1 PAIRS OF EQUATIONS

Page No: 10 & 11

Now try these problems in any way you like: as mental math, as an equation with a single letter or as a pair of equations with two letters:

(1) Priya bought a bag and a pair of slippers for 1100 rupees. The bag costs 300 rupees more than the slippers. What is the price of the slippers? And the price of the bag?

ANSWER

The price of the slippers = x

The price of the bag = $x + 300$

Price of bag and shoes =1100

$x + x + 300 = 1100$

$2x + 300 = 1100$

$2x = 1100 - 300$

$2x = 800$

$x = \frac{800}{2}$

$x = 400$

∴ The price of the slippers = ₹ 400

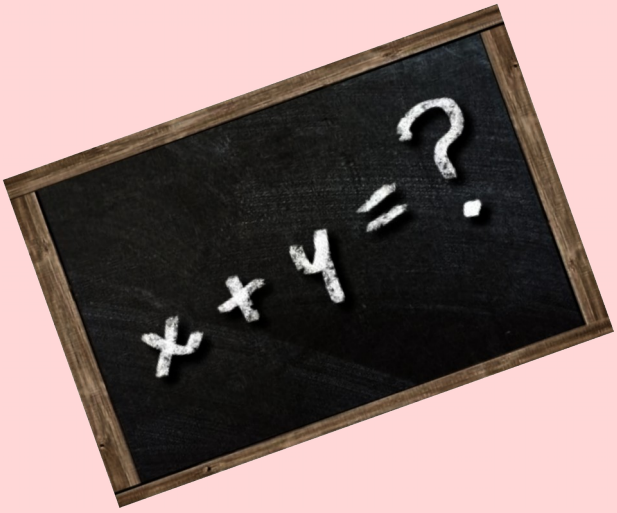
The price of the bag = 400+300 = ₹ 700

(2) The sum of two numbers is 26 and their difference is 4. What are the numbers ?

ANSWER

Large number = x

Small number= y



From the given

$x + y = 26$ -------(1)

$x - y = 4$ --------(2)

From the equation number (2)
substitute the value $x = 4+y$ in
equation number (1)

$4+y+y = 26$

$4+2y = 26$

$2y = 26-4$

$2y= 22$

$y= \frac{22}{2}$

$y= 11$

substitute the value $y = 11$ in equation number (1)

$x + 11 = 26$

$x = 26 - 11$

$x= 15$

∴ The numbers are 15 & 11

(3) The perimeter of a rectangle is 40 centimetres, and one side is 8 centimetres longer than the other. Calculate the lengths of the sides.

ANSWER

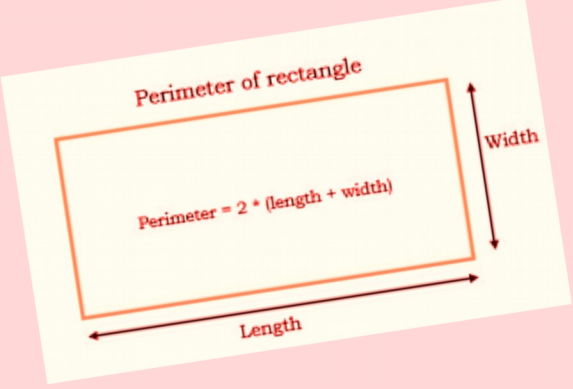
Perimeter of rectangle = 40 cm

One side = x cm

Other side = $(x + 8)$ cm

$2 (x + x + 8) = 40$ cm

$2 (2x + 8) = 40$ cm



$(2x + 8) = \frac{40}{2}$

$(2x + 8) = 20$

$2x = 20 - 8$

$2x = 12$

$x = \frac{12}{2}$

$x = 6$

∴ One side = 6 cm

Other side = 6 + 8 = 14 cm

(4) A wire three and a half metres long is to be cut into two pieces, with one piece bent into a square and the other into an equilateral triangle. The lengths of the sides of both must be the same. How should the wire be cut ?

