

Linear Equations

LINEAR EQUATION IN ONE VARIABLE

A linear equation in one variable is an equation of the type $ax + b = 0$ or $ax = c$, where a, b, c are constants (real numbers), $a \neq 0$ and x is an unknown variable.

The solution of the linear equation $ax + b = 0$ is $x = -\frac{b}{a}$. We also say that $-\frac{b}{a}$ is the root of the linear equation $ax + b = 0$.

For example, the equation $2x + 3 = 0$ is a linear equation in one unknown variable x . Its solution or root is $-\frac{3}{2}$.

LINEAR EQUATION IN TWO VARIABLES

A linear equation in two variables is an equation of the type $ax + by + c = 0$ or $ax + by = d$, where a, b, c and d are constants, $a \neq 0, b \neq 0$.

For example, $3x + 4y + 7 = 0$ and $2x - 3y = 5$ are linear equations in two variables x and y .

Methods of Solving Two Simultaneous Linear Equations

1. Method of Substitution

- Step 1** Find the value of one variable, say y , in terms of the other, i.e., x from either equation.
- Step 2** Substitute the value of y so obtained in the other equation. Thus, we get an equation in only one variable x .
- Step 3** Solve this equation for x .
- Step 4** Substitute the value of x , thus obtained, in step 1 and find the value of y .

Illustration 1 Solve $2x + 3y = 7$, $3x - y = 5$

Solution: The given equations are

$$x + y = 7 \quad (1)$$

and $3x - 2y = 11 \quad (2)$

From Eq. (1), we get $y = 7 - x$

Substituting $y = 7 - x$ in Eq. (2), we get

$$\begin{aligned} 3x - 2(7 - x) &= 11 \Rightarrow 3x - 14 + 2x = 11 \\ &\Rightarrow 5x = 25 \Rightarrow x = 5 \end{aligned}$$

Substituting this value of x in Eq. (1), we get

$$5 + y = 7 \Rightarrow y = 7 - 5 \text{ or } y = 2$$

Hence, $x = 5, y = 2$ is the required solution.

2. Method of Elimination

- Step 1** Multiply both the equations by such numbers so as to make the coefficients of one of the two unknowns numerically the same.
- Step 2** Add or subtract the two equations to get an equation containing only one unknown. Solve this equation to get the value of the unknown.
- Step 3** Substitute the value of the unknown in either of the two original equations. By solving that the value of the other unknown is obtained.

Illustration 2 Solve: $-6x + 5y = 2$, $-5x + 6y = 9$

Solution: The given equations are

$$-6x + 5y = 2 \quad (1)$$

$$-5x + 6y = 9 \quad (2)$$

Multiply Eq. (1) by 6,

$$-36x + 30y = 12 \quad (3)$$

Multiply Eq. (2) by 5,

$$-25x + 30y = 45 \quad (4)$$

Subtract Eq. (4) from Eq. (3), we get

$$-11x = -33 \text{ or } x = 3$$

Substitute $x = 3$ in Eq. (1), we get

$$-18 + 5y = 2 \text{ or } y = 4$$

Hence, $x = 3$ and $y = 4$ is the required solution.

3. Short-cut Method

Let the two equations be

$$a_1x + b_1y = c_1$$

$$a_2x + b_2y = c_2.$$

The solution is written as

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{-1}{a_1b_2 - a_2b_1}$$

$$\text{i.e., } x = -\frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}, y = -\frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}.$$

Illustration 3 Solve $3x + 2y = -25$, $-2x - y = 10$

Solution: The two equations are

$$3x + 2y = -25$$

$$-2x - y = 10$$

The solution is given by

$$\begin{aligned} \frac{x}{2 \times 10 - (-1) \times (-25)} &= \frac{y}{(-25) \times (-2) - 3 \times 10} \\ &= \frac{-1}{3 \times (-1) - (-2) \times 2} \end{aligned}$$

$$\text{or, } \frac{x}{-5} = \frac{y}{20} = \frac{-1}{1}$$

$$\text{or, } x = 5, y = -20$$

Consistent and Inconsistent Equations

When a system of equations has a solution, the system is called consistent. When a system of equations has no solution, the system is called inconsistent.

