

## Exercise 6(E)

### Solution:

Given,

Speed of car =  $x$  km/hr

Speed of train =  $(x + 16)$  km/hr

And, we know that

Time = Distance/ Speed

(i) Time taken by the car to reach town B from town A =  $216/x$  hrs

(ii) Time taken by the train to reach town B from A =  $208/(x + 16)$  hrs

(iii) According to the question, we have

$$\frac{216}{x} - \frac{208}{x + 16} = 2$$

$$\frac{216x + 3456 - 208x}{x(x + 16)} = 2$$

$$\frac{8x + 3456}{x(x + 16)} = 2$$

$$4x + 1728 = x^2 + 16x$$

$$x^2 + 12x - 1728 = 0$$

$$x^2 + 48x - 36x - 1728 = 0$$

$$x(x + 48) - 36(x + 48) = 0$$

$$(x + 48)(x - 36) = 0$$

$$x = -48, 36$$

As speed cannot be negative,

$$x = 36$$

(iv) Therefore, the speed of the train is  $(x + 16) = (36 + 16)$ km/hr = 52 km/h

**1. A trader buys  $x$  articles for a total cost of Rs 600.**

**(i) Write down the cost of one article in terms of  $x$ .**

**If the cost per article were Rs 5 more, the number of articles that can be bought for Rs 600 would be four less.**

**(ii) Write down the equation in  $x$  for the above situation and solve it for  $x$ .**

**Solution:**

We have,

Number of articles =  $x$

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And, the total cost of articles = Rs 600

Then,

(i) Cost of one article = Rs  $600/x$

(ii) From the question we have,

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

$$\frac{480}{x(x-4)} = 1$$

$$x^2 - 4x - 480 = 0$$

$$x^2 - 24x - 20x - 480 = 0$$

$$x(x-24) + 20(x-24) = 0$$

$$(x-24)(x+20) = 0$$

$$x = 24 \text{ or } -20$$

As the number of articles cannot be negative,  $x = 24$ .

### Solution:

Let's assume the number of people staying overnight as  $x$ .

Given, total hotel bill = Rs 4800

So, hotel bill for each person = Rs  $4800/x$

Then, according to the question

$$\frac{4800}{x} - \frac{4800}{x+4} = 200$$
$$\frac{4800x + 4800 \times 4 - 4800x}{x(x+4)} = 200$$

$$\frac{96}{x^2 + 4x} = 1$$

$$x^2 + 4x - 96 = 0$$

$$x^2 + 12x - 8x - 96 = 0$$

$$x(x+12) - 8(x+12) = 0$$

$$(x-8)(x+12) = 0$$

$$\text{So, } x = 8 \text{ or } -12$$

As, the number of people cannot be negative. We take  $x = 8$ .

Therefore, the number of people staying overnight is 8.

**2. An aeroplane travelled a distance of 400 km at an average speed of  $x$  km/hr. On the return journey, the speed was increased by 40 km/hr. Write down an expression for the time taken for:**

**(i) the onward journey;**

**(ii) the return journey.**

**If the return journey took 30 minutes less than the onward journey, write down an equation in  $x$**

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and find its value.

**Solution:**

Given,

Distance = 400 km

Average speed of the aeroplane =  $x$  km/hr

And, speed while returning =  $(x + 40)$  km/hr

We know that,

Time = Distance/ Speed

(i) Time taken for onward journey =  $400/x$  hrs

(ii) Time take for return journey =  $400/(x + 40)$  hrs

Then according to the question,

$$\frac{400}{x} - \frac{400}{x + 40} = \frac{30}{60}$$

$$\frac{400x + 16000 - 400x}{x(x + 40)} = \frac{1}{2}$$

$$\frac{16000}{x(x + 40)} = \frac{1}{2}$$

$$x^2 + 40x - 32000 = 0$$

$$x^2 + 200x - 160x - 32000 = 0$$

$$x(x + 200) - 160(x + 200) = 0$$

$$(x + 200)(x - 160) = 0$$

So,  $x = -200$  or  $160$

As the speed cannot be negative,  $x = 160$  is only valid.