ANSWER

Length of wire = $3\frac{1}{2}$ m = $\frac{7}{2}$ m

Since the sides of a square and an equilateral triangle are equal,

so $\frac{7}{2}$ m wire divide into 7 equal parts

That is $\frac{7}{2} \div 7$

$\frac{7}{2} \times \frac{1}{7} = \frac{1}{2}$

Each side = $\frac{1}{2}$ m

∴ Length of wire required to make a square = $4 \times \frac{1}{2} = 2$ m

Length of wire required to make an equilateral triangle = $3 \times \frac{1}{2} = 1\frac{1}{2}$ m

(5) In a class, there are 4 more girls than boys. On a day when only 8 boys were absent, the number of girls was twice the number of boys. How many boys and girls are there in the class ?

ANSWER

Number of boys = x

Number of girls = $x + 4$

On the day when only 8 boys were absent , the number of boys = $x - 8$

$2(x - 8) = x + 4$

$2x - 16 = x + 4$

$2x - x = 4 + 16$

$x = 20$

∴ Number of boys = $x = 20$

Number of girls = $x + 4 = 20 + 4 = 24$

(6) A fraction simplified after adding 1 to its numerator becomes $\frac{1}{3}$. If instead, 1 is added to the denominator and then simplified, it becomes $\frac{1}{4}$. What is the fraction?

ANSWER

Let the fraction = $\frac{x}{y}$

A fraction simplified after adding 1 to its numerator becomes $\frac{1}{3}$

$\frac{x+1}{y} = \frac{1}{3}$

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

A fraction simplified after adding 1 to its denominator becomes $\frac{1}{4}$

$\frac{x}{y+1} = \frac{1}{4}$

$4x = y + 1$ ---------- (2)

From the equation number (1) substitute the value of y in equation number (2)

$4x = 3(x + 1) + 1$

$4x = 3x + 3 + 1$

$4x = 3x + 4$

$4x - 3x = 4$

$x = 4$

substitute the value $x=4$ in equation number (1)

$y = 3(4 + 1) = 15$

∴ The fraction = $\frac{4}{15}$

(7) A person invested 100000 rupees in two schemes, with interest rates 7% and 6%. After one year, they got 6750 rupees as interest from both these together. How much did they invest in each scheme?

ANSWER

Total amount = ₹ 100000

Amount invested in the first scheme= ₹ x

Amount invested in the second scheme= $100000 - x$

Interest received from the first scheme after one year = $x \times \frac{7}{100}$

Interest received from the second scheme= $(100000 - x) \times \frac{6}{100}$

Total Interest Earned= ₹ 6750

$$x \times \frac{7}{100} + (100000 - x) \times \frac{6}{100} = 6750$$

$$\frac{7x}{100} + \frac{6(100000 - x)}{100} = 6750$$

$$\frac{7x + 600000 - 6x}{100} = 6750$$

$7x + 600000 - 6x = 675000$

$x = 675000 - 600000 = 75000$

∴ Amount invested in the first scheme = ₹ 75000

Amount invested in the second scheme = 100000 – 75000 = ₹ 25000

(8) An object starts with a speed of u m/s and travels along a straight line. If the speed increases at the rate of a m/s every second, the speed at time t seconds is $u + at$. The speed at one second is 5 m/s and at five seconds, 13 m/s. What is the rate at which speed is increasing ? What was the starting speed?

ANSWER

Speed in t second= $u + at$

The speed at one second = 5 m/s

$u + a = 5$ ---------- (1)

The speed at five second = 13m/s

$u + 5a = 13$ ---------- (2)

From the equation number (1) substitute the value u = 5-a in equation number (2)

$5 - a + 5a = 13$

$4a + 5 = 13$

$4a = 13 - 5$

$4a = 8$

$a = \frac{8}{4} = 2$

substitute the value $a=2$ in equation number (1)

$u + 2 = 5$

$u = 5 - 2 = 3$

∴ Rate at which the speed is increase = a = 2 m/s

Starting speed = u = 3 m/s

Page No: 14

(1) The price of 4 pens and 3 pencils is 66 rupees. The price of 7 pens and 3 pencils is 111 rupees. What is the price of a pen? The price of a pencil ?