Test for Consistency

If we are given two linear equations

$$a_1x + b_1y = c_1 \text{ and } a_2x + b_2y = c_2. \text{ Then,}$$

(a) If $\frac{a_1}{a_2} = \frac{b_1}{b_2}$, the system will have exactly one solution and will be consistent.

Note: The graphs of such equations will have intersecting lines.

(b) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$, the system is consistent

and has infinitely many solutions.

Note: The graphs of such equations will have coincident lines.

(c) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$, the system has no solution and is inconsistent.

Note: The graphs of such equations will have parallel lines.

Illustration 4 For what values of k will the system of equations $kx + 2y = 5$ and $3x + y = 1$ have a unique solution?

Solution: If the given system of equations has a unique solution,

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{k}{3} \neq \frac{2}{1} \Rightarrow k \neq 6$$

Hence, for $k \neq 6$, the given system of equations will have a unique solution.

Illustration 5 For what value of k , the system of equations $3x + 4y = 6$ and $6x + 8y = k$ represent, coincident lines?

Solution: If the given system of equations represents coincident lines

$$\begin{aligned} \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} &\Rightarrow \frac{3}{6} = \frac{4}{8} = \frac{6}{k} \\ &\Rightarrow k = \frac{6 \times 8}{4} = 12 \end{aligned}$$

Illustration 6 For what value of k the equations $9x + 4y = 9$ and $7x + ky = 5$ have no solution?

Solution: The given system of equations will have no solution

$$\text{if } \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{9}{7} = \frac{4}{k} \neq \frac{9}{5}$$

$$\Rightarrow 9k = 28 \text{ or } k = \frac{28}{9}$$

Practice Exercises

DIFFICULTY LEVEL-1 (BASED ON MEMORY)

- Village A has a population of 6800, which is decreasing at the rate of 120 per year. Village B has a population of 4200, which is increasing at the rate of 80 per year. In how many years will the population of the two villages be equal?
(a) 9 (b) 11
(c) 13 (d) 16
[Based on MAT, 2004]
- Ram and Mohan are friends. Each has some money. If Ram gives ₹30 to Mohan, then Mohan will have twice the money left with Ram. But, If Mohan gives ₹10 to Ram, then Ram will have thrice as much as is left with Mohan. How much money does each have?
(a) ₹62, ₹34 (b) ₹6, ₹2
(c) ₹170, ₹124 (d) ₹43, ₹26
[Based on MAT, 2003]
- In an examination, a student attempted 15 questions correctly and secured 40 marks. If there were two types of questions (2 marks and 4 marks questions), how many questions of 2 marks did he attempt correctly?
(a) 5 (b) 10
(c) 20 (d) 40
[Based on MAT, 2003]
- In a zoo, there are rabbits and pigeons. If their heads are counted, these are 90 while their legs are 224. Find the number of pigeons in the zoo.
(a) 70 (b) 68
(c) 72 (d) 22
[Based on MAT, 2001]
- At the first stop on his route, a driver unloaded $\frac{2}{5}$ of the packages in his van. After he unloaded another three packages at his next stop, $\frac{1}{2}$ of the original number of packages remained. How many packages were in the van before the first delivery?
(a) 25 (b) 10
(c) 30 (d) 36
[Based on MAT, 2008]
- There are two solutions of sulphuric acid in water. The first is 40% strong and the second is 60% strong. The two solutions are mixed, 5 kg of pure water added and a 20% solution is obtained. If instead, 5 kg of an 80% solution is added, a 70% solution is obtained, how much of the 40% solution and 60% solution were there initially?
(a) 2 kg; 1 kg (b) 1 kg; 1 kg
(c) 2 kg; 3 kg (d) 1 kg; 2 kg
- There are 190 chairs, they are to be arranged in rectangular manner. Initially, when the chairs are arranged 5 more chairs are needed. When number of rows is increased by 2, 35 more chairs are needed, how many rows were there initially?
(a) 17 (b) 13
(c) 15 (d) None of these
- Neha buys 5 kg of rice and 7 kg of dal for ₹339 and Mani buys 5 kg of dal and 7 kg of rice for ₹321. Find the cost of rice and dal in ₹ per kg.
(a) 23, 32 (b) 11, 44
(c) 17, 38 (d) Data insufficient
- The students present in an auditorium are asked to stand in rows. If there were 4 students extra in a row there would be 4 less rows. However, if 2 students were less in a row, there would be 4 more rows. The number of students present in the auditorium is:
(a) 80 (b) 96
(c) 100 (d) 128
[Based on MAT (Feb), 2010]
- The fuel indicator in a car shows one-fifth of the fuel tank as full. When 22 more litres of fuel are poured into the tank, the indicator rests at the three-fourths of the full mark. Find the capacity of the fuel tank.
(a) 25 litres (b) 35 litres
(c) 30 litres (d) 40 litres
[Based on MAT (Dec), 2008]
- The highest score in an innings was two-ninths of the total score and the next highest was two-ninths of the remainder. These scores differ by 8 runs. What was the total score in the innings?
(a) 152 (b) 162
(c) 142 (d) 132
[Based on MAT (May), 2008]
- At the first stop on his route, a driver unloaded $\frac{2}{5}$ of the packages in his van. After he unloaded another three packages at his next stop, half of the original number of packages remained. How many packages were in the van before the first delivery?
(a) 25 (b) 10
(c) 30 (d) 36
[Based on MAT (Feb), 2008]
- The present population of a village is 5500. If the number of males increases by 11% and the number of females

