

SIMPLE EQUATIONS

(A) Main Concepts and Results

- The word variable means something that can vary i.e., change and constant means that does not vary. The value of a variable is not fixed. Variables are denoted usually by letters of the English alphabets such as x, y, z, l, m, n, p, a etc.
- The expressions are formed by performing operations like addition, subtraction, multiplication and division on the variables and constants.
- An equation is a condition on a variable (or variables) such that two expressions in the variable (variables) have equal value.
- The value of the variable for which the equation is satisfied is called the solution or root of the equation.
- An equation remains the same if the LHS and the RHS are interchanged.
- In case of balanced equation if we (i) add the same number to both the sides, or (ii) subtract the same number from both the sides, or (iii) multiply both sides by the same non-zero number or (iv) divide both sides by the same non-zero number, the balance remains undisturbed.
- Transposing means moving from one side to the other. When a term is transposed from one side of the equation to the other side, its sign gets changed.
- Transposition of an expression can be carried out in the same way as the transposition of a term.

- To solve practical problems:
 - Read the problem carefully and denote the unknown quantity by variable x , y etc.
 - Form the equation according to the given conditions.
 - Solve the equation i.e., find the value of the unknown quantity (variable).

(B) Solved Examples

In Examples 1 to 3, there are four options, out of which one is correct. Choose the correct one.

Example 1: The solution of the equation $3x + 5 = 0$ is

- (a) $\frac{5}{3}$ (b) -5 (c) $-\frac{5}{3}$ (d) 5

Solution : Correct answer is (c).

Example 2: -1 is not a solution of the equation

- (a) $x + 1 = 0$ (b) $x - 1 = 2$ (c) $2y + 3 = 1$ (d) $2p + 7 = 5$

Solution : Correct answer is (b).

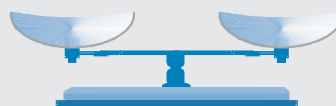
Example 3: Which of the following equations can be formed using the expression $x = 5$:

- (a) $2x + 3 = 13$ (b) $3x + 2 = 13$
 (c) $x - 5 = 1$ (d) $4x - 9 = 21$

Solution: Correct answer is (a).

[Hint: $x = 5$ on multiplying both sides by 2 gives $2x = 10$ which on adding 3 both sides gives $2x + 3 = 13$]

An **equation** is a mathematical sentence that uses an equality sign to show that two expressions have the same value. All of these are equations.



$$3 + 8 = 11$$

$$r + 6 = 14$$

$$-24 = x - 7$$

$$\frac{-100}{2} = -50$$

To solve an equation that contains a variable, find the value of the variable that makes the equation true. This value of the variable is called the solution of the equation.

In Examples 4 to 6, fill in the blanks to make it a true statement.

Example 4: Any value of the variable which makes both sides of an equation equal, is known as a _____ of the equation.

Solution: Solution

Example 5: The root of the equation $y - 13 = 9$ is _____.

Solution: 22

Example 6: $2x + \underline{\hspace{2cm}} = 11$ has the solution -4 .

Solution: 19

ADDITION PROPERTY OF EQUALITY

| Words | Numbers | Algebra |
|---|--|------------------------------------|
| You can add the same number to both sides of an equation, and the statement will still be true. | $\begin{array}{r} 2 + 3 = 5 \\ + 4 = +4 \\ \hline 2 + 7 = 9 \end{array}$ | $x = y$ implies $x + z = y + z$ |

In Examples 7 to 10, state whether the statements are True or False.

Example 7: 12 is a solution of the equation $4x - 5 = 3x + 10$.

Solution: False

[LHS = $4 \times 12 - 5 = 43$

and RHS = $3 \times 12 + 10 = 46$ They are not equal.]

Example 8: A number x divided by 7 gives 2 can be written as $\frac{x+1}{7} = 2$.

Solution: False.

Example 9: $x + 2 = 5$ and $3x - 1 = 8$ have the same solutions.

Solution: True

Example 10: The equation $3x + 7 = 10$ has 1 as its solution.

Solution: True

In each of the Examples 11 to 13, form an equation for each statement.

Example 11 : One fourth of a number is 20 less than the number itself.

Solution : Let the number be x .

So, one fourth of the number is $\frac{x}{4}$.

