Finding the Unknown Class 7 Solutions Maths Ganita Prakash Part 2 Chapter 7

7.1 Find the Unknowns, 7.2 Solving Equations Systematically

Figure It Out (Page 172)

Question 1.
Solve these equations and check the solutions. (a) 3x – 10 = 35 (b) 5s = 3s (c) 3u – 7 = 2u + 3 (d) 4(m + 6) – 8 = 2m – 4 (e) u15 = 6

Solution:
(a) 3x – 10 = 35
Add 10 on both sides
3x – 10+ 10 = 35 + 10
⇒ 3x = 45
Divide by 3 on both sides
⇒ 3x3=453 ⇒ x = 15 Check: LHS = 3x – 10 for x = 15 = 3 × 15 – 10 = 45 – 10 = 35 LHS = RHS Hence checked.

(b) 5s = 3s Bring unknown terms on one side by subtracting 3s ⇒ 5s – 3s = 3s – 3s ⇒ 2s = 0 Divide by 2 on both sides 2 ⇒ 2s2=02 ⇒ s = 0 Check: LHS = 5s = 5 × 0 = 0 RHS = 3s = 3 × 0 = 0 LHS = RHS Hence checked.

(c) 3u – 7 = 2u + 3 Bring the unknown terms to one side By subtracting 2u from both sides ⇒ 3u – 7 – 2u = 2u + 3 – 2u ⇒ u – 7 = 3 Add 7 to both sides ⇒ u – 7 + 7 = 3 + 7 ⇒ u = 10 Check: For u = 10 LHS = 3u – 7 = 3 × 10 – 7 = 30 – 7 = 23 RHS = 2u + 3 = 2 × 10 + 3 = 20 + 3 = 23 LHS = RHS Hence checked.

(d) 4(m + 6) – 8 = 2m – 4 Apply the distributive property 4m + 24 – 8 = 2m – 4 ⇒ 4m + 16 = 2m – 4 Subtract 2m from both sides 4m + 16 – 2m = 2m – 4 – 2m ⇒ 2m + 16 = -4 Subtract 16 from both sides 2m + 16 – 16 = -4 – 16 ⇒ 2m = -20 Divide by 2 on both sides 2m ÷ 2 = -20 ÷ 2 ⇒ m = -10 Check: LHS = 4(m + 6) – 8 = 4(-10 + 6) – 8 = 4(-4) – 8 = -16 – 8 = -24 RHS = 2m – 4 = 2(-10) – 4 = -20 – 4 = -24 LHS = RHS Hence checked.

(e) u15 = 6
Multiply both sides by 15
u15 × 15 = 6 × 15
⇒ u = 90
Check:
LHS = u15
9015 = 6 RHS = 6 LHS = RHS Hence checked.

Question 2.
Frame an equation that has no solution. [Hint: 4 more than a number, and 5 more than a number can never be equal!]

Solution: Equation u + 6 = u + 2 has no solution Subtract u from both sides u + 6 – u = u + 2 – u ⇒ 6 = 2, which is an incorrect statement.

Figure It Out (Page 181)

Question 1.
Write 5 equations whose solution is x = -2.

Solution:
(i) x = -2 Add 3 on both sides x + 3 = -2 + 3 ⇒ x + 3 = 1 Multiply both sides by 2 2(x + 3) = 2

(ii) x = -2 Multiply both sides by 3 3x = -6 Add 2 on both sides 3x + 2 = -6 + 2 ⇒ 3x + 2 = -4

(iii) x = -2 Divide both sides by 4 x4=−24
x4=−12

(iv) x = -2 Multiply both sides by 5 5x = -10 Add 12 on both sides 5x + 12 = -10 + 12 ⇒ 5x + 12 = 2

(v) x = -2 Subtract 7 from both sides x – 7 = -2 – 7 x – 7 = -9

Question 2.
Find the value of each unknown: (a) 2y = 60 (b) -8 = 5x – 3 (c) -53w = -15 (d) 13 – z = 8 (e) k + 8 = 12 – k (f) 7m = m – 3 (g) 3n = 10 + n

Solution:
(a) 2y = 60 Divide both sides by 2 2y2=602 ⇒ y = 30

(b) -8 = 5x – 3 Add 3 on both sides -8 + 3 = 5x ⇒ -5 = 5x Divide both sides by 5 −55=5x5 ⇒ -1 = x

(c) -53w = -15 Divide both sides by -53 −53w−53=−15−53
⇒ w = 1553

(d) 13 – z = 8 Subtract 13 from both sides 13 – z – 13 = 8 – 13 ⇒ -z = -5 Divide both sides by -1 −z−1=−5−1 ⇒ z = +5