increases by 20% then the population will become 6330. What is the present population of females in the village?

- (a) 3000 (b) 3500
(c) 2500 (d) 2000

[Based on MAT (Feb), 2011]

14. Postcard costing 30 paise each and inland letters costing ₹1.50 each were purchased for ₹66. Total number of postcards and inland letters purchased was 60. If the number of postcards and inland letters is interchanged, then the cost is:

- (a) ₹42 (b) ₹30
(c) ₹21 (d) ₹60

[Based on MAT (Feb), 2011]

15. A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Sanchit paid ₹45 for a book kept for 7 days, while Karan paid ₹25 for the book he kept for 5 days. The fixed charge and the charge for each extra day is:

- (a) ₹5 and ₹10 (b) ₹10 and ₹5
(c) ₹15 and ₹5 (d) ₹5 and ₹15

[Based on MAT (Feb), 2011]

16. There are two examination rooms A and B. If 10 candidates are sent from A to B, the number of students in each room is the same. If 20 candidates are sent from B to A, the number of students in A is double the number of students in B. How many students are there in rooms A and B respectively?

- (a) 100 and 80 (b) 120 and 60
(c) 80 and 100 (d) 140 and 60

[Based on MAT (Dec), 2010 (May), 1999]

17. The basic one-way railway fare for a child aged between 3 and 10 years costs half the regular fare for an adult plus a reservation charge that is the same on the child's ticket as on the adult's ticket. One reserved ticket for an adult costs ₹216 and the cost of a reserved ticket for an adult and a child (aged between 3 and 10) costs ₹327. What is the basic fare for the journey for an adult?

- (a) ₹210 (b) ₹52.50
(c) ₹111 (d) ₹58.50

[Based on MAT (May), 2010]

18. One-fourth of Nikhil's money is equal to one-sixth of Yogesh's money. If both together have ₹600, what is the difference between their amounts?

- (a) ₹160 (b) ₹240
(c) ₹200 (d) ₹120

[Based on MAT (Feb), 2010]

19. The electricity bill of a certain establishment is partly fixed and partly varies as the number of units of electricity consumed. When in a certain month 540 units are consumed, the bill is ₹1800. In another month, 620 units are consumed and the bill is ₹2040. In

yet another month, 500 units are consumed. The bill for that month would be:

- (a) ₹1560 (b) ₹1680
(c) ₹1840 (d) ₹1950

[Based on MAT (Sept), 2009]

20. Krishan has some hens and some cows. If the total number of animal heads are 59 and the total number of feet are 190, how many cows Krishan has?