ANSWER

The price of the pen = x

The price of the pencil = y

$4x + 3y = 66$ ---------- (1)

$7x + 3y = 111$ ----------(2)

Equation (2) – Equation (1) $\Longrightarrow 7x + 3y = 111$ ----------(2)

$4x + 3y = 66$ ----------(1)

$3x = 45$

$x = \frac{45}{3} = 15$

substitute the value $x=15$ in equation number (1)

$4\times15 + 3y = 66$

$60+3y=66$

$3y = 66 - 60 = 6$

$y = \frac{6}{3} = 2$

∴ The price of the pen = ₹15

∴ The price of the pencil = ₹ 2

(2) The perimeter of a rectangle is 26 centimetres. Another rectangle with twice the length and thrice the breadth has perimeter 62 centimetres. What are the length and breadth of the first rectangle ?

ANSWER

If the length of the first rectangle is taken as x and breadth as y

The second square has length $2x$ and breadth $3y$.

The perimeter of the first rectangle $= 2(x + y) = 26$

$2x + 2y = 26$ ---------- (1)

The perimeter of the second rectangle $= 2(2x + 3y) = 62$

$2x + 3y = 31$ ----------(2)

Equation (2) – Equation (1) $\Longrightarrow$ $2x + 3y = 31$ ----------(2)

$2x + 2y = 26$ ----------(1)

$y = 5$

substitute the value $y=5$ in equation number (1)

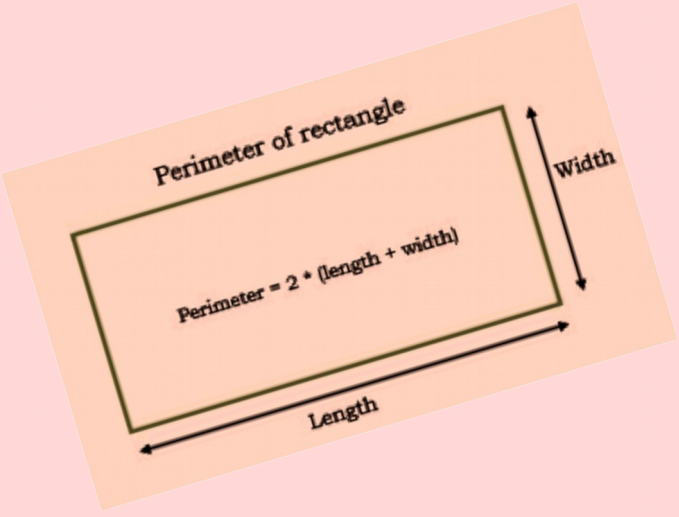
$2x + 2\times5 = 26$

$2x + 10 = 26$

$2x = 26 - 10 = 16$

$x = \frac{16}{2} = 8$

∴ The length of the first rectangle = 8 cm, breadth = 5 cm



Page No: 15 & 16

(1) The price of two kilograms of orange and three kilograms of apple is 520 rupees. The price of three kilograms of orange and two kilograms of apple is 480 rupees. What is the price of each ?

ANSWER

Price of one kilograms of orange = ₹ x

Price of one kilograms of apple = ₹ y

$2x + 3y = 520$ ---------- (1)

$3x + 2y = 480$ ---------- (2)

(1) + (2) $\Longrightarrow$ $5x + 5y = 1000$

$\Longrightarrow x + y = 200$ ---------- (3)

(1) – (2) $\Longrightarrow -x + y = 40$ ---------- (4)

(3) + (4) $x + y = 200$ ---------- (3)

$-x + y = 40$ ---------- (4)

$\Longrightarrow 2y = 240$

$\Longrightarrow y = \frac{240}{2} = 120$

substitute the value $y=120$ in equation number (3)

$x+120 = 200$

$x= 200-120 = 80$

∴ Price of one kilograms of orange = ₹ 80

∴ Price of one kilograms of apple = ₹ 120

(2) A wire one metre long is cut into two pieces, one of which is bent into a square and the other into an equilateral triangle. Three times the side of the square and two times the side of the equilateral triangle makes 71 centimetres. What are the lengths of the pieces ?