(e) k + 8 = 12 – k Add k on both sides k + 8 + k = 12 – k + k ⇒ 2k + 8 = 12 Subtract 8 from both sides 2k + 8 – 8 = 12 – 8 ⇒ -2k = 4 Divide both sides by 2 2k2=42 ⇒ k = 2

(f) 7m = m – 3 Subtract m from both sides 7m – m = m – 3 – m ⇒ 6m = -3
Divide both sides by 6 6m6=−36
⇒ m = −12

(g) 3n = 10 + n Subtract n from both sides 3n – n = 10 + n – n ⇒ 2n = 10
Divide both sides by 2 2n2=102 ⇒ n = 5

Question 3.
I am a 3-digit number. My hundred's digit is 3 less than my ten's digit. My ten's digit is 3 less than my unit's digit. The sum of all three digits is 15. Who am I?

Solution:
Let the ten's place digit be x. Then hundred's place digit = x – 3 Unit's digit = x + 3 Sum of digits = 15 According to the question, (x – 3) + x + (x + 3) = 15 ⇒ 3x = 15 Divide both sides by 3 3x3=153 ⇒ x = 5 Ten's digit = 5 Hundred's digit = 5 – 3 = 2 Unit's digit = 5 + 3 = 8 Number formed = 258

Question 4.
The weight of a brick is 1kg more than half its weight. What is the weight of the brick?

Solution:
Let the weight of a brick be x kg. According to the question, x = x2 + 1
Subtract x2 from both sides
x1−x2=x2+1−x2
⇒ 2x−x2 = 1
⇒ x2 = 1
Multiply both sides by 2
x2 × 2 = 1 × 2 ⇒ x = 2 ∴ Weight of the brick = 2 kg

Question 5.
One quarter of a number increased by 9 gives the same number. What is the number?

Solution:
Let the number be x. According to the question, 14 × x + 9 = x
x4 + 9 = x
Subtract x4 from both sides
x4+9−x4=x1−x4
⇒ 9 = 4x−x4 [LCM of 1 and 4 = 4]
⇒ 9 = 3x4

Divide both sides by 34
⇒ 9÷34=3x4÷34
⇒ 9×43=3x4×43 ⇒ 12 = x The required number is 12.

Question 6.
Given 4k + 1 = 13, find the values of: (a) 8k+ 2 (b) 4k (c) k (d) 4k – 1 (e) -k – 2

Solution:
4k + 1 = 13 Subtract 1 from both sides 4k + 1 – 1 = 13 – 1 ⇒ 4k = 12 Divide both sides by 4 4k ÷ 4 = 12 ÷ 4 ⇒ k = 3 (a) 8k + 2 = 8(3)+ 2 = 24 + 2 = 26 (b) 4k = 4 × 3 = 12 (c) k = 3 (d) 4k – 1 = 4(3) – 1 = 12 – 1 = 11 (e) -k – 2 = -3 – 2 = -5

7.3 Mind the Mistake, Mend the Mistake, 7.4 A Pinch of History

Figure It Out (Pages 185-189)

Question 1.
Fill in the blanks with integers. (a) 5 × ____ -8 = 37 (b) 37 – (33 – ____) = 35 (c) -3 × (-11 + ____) = 45

Solution:
(a) 5 × ____ -8 = 37 Let unknown be x. 5 × x – 8 = 37 ⇒ 5x – 8 = 37 ⇒ 5x = 37 + 8 ⇒ 5x = 45 ⇒ x = 45 ÷ 5 ⇒ x = 9 ∴ 5 × 9 – 8 = 37

(b) 37 – (33- ____) = 35 Let unknown be x. 37 – (33 – x) = 35 ⇒ 37 – 33 + x = 35 ⇒ 4 + x = 35 ⇒ x = 35 – 4 ⇒ x = 31 ∴ 37 – (33 – 31) = 35

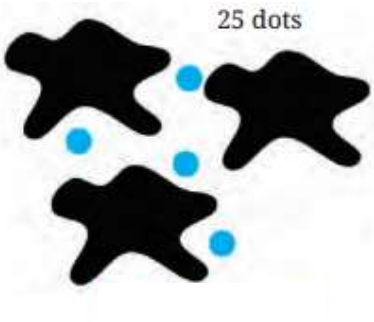
(c) -3 × (-11 + ____) = 45 Let unknown be y. -3 × (-11 + y) = 45 ⇒ (-11 + 7) = 45 ÷ (-3) ⇒ -11 + y = -15 ⇒ y = -15 + 11 ⇒ y = -4 ∴ -3 × (-11 + (-4)) = 45

Question 2.
Ranju is a daily wage labourer. She earns ₹ 750 a day. Her employer pays her in 50 and 100-rupee notes. If Ranju gets an equal number of 50 and 100 rupee notes, how many notes of each does she have?