- (a) 36 (b) 32
(c) 23 (d) Cannot be determined

[Based on MAT (May), 2009 (Feb), 2006]

21. The cost of 3 chairs and 10 tables is ₹9856. What is the cost of 6 chairs and 20 tables?

- (a) ₹17227 (b) ₹19712
(c) ₹19172 (d) Cannot be determined

[Based on MAT (May), 2009]

22. A manufacturer of a certain item can sell all he can produce at the selling price of ₹60 each. It costs him ₹40 in materials and labour to produce each item and he has overhead expenses of ₹3000 per week in order to operate that plant. The number of units he should produce and sell in order to make a profit of at least ₹1000 per week is:

- (a) 300 (b) 400
(c) 250 (d) 200

[Based on MAT (Feb), 2009]

23. A lamp post has half of its length in mud, $\frac{1}{3}$ of its length in water and $3\frac{1}{3}$ m above the water. Find the total length of the post.

- (a) 20 m (b) 15 m
(c) 25 m (d) 30 m

[Based on MAT (Feb), 2009]

24. There were 35 students in a hostel. If the number of students increases by 7, the expenses of the mess increase by ₹42 per day while the average expenditure per head diminishes by ₹1. Find the original expenditure of the mess.

- (a) ₹480 (b) ₹520
(c) ₹420 (d) ₹460

[Based on MAT (Dec), 2008]

25. A group consisting of 25 teachers, 20 engineers, 18 doctors and 12 salesmen visited a fair spent ₹1330 altogether. It was found that 5 teachers spent as much as 4 engineers; 12 engineers spent as much as 9 doctors and 6 doctors spent as much as 8 salesmen. If every person in a professional group spent the same amount, the amount spent by each engineer is:

- (a) ₹18 (b) ₹17.50
(c) ₹14 (d) ₹21

[Based on MAT (Sept), 2008]

26. In a family, each daughter has the same number of brothers as she has sisters and each son has twice as many sisters as he has brothers. How many sons are there in the family?

- (a) 4
(c) 2

- (b) 3
(d) 5

[Based on MAT (Sept), 2008]

27. In a triangle ABC , $\angle A = x^\circ$, $\angle B = y^\circ$ and $\angle C = (y + 20)^\circ$. If $4x - y = 10$, then the triangle is:

- (a) Right angled (b) Obtuse angled
(c) Equilateral (d) None of these

28. A body of 7300 troops is formed of 4 battalions so that half of the first, two-thirds of the second, three-fourths of the third and four-fifths of the fourth are all composed of the same number of men. Find the same number.

- (a) 1250 (b) 1200
(c) 1300 (d) 1350

[Based on MAT (May), 2008]

29. A farmer has decided to build a wire fence along one straight side of his property. For this, he planned to place several fence-posts at 6 m intervals, with posts fixed at both ends of the side. After he bought the posts and wire, he found that the number of posts he had bought was 5 less than required. However, he discovered that the number of posts he had bought would be just sufficient if he spaced them 8 m apart. What is the length of the side of his property and how many posts did he buy?

- (a) 100 m, 15 (b) 100 m, 16
(c) 120 m, 15 (d) 120 m, 16

[Based on MAT (Dec), 2006]

30. A part of monthly expenses of a family is constant and the remaining varies with the price of wheat. When the rate of wheat is ₹250 a quintal, the total monthly expenses of the family are ₹1000 and when it is ₹240 a quintal, the total monthly expenses are ₹980. Find the total monthly expenses of the family when the cost of wheat is ₹350 a quintal.

- (a) ₹1000 (b) ₹1400
(c) ₹1200 (d) ₹800

[Based on MAT (May), 2006]

31. A company received two shipments of ball bearings. In the first shipment, 1% of the ball bearings were defective. In the second shipment, which was twice as large as the first, 4.5% of the ball bearings were defective. If the company received a total of 100 defective ball bearings, how many ball bearings were there in the first shipment?