$\frac{x}{4}$ is 20 less than the number itself. So, the required equation is

$$\frac{x}{4} = x - 20.$$

Example 12 : On subtracting 13 from 3 times of a number, the result is 8.

Solution : Let the number be x .

So, 3 times the number = $3x$

On subtracting 13 from it, we get $3x - 13$.

Therefore, $3x - 13 = 8$ is the required equation.

Example 13 : Two times a number increased by 5 equals 9.

Solution : Let the required number be x .

So, 2 times this number = $2x$

When increased by 5, it gives the expression $2x + 5$

Thus, required equation is $2x + 5 = 9$.

Example 14 : 9 added to twice a number gives 13. Find the number.

Solution : Let the number be x .

As per the given condition,

$$2x + 9 = 13$$

$$\text{or } 2x = 4$$

$$\text{or } x = 2$$

PROBLEM SOLVING TIP

Always check the solution after solving equations.

Example 15 : 1 subtracted from one third of a number gives 1. Find the number.

Solution : Let the number be x .

According to the given condition,

$$\frac{1}{3}x - 1 = 1$$

$$\text{or } \frac{1}{3}x = 1 + 1$$

$$\text{or } \frac{1}{3}x = 2 \text{ or } x = 6.$$

Example 16: Correct the incorrect equation written in Roman numerals by moving only one tooth pick.

$$V - II = VI$$

Solution: By moving one tooth pick from numeral II , change the minus sign to plus, we get

$$V + I = VI$$

Example 16: Solve the riddle “What is too much fun for one, enough for two, and means nothing to three?” The answer to this is hidden in the equations given below.

If $4c = 16$, then $c = ?$

If $4e + 8 = 20$, then $e = ?$

If $2r - 3 = 7$, then $r = ?$

If $3t + 8 = 29$, then $t = ?$

If $2s + 4 = 4s$, then $s = ?$

To get the answer substitute the numbers for the letters it equals in the following:

manner: $\frac{\square}{2}, \frac{\square}{3}, \frac{\square}{4}, \frac{\square}{5}, \frac{e}{\square}, \frac{\square}{7}$

Solution : Solving the given equations:

If $4c = 16$, we get $c = \frac{16}{4} = 4$. Thus, $c = 4$.

If $4e + 8 = 20$, we get $4e = 12$ or $e = \frac{12}{4} = 3$. Thus, $e = 3$.

If $2r - 3 = 7$, we get $2r = 10$ or $r = \frac{10}{2} = 5$, i.e., $r = 5$.

If $3t + 8 = 29$, we get $3t = 29 - 8$

or $3t = 21$, or $t = \frac{21}{3}$, or $t = 7$

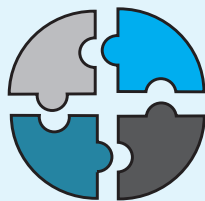
If $2s + 4 = 4s$, we get $4 = 4s - 2s$

or $2s = 4$ or $s = \frac{4}{2}$ or $s = 2$.

Replacing the solutions by the corresponding letters we get

$$\frac{s}{2}, \frac{e}{3}, \frac{c}{4}, \frac{r}{5}, \frac{e}{3}, \frac{t}{7}$$

Application on Problem Solving Strategy



Example 18

Solve the following equation.

$$10 = 4 + 3(t + 2)$$

Solution :



Understand and Explore the Problem

- What do you know?

Solving an equation means to find value of the variable used in the equation.

Distributive property can be used to open the bracket of expression in RHS of the above equation.

Method of transposition can help in solving the equation

- To find value of 't' which satisfy the above equation.



Plan a Strategy

- What are the most appropriate steps to solve this equation?

First we should remove all the brackets appearing in the equation.

Solve and simplify the expression on one side of equation and then use method of transposition to collect terms with variable on one side and without variable on the other side of equation.



Solve

- Step 1 : $10 = 4 + 3(t + 2)$ [open the brackets]
- Step 2 : $10 = 4 + 3t + 6$ [simplify RHS]
- Step 3 : $10 = 10 + 3t$ [collect terms without
- Step 4 : $10 - 10 = 3t$ variable on one side]
- Step 5 : $0 = 3t$
- Step 6 : $t = \frac{0}{3}$
i.e., $t = 0$



Revise

Solution of an equation can always be checked by substituting the value of variable and confirming whether LHS is equal to RHS or not

$$\text{LHS} = 10$$

$$\text{RHS} = 4 + 3(t + 2)$$

Substituting ' $t = 0$ '

$$= 4 + 3(0 + 2)$$

$$= 4 + 6$$

$$= 10 = \text{LHS}$$

Hence, LHS = RHS

Thus, ' $t = 0$ ' is the correct answer.