Solution:
Let no. of ₹ 50 notes with Ranju be x. Then no. of ₹ 100 notes with Ranju is also x. Total money with Ranju = ₹ 750 According to the question, Value of ₹ 50 notes = ₹ 50x Value of ₹ 100 notes = ₹ 100x ₹ 50x + ₹ 100x = ₹ 750 ⇒ 150x = 750 ⇒ x = 5 No. of notes of ₹ 50 is 5. No. of notes of ₹ 100 is 5.

Question 3.

In the given picture, each black blob hides an equal number of blue dots. If there are 25 dots in total, how many dots are covered by one blob? Write an equation to describe this problem.

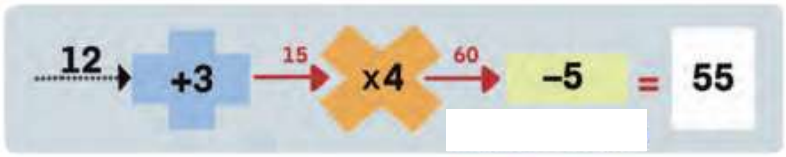


Solution:

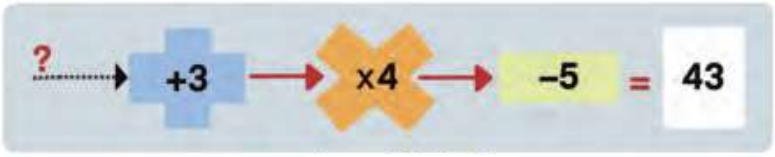
Let each black blob hide the blue dots. There are 3 black blobs and 4 blue dots in the picture. We are given total blue dots = 25 According to the question, 3u + 4 = 25 ⇒ 3u = 25 – 4 ⇒ 3u = 21 ⇒ u = 7 Each black blob hides 7 blue dots.

Question 4.

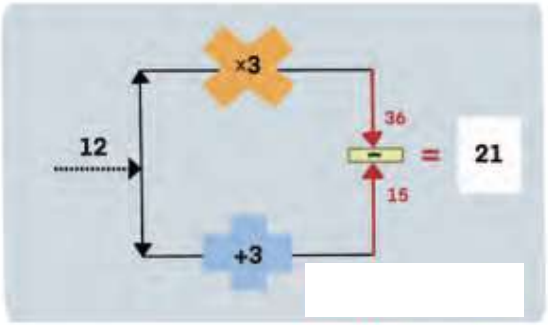
Here are machines that take an input, perform an operation on it, and send out the result as an output. (a)



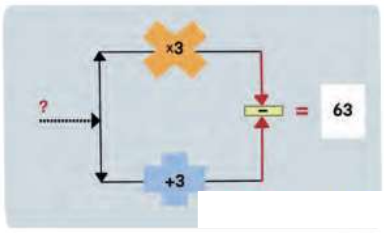
Find the inputs in the following cases:

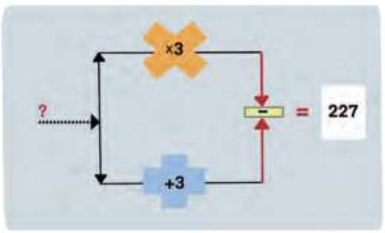


(b)



Find the inputs in the following cases:





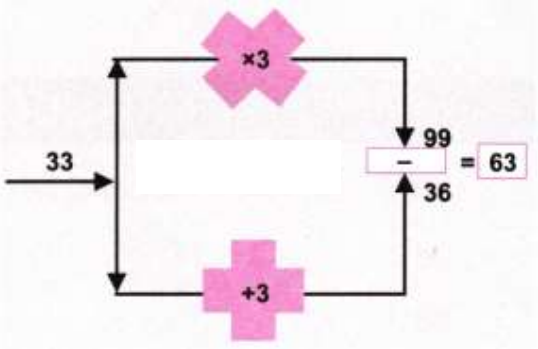
Solution:

(a)

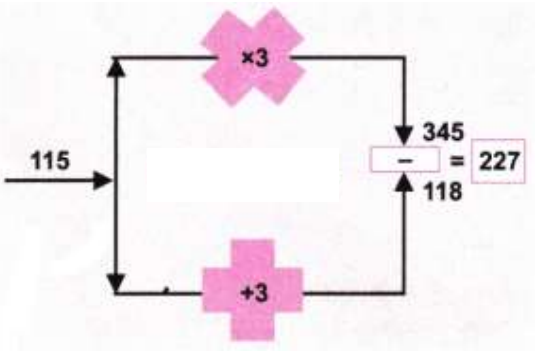
$$(i)\quad \xrightarrow{(9)} +3 \xrightarrow{(12)} \times 4 \xrightarrow{(48)} -5 = 43$$

$$(ii)\quad \xrightarrow{17} +3 \xrightarrow{20} \times 4 \xrightarrow{80} -5 = 75$$