- (a) 990 (b) 2000
(c) 1000 (d) 3000

[Based on MAT (May), 2006]

32. Two audio cassettes and three video cassettes cost ₹425, and three audio cassettes and two video cassettes cost ₹350. The price of a video cassette is:

- (a) ₹150 (b) ₹120
(c) ₹110 (d) ₹115

[Based on MAT, 1998]

33. In a group of buffaloes and ducks, the number of legs are 24 more than twice the number of heads. What is the number of buffaloes in the group?

- (a) 6
(c) 8

- (b) 12
(d) None of these

[Based on MAT, 1999]

34. In a certain party, there was a bowl of rice for every two guests, a bowl of broth for every three of them and a bowl of meat for every four of them. If in all, there were 65 bowls of food, then how many guests were there in the party?

- (a) 65 (b) 24
(c) 60 (d) 48

[Based on MAT, 1999]

35. The sum of the two digits of a number is 15. If 9 be added to the number, then the digits are reversed. The number is:

- (a) 96 (b) 87
(c) 78 (d) 69

[Based on MAT, 1999]

36. There are two examination rooms A and B . If 10 candidates are sent from room A to room B , the number of candidates in each room is the same, while if 20 are sent from room B to room A , the number in room A becomes double the number in room B . The number of candidates in each room are respectively:

- (a) 80 and 100 (b) 100 and 80
(c) 80 and 120 (d) 100 and 60

[Based on MAT, 1999]

37. If two mixers and one TV cost ₹7,000, while two TVs and one mixer cost ₹9,800, the value of one TV is:

- (a) ₹2,800 (b) ₹2,100
(c) ₹4,200 (d) ₹4,800

[Based on MAT, 2000]

38. The prices of a scooter and a television set are in the ratio 3:2. If a scooter costs ₹6,000 more than the television set, the price of the television set is:

- (a) ₹6,000 (b) ₹10,000
(c) ₹12,000 (d) ₹18,000

[Based on MAT, 2000]

39. Shyam had 85 currency notes in all, some of which were of ₹100 denomination and the remaining of ₹50 denomination. The total amount of all these currency notes was ₹5000. How much amount in rupees did he have in the denomination of ₹50?

- (a) 3,500 (b) 70
(c) 15 (d) 1,500

40. The difference between a two-digit number and the number obtained by interchanging the two digits of the number is 9. What is the difference between the two digits of the number?

- (a) 3 (b) 2
(c) 1 (d) Cannot be determined

[Based on NABARD Bank PO, 2009]

41. Sushil planned to drive a distance of x Km. After driving 120 Km, Sushil stopped for petrol. What fractional part of the trip had Sushil covered when he stopped?

(a) $x/120$ (b) $x/(x+120)$
(c) $1/(x+120)$ (d) None of these

42. The electricity bill of a certain establishment is partly fixed and partly varies with the number of units of electricity consumed. When in a certain month 540 units are consumed, the bill is ₹1800. In another month, 620 units are consumed and the bill is ₹2040. In yet another month 500 units are consumed. The bill for that month would be:

(a) ₹1680 (b) ₹1560
(c) ₹184 (d) ₹1950

[Based on MAT, 2013]

43. Two trains, 330 and 110 m long, are going in the same direction. The faster train takes one minute to pass the other completely. If they are moving in opposite directions, they pass each other completely in 3 seconds. What is the speed of the faster train?

(a) 42 m/s (b) 38 m/s
(c) 46 m/s (d) 50 m/s

[Based on MAT, 2013]

44. In a zoo, there are healthy deers and ducks. If the heads are counted, there are 180, while the legs are 448. What will be the number of deers in the zoo?

(a) 156 (b) 68
(c) 22 (d) 44

[Based on MAT, 2014]

45. A bus starts from city X. The number of women in the bus is half of the number of men. In city Y, 10 men leave the bus and five women enter. Now the number of men and women is equal. In the beginning, how many passengers entered the bus?

