

## EXERCISE 4.10

**Q.1** The product of one less than a certain positive number and two less than three times the number is 14. Find the number.

**Solution:**

Let the required positive number is  $= x$   
 then according to the given condition

$$(x - 1)(3x - 2) = 14$$

$$\Rightarrow 3x^2 - 2x - 3x + 2 - 14 = 0$$

$$\Rightarrow 3x^2 - 5x - 12 = 0$$

$$\Rightarrow 3x^2 - 9x + 4x - 12 = 0$$

$$\Rightarrow 3x(x - 3) + 4(x - 3) = 0$$

$$\Rightarrow (x - 3)(3x + 4) = 0$$

$$\Rightarrow \text{Either } x - 3 = 0 \quad \text{or} \quad 3x + 4 = 0$$

$$\Rightarrow x = 3 \quad \text{or} \quad x = -\frac{4}{3}$$

$$\Rightarrow \text{required positive number} = 3$$

**Q.2** The sum of a positive number and its square is 380. Find the number.

(Gujranwala Board 2007)

**Solution:**

Let the required positive number  $= x$   
 Then according to the given condition

$$x + x^2 = 380$$

$$\Rightarrow x^2 + x - 380 = 0$$

$$\Rightarrow x^2 + 20x - 19x - 380 = 0$$

$$\Rightarrow x(x + 20) - 19(x + 20) = 0$$

$$\Rightarrow (x + 20)(x - 19) = 0$$

$$\Rightarrow \text{Either } x + 20 = 0 \quad \text{or} \quad x - 19 = 0$$

$$x = -20 \quad \text{or} \quad x = 19$$

Hence, the required positive number  $= 19$

**Q.3** Divide 40 into two parts such that the sum of their square is greater than 2 times their product by 100.

**Solution:**

Let one part is =  $x$   
 then other part =  $40 - x$

$$\Rightarrow x^2 + (40 - x)^2 = 2x(40 - x) + 100$$

$$\Rightarrow x^2 + 1600 + x^2 - 80x = 80x - 2x^2 + 100$$

$$\Rightarrow 2x^2 + 1600 - 80x - 80x + 2x^2 - 100 = 0$$

$$\Rightarrow 4x^2 - 160x + 1500 = 0$$

$$\Rightarrow 4(4x^2 - 40x + 375) = 0$$

$$\Rightarrow x^2 - 40x + 375 = 0$$

$$\Rightarrow x^2 - 25x - 15x + 375 = 0$$

$$\Rightarrow x(x - 25) - 15(x - 25) = 0$$

$$\Rightarrow (x - 25)(x - 15) = 0$$

Either  $x - 25 = 0$  or  $x - 15 = 0$   
 $x = 25$  or  $x = 15$

$$\Rightarrow \text{If one part is } 25 \text{ then other is } 40 - 25 = 15 \text{ and if one part is } 15 \text{ then the other is } 40 - 15 = 25$$

$$\Rightarrow \text{Required parts are } 15, 25.$$

**Q.4** The sum of a number and its reciprocal is  $\frac{26}{5}$ . Find the number.

(Gujranwala Board 2007)

**Solution:**

Let the required positive number =  $x$   
 According to the given condition

$$x + \frac{1}{x} = \frac{26}{5}$$

$$\Rightarrow \frac{x^2 + 1}{x} = \frac{26}{5}$$

$$\Rightarrow 5(x^2 + 1) = 26x$$

$$\Rightarrow 5x^2 + 5 - 26x = 0$$

$$\Rightarrow 5x^2 - 26x + 5 = 0$$

$$\begin{aligned}
 \Rightarrow 5x^2 - 25x - x + 5 &= 0 \\
 \Rightarrow 5x(x-5) - 1(x-5) &= 0 \\
 \Rightarrow (x-5)(5x-1) &= 0 \\
 \Rightarrow \text{Either } x-5 &= 0 \quad \text{or} \quad 5x-1 = 0 \\
 \Rightarrow x &= 5 \quad \text{or} \quad x = \frac{1}{5}
 \end{aligned}$$