Think and Discuss

1. **Can** variable ' t ' take any other value also for same equation?
2. **Can** more equations have solution as ' $t = 0$ '?

(C) Exercise

In the Questions 1 to 18, there are four options out of which, one is correct. Choose the correct one.

1. The solution of the equation $ax + b = 0$ is
 - (a) $\frac{a}{b}$
 - (b) $-b$
 - (c) $-\frac{b}{a}$
 - (d) $\frac{b}{a}$
2. If a and b are positive integers, then the solution of the equation $ax = b$ will always be a
 - (a) positive number
 - (b) negative number
 - (c) 1
 - (d) 0
3. Which of the following is not allowed in a given equation?
 - (a) Adding the same number to both sides of the equation.
 - (b) Subtracting the same number from both sides of the equation.

- (c) Multiplying both sides of the equation by the same non-zero number.
- (d) Dividing both sides of the equation by the same number.
4. The solution of which of the following equations is neither a fraction nor an integer?
- (a) $2x + 6 = 0$ (b) $3x - 5 = 0$
- (c) $5x - 8 = x + 4$ (d) $4x + 7 = x + 2$
5. The equation which cannot be solved in integers is
- (a) $5y - 3 = -18$ (b) $3x - 9 = 0$
- (c) $3z + 8 = 3 + z$ (d) $9y + 8 = 4y - 7$
6. If $7x + 4 = 25$, then x is equal to
- (a) $\frac{29}{7}$ (b) $\frac{100}{7}$ (c) 2 (d) 3
7. The solution of the equation $3x + 7 = -20$ is
- (a) $\frac{17}{7}$ (b) -9 (c) 9 (d) $\frac{13}{3}$
8. The value of y for which the expressions $(y - 15)$ and $(2y + 1)$ become equal is
- (a) 0 (b) 16 (c) 8 (d) -16

SUBTRACTION PROPERTY OF EQUALITY

| Words | Numbers | Algebra |
|--|---|---|
| You can subtract the same number from both sides of an equation, and the statement will still be true. | $\begin{array}{r} 4 + 7 = 11 \\ - 3 = -3 \\ \hline 4 + 4 = 8 \end{array}$ | $\begin{array}{l} x = y \text{ implies} \\ x - z = y - z \end{array}$ |

9. If $k + 7 = 16$, then the value of $8k - 72$ is
- (a) 0 (b) 1 (c) 112 (d) 56
10. If $43m = 0.086$, then the value of m is
- (a) 0.002 (b) 0.02 (c) 0.2 (d) 2

11. x exceeds 3 by 7, can be represented as
 (a) $x + 3 = 2$ (b) $x + 7 = 3$ (c) $x - 3 = 7$ (d) $x - 7 = 3$
12. The equation having 5 as a solution is:
 (a) $4x + 1 = 2$ (b) $3 - x = 8$ (c) $x - 5 = 3$ (d) $3 + x = 8$
13. The equation having -3 as a solution is:
 (a) $x + 3 = 1$ (b) $8 + 2x = 3$ (c) $10 + 3x = 1$ (d) $2x + 1 = 3$
14. Which of the following equations can be formed starting with $x = 0$?
 (a) $2x + 1 = -1$ (b) $\frac{x}{2} + 5 = 7$ (c) $3x - 1 = -1$ (d) $3x - 1 = 1$
15. Which of the following equations cannot be formed using the equation $x = 7$?
 (a) $2x + 1 = 15$ (b) $7x - 1 = 50$ (c) $x - 3 = 4$ (d) $\frac{x}{7} - 1 = 0$
16. If $\frac{x}{2} = 3$, then the value of $3x + 2$ is
 (a) 20 (b) 11 (c) $\frac{13}{2}$ (d) 8
17. Which of the following numbers satisfy the equation $-6 + x = -12$?
 (a) 2 (b) 6 (c) -6 (d) -2
18. Shifting one term from one side of an equation to another side with a change of sign is known as
 (a) commutativity (b) transposition
 (c) distributivity (d) associativity

Build Understanding

One-step equations can be solved by applying a single inverse operation. To solve two-step equations, apply more than one inverse operation.