(a) 15 (b) 30
(c) 36 (d) 45

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46. A teacher noticed a strange distribution of marks in the exam. There were only three distinct scores : 6, 8 and 20. The mode of the distribution was 8. The sum of the scores of all the students was 504. The number of students in the in most populated category was equal to the sum of the number of students with lowest score and twice the number of students with the highest score. The total number of students in the class was:

(a) 50 (b) 51
(c) 53 (d) 57

[Based on XAT, 2014]

DIFFICULTY LEVEL-2 (BASED ON MEMORY)

1. Which one of the following conditions must p , q and r satisfy so that the following system of linear simultaneous equations has at least one solution, such that $p + q + r \neq 0$?

$$x + 2y - 3z = p$$

$$2x + 5y - 11z = q$$

$$x - 2y + 7z = r$$

(a) $5p - 2q - r = 0$ (b) $5p + 2q + r = 0$
(c) $5q + 2q - r = 0$ (d) $5q - 2q + r = 0$

[Based on CAT, 2003]

2. A leather factory produces two kinds of bags, standard and deluxe. The profit margin is ₹20 on a standard bag and ₹30 on a deluxe bag. Every bag must be processed on machine A and on machine B. The processing times per bag on the two machines are as follows:

Time required (Hours/bag)

	Machine A	Machine B
Standard Bag	4	6
Deluxe Bag	5	10

The total time available on machine A is 700 hours and on machine B is 1250 hrs. Among the following production

plans, which one meets the machine availability constraints and maximises the profit?

(a) Standard 75 bags, Deluxe 80 bags
(b) Standard 100 bags, Deluxe 60 bags
(c) Standard 50 bags, Deluxe 100 bags
(d) Standard 60 bags, Deluxe 90 bags

[Based on CAT, 2003]

3. If x and y are integers then the equation:

$$5x + 19y = 64 \text{ has}$$

(a) No solution for $x < 300$ and $y < 0$
(b) No solution for $x > 250$ and $y > -100$
(c) A solution for $250 < x < 300$
(d) A solution for $-59 < y < -56$

[Based on CAT, 2004]

4. If the demand for fertilizer product is given by $p + 5q = 21$ and the supply is determined by $p - 2q = 7$, where p and q denote the price of the commodity and q is the number of units of fertilizer product supplied. If a man wants to buy q units of fertilizer product, then the amount paid by him is:

(a) ₹22 (b) ₹30
(c) ₹32 (d) ₹24

5. The quantity of fat in a kilogram of food A plus the quantity of protein in a kilogram of food A is 100 g. The quantity of protein in a kilogram of food A minus twice the quantity of fat in a kilogram of food A is 10 g. How many grams of protein are there in a kilogram of food A ?

(a) 30 (b) 45
(c) 50 (d) 70

6. Shyam had 85 currency notes in all, some of which were of ₹100 denomination and the remaining of ₹50 denomination. The total amount of all these currency notes was ₹5000. How much amount in rupees did he have in the denomination of ₹50?

(a) 3500 (b) 70
(c) 15 (d) 1500

7. A florist was asked to make a bouquet worth exactly ₹1000 with 100 sticks of roses of three colours— Pink, Yellow and Red. While Pink roses cost Re 0.50 a stick, Red roses cost ₹10.00 per stick and Yellow roses cost ₹50.00 per stick. How many Red roses did the florist use in the bouquet?

(a) 1
(b) 5
(c) 80
(d) Several combinations are possible

[Based on FMS (Delhi), 2004]

8. A lady went to the market with a few one-rupee notes and a few 20-paise coins. When she returned, she had as many one-rupee notes as she originally had 20-paise coins and vice versa. She actually came back with about one-third of what she had gone with. How much did she spend in the market?

(a) ₹14.40 (b) ₹14.70
(c) ₹15.50 (d) ₹17.40

[Based on FMS (Delhi), 2004]

9. A student was asked to divide a number by $17/8$. Instead, he actually multiplied it by $17/8$ and hence got 225 more than the expected answer. What was the expected answer?

(a) 126 (b) 136
(c) 64 (d) None of these

[Based on IIT Joint Man. Ent. Test, 2004]

10. A tells B "If you give me ₹400, then I shall have 25% more than what you have". B tells A , "If you give me ₹200, then I shall have three-and-a-half times as much as you have." How much does B have?