Hence the required numbers =  $5, \frac{1}{5}$

**Q.5** A number exceeds its square root by 56. Find the number.

**Solution:**

Let the required number =  $x$

According to the given condition

$$x = \sqrt{x} + 56$$

$$\begin{aligned}
 \Rightarrow \sqrt{x} &= x - 56 \\
 \Rightarrow (\sqrt{x})^2 &= (x - 56)^2 \\
 \Rightarrow x &= x^2 + 3136 - 112x \\
 \Rightarrow x^2 + 3136 - 112x - x &= 0 \\
 \Rightarrow x^2 - 113x + 3136 &= 0 \\
 \Rightarrow x^2 - 64x - 49x + 3136 &= 0 \\
 \Rightarrow x(x-64) - 49(x-64) &= 0 \\
 \Rightarrow (x-64)(x-49) &= 0 \\
 \Rightarrow \text{Either } x-64 &= 0 \quad \text{or} \quad x-49 = 0 \\
 \Rightarrow x &= 64 \quad \text{or} \quad x = 49
 \end{aligned}$$

As  $x = 64$  obeys the given condition.

$\Rightarrow$  Required number is 64.

**Q.6** Find two consecutive numbers, whose product is 132. (Lahore Board 2010)

**Solution:**

Let two consecutive numbers are  $x, x+1$

According to the given condition,

$$x(x+1) = 132$$

$$\begin{aligned}
 \Rightarrow x^2 + x - 132 &= 0 \\
 \Rightarrow x^2 + 12x - 11x - 132 &= 0 \\
 \Rightarrow x(x+12) - 11(x+12) &= 0
 \end{aligned}$$

$$\Rightarrow (x + 12)(x - 11) = 0$$

$$\Rightarrow \text{Either } x + 12 = 0 \quad \text{or} \quad x - 11 = 0$$

$$x = -12 \quad \text{or} \quad x = 11$$

$$\text{If } x = -12 \Rightarrow x + 1 = -12 + 1 = -11$$

$$\text{If } x = 11 \Rightarrow x + 1 = 11 + 1 = 12$$

$$\Rightarrow \text{Required numbers are } -12, -11 \text{ or } 11, 12.$$

**Q.7 The difference between the cubes of two consecutive even numbers is 296. Find them.**

**Solution:**

Let the required numbers are  $x, x + 2$

According to the given condition,

$$(x + 2)^3 - (x)^3 = 296$$

$$\Rightarrow x^3 + 6x^2 + 12x + 8 - x^3 = 296$$

$$\Rightarrow 6x^2 + 12x + 8 - 296 = 0$$

$$\Rightarrow 6x^2 + 12x - 288 = 0$$

$$\Rightarrow 6(x^2 + 2x - 48) = 0$$

$$\Rightarrow x^2 + 2x - 48 = 0$$

$$\Rightarrow x^2 + 8x - 6x - 48 = 0$$

$$\Rightarrow x(x + 8) - 6(x + 8) = 0$$

$$\Rightarrow (x + 8)(x - 6) = 0$$

$$\Rightarrow \text{Either } x + 8 = 0 \quad \text{or} \quad x - 6 = 0$$

$$\Rightarrow x = -8 \quad \text{or} \quad x = 6$$

$$\text{If } x = -8 \text{ then } x + 2 = -8 + 2 = -6$$

$$\text{If } x = 6 \text{ then } x + 2 = 6 + 2 = 8$$

Hence required numbers are  $-8, -6$  or  $6, 8$ .