The order of operations for $2x + 5 = 7$ is to start with x , multiply by 2 and add 5. The result is 7.

Order of Operations: x multiply by 2 add 5 7

To solve the equation, inverse the steps. Start with 7, subtract 5, then divide by 2 to find x .

Solve the equation: 7 subtract 5 divide by 2 x

In Questions 19 to 48, fill in the blanks to make the statements true.

19. The sum of two numbers is 60 and their difference is 30.
- If smaller number is x , the other number is _____.(use sum)
 - The difference of numbers in term of x is _____.
 - The equation formed is _____.
 - The solution of the equation is _____.
 - The numbers are _____ and _____.

MULTIPLICATION PROPERTY OF EQUALITY

| Words | Numbers | Algebra |
|---|---|---|
| Multiply both sides of an equation by the same non-zero number, and the statement will still be true. | $2 \times 3 = 6$ $4 \times 2 \times 3 = 4 \times 6$ $8 \times 3 = 24$ | $x = y$ implies $zx = zy$ ($z \neq 0$) |

20. Sum of two numbers is 81. One is twice the other.
- If smaller number is x , the other number is _____.
 - The equation formed is _____.
 - The solution of the equation is _____.
 - The numbers are _____ and _____.
21. In a test Abha gets twice the marks as that of Palak. Two times Abha's marks and three times Palak's marks make 280.
- If Palak gets x marks, Abha gets _____ marks.
 - The equation formed is _____.
 - The solution of the equation is _____.
 - Marks obtained by Abha are _____.
22. The length of a rectangle is two times its breadth. Its perimeter is 60 cm.
- If the breadth of rectangle is x cm, the length of the rectangle is _____.

- (b) Perimeter in terms of x is _____.
- (c) The equation formed is _____.
- (d) The solution of the equation is _____.

23. In a bag there are 5 and 2 rupee coins. If they are equal in number and their worth is ₹ 70, then

- (a) The worth of x coins of ₹ 5 each _____.
- (b) The worth of x coins of ₹ 2 each _____.
- (c) The equation formed is _____.
- (d) There are _____ 5 rupee coins and _____ 2 rupee coins.

Think and Discuss

1. **Describe** how you would solve $4(x - 2) = 16$.
2. **Express** how to check your solution to an equation.

24. In a Mathematics quiz, 30 prizes consisting of 1st and 2nd prizes only are to be given. 1st and 2nd prizes are worth ₹ 2000 and ₹ 1000, respectively. If the total prize money is ₹ 52,000 then show that:

- (a) If 1st prizes are x in number the number of 2nd prizes are _____.
- (b) The total value of prizes in terms of x are _____.
- (c) The equation formed is _____.
- (d) The solution of the equation is _____.
- (e) The number of 1st prizes are _____ and the number of 2nd prizes are _____.

25. If $z + 3 = 5$, then $z =$ _____.

26. _____ is the solution of the equation $3x - 2 = 7$.

27. _____ is the solution of $3x + 10 = 7$.

28. If $2x + 3 = 5$, then value of $3x + 2$ is _____.

29. In integers, $4x - 1 = 8$ has _____ solution.

DIVISION PROPERTY OF EQUALITY

| Words | Numbers | Algebra |
|---|--|--|
| You can divide both sides of an equation by the same non-zero number, and the statement will still be true. | $4 \times 3 = 12$ $\frac{4 \times 3}{2} = \frac{12}{2}$ $\frac{12}{2} = 6$ | $x = y$, implies $\frac{x}{z} = \frac{y}{z}, z \neq 0$ |