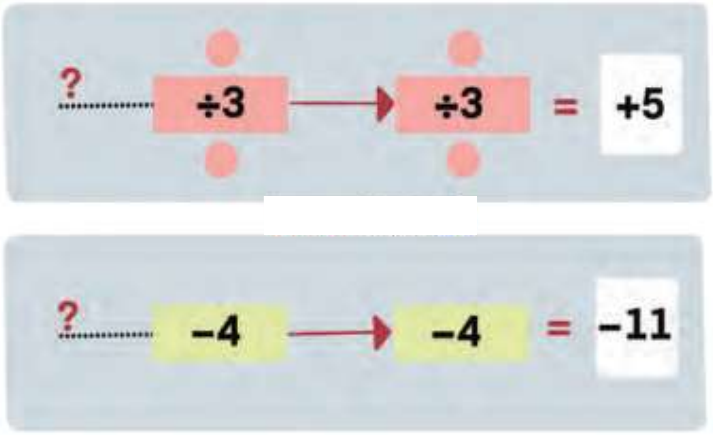
(b) (i) Let the unknown number be x. x × 3 – (x + 3) = 63 ⇒ 3x – x – 3 = 63 ⇒ 2x – 3 = 63 ⇒ 2x = 66 ⇒ x = 33



(ii) Let the unknown number be y. y × 3 – (y + 3) = 227 ⇒ 3y – y – 3 = 227 ⇒ 2y = 227 + 3 ⇒ 2y = 230 ⇒ y = 115 The unknown number is 115.



Question 5.
What are the inputs to these machines?



Solution:
(i)
Let the unknown number be a. (a ÷ 3) ÷ 3 = 5 ⇒ a ÷ 3 = 5 × 3 ⇒ a ÷ 3 = 15 ⇒ a = 15 × 3 ⇒ a = 45 The unknown number is 45.

(ii) Let the unknown number be b. (b – 4) – 4 = -11 ⇒ b – 4 – 4 = -11 ⇒ b – 8 = -11 ⇒ b = -11 + 8 ⇒ b = -3 The unknown number is -3.

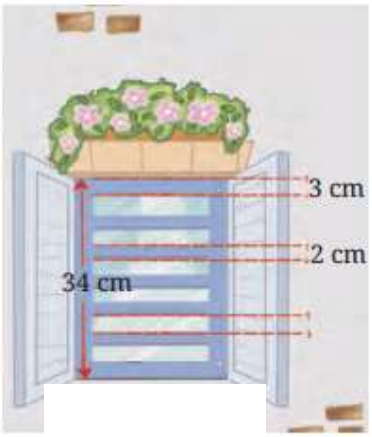
Question 6.
A taxi driver charges a fixed fee of ₹ 800 per day plus ₹ 20 for each kilometer traveled. If the total cost for a taxi ride is ₹ 2200, determine the number of kilometres traveled.

Solution:
Fixed charges by Taxi driver = ₹ 800 Charge per kilometer = ₹ 20 Let the distance covered be x km. According to the question x × 20 + 800 = 2200 ⇒ 20x = 2200 – 800 ⇒ 20x = 1400 ⇒ x = 70 Total distance covered is 70 km.

Question 7.
The sum of two numbers is 76. One number is three times the other number. What are the numbers?

Solution:
Let the two numbers be x and 3x. According to the question x + 3x = 76 ⇒ 4x = 76 ⇒ x = 19 The two numbers are 19 and 3 × 19, i.e., 19 and 57.

Question 8.
The figure shows the diagram for a window with a grill. What is the gap between the two rods in the grill?



Solution:
Total height of the window, including the frame = 34 cm Total height of the window excluding the frame = 34 cm – 3 cm – 3 cm = 28 cm Width of one rod of grill = 2 cm No. of rods of the grill = 5 Total width of 5 rods = 5 × 2 cm = 10 cm Let the height of 1 gap be x cm. No. of gaps = 6 Total height of gaps = 6x According to the question 10 + 6x = 28 ⇒ 6x = 28 – 10 ⇒ 6x = 18 ⇒ x = 3 Gap between two rods = 3 cm.

Question 9.
In a restaurant, a fruit juice costs ₹ 15 less than a chocolate milkshake. If 4 fruit juices and 7 chocolate milkshakes cost ₹ 600, find the cost of the fruit juice and milkshake.