**Q.8 A farmer bought some sheep for Rs. 9000. If he had paid Rs. 100 less for each, he would have got 3 sheep more for the same money. How many sheep did he buy, when the rate in each case is uniform?**

**Solution:**

Suppose no. of sheep =  $x$

Price of  $x$  sheep = Rs. 9000

$$\text{Price of 1 sheep} = \text{Rs. } \frac{9000}{x} \quad \dots\dots\dots (1)$$

$$\text{If no. of sheep} = x + 3$$

$$\text{then the price of 1 sheep} = \text{Rs. } \frac{9000}{x + 3} \quad \dots\dots\dots (2)$$

then according to the given condition.

$$\Rightarrow \frac{9000}{x} - 100 = \frac{9000}{x + 3}$$

$$\Rightarrow \frac{9000 - 100x}{x} = \frac{9000}{x + 3}$$

$$\Rightarrow (x + 3)(9000 - 100x) = 9000x$$

$$\Rightarrow 9000x - 100x^2 + 27000 - 300x - 9000x = 0$$

$$\Rightarrow -100x^2 - 300x + 27000 = 0$$

$$\Rightarrow -100(x^2 + 3x - 270) = 0$$

$$\Rightarrow x^2 + 3x - 270 = 0$$

$$\Rightarrow x^2 + 18x - 15x - 270 = 0$$

$$\Rightarrow x(x + 18) - 15(x + 18) = 0$$

$$\Rightarrow (x + 18)(x - 15) = 0$$

$$\Rightarrow \text{Either } x + 18 = 0 \quad \text{or} \quad x - 15 = 0$$

$$x = -18 \quad \text{or} \quad x = 15$$

$x = -18$  neglecting as it is negative

$$\Rightarrow \text{Required number of sheep} = 15$$

**Q.9** A man sold his stock of eggs for Rs. 240. He has 2 dozen, more, he would have got the same money by selling the whole for Rs. 0.50 per dozen cheaper. How many dozen eggs did he sell?

**Solution:**

Suppose the number of eggs =  $x$  dozen

Price of  $x$  dozen eggs = Rs. 240

$$\text{Price of 1 dozen eggs} = \text{Rs. } \frac{240}{x} \quad \dots\dots\dots (1)$$

And if, Price of  $x + 2$  dozen eggs = Rs. 240

$$\text{Price of 1 dozen eggs} = \text{Rs. } \frac{240}{x + 2} \quad \dots\dots\dots (2)$$

According to the given condition

$$\Rightarrow \frac{240}{x} - 0.50 = \frac{240}{x+2}$$

$$\Rightarrow \frac{240}{x} - \frac{50}{100} = \frac{240}{x+2}$$

$$\Rightarrow \frac{240}{x} - \frac{1}{2} = \frac{240}{x+2}$$

$$\Rightarrow \frac{480-x}{2x} = \frac{240}{x+2}$$

$$240(2x) = (480-x)(x+2)$$

$$\Rightarrow 480x = 480x + 960 - x^2 - 2x$$

$$\Rightarrow x^2 + 2x - 480x - 960 + 480x = 0$$

$$\Rightarrow x^2 + 2x - 960 = 0$$

$$\Rightarrow x^2 + 32x - 30x - 960 = 0$$

$$\Rightarrow x(x+32) - 30(x+32) = 0$$

$$\Rightarrow (x-32)(x+30) = 0$$

$$\Rightarrow \text{Either } x+32 = 0 \quad \text{or} \quad x-32 = 0$$

$$x = -32 \text{ (neglect)} \quad \text{or} \quad x = 30$$

$$\Rightarrow \text{Required dozen of eggs} = 30$$

**Q.10** A cyclist travelled 48km at a uniform speed. Had he travelled 2km/h slower, he would have taken two hours more to perform journey, how long he did take 48 km?

**Solution:**

Let the Speed of the cyclist =  $v$  km/h

and time taken for 48 km =  $t$  hours

by first condition

$$vt = 48 \quad \dots\dots\dots (1)$$

If the speed of cyclist is  $(v-2)$  km/hour, then he will take  $(t+2)$  hours to cover 48 km.

