journey at 8 a.m.

∴ He will be at point B at 11 a.m.

A and B will be at distance of 52 kms apart from each other at 11 a.m.

No. 63

QUADRATIC EQUATIONS

- **Word Problem based on Speed, Distance and Time (Car)**

(Q) A car covers a distance of 240km with some speed. If its speed is increased by 20 km/hr, it will cover the same distance in 2 hours less. Find the speed of the car.

Old time taken – New time taken = 2

Sol. Let the speed of the car be x km/hr

∴ New speed of the car = (x + 20)km/hr

As per the given condition,

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

	Old	New
SPEED	x km/hr	x + 20 km/hr
DISTANCE	240 km	240 km
TIME = DISTANCE / SPEED	$\frac{240}{x}$ hrs	$\frac{240}{x+20}$ hrs

x Km/hr

240 Km

(x+20) Km/hr

240 Km

= 8 hrs

(Q) A car covers a distance of 240km with some speed. If its speed is increased by 20 km/hr, it will cover the same distance in 2 hours less. Find the speed of the car.

Sol. Let the speed of the car be x km/hr

$\therefore$ New speed of the car = (x + 20)km/hr

As per the given condition,

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

(Q) A car covers a distance of 240km with some speed. If its speed is increased by 20 km/hr, it will cover the same distance in 2 hours less. Find the speed of th

Sol. Let the speed of t

∴ New speed of the car = (x + 20)km/hr

As per the given condition,

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

60 – 40 = 20

$$\therefore \quad 240\left(\frac{1}{x} - \frac{1}{x+20}\right) = 2$$

$$\therefore \quad \frac{x + 20 - x}{x(x+20)} = \frac{2^{1}}{240_{120}}$$

$$\therefore \quad \frac{20}{x^2 + 20x} = \frac{1}{120}$$

$$\therefore \quad 20\,(120) = 1\,(x^2 + 20x)$$

Multiplying throughout by – 1

$$\therefore \quad 2400 = x^2 + 20x$$

$$\therefore \quad -x^2 - 20x + 2400 = 0$$

$$\therefore \quad 1x^2 + 20x - 2400 = 0$$

$$\therefore \quad x^2 + \quad$$

$$\therefore \quad x(x + \quad)(x - 60) = 0$$

$$\therefore \quad (x + \quad$$

$$\therefore \quad x + \quad \text{or } x - 40 = 0$$

$$\therefore \quad x = -60 \text{ or } x = 40$$

Find two factors of 2400 in such a way that by subtracting factors we get middle no. 20