Solution:
Let the cost of a chocolate milkshake be ₹ x. Cost of fruit juice = ₹(x – 15) Cost of 4 fruit juices and 7 chocolate milkshakes = ₹ 600 According to the question 4(x – 15) + 7x = 600 ⇒ 4x – 60 + 7x = 600 ⇒ 4x + 7x = 600 + 60 ⇒ 11x = 660 ⇒ x = 60 Cost of 1 chocolate milkshake = ₹ 60 Cost of 1 fruit juice = ₹ 60 – ₹ 15 = ₹ 45

Question 10.
Given 28p – 36 = 98, find the value of 14p – 19 and 28p – 38.

Solution:
28p – 36 = 98 ⇒ 28p = 98 + 36 ⇒ 28p = 134 ⇒ p = 13428
⇒ p = 6714
Now to find the value of
(i) 14p – 19 = 14 × 6714 – 19
= 67 – 19
= 48
(ii) 28p – 38 = 28 × 6714 – 38 = 134 – 38 = 96

Question 11.
The steps to solve three equations are shown below. Identify and correct any mistakes. (a) 6x + 9 = 66 x + 9 = 11 x = 11 – 9 x = 2 (b) 14y + 24 = 36 7y + 12 = 18 7y = 6 y = 67
(c) 4x – 5 = 9x + 8
4x = 9x + 8 – 5
4x = 9x + 3
4x – 9x = 3
-5x = 3
x = −53

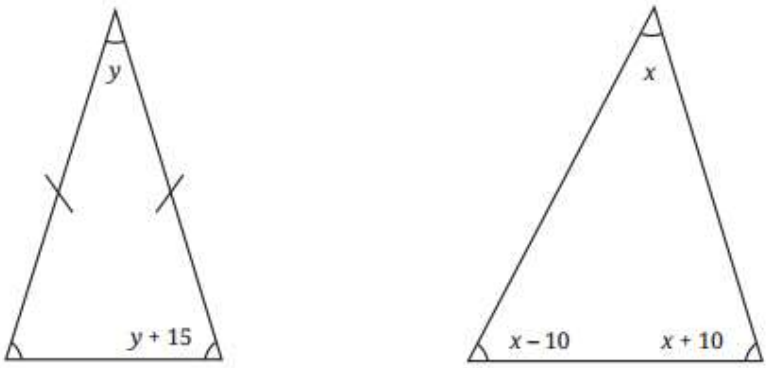
Solution:
(a) 6x + 9 = 66 → Error
Variable terms should be on one side and constants on the other side before separating the coefficient from the variable.
Correction
6x + 9 = 66
6x = 66 – 9
6x = 57
x = 576
x = 192
x = 912

(b) 14y + 24 = 36 7y + 12 = 18 [Dividing by 2 throughout] 7y = 6 y = 67 → No Error

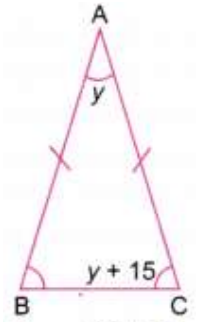
(c) 4x – 5 = 9x + 8 4x = 9x + 8 – 5 → Error 4x = 9x + 3 4x – 9x = 3 -5x = 3 x = −53 → Error
Correction
4x – 5 = 9x + 8
4x = 9x + 8 + 5

4x = 9x + 13
4x – 9x = 13
-5x = 13
x = −135
x = -235

Question 12.
Find the measures of the angles of these triangles.

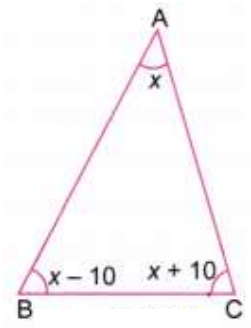


Solution:
(i) In ∆ABC,



AB = AC [Given] ∠B = ∠C [Angles opposite to equal sides in a triangle are equal] So ∠B = y + 15 ∠A + ∠B + ∠C = 180° [Angle sum property of ∆] ⇒ y + y + 15 + y + 15 = 180° ⇒ 3y + 30 = 180° ⇒ 3y = 180 – 30 ⇒ 3y = 150 ⇒ y = 50 ∠A = 50°, ∠B = 50° + 15° = 65°, and ∠C = 50° + 15° = 65°

(ii) In ∆ABC,



∠A + ∠B + ∠C = 180° [Sum of angles of a triangle is 180°] ⇒ x + x – 10 + x + 10 = 180° ⇒ 3x = 180° ⇒ x = 60° ∠A = 60°, ∠B = 60° – 10° = 50° and ∠C = 60° + 10° = 70°

Question 13.
Write 4 equations whose solution is u = 6.