Now by 2nd condition

$$(v-2)(t+2) = 48 \quad \dots\dots\dots (2)$$

from equation (1)

$$v = \frac{48}{t}$$

Put this value in equation (2)

$$\Rightarrow \left( \frac{48}{t} - 2 \right) (t + 2) = 48$$

$$\Rightarrow \left( \frac{48 - 2t}{t} \right) (t + 2) = 48$$

$$\Rightarrow (48 - 2t)(t + 2) = 48t$$

$$\Rightarrow 48t + 96 - 2t^2 - 4t - 48t = 0$$

$$\Rightarrow -2t^2 - 4t + 96 = 0$$

$$\Rightarrow -2(t^2 + 2t - 48) = 0$$

$$\Rightarrow t^2 + 2t - 48 = 0$$

$$\Rightarrow t^2 + 8t - 6t - 48 = 0$$

$$\Rightarrow t(t + 8) - 6(t + 8) = 0$$

$$\Rightarrow (t + 8)(t - 6) = 0$$

$$\Rightarrow \begin{array}{ll} \text{Either } t + 8 = 0 & \text{or } t - 6 = 0 \\ t = -8 & \text{or } t = 6 \end{array}$$

$$t = -8 \text{ (neglecting)}$$

$$\Rightarrow \text{Required time} = 6 \text{ hours.}$$

**Q.11** The area of rectangular region 297 square meters. Had it been 3 meters longer and one meter shorter, the area would have been 3 square meter more. Find its length and breath.

**Solution:**

Let length of rectangular region = x

and breath of rectangular region = y

By 1st condition

$$xy = 297 \quad \dots\dots\dots (1)$$

By 2nd condition

$$(x + 3)(y - 1) = 297 + 3$$

$$\Rightarrow xy - x + 3y - 3 = 300$$

$$xy - x + 3y = 303 \quad \dots\dots\dots (2)$$

Now from equation (1)

$$x = \frac{297}{y} \quad \dots\dots\dots (3)$$

Put this value in equation (2)

$$\Rightarrow \frac{297}{y} \cdot y - 3y = 303$$

$$\Rightarrow 297 - \frac{297}{y} + 3y = 303$$

$$\Rightarrow 297 - 303 = \frac{297}{y} - 3y$$

$$\Rightarrow -6 = \frac{297 - 3y^2}{y}$$

$$\Rightarrow -6y = -3y^2 + 297$$

$$\Rightarrow 3y^2 - 6y - 297 = 0$$

$$\Rightarrow 3(y^2 - 2y - 99) = 0$$

$$\Rightarrow y^2 - 2y - 99 = 0$$

$$\Rightarrow y^2 - 11y + 9y - 99 = 0$$

$$\Rightarrow y(y - 11) + 9(y - 11) = 0$$

$$\Rightarrow (y - 11)(y + 9) = 0$$

$$\Rightarrow \text{Either } y - 11 = 0 \quad \text{or} \quad y + 9 = 0$$

$$\Rightarrow y = 11 \quad \text{or} \quad y = -9 \text{ (neglecting)}$$

Put  $y = 11$  in equation (3)

$$x = \frac{297}{11} = 27$$

$$\Rightarrow \text{length of rectangle} = 27 \text{ m}$$

$$\text{breadth of rectangle} = 11 \text{ m}$$

**Q.12** The length of a rectangular piece of paper exceeds its breath by 5cm. If a strip 0.5cm wide be cut all around the piece of paper, the area of the remaining part would be 500 square cms. Find its original dimensions.