30. In natural numbers, $4x + 5 = -7$ has _____ solution.
31. In natural numbers, $x - 5 = -5$ has _____ solution.
32. In whole numbers, $x + 8 = 12 - 4$ has _____ solution.
33. If 5 is added to three times a number, it becomes the same as 7 is subtracted from four times the same number. This fact can be represented as _____.
34. $x + 7 = 10$ has the solution _____.
35. $x - 0 =$ _____ ; when $3x = 12$.
36. $x - 1 =$ _____ ; when $2x = 2$.
37. $x -$ _____ = 15; when $\frac{x}{2} = 6$.
38. The solution of the equation $x + 15 = 19$ is _____.
39. Finding the value of a variable in a linear equation that _____ the equation is called a _____ of the equation.
40. Any term of an equation may be transposed from one side of the equation to the other side of the equation by changing the _____ of the term.
41. If $\frac{9}{5}x = \frac{18}{5}$, then $x =$ _____.
42. If $3 - x = -4$, then $x =$ _____.
43. If $x - \frac{1}{2} = -\frac{1}{2}$, then $x =$ _____.

44. If $\frac{1}{6} - x = \frac{1}{6}$, then $x =$ _____.
45. If 10 less than a number is 65, then the number is _____.
46. If a number is increased by 20, it becomes 45. Then the number is _____.
47. If 84 exceeds another number by 12, then the other number is _____.
48. If $x - \frac{7}{8} = \frac{7}{8}$, then $x =$ _____.

Think and Discuss

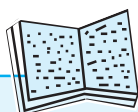
- Give** two words or phrases that can be used to express each operation: addition, subtraction, multiplication, and division.
- Express** $5 + 7n$ in words in at least two different ways.

In Questions 49 to 55, state whether the statements are True or False.

49. 5 is the solution of the equation $3x + 2 = 17$.
50. $\frac{9}{5}$ is the solution of the equation $4x - 1 = 8$.
51. $4x - 5 = 7$ does not have an integer as its solution.
52. One third of a number added to itself gives 10, can be represented as $\frac{x}{3} + 10 = x$.
53. $\frac{3}{2}$ is the solution of the equation $8x - 5 = 7$.
54. If $4x - 7 = 11$, then $x = 4$.
55. If 9 is the solution of variable x in the equation $\frac{5x - 7}{2} = y$, then the value of y is 28.

56. Match each of the entries in Column I with the appropriate entries in Column II.

| Column I | Column II |
|---|--------------------|
| (i) $x + 5 = 9$ | (A) $-\frac{5}{3}$ |
| (ii) $x - 7 = 4$ | (B) $\frac{5}{3}$ |
| (iii) $\frac{x}{12} = -5$ | (C) 4 |
| (iv) $5x = 30$ | (D) 6 |
| (v) The value of y which satisfies $3y = 5$ | (E) 11 |
| (vi) If $p = 2$, then the value of $\frac{1}{3}(1 - 3p)$ | (F) -60 |
| | (G) 3 |



To become familiar with some of the vocabulary terms consider the following:

1. The word **constant** means “unchanging.” What do you think a **constant** in mathematics refers to?
2. The word **equation** looks like the word equal, which means “having the same value.” How do you think this meaning applies to an equation?
3. The word **inequality** begins with the prefix ‘in’ which means “not”, and has the same root as the word equation. Together, what do you think the prefix and root mean?
4. The word ‘vary’ which is the root of **variable** means “to change.” How do you think this applies to mathematics?

In Questions 57 to 67, express each of the given statements as an equation.

- 57.** 13 subtracted from twice of a number gives 3 .
- 58.** One-fifth of a number is 5 less than that number.
- 59.** A number is 7 more than one-third of itself.
- 60.** Six times a number is 10 more than the number.
- 61.** If 10 is subtracted from half of a number, the result is 4.
- 62.** Subtracting 5 from p , the result is 2.
- 63.** Five times a number increased by 7 is 27.
- 64.** Mohan is 3 years older than Sohan. The sum of their ages is 43 years.
- 65.** If 1 is subtracted from a number and the difference is multiplied by $\frac{1}{2}$, the result is 7.
- 66.** A number divided by 2 and then increased by 5 is 9.
- 67.** The sum of twice a number and 4 is 18.
- 68.** The age of Sohan Lal is four times that of his son Amit. If the difference of their ages is 27 years, find the age of Amit.
- 69.** A number exceeds the other number by 12. If their sum is 72, find the numbers.
- 70.** Seven times a number is 12 less than thirteen times the same number. Find the number.
- 71.** The interest received by Karim is ₹ 30 more than that of Ramesh. If the total interest received by them is ₹ 70, find the interest received by Ramesh.
- 72.** Subramaniam and Naidu donate some money in a Relief Fund. The amount paid by Naidu is ₹ 125 more than that of Subramaniam. If the total money paid by them is ₹ 975, find the amount of money donated by Subramaniam.