Solution:
(i) u = 6 Multiply both sides by 23
⇒ 23u = 23 × 6
⇒ 23u = 4

(ii) u = 6 Add 7 to both sides u + 7 = 6 + 7 ⇒ u + 1 = 13

(iii) u = 6 Multiply both sides by 2 2u = 12 Add 3 to both sides ⇒ 2u + 3 = 12 + 3 ⇒ 2u + 3 = 15

(iv) u = 6 Multiply both sides by 3 3u = 18 Subtract 5 from both sides 3u – 5 = 18 – 5 ⇒ 3u – 5 = 13

Question 14.
The Bakhshali Manuscript (300 CE) mentions the following problem. The amount given to the first person is not known. The second person is given twice as much as the first. The third person is given thrice as much as the second, and the fourth person four times as much as the third. The total amount distributed is 132. What is the amount given to the first person?

Solution:
Let the amount given to the first person be x. Amount given to second person = 2x Amount given to third person = 3(2x) = 6x Amount given to fourth person= 4(6x) = 24x Total amount = 132 ⇒ x + 2x + 6x + 24x = 132 ⇒ 33x = 132 ⇒ x = 1324 ⇒ x = 4 The amount given to the first person is 4.

Question 15.

The height of a giraffe is two and a half metres more than half its height. How tall is the giraffe?

Solution:

Let the height of a giraffe be x m. According to the question

$$x\ \text{m} = 2\frac{1}{2}\ \text{m} + \frac{x}{2}\ \text{m}$$

$$\Rightarrow \quad x = \frac{5}{2} + \frac{x}{2}$$

$$\Rightarrow \quad \frac{x}{1} - \frac{x}{2} = \frac{5}{2}$$

$$\Rightarrow \quad \frac{2x - x}{2} = \frac{5}{2}$$

$$\Rightarrow \quad \frac{x}{2} = \frac{5}{2}$$

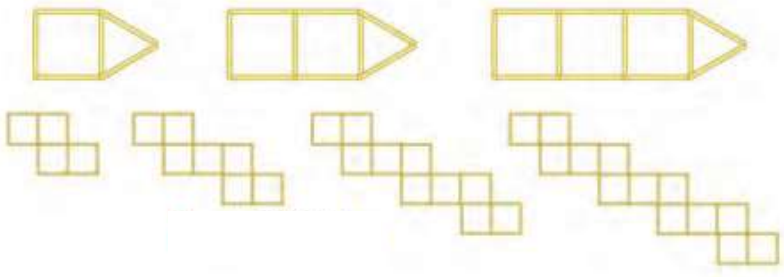
$$\Rightarrow \quad x = \frac{5}{2} \times 2$$

$$\Rightarrow \quad x = 5$$

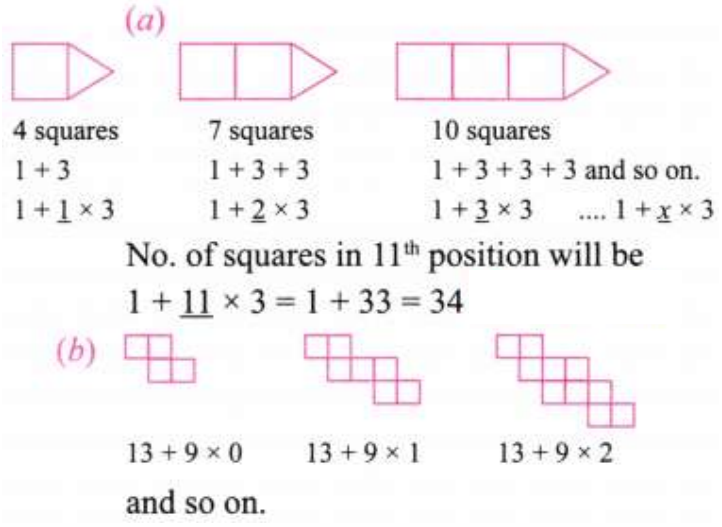
∴ Height of the giraffe = 5 m.

Question 16.

Two separate figures are given below. Each figure shows the first few positions in a sequence of arrangements made with sticks. Identify the pattern and answer the following questions for each figure: (a) How many squares are in position number 11 of the sequence? (b) How many sticks are needed to arrange position number 11 of the sequence? (c) Can an arrangement in this sequence be made using exactly 85 sticks? If yes, which position number will it correspond to? (d) Can an arrangement in this sequence be made using exactly 150 sticks? If yes, which position number will it correspond to?



Solution:



So, no. of sticks needed in 11th position will be 13 + 9 × 10 = 103

(c) Let the nth arrangement have 85 sticks. 13 + (n – 1) × 9 = 85 ⇒ 13 + 9n – 9 = 85 ⇒ 4 + 9n = 85 ⇒ 9n = 85 – 4 ⇒ 9n = 81 ⇒ n = 9 Yes, the arrangement will have 85 sticks.