**Solution:**

Let length of rectangular paper =  $x$

then Breath of rectangular paper =  $x - 5$

If a strip of 0.5 cm wide be cut all around the piece of paper. Then



$$\begin{aligned}
 &\text{Length of paper} = x - 0.5 - 0.5 = x - 1 \\
 \text{and } &\text{breadth of paper} = x - 5 - 0.5 - 0.5 = x - 6 \\
 &\text{According to the given condition} \\
 \Rightarrow &(x - 1)(x - 6) = 500 \\
 \Rightarrow &x^2 - 6x - x + 6 = 500 \\
 \Rightarrow &x^2 - 7x + 6 - 500 = 0 \\
 \Rightarrow &x^2 - 7x - 494 = 0 \\
 \Rightarrow &x^2 - 26x + 19x - 494 = 0 \\
 \Rightarrow &x(x - 26) + 19(x - 26) = 0 \\
 \Rightarrow &(x - 26)(x + 19) = 0 \\
 \Rightarrow &\text{Either } x - 26 = 0 \quad \text{or} \quad x + 19 = 0 \\
 \Rightarrow &x = 26 \quad \text{or} \quad x = -19 \quad (\text{neglecting}) \\
 \Rightarrow &\text{length of rectangular paper} = 26 \\
 &\text{breadth of rectangular paper} = x - 5 = 26 - 5 = 21
 \end{aligned}$$

**Q.13** A number consists of two digits whose product is 18. If digits are interchanged. New number becomes 27 less than original number. Find the number.

**Solution:**

$$\begin{aligned}
 &\text{Suppose tens digit} = x \\
 &\text{and unit digit} = y \\
 \therefore &\text{The number} = 10x + y \\
 &\text{By interchanging the digits, the new number} = 10y + x \\
 &\text{Product of the digits} = xy \\
 &\text{By the condition of question} \\
 &xy = 18 \quad \dots\dots\dots (1) \\
 \text{and } &10x + y = 10y + x + 27 \\
 \text{or } &10x + y - 10y - x - 27 = 0 \\
 \text{or } &9x - 9y - 27 = 0 \\
 \text{or } &9(x - y - 3) = 0 \\
 &x - y - 3 = 0 \\
 &y = x - 3 \quad \dots\dots\dots (2)
 \end{aligned}$$

Put this value in equation (1)

$$\Rightarrow x(x-3) = 18$$

$$\Rightarrow x^2 - 3x - 18 = 0$$

$$\Rightarrow x^2 - 6x + 3x - 18 = 0$$

$$\Rightarrow x(x-6) + 3(x-6) = 0$$

$$\Rightarrow (x-6)(x+3) = 0$$

$$\Rightarrow \text{Either } x-6 = 0 \quad \text{or} \quad x+3 = 0$$

$$\Rightarrow x = 6 \quad \text{or} \quad x = -3 \text{ (neglecting)}$$

Put  $x = 6$  in equation (2)

$$y = x - 3 = 6 - 3 = 3$$

$$\Rightarrow \text{tens digit} = x = 6$$

$$\Rightarrow \text{unit digit} = y = 3$$

$$\Rightarrow \text{required number} = 63$$

**Q.14** A number consists of two digits whose product is 14. If digits are interchanged the resulting number will exceed the original number by 45. Find the number.

**Solution:**

Suppose tens digit =  $x$

and unit digit =  $y$

$\therefore$  the number =  $10x + y$

By interchanging the digits, the new number =  $10y + x$

Product of the digits =  $xy$

By the condition of question

$$xy = 14 \quad \dots\dots\dots (1)$$

$$\text{and } 10y + x - 45 = 10x + y$$

$$\Rightarrow 10x + y - 10y - x - 45 = 0$$

$$\Rightarrow 9x - 9y + 45 = 0$$

$$\Rightarrow 9(x - y + 5) = 0$$

$$\Rightarrow x - y + 5 = 0$$

$$\Rightarrow y = x + 5 \quad \dots\dots\dots (2)$$

Put this value in equation (1)

$$\Rightarrow x(x+5) = 14$$

$$\Rightarrow x^2 + 5x - 14 = 0$$

$$\Rightarrow x^2 + 7x - 2x - 14 = 0$$

$$\Rightarrow x(x+7) - 2(x+7) = 0$$

$$\Rightarrow (x+7)(x-2) = 0$$

$$\Rightarrow \text{Either } x+7 = 0 \quad \text{or} \quad x-2 = 0$$

$$\Rightarrow x = -7 \text{ (neglect)} \quad \text{or} \quad x = 2$$

Put  $x = 2$  in equation (2)

$$y = 2 + 5 = 7$$

$$\Rightarrow \text{tens digit} = x = 2$$

$$\Rightarrow \text{unit digit} = y = 7$$

$$\Rightarrow \text{required number} = 27$$

**Q.15** The area of right triangle is 210 square meters. If its hypotenuse is 37 meters long. Find length of the base and altitude.