(a) ₹1200 (b) ₹900
(c) ₹800 (d) ₹1600

[Based on IIT Joint Man. Ent. Test, 2004]

11. In theater when price is ₹ x per ticket for a show then only 60% of theater gets filled. But when its price is reduced by $\frac{y}{100}$, then whole theater gets filled and the revenue increased by 10%. Then y in terms of x is:

(a) $\frac{34}{100x}$ (b) $34x$

(c) $x \left(1 - \frac{34}{100x} \right)$ (d) $44x$

12. A woman sells to the first customer half her stock and half an apple, to the second customer she sells half her remaining stock and half an apple, and so on to the third, and to a fourth customer. She finds that she has now 15 apples left. How many apples did she have before she started selling?

(a) 63 (b) 127
(c) 240 (d) None of these

[Based on Narsee Manjee Inst. of Man. Studies, 2003]

13. The equations $3x - 4y = 5$ and $12x - 16y = 20$ have:

(a) No common solution
(b) Exactly one common solution
(c) Exactly two common solutions
(d) More than two common solutions

[Based on FMS (Delhi), 2003]

14. There are two examination halls, P and Q . If 10 students are sent from P to Q , then the number of students in each hall is the same. If 20 students are sent from Q to P , then the number of students in P is double of that in Q . The number of students in halls P and Q respectively are:

(a) 100, 80 (b) 80, 60
(c) 70, 50 (d) 60, 40

[Based on FMS (Delhi), 2003]

15. To a proper fraction, when six is added to the numerator and the denominator is increased by 50%, the ratio becomes half and when the numerator is multiplied by 4 and denominator is reduced by 8, then the fraction becomes 3. The fraction (simplified) is:

(a) $\frac{1}{3}$ (b) $\frac{15}{28}$
(c) $\frac{33}{52}$ (d) Cannot be determined

16. There are two numbers, such that they form the first and the last numbers of three numbers in an A.P. as well as that of three numbers in a G.P. Their sum is 10 while the difference between the square of middle number in A.P. and that in G.P. is 1. Find the numbers.

(a) 2, 8 (b) 3, 7
(c) 4, 6 (d) 5, 5

17. A confused bank teller transposed the rupees and paise when he cashed a cheque for Shailaja, giving her rupees instead of paise and paise instead of rupees. After buying a toffee for 50 paise, Shailaja noticed that she was left with exactly three times as much as the amount of the

cheque. Which of the following is a valid statement about the cheque amount?

- (a) Over rupees 22 but less than rupees 23
- (b) Over rupees 18 but less than rupees 19
- (c) Over rupees 4 but less than rupees 5
- (d) Over rupees 13 but less than rupees 14

[Based on CAT, 2007]

18. The pair of equations $3^{x+y} = 81$; $81^{x-y} = 3$ has:

- (a) No solution
- (b) The solution $x = 2\frac{1}{2}$, $y = 1\frac{7}{8}$
- (c) The solution $x = 2$, $y = 2$
- (d) The solution $x = 2\frac{1}{8}$, $y = 1\frac{7}{8}$

19. Given $x = a$, $y = b$ and $z = c$ ($a, b, c \neq 0$) satisfy the following system of linear equations

$$\begin{aligned}x - y + z &= 0 \\x - 2y + 3z &= 0 \\2x - 3y + 4z &= 0\end{aligned}$$

Which of the following relations is valid?

- (a) $a:b:c :: 2:1:1$
- (b) $a:b:c :: 1:1:2$
- (c) $a:b:c :: 1:2:1$
- (d) $a:b:c :: 1:2:2$

20. The charge for sending a telegram is constant for the first 10 or less words and an amount proportional to the number of words exceeding 10. If the charge for sending a 15 words telegram is ₹3 and that for a 20 words is ₹4.25, how much it cost to send a 35 words telegram?