(d) Let the nth arrangement have 150 sticks. 13 + (n – 1) × 9 = 150 ⇒ 13 + 9n – 9 = 150 ⇒ 4 + 9n = 150 ⇒ 9n = 150 – 4 ⇒ 9n = 146 ⇒ n = 1469
⇒ n = 1629 It is not a whole number. So, no arrangement can be made with 150 sticks.

Question 17.
A number increased by 36 is equal to ten times itself. What is the number?

Solution:
Let the number be x. According to the question x + 36 = 10 × x ⇒ x + 36 = 10x ⇒ 36 = 10x – x ⇒ 36 = 9x ⇒ 36 ÷ 9 = x ⇒ 4 = x

Question 18.
Solve these equations: (a) 5(r + 2) = 10 (b) -3(u + 2) = 2(u – 1) (c) 2(7 – 2n) = -6 (d) 2(x – 4) = -16 (e) 6(x – 1) = 2(x – 1) – 4 (f) 3 – 7s = 7 – 3s (g) 2x + 1 = 6 – (2x – 3) (h) 10 – 5x = 3(x – 4) – 2(x – 7)

Solution:
(a) 5(r + 2) =10 ⇒ 5 × (r + 2) = 10 ⇒ (r + 2) = 10 ÷ 5 ⇒ r + 2 = 2 ⇒ r = 2 – 2 ⇒ r = 0

(b) -3(u + 2) = 2(u – 1) ⇒ -3u – 6 = 2u – 2 ⇒ -3u – 2u = -2 + 6 ⇒ -5u = 4 ⇒ u = −45

(c) $2(7 - 2n) = -6 \Rightarrow 2 \times (7 - 2n) = -6 \Rightarrow 7 - 2n = -6 \div 2 \Rightarrow 7 - 2n = -3 \Rightarrow -2n = -3 - 7 \Rightarrow -2n = -10 \Rightarrow n = 5$

(d) $2(x - 4) = -16 \Rightarrow x - 4 = -8 \Rightarrow x = -8 + 4 \Rightarrow x = -4$

(e) $6(x - 1) = 2(x - 1) - 4$ [Distributive property] $\Rightarrow 6x - 6 = 2x - 2 - 4 \Rightarrow 6x - 6 = 2x - 6 \Rightarrow 6x - 2x = -6 + 6 \Rightarrow 4x = 0 \Rightarrow x = 0$

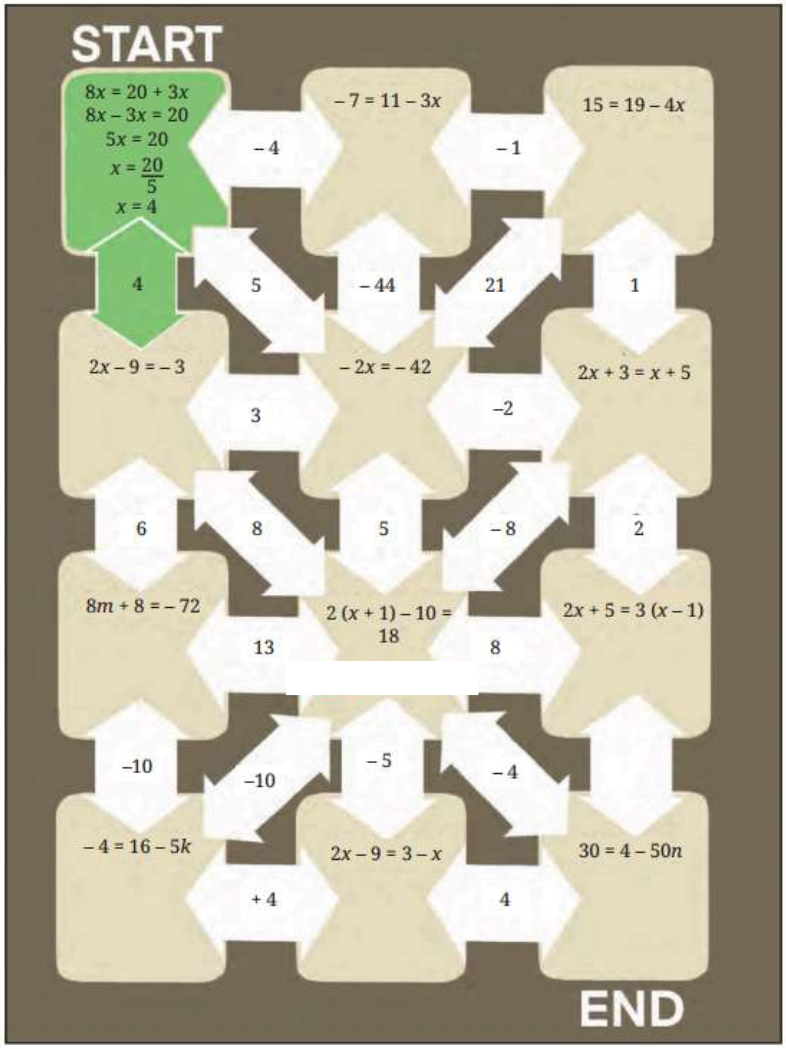
(f) $3 - 7s = 7 - 3s \Rightarrow 3 - 7 = -3s + 7s \Rightarrow -4 = 4s \Rightarrow s = -1$