**Solution:**

Suppose length of base of right triangle =  $x$

and its altitude =  $y$

As area of right triangle =  $\frac{1}{2} \times \text{base} \times \text{altitude}$

$$\Rightarrow A = \frac{1}{2} \cdot x \cdot y$$

According to the given condition

$$A = 210$$

$$\Rightarrow \frac{1}{2}xy = 210 \Rightarrow xy = 420 \quad \dots\dots\dots (1)$$

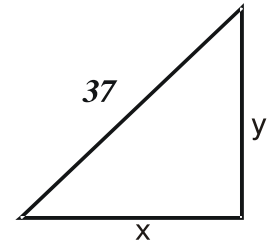
Also given that hypotenuse = 37

$$\Rightarrow \sqrt{x^2 + y^2} = 37$$

$$\Rightarrow x^2 + y^2 = 1369 \quad \dots\dots\dots (2)$$

From equation (1)

$$x = \frac{420}{y} \quad \dots\dots\dots (3)$$



Put this value in equation (2)

$$\Rightarrow \left(\frac{420}{y}\right)^2 + y^2 = 1369$$

$$\Rightarrow \frac{176400}{y^2} + y^2 = 1369$$

$$\Rightarrow \frac{176400 + y^4}{y^2} = 1369$$

$$\Rightarrow y^4 + 176400 = 1369y^2$$

$$\Rightarrow y^4 - 1369y^2 + 176400 = 0$$

$$\Rightarrow y^2 = \frac{1369 \pm \sqrt{(-1369)^2 - 4(1)(176400)}}{2(1)}$$

$$\Rightarrow = \frac{1369 \pm \sqrt{1874161 - 705600}}{2} = \frac{1369 \pm \sqrt{1168561}}{2}$$

$$\Rightarrow y^2 = \frac{1369 \pm 1081}{2}$$

$$\Rightarrow y^2 = \frac{1369 + 1081}{2}$$

$$\Rightarrow y^2 = \frac{2450}{2}$$

$$\Rightarrow y^2 = 1225$$

$$\Rightarrow y = \pm 35$$

$$\Rightarrow y = 35$$

$$\text{or } y^2 = \frac{1369 - 1081}{2}$$

$$y^2 = \frac{288}{2}$$

$$y^2 = 144$$

$$y = \pm 12$$

$$y = 12$$

neglecting -ve values

Put these values in equation (3)

$$\text{when } y = 35 \Rightarrow x = \frac{420}{y} = \frac{420}{35} = 12$$

$$\text{when } y = 12 \Rightarrow x = \frac{420}{12} = 35$$

$\Rightarrow$  If length of base = 35 meters

then length of altitude = 12 meters

and if length of base = 12 meters

then length of altitude = 35 meters

**Q.16** The area of a rectangle is 1680 square meters. If its diagonal is 58 meters long, find the length and the breadth of the rectangle.

**Solution:**

Suppose length of rectangle =  $x$

and breadth of rectangle =  $y$

Area of rectangle =  $xy = 1680$  ..... (1)

and  $x^2 + y^2 = (58)^2$

$\Rightarrow x^2 + y^2 = 3364$  ..... (2)

From equation (1)

$x = \frac{1680}{y}$  ..... (3)

Put this value in equation (2)