**Solution:**

Let's take the original number of persons to be  $x$ .

Total money which was divided = Rs 6500

Each person's share = Rs  $6500/x$

Then, according to the question

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

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

$$\frac{3250}{x(x + 15)} = 1$$

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

$$x^2 + 65x - 50x - 3250 = 0$$

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

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

So,  $x = -65$  or  $50$

As, the number of persons cannot be negative.  $x = 50$

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Therefore, the original number of persons are 50.

**3. A plane left 30 minutes later than the schedule time and in order to reach its destination 1500 km away in time, it has to increase its speed by 250 km/hr from its usual speed. Find its usual speed.**

**Solution:**

Let's consider the usual speed of the plane to be  $x$  km/hr

The distance to travel = 1500km

We know that,

Time = Distance/ Speed

Then according to the question, we have

$$\frac{1500}{x} - \frac{1500}{x + 250} = \frac{30}{60}$$

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

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

$$x^2 + 250x - 750000 = 0$$

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

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

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

So,  $x = -1000$  or  $750$

As, speed cannot be negative. We take  $x = 750$  as the solution.

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

**4. Two trains leave a railway station at the same time. The first train travels due west and the second train due north. The first train travels 5 km/hr faster than the second train. If after 2 hours, they are 50 km apart, find the speed of each train.**

**Solution:**

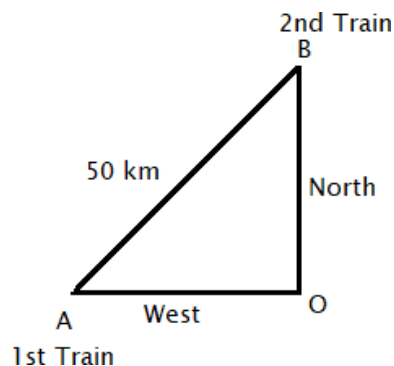
Let take the speed of the second train to be  $x$  km/hr.

Then, the speed of the first train is  $(x + 5)$  km/hr

Let O be the position of the railway station from which the two trains leave.

Distance travelled by the first train in 2 hours = OA = speed  $\times$  time =  $2(x + 5)$  km

Distance travelled by the second train in 2 hours = OB = speed  $\times$  time =  $2x$  km



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By Pythagoras Theorem, we have

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

$$(50)^2 = [2(x + 5)]^2 + (2x)^2$$

$$2500 = 4(x^2 + 10x + 25) + 4x^2$$

$$2500 = 8x^2 + 40x + 100$$

$$x^2 + 5x - 300 = 0$$

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

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

$$\text{So, } x = -20 \text{ or } x = 15$$

As  $x$  cannot be negative, we have  $x = 15$

Thus, the speed of the second train is 15 km/hr and the speed of the first train is 20 km/hr.

**5. The sum  $S$  of first  $n$  even natural numbers is given by the relation  $S = n(n + 1)$ . Find  $n$ , if the sum is 420.**

**Solution:**

Given relation,  $S = n(n + 1)$

And,  $S = 420$

So,  $n(n + 1) = 420$

$$n^2 + n - 420 = 0$$

$$n^2 + 21n - 20n - 420 = 0$$

$$n(n + 21) - 20(n + 21) = 0$$

$$(n + 21)(n - 20) = 0$$

$$n = -21, 20$$

As,  $n$  cannot be negative.

Therefore,  $n = 20$ .

**6. The sum of the ages of a father and his son is 45 years. Five years ago, the product of their ages (in years) was 124. Determine their present ages.**

**Solution:**

Let's assume the present ages of father and his son to be  $x$  years and  $(45 - x)$  years respectively.

So five years ago,

Father's age =  $(x - 5)$  years

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

From the question, the below equation can be formed

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

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

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

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

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

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

$$x = 36, 9$$

So, if  $x = 9$ ,

The father's age = 9 years and the son's age =  $(45 - x) = 36$  years

This is not possible.

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Hence,  $x = 36$

Therefore,

The father's age = 36 years

The son's age =  $(45 - 36)$  years = 9 years



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