- 73.** In a school, the number of girls is 50 more than the number of boys. The total number of students is 1070. Find the number of girls.
- 74.** Two times a number increased by 5 equals 9. Find the number.
- 75.** 9 added to twice a number gives 13. Find the number.
- 76.** 1 subtracted from one-third of a number gives 1. Find the number.
- 77.** After 25 years, Rama will be 5 times as old as he is now. Find his present age.
- 78.** After 20 years, Manoj will be 5 times as old as he is now. Find his present age.
- 79.** My younger sister's age today is 3 times, what it will be 3 years from now minus 3 times what her age was 3 years ago. Find her present age.
- 80.** If 45 is added to half a number, the result is triple the number. Find the number.
- 81.** In a family, the consumption of wheat is 4 times that of rice. The total consumption of the two cereals is 80 kg. Find the quantities of rice and wheat consumed in the family.
- 82.** In a bag, the number of one rupee coins is three times the number of two rupees coins. If the worth of the coins is ₹ 120, find the number of 1 rupee coins.
- 83.** Anamika thought of a number. She multiplied it by 2, added 5 to the product and obtained 17 as the result. What is the number she had thought of ?
- 84.** One of the two numbers is twice the other. The sum of the numbers is 12. Find the numbers.
- 85.** The sum of three consecutive integers is 5 more than the smallest of the integers. Find the integers.
- 86.** A number when divided by 6 gives the quotient 6. What is the number?
- 87.** The perimeter of a rectangle is 40m. The length of the rectangle is 4 m less than 5 times its breadth. Find the length of the rectangle.

88. Each of the 2 equal sides of an isosceles triangle is twice as large as the third side. If the perimeter of the triangle is 30 cm, find the length of each side of the triangle.
89. The sum of two consecutive multiples of 2 is 18. Find the numbers.
90. Two complementary angles differ by 20° . Find the angles.
91. 150 has been divided into two parts such that twice the first part is equal to the second part. Find the parts.
92. In a class of 60 students, the number of girls is one third the number of boys. Find the number of girls and boys in the class.
93. Two-third of a number is greater than one-third of the number by 3. Find the number.
94. A number is as much greater than 27 as it is less than 73. Find the number.
95. A man travelled two fifth of his journey by train, one-third by bus, one-fourth by car and the remaining 3 km on foot. What is the length of his total journey?
96. Twice a number added to half of itself equals 24. Find the number.
97. Thrice a number decreased by 5 exceeds twice the number by 1. Find the number.
98. A girl is 28 years younger than her father. The sum of their ages is 50 years. Find the ages of the girl and her father.
99. The length of a rectangle is two times its width. The perimeter of the rectangle is 180 cm. Find the dimensions of the rectangle.
100. Look at this riddle?

If she answers the riddle correctly how ever will she pay for the pencils?



Bhaiya, please give me 10 pencils

I will give you one pencil free if you answer my riddle



'Really! Ask the riddle then

If 7 pencils would cost you ₹ 6 more than 5 pencils, then find the cost of your 10 pencils



- 101.** In a certain examination, a total of 3768 students secured first division in the years 2006 and 2007. The number of first division in 2007 exceeded those in 2006 by 34. How many students got first division in 2006?
- 102.** Radha got ₹ 17,480 as her monthly salary and over-time. Her salary exceeds the over-time by ₹ 10,000. What is her monthly salary ?
- 103.** If one side of a square is represented by $18x - 20$ and the adjacent side is represented by $42 - 13x$, find the length of the side of the square.
- 104.** Follow the directions and correct the given incorrect equation, written in Roman numerals:

- (a) Remove two of these matchsticks to make a valid equation:

$$IX - VI = V$$

- (b) Move one matchstick to make the equation valid. Find two different solutions.

$$VI - IV = XI$$

- 105.** What does a duck do when it flies upside down? The answer to this riddle is hidden in the equation given below:

If $i + 69 = 70$, then $i = ?$ If $8u = 6u + 8$, then $u = ?$

If $4a = -5a + 45$, then $a = ?$ if $4q + 5 = 17$, then $q = ?$

If $-5t - 60 = -70$, then $t = ?$ If $\frac{1}{4}s + 98 = 100$, then $s = ?$

If $\frac{5}{3}p + 9 = 24$, then $p = \underline{\hspace{2cm}}$?