$\Rightarrow \left(\frac{1680}{y}\right)^2 + y^2 = 3364$

$\Rightarrow \frac{2822400}{y^2} + y^2 = 3364$

$\Rightarrow \frac{2822400 + y^4}{y^2} = 3364$

$\Rightarrow y^4 + 2822400 = 3364y^2$

$\Rightarrow y^4 - 3364y^2 + 2822400 = 0$

$\Rightarrow y^2 = \frac{-(-3364) \pm \sqrt{(-3364)^2 - 4(1)(2822400)}}{2(1)}$

$\Rightarrow = \frac{3364 \pm \sqrt{11316496 - 11289600}}{2}$

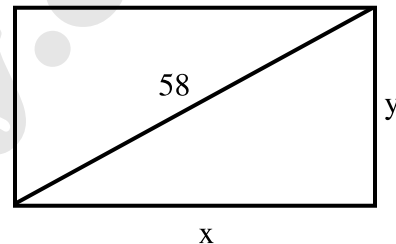
$\Rightarrow = \frac{3364 \pm \sqrt{26896}}{2} = \frac{3364 \pm 164}{2}$

$\Rightarrow y^2 = \frac{3364 + 164}{2}$  or  $y^2 = \frac{3364 - 164}{2}$

$\Rightarrow y^2 = 1764$   $y^2 = 1600$

$\Rightarrow y = 42$   $y = 40$

$\Rightarrow$  Put these values in equation (3)



$$x = \frac{1680}{42} = 40$$

or

$$x = \frac{1680}{40} = 42$$

⇒ If breadth of rectangle =  $y = 40$  meters

⇒ Then length of rectangle =  $x = 42$  meters and if

breadth of rectangle =  $y = 42$  meters

then length of rectangle =  $x = 40$  meters

**Q.17 To do a piece of work, A takes 10 days more than B. Together they finish work in 12 days. How long would B take to finish it alone?**

**Solution:**

Suppose B takes 'x' days and A takes  $x + 10$  days to do the work.

Then one day's work of B =  $\frac{1}{x}$

one day's work of A =  $\frac{1}{x + 10}$

One day's work of both =  $\frac{1}{x} + \frac{1}{x + 10}$  ..... (1)

If they do work in 12 days together then

one day's work of both =  $\frac{1}{12}$  ..... (2)

Equating (1) and (2)

$$\Rightarrow \frac{1}{x} + \frac{1}{x + 10} = \frac{1}{12}$$

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

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

$$\Rightarrow x^2 + 10x = 12(2x + 10)$$

$$\Rightarrow x^2 + 10x = 24x + 120$$

$$\Rightarrow x^2 + 10x - 24x - 120 = 0$$

$$\Rightarrow x^2 - 14x - 120 = 0$$

$$\Rightarrow x^2 - 20x + 6x - 120 = 0$$

$$\Rightarrow x(x - 20) + 6(x - 20) = 0$$

$$\Rightarrow (x - 20)(x + 6) = 0$$

$$\text{Either } x - 20 = 0 \quad \text{or} \quad x + 6 = 0$$

$$\Rightarrow x = 20 \quad \text{or} \quad x = -6 \text{ (neglecting)}$$

⇒ 'B' will take 20 days to do the work.

**Q.18** To complete a job, A and B take 4 days working together. A alone takes twice as long as B alone to finish the same job. How long would each one alone take to do the job?

**Solution:**

As A and B together finish a job in 4 days.

$$\Rightarrow \text{one day's work together} = \frac{1}{4} \quad \dots\dots\dots (1)$$

Suppose B takes 'x' days then A will take 2x days.

$$\text{Now one day's work of A} = \frac{1}{2x}$$

$$\text{and one day's work of B} = \frac{1}{x}$$

$$\text{one day's work of both} = \frac{1}{x} + \frac{1}{2x} \quad \dots\dots\dots (2)$$

From equations (1) and (2)

$$\Rightarrow \frac{1}{x} + \frac{1}{2x} = \frac{1}{4}$$

$$\Rightarrow \frac{2+1}{2x} = \frac{1}{4}$$

$$\Rightarrow \frac{3}{2x} = \frac{1}{4}$$

$$\Rightarrow 2x = 12 \Rightarrow 2x - 12 = 0$$

$$\Rightarrow 2(x - 6) = 0 \Rightarrow x - 6 = 0 \Rightarrow x = 6$$

$\Rightarrow$  B will take 6 days to do the work and A will take 12 days to do the work.

