

Exercise 6(C)

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1. The speed of an ordinary train is x km per hr and that of an express train is $(x + 25)$ km per hr.

(i) Find the time taken by each train to cover 300 km.

(ii) If the ordinary train takes 2 hrs more than the express train; calculate speed of the express train.

Solution:

(i) Given,

Speed of the ordinary train = x km/hr

Speed of the express train = $(x + 25)$ km/hr

Distance = 300 km

We know that,

Time = Distance/ Speed

So, the time taken by the ordinary train to cover 300 km = $300/x$ hrs

And the time taken by the express train to cover 300 km = $300/(x + 25)$ hrs

(ii) From the question, it's given that the ordinary train takes 2 hours more than the express train to cover the distance of 300kms.

Hence, we can write

$$\frac{300}{x} - \frac{300}{x + 25} = 2$$

$$\frac{300x + 7500 - 300x}{x(x + 25)} = 2$$

$$7500 = 2x^2 + 50x$$

$$2x^2 + 50x - 7500 = 0$$

$$x^2 + 25x - 3750 = 0$$

$$x^2 + 75x - 50x - 3750 = 0$$

$$x(x + 75) - 50(x + 75) = 0$$

$$(x - 50)(x + 75) = 0$$

Thus, $x = 50$ or -75

As speed cannot be negative we shall ignore $x = -75$

Therefore,

The speed of the express train = $(x + 25)$ km/hr = 75 km/hr

2. If the speed of a car is increased by 10 km per hr, it takes 18 minutes less to cover a distance of 36 km. Find the speed of the car.

Solution:

Let's assume the speed of the car to be x km/hr.

Given, distance = 36 km

So, the time taken to cover a distance of 36 km = $36/x$ hrs [Since, Time = Distance/ Speed]

And, the new speed of the car = $(x + 10)$ km/hr

So, the new time taken by the car to cover a distance of 36 km = $36/(x + 10)$ hrs

Then according to the question, we can write

$$\frac{36}{x} - \frac{36}{x+10} = \frac{18}{60}$$

$$\frac{36x + 360 - 36x}{x(x+10)} = \frac{3}{10}$$

$$\frac{360}{x^2 + 10x} = \frac{3}{10}$$

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

$$x^2 + 10x - 1200 = 0$$

$$x^2 + 40x - 30x - 1200 = 0$$

$$x(x + 40) - 30(x + 40) = 0$$

$$(x + 40)(x - 30) = 0$$

Thus,

$$x = -40 \text{ or } 30$$

But, as speed cannot be negative. $x = 30$ is only considered.

Therefore, the original speed of the car is 30 km/hr.

3. If the speed of an aeroplane is reduced by 40 km/hr, it takes 20 minutes more to cover 1200 km. Find the speed of the aeroplane.

Solution:

Let's consider the original speed of the aeroplane to be x km/hr.

Now, the time taken to cover a distance of 1200 km = $1200/x$ hrs [Since, Time = Distance/ Speed]

Let the new speed of the aeroplane be $(x - 40)$ km/hr.

So, the new time taken to cover a distance of 1200 km = $1200/(x - 40)$ hrs

According to the question, we have

$$\frac{1200}{x-40} - \frac{20}{60} = \frac{1200}{x}$$

$$\frac{1200}{x-40} - \frac{1200}{x} = \frac{20}{60}$$

$$\frac{1200x - 1200x + 48000}{x(x-40)} = \frac{1}{3}$$

$$x(x - 40) = 48000 \times 3$$

$$x^2 - 40x - 144000 = 0$$

$$x^2 - 400x + 360x - 144000 = 0$$

$$x(x - 400) + 360(x - 400) = 0$$

$$(x - 400)(x + 360) = 0$$

As, speed cannot be negative. So we only take, $x = 400$.

Therefore, the original speed of the aeroplane is 400 km/hr.

4. A car covers a distance of 400 km at a certain speed. Had the speed been 12 km/h more, the time taken for the journey would have been 1 hour 40 minutes less. Find the original speed of the car.

Solution:

Let's assume x km/h to be the original speed of the car.

We know that,

Time = Distance/ Speed

From the question,

The time taken by the car to complete 400 km = $400/x$ hrs

Now, when the speed is increased by 12 km.

Increased speed = $(x + 12)$ km/h

And, the new time taken by the car to complete 400 km = $400/(x + 12)$ hrs

Thus, according to the question we can write

$$\frac{400}{x} - \frac{400}{x + 12} = 1 \text{ hour } 40 \text{ minutes}$$

$$\Rightarrow \frac{400}{x} - \frac{400}{x + 12} = 1 \frac{40}{60}$$

$$\Rightarrow \frac{400(x + 12) - 400x}{x(x + 12)} = 1 \frac{2}{3}$$

$$\Rightarrow \frac{400x + 4800 - 400x}{x(x + 12)} = \frac{5}{3}$$

$$\Rightarrow \frac{4800}{x(x + 12)} = \frac{5}{3}$$

$$4800 \times 3 = 5x(x + 12)$$

$$5x^2 + 60x - 14400 = 0$$

Dividing by 5 we get,

$$x^2 + 12x - 2880 = 0$$

$$x^2 + 60x - 48x - 2880 = 0$$

$$x(x + 60) - 48(x + 60) = 0$$

$$(x + 60)(x - 48) = 0$$

So, $x + 60$ or $x - 48$

$$x = -60 \text{ or } 48$$

As, speed cannot be negative.

$x = 48$ is only valid

Therefore, the speed of the car is 48 km/h.

5. A girl goes to her friend's house, which is at a distance of 12 km. She covers half of the distance at a speed of x km/hr and the remaining distance at a speed of $(x + 2)$ km/hr. If she takes 2 hrs 30 minutes to cover the whole distance, find 'x'.

Solution:

Given,

The girl covers a distance of 6 km at a speed x km/ hr.

So, the time taken to cover first 6 km = $6/x$ hr [Since, Time = Distance/ Speed]

Also given, the girl covers the remaining 6 km distance at a speed $(x + 2)$ km/ hr.

So, the time taken to cover next 6 km = $6/(x + 2)$

And, the total time taken to cover the whole distance = 2 hrs 30 mins = $(120 + 30)/60 = 5/2$ hrs

Then the below equation can be formed,

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

$$\frac{6x + 12 + 6x}{x(x+2)} = \frac{5}{2}$$

$$\frac{12 + 12x}{x^2 + 2x} = \frac{5}{2}$$

$$24 + 24x = 5x^2 + 10x$$

$$5x^2 - 14x - 24 = 0$$

$$5x^2 - 20x + 6x - 24 = 0$$

$$5x(x - 4) + 6(x - 4) = 0$$

$$(5x + 6)(x - 4) = 0$$

$$\text{So, } x = -6/5 \text{ or } 4$$

As speed cannot be negative. $x = 4$ is only valid

Therefore, the value of x is 4.