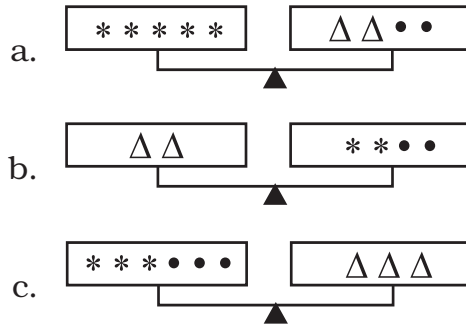
If $3c = c + 12$, then $c = \underline{\hspace{2cm}}$?

If $3(k + 1) = 24$, then $k = \underline{\hspace{2cm}}$?

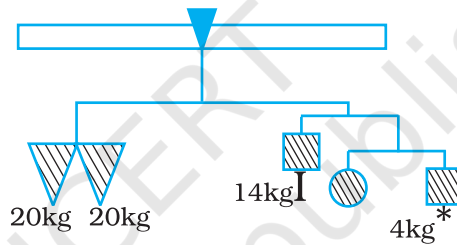
For riddle answer : substitute the number for the letter it equals

$$\frac{\quad}{1} \quad \frac{\quad}{2} \quad \frac{\quad}{3} \quad \frac{\quad}{4} \quad \frac{\quad}{5} \quad \frac{\quad}{6} \quad \frac{\quad}{7} \quad \frac{\quad}{8} \quad \frac{\quad}{4} \quad \frac{\quad}{9}$$

106. The three scales below are perfectly balanced if $\bullet = 3$. What are the values of Δ and $*$?



107. The given figure represents a weighing balance. The weights of some objects in the balance are given. Find the weight of each square and the circle.



(D) Application

1. Crossword Number Puzzle

Get cracking on the following questions to fill the crossword puzzle as per mentioned clues of down and across. Clue number is written at the corner of boxes. Answers of Clue have to be filled up in their respective boxes.

Down 1: I spent one third of my sleeping time while dreaming. If I dreamt for 3 hours, then how long did I sleep?

Down 2: I ran around three sides of a square park whose perimeter is 200 m. How far am I from the starting point?

Down 4: I purchased three sarees and was left with ₹ 1000 out of my savings of ₹ 10000. How much is each saree worth?

Down 8: I have 4 coins worth 50 paise each and a few coins of ₹ 1 each. If I have ₹ 45 in total, how many coins of ₹ 1 do I possess?

Down 9: The unequal angle of an isosceles triangle measures 12° . How much is each of the remaining angles?

Down 11: For what value of y is $3(y - 1) + 7 = 40$?

Across 3: Out of 40 chocolates, Ram and I shared in the ratio 1 : 3. How many chocolates did Ram get?

Across 5: Sum of two consecutive numbers is 111. What is the smaller number of the two?

Across 7: Out of a flock of birds, half flew away while one got injured, if 244 remain, then how many did we begin with?

Across 10: If $2x + 7 = 1573$, then $x = ?$

Across 12: What value of z satisfies

$$\frac{2}{5}z + 8 = 58?$$

| | | | | | |
|---|----|----|----|--|---|
| 6 | | | | | |
| 1 | | | 10 | | 4 |
| | 5 | 2 | | | |
| | 3 | | 9 | | |
| 8 | | | 7 | | |
| | | 11 | | | |
| | 12 | | | | |

2. Crossword Puzzle

Fill the following crossword puzzle as per the mentioned clues of down and across. Clue's number is written at the corner of boxes. Answers of Clues have to fill up in their respective boxes.

Down 1: A mathematical statement with two expressions that have same value.