**Q.19** An open box is to be made from a square piece of tin by cutting a piece 2 dm square from each corner and then folding the sides of the remaining piece. If the capacity of the box is to be 128 c.dm, find the length of the side of the piece.

**Solution:**

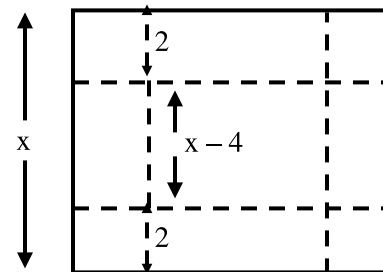
Let 'x' be the length of the square piece.

Then length of box = x - 4

Breadth of box = x - 4

Height of box = 2

Volume of box = 2 (x - 4) (x - 4)



But given that volume = 128

$$\Rightarrow 2(x-4)(x-4) = 128$$

$$\Rightarrow (x-4)^2 = \frac{128}{2}$$

$$\Rightarrow (x-4)^2 = 64$$

$$\Rightarrow x-4 = 8$$

$$\Rightarrow x = 8 + 4 = 12$$

$$\Rightarrow \text{required length of side} = 12\text{dm}$$

**Q.20** A man invest Rs. 100,000 in two companies. His total profit is Rs. 3080. If he receives Rs. 1980 from one company at the rate 1% more from the other. Find the amount of each investment.

**Solution:**

Suppose the amount invested in 1<sup>st</sup> company = x

then the amount invested in 2<sup>nd</sup> company = 100,000 - x

Let the profit from 1<sup>st</sup> company = y% of x =  $\frac{yx}{100}$

but it is given that profit from 1<sup>st</sup> company = 1980

$$\Rightarrow \frac{yx}{100} = 1980$$

$$\Rightarrow xy = 198000 \quad \dots\dots\dots (1)$$

As he gets profit 1% more from the other company

$$\Rightarrow \text{Profit from 2<sup>nd</sup> company} = (y+1)\% \text{ of } (100,000 - x) = \frac{y+1}{100} (100,000 - x)$$

but it is given that profit from 2<sup>nd</sup> company = 3080

$$\Rightarrow \frac{y+1}{100} (100,000 - x) = 3080$$

$$\Rightarrow (y+1)(100,000 - x) = 308000$$

$$\Rightarrow 100,000y - xy + 100000 - x - 308000 = 0$$

Put  $xy = 198000$  from equation (1) in above equation

$$\Rightarrow 100000y - 198000 + 100000 - x - 308000 = 0$$

$$\Rightarrow 100000y - x - 406000 = 0$$

$$\Rightarrow x = 100000y - 406000 \quad \dots\dots\dots (2)$$



Put this value in equation (1)

$$\Rightarrow (100000y - 406000)y = 198000$$

$$\Rightarrow 100000y^2 - 406000y - 198000 = 0$$

$$\Rightarrow 2000(50y^2 - 203y - 99) = 0$$

$$\Rightarrow 50y^2 - 203y - 99 = 0$$

$$\Rightarrow y = \frac{-(-203) \pm \sqrt{(-203)^2 - 4(50)(-99)}}{2(50)}$$

$$\Rightarrow y = \frac{203 \pm \sqrt{41209 + 19800}}{100} = 203 \pm \sqrt{61009} = \frac{203 \pm 247}{100}$$

$$\Rightarrow y = \frac{203 + 247}{100} \quad \text{or} \quad y = \frac{203 - 247}{100}$$

$$\Rightarrow y = \frac{450}{100} = 4.5 \quad y = -0.44 \text{ (neglecting)}$$

Put  $y = 4.5$  in equation (2)

$$x = 100000(4.5) - 406000 = 44000$$

$$\Rightarrow \text{Amount invested in 1}^{\text{st}} \text{ company} = \text{Rs. } 44000$$

$$\text{and Amount invested in 2}^{\text{nd}} \text{ company} = 100000 - 44000 = \text{Rs. } 56000$$