2400

+ 60 **– 40**

$\because$ The speed of car can never be negative

$\therefore \quad x \neq -60$ Hence $x = 40$

$\therefore$ **The original speed of car is 40 km/hr.**

No. 64

QUADRATIC EQUATIONS

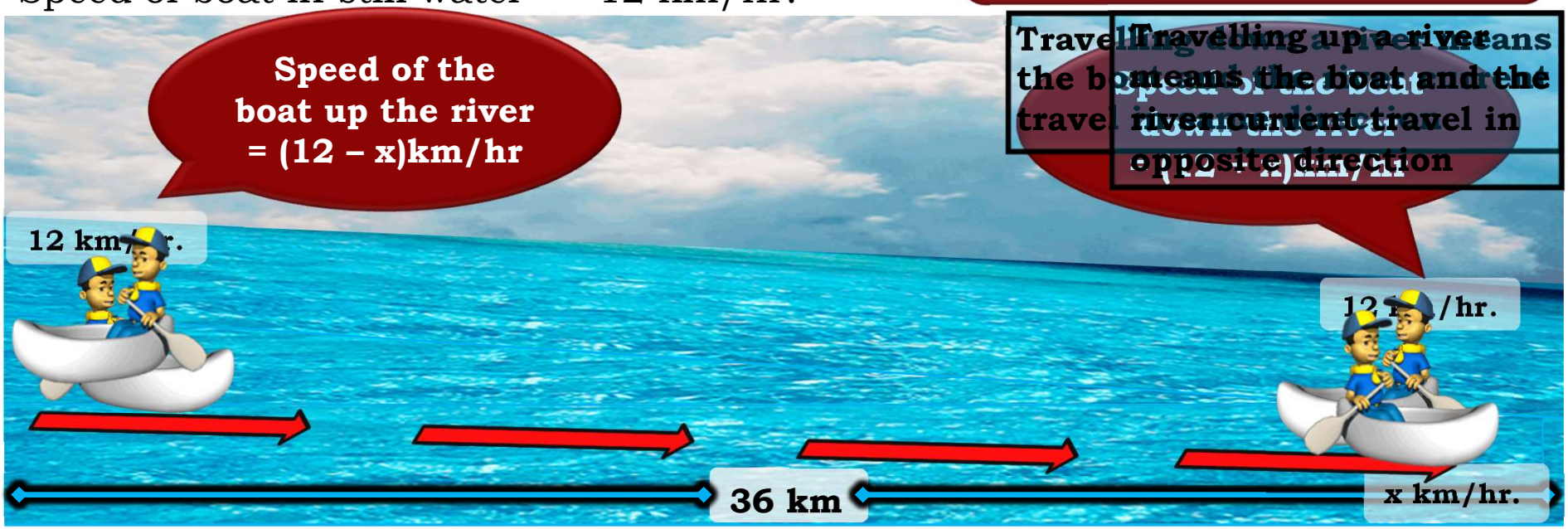
- **Word problem based on Speed, Distance and Time**

Q. A man travels by boat 36 km down a river and back in 8 hours. If the speed of his boat in still water is 12 km per hour, find the speed of the river current.

Sol:

Let speed of river current = x km/hr.

Speed of boat in still water = 12 km/hr.



Q. **A man travels by boat 36 km down a river and back in 8 hours. If the speed of his boat in still water is 12 km per hour, find the speed of the river current.**

Sol:

Let speed of river current = x km/hr.

Speed of boat in still water = 12 km/hr.

Speed of boat down the river = (12 + x) km/hr.

Speed of boat up the river = (12 – x) km/hr.

Total time taken = 8 hours

	Down the river	Up the river
Speed	**(12 + x) km/hr**	**(12 – x) km/hr**
Distance	**36 km**	**36 km**
Time = Distance / Speed	$\frac{36}{12+x}$ **hrs**	$\frac{36}{12-x}$ **hrs**

$$\frac{36}{12+x} + \frac{36}{12-x} = 8$$

Q. A man travels by boat 36 km down a river and back in 8 hours. If the speed of his boat in still water is 12 km per hour, find the speed of the river current.

Sol: Let speed of river current = x km/hr.

Speed of boat in still water = 12 km/hr.

Speed of boat down the river = (12 + x) km/hr.

Speed of boat up the river = (12 – x) km/hr.

As per the given condition

$$\frac{36}{12+x} + \frac{36}{12-x} = 8$$

$$\therefore \quad 36\left(\frac{1}{12+x} + \frac{1}{12-x}\right) = 8$$

$$\therefore \quad 36\left(\frac{12-x+12+x}{(12+x)(12-x)}\right) = 8$$

$$\therefore \quad 36\left(\frac{24}{(12)^2 - x^2}\right) = 8$$

$$\therefore \quad 36 \times \left(\frac{24}{144 - x^2}\right) = 8$$

$$\therefore \quad \frac{36 \times 24^{3}}{8_{1}} = 144 - x^2$$

$$\therefore \quad 108 = 144 - x^2$$

$$\therefore \quad x^2 = 144 - 108$$

$$\therefore \quad x^2 = 36$$

$$\therefore \quad x = \pm 6 \text{ (Taking Square root)}$$

$\therefore$ x = – 6 is not acceptable because speed cannot be negative

$\therefore$ x = 6

$\therefore$ The speed of river current is 6km/hr

Thank You