Down 2: The property that states $a(b + c) = ab + ac$

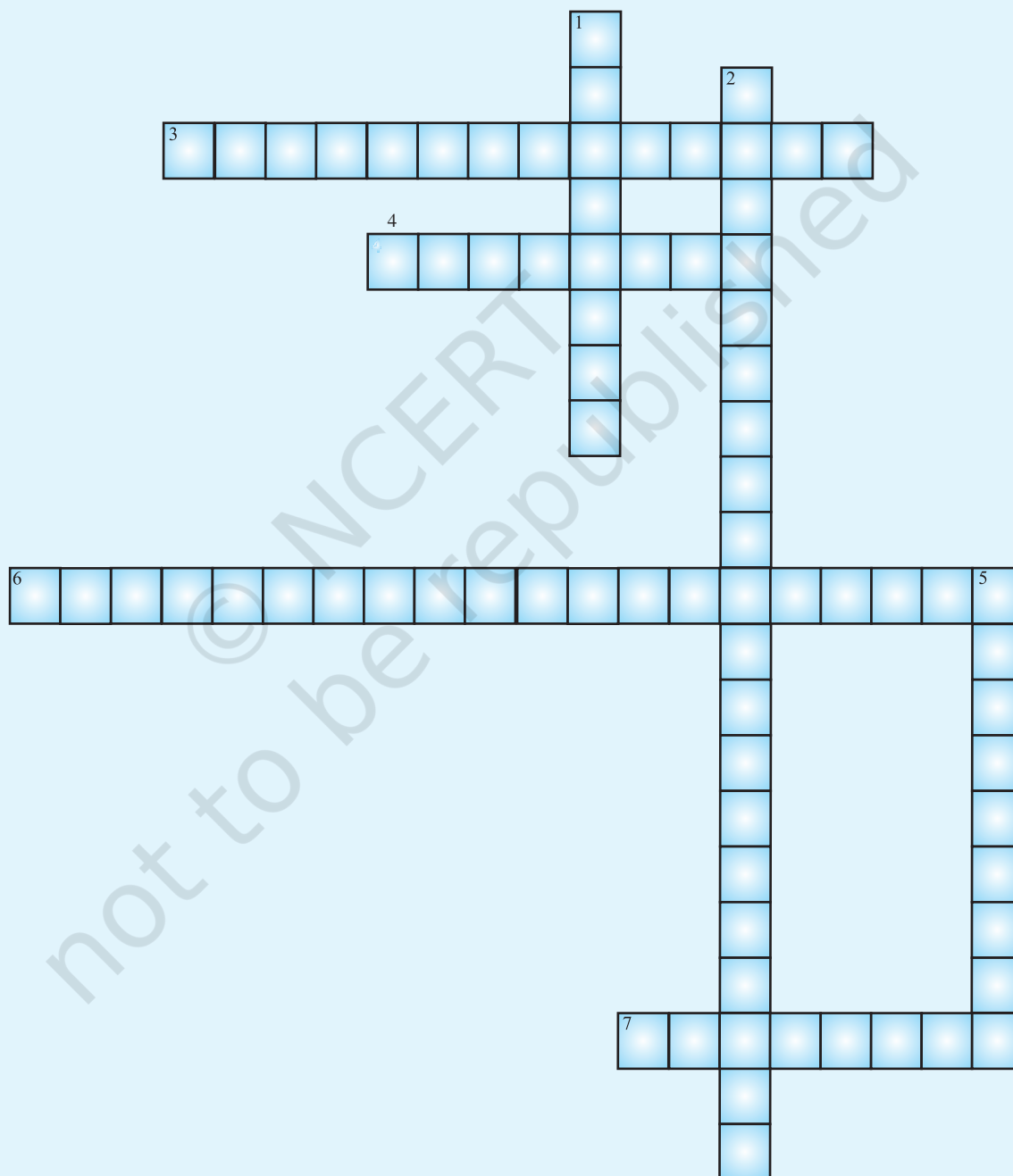
Down 5: An operation that undoes another operation.

Across 3: The expression which can be formed by performing mathematical operations on variables and constants.

Across 4: A number that does not change.

Across 6: A number that multiply the variable.

Across 7: A letter that represents an unknown number.



3. Game Time

There are nine identical looking pearl. Eight are real and one is fake. Using a balance scale that consists of two pans, you must find the fake pearl.



The real pearls weigh the same and the fake weighs less. Also, the scale can be used maximum twice.

Now find the Phony!

[**Hint:** Divide the pearls into three equal groups and then proceed for weighing.]