(g) $2x + 1 = 6 - (2x - 3) \Rightarrow 2x + 1 = 6 - 2x + 3 \Rightarrow 2x + 2x = 6 + 3 - 1 \Rightarrow 4x = 8 \Rightarrow x = 2$

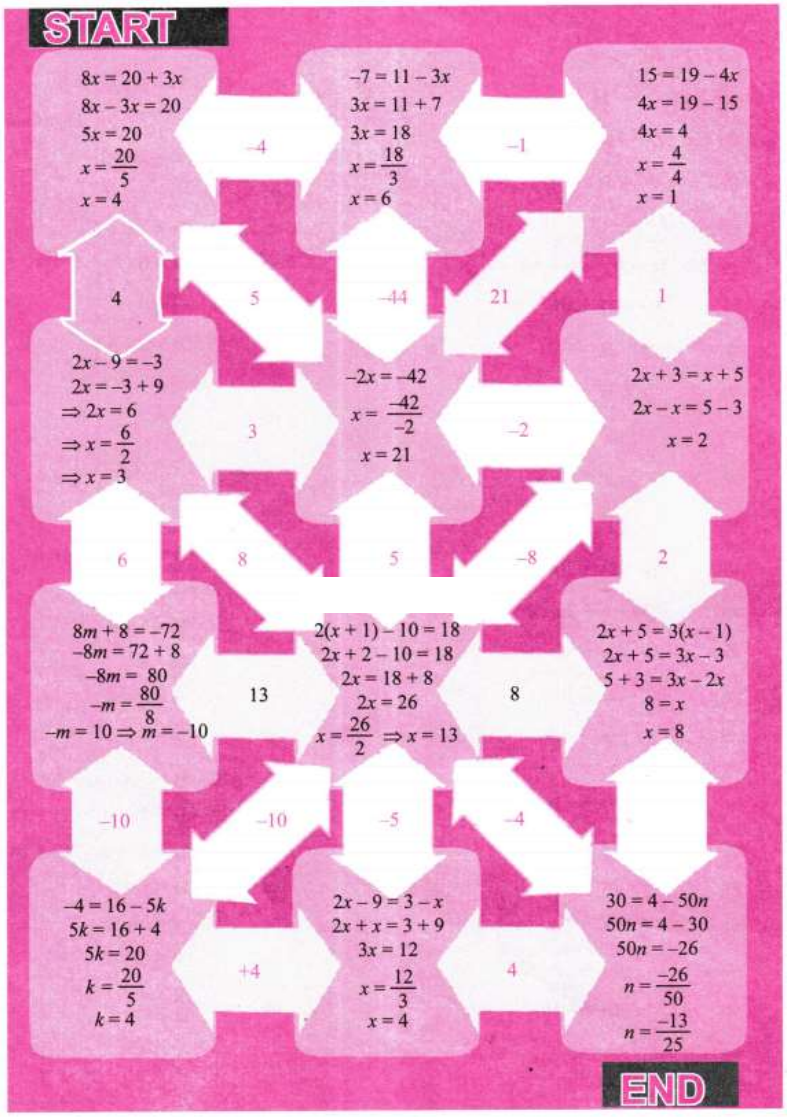
(h) $10 - 5x = 3(x - 4) - 2(x - 7) \Rightarrow 10 - 5x = 3x - 12 - 2x + 14 \Rightarrow 10 - 5x = 3x - 2x - 12 + 14 \Rightarrow 10 - 5x = x + 2 \Rightarrow 10 - 2 = x + 5x \Rightarrow 8 = 6x \Rightarrow x = 43$

Question 19.

Solve the equations to find a path from Start to the End. Show your work in the given boxes provided and colour your path as you proceed.



Solution:



Question 20.
There are some children and donkeys on a beach. Together they have 28 heads and 80 feet. How many donkeys are there? How many children are there?

Solution:
Let the number of children be x. Let the number of donkeys be y. x + y = 28 y = 28 – x ……(i) Children have 2 feet, but donkeys have 4 feet. According to the question 2x + 4y = 80 ⇒ 2x + 4(28 – x) = 80 [From (i)] ⇒ 2x + 112 – 4x = 80 ⇒ -2x + 112 = 80 ⇒ -2x = 80 – 112 ⇒ -2x = -32 ⇒ x = 16 There are 16 children, and (28 – 16) = 12 donkeys.