ANSWER

Length of wire= 1 m = 100 cm

Let us take one side of the square as x and one side of the equilateral triangle as y

Sum of the perimeters = 100cm

$4x + 3y = 100$ ---------- (1)

Adding 3 times the side of a square and 2 times the side of an equilateral triangle gives 71 cm.

$3x + 2y = 71$ ---------- (2)

Equation (1) $\times$ 2 $\Longrightarrow$ $8x + 6y = 200$ ---------- (3)

Equation (2) $\times$ 3 $\Longrightarrow$ $9x + 6y = 213$ ---------- (4)

(4) – (3) $\Longrightarrow$ $x = 13$

substitute the value $x=13$ in equation number (2)

$\Longrightarrow 3x+2y = 71$

$3 \times 13 + 2y = 71$

$\Longrightarrow 2y = 71-39$

$\Longrightarrow y = \frac{32}{2} = 16$

Perimeter of square= $4x = 4 \times 13 = 52$ cm

Perimeter of an equilateral triangle = $3y = 3 \times 16 = 48$ cm

$\therefore$ Lengths of pieces = 52 cm, 48 cm

(3) Four years ago, Rahim's age was three times the age of Ramu. After two years, this would become two times. What are their ages now ?

ANSWER

Present age of Rahim= x

Present age of Ramu = y

4 years ago

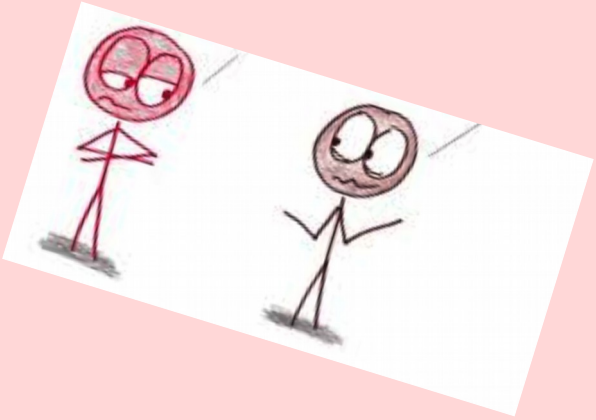
Rahim's age = $x - 4$

Ramu's age = $y - 4$

$x - 4 = 3(y - 4)$

$x - 4 = 3y - 12$

$3y - x = 8$ ---------- (1)



After 2 years

Rahim's age = $x + 2$

Ramu's age = $y + 2$

$x + 2 = 2(y + 2)$

$x + 2 = 2y + 4$

$x - 2y = 2$ --------- (2)

(1) + (2) $\Longrightarrow$ $3y - x = 8$ --------- (1)

$-2y + x = 2$ --------- (2)

$y = 10$

substitute the value $y=10$ in equation number (2)

$x - 2y = 2$ --------- (2)

$x=2 + 2y$

$x = 2+2\times10 = 22$

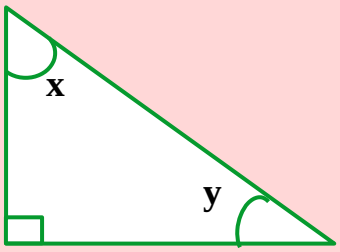
$\therefore$ Present age of Rahim = 22

$\therefore$ Present age of Ramu = 10

Page No: 18

(1) The difference of the two smaller angles of a right triangle is 20°. Calculate all three angles.

ANSWER



Let the angles be x and y, $x > y$

$$x + y = 90° \text{ --------- (1)}$$

$$x - y = 20° \text{ --------- (2)}$$

(1) + (2) $\Longrightarrow 2x = 110°$

$$x = \frac{110}{2} = 55°$$

substitute the value $x = 55$ in equation number (1)

$$\Longrightarrow y = 90 - 55 = 35°$$

∴ The angles be= 35°, 55°

(2) When a larger number is divided by a smaller number, the quotient and remainder are both 2. When 5 times the smaller is divided by the larger, the quotient and remainder are still both 2. What are the numbers ?

ANSWER

Let the smaller number be x and the larger number be y.

Divide the larger by the smaller, get the quotient and remainder be 2

$y = 2x + 2$ ---------- (1)

Dividing 5 times the smaller number by the larger number gives the quotient and remainder be 2

$5x = 2y + 2$ ---------- (2)

The value of y in equation (1) is given in the equation (2).

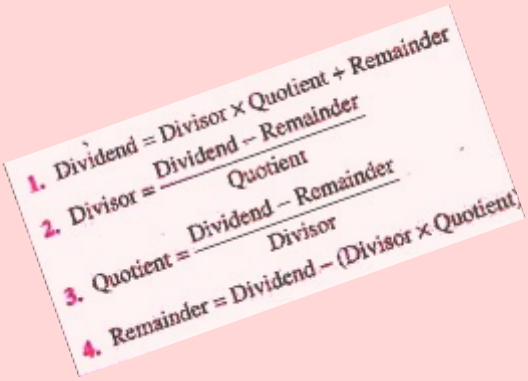
$5x = 2(2x + 2) + 2$

$5x = 4x + 4 + 2$

$x = 6$

$y = 2 \times 6 + 2 = 12 + 2 = 14$

∴ The numbers are = 6, 14



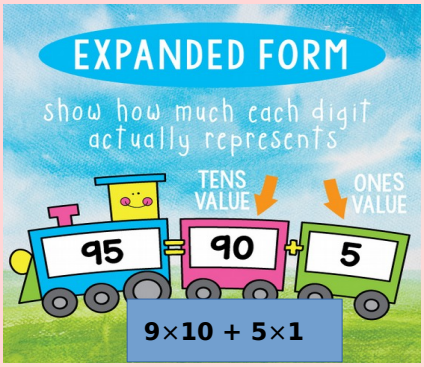
(3) The sum of the digits of a two digit number is 11. The number got by interchanging the digits is 27 more than the original number. What is the number ?

ANSWER

Two-digit number = $10x + y$

sum of digits = 11 $\Longrightarrow x + y = 11$ ---------- (1)

The number obtained by interchanging the digits = $10y + x$



$10y + x = 10x + y + 27$

$9y - 9x = 27$

$y - x = 3$ ---------- (2)

(1) + (2) $\Longrightarrow 2y = 14$

$y = \frac{14}{2} = 7$

substitute the value $y=7$ in equation number (1)

$x = 11 - 7 = 4$

$\therefore$ Two-digit number = 47

(4) The price of 17 trophies and 16 medals is 2180 rupees. The price of 16 trophies and 17 medals is 2110 rupees. What is the price of each ?

ANSWER

Price of the trophy = x, Price of the medal = y

2180 rupees for 17 trophies and 16 medals

$17x + 16y = 2180$ ---------- (1)

2110 for 16 trophies and 17 medals

$16x + 17y = 2110$ ---------- (2)

(1) + (2) $\Longrightarrow 33x + 33y = 4290$

$\Longrightarrow x + y = 130$ ---------- (3)

(1) – (2) $\Longrightarrow x - y = 70$ ---------- (4)

(3) + (4) $\Longrightarrow 2x = 200 \Longrightarrow x = 100$

substitute the value $x=100$ in equation number (3)

$\Longrightarrow y = 130 - 100 = 30$

$\therefore$ Price of the trophy= ₹ 100

Price of the medal = ₹ 30

(5) An object starts with a speed of u m/s and travels along a straight line. If the speed increases at the rate of a m/s every second, the distance travelled in time t seconds is $ut + \frac{1}{2}at^2$. The distance travelled in 2 seconds is 10 metres and the distance travelled in 4 seconds is 28 metres. What was the starting speed ? What is the rate at which speed is increasing ?

ANSWER

The distance = $ut + \frac{1}{2} at^2$

Travels 10 meters in 2 seconds

$2u + \frac{1}{2} \times a \times 2^2 = 10$

$2u + 2a = 10$

$u + a = 5$ --------- (1)

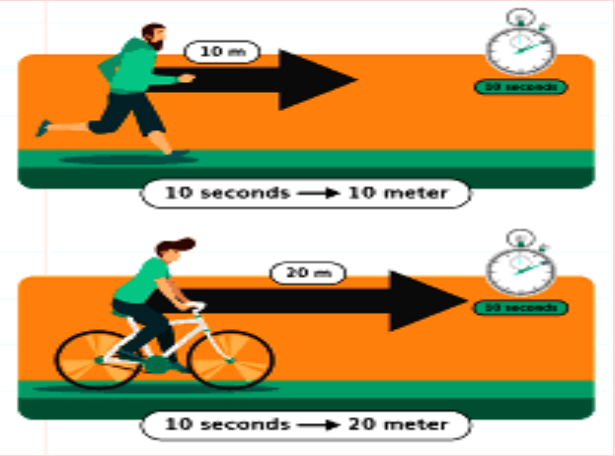
Travels 28 meters in 4 seconds

$4u + \frac{1}{2} a \times 4^2 = 28$

$4u + 8a = 28$

$u + 2a = 7$ -------- (2)

(2) – (1) $\Longrightarrow a = 2$



substitute the value $a=2$ in equation number (1)

$u = 5 - 2 = 3$

$\therefore$ The starting speed = 3 m/s

The Rate at which the speed is increasing = 2 m/s

(6) A two digit number is equal to 6 times the sum of its digits. The number got by interchanging the digits is 9 more than 4 times the sum of the digits. What is the number ?

ANSWER

Two-digit number = $10x + y$

sum of digits = $x + y$

$10x + y = 6(x + y)$

$10x + y = 6x + 6y$

$4x = 5y$ --------- (1)

A two-digit number obtained by interchanging the digits = $10y + x$

This number is 9 more than 4 times the sum of the digits

$10y + x = 4(x + y) + 9$

$10y + x = 4x + 4y + 9$

$6y = 3x + 9$

$2y = x + 3$

$x = 2y - 3$ ---------- (2)

(2) $\times$ 4 $\Longrightarrow$ $4x = 8y - 12$ ---------- (3)

From (1) and (3) , $8y - 12 = 5y$

$3y = 12$

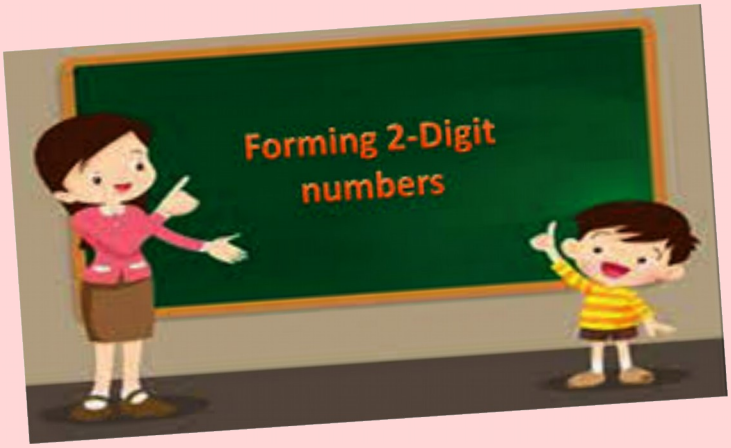
$y = 4$

substitute the value $y=4$ in equation number (2)

$x = 2\times4 - 3$

$x=8 - 3= 5$

$\therefore$ Two digit number= 54



(7) 11 added to a number gives twice another number. 20 added to the second number gives twice the first number. What are the numbers ?

ANSWER

First number= x, Second number= y

11 added to the first number, gives twice the second number.

$x + 11 = 2y$

$x - 2y = -11$ ---------- (1)

20 added to the second number gives twice the first number

$y + 20 = 2x$

$2x - y = 20$ ------- (2)

Equation (2) $\times$ 2 $\Longrightarrow$ $4x - 2y = 40$ ---------- (3)

(3) – (1) $\Longrightarrow 3x = 51$

$\Longrightarrow x = \frac{51}{3} = 17$

substitute the value $x=17$ in $y + 20 = 2x$

$y = 2\times17 - 20$

$y = 34 - 20$

$y = 14$

$\therefore$ The numbers = 17, 14