- (a) ₹7
- (b) ₹7.25
- (c) ₹8
- (d) ₹7.75

21. Find the value of x and y , if $\frac{5x}{8} + \frac{7y}{18} = 6$ and

$$2(x - y) = -10.$$

- (a) 4, 9
- (b) 5, 7
- (c) 3, 12
- (d) 10, 4

22. If the numerator and the denominator of a fraction are each increased by 4, the fraction becomes $\frac{2}{1}$ and when numerator and denominator of the same fraction are each decreased by 6, the fraction becomes $\frac{12}{1}$. The sum of the numerator and the denominator is:

- (a) 11
- (b) -11
- (c) 25
- (d) -25

23. There is a *chaat* shop in a colony. Manu had 2 plates of *gol gappas*, 5 plates of *tikki* and 4 plates of *paapdi*. His bill amount was ₹80. Tanu had 4 plates of *gol gappas*, 3 plates of *tikki* and 1 plate of *paapdi*. His bill amount was ₹62. Ram had just one plate of *tikki* and one plate of *pappdi*. How much was the bill amount of Ram?

- (a) ₹14
- (b) ₹18
- (c) ₹20
- (d) None of these

24. Sum of two-third of a number and three-fourth of another number is equal to 23. Also sum of one-fourth of the first and one-fifth of the second number is 7. Find the greater of the two numbers.

- (a) 12
- (b) 16
- (c) 20
- (d) 24

25. A leather factory produces two kinds of bags, standard and deluxe. The profit margin is ₹20 on a standard bag and ₹30 on a deluxe bag. Every bag must be processed on machine A and on machine B. The processing times per bag on the two machines are as follows:

	Machine A	Machine B
Standard Bag	4	6
Deluxe Bag	5	10

The total time available on machine A is 700 hours and on machine B is 1250 hours. Among the following production plans, which one meets the machine availability constraints and maximizes the profit?

- (a) Standard 75 bags, Deluxe 80 bags
- (b) Standard 100 bags, Deluxe 60 bags
- (c) Standard 50 bags, Deluxe 100 bags
- (d) Standard 60 bags, Deluxe 90 bags

26. How can the relationship between x and y be best defined, if values of x and y are as follows?

x	2	3	4	5	6
y	0	2	6	12	20

- (a) $y = 2x - 4$
- (b) $y = x^2 - 3x + 2$
- (c) $y = x^2 - 4x$
- (d) $y = x^2 - 4$

27. A man buys a certain quantity of apples, mangoes and bananas. If the mangoes were to cost the same as apples, he would have to forgo the bananas to buy the same number of mangoes as he had bought earlier (for the same total amount). The amount spent by him on mangoes and bananas together is 50% more than the amount spent on apples. The total amount spent in the transaction is ₹140. The number of mangoes bought is the same as the number of bananas. If he wishes to buy the same number of apples as well how much additional amount would have to be spent by him?

- (a) 56
- (b) 140
- (c) 28
- (d) 42

28. In a certain party, there was a bowl of rice for every two guests, a bowl of broth for every three of them and a bowl of meat for every four of them. If in all there were 65 bowls of food, then how many guests were there in the party?

- (a) 65
- (b) 24
- (c) 60
- (d) 48

29. A person buys 18 local tickets for ₹110. Each first class ticket costs ₹10 and each second class ticket costs ₹3. What will another lot of 18 tickets in which the number of first class and second class tickets are interchanged cost?

(a) 112 (b) 118
(c) 121 (d) 124

[Based on SNAP, 2008]

30. A sum of ₹312 was divided among 100 boys and girls in such a way that each boys gets ₹3.60 and each girls gets ₹2.40. The number of girls is:

(a) 40 (b) 60
(c) 35 (d) 65

[Based on FMS (MS), 2006]

31. The solution of the equations $\frac{3x - y + 1}{3} = \frac{2x + y + 2}{5} =$

$\frac{3x + 2y + 1}{6}$ is given by:

(a) $x = 2, y = 1$ (b) $x = 1, y = 1$
(c) $x = -1, y = -1$ (d) $x = 1, y = 2$

[Based on FMS, 2005]

32. The condition for which the system of equations $kx - y = 2$ and $6x - 2y =$ has a unique solution, if:

(a) $k = 3$ (b) $k \neq 3$
(c) $k \neq 0$ (d) $k = 0$

[Based on FMS, 2006]

33. Given, $2^x = 8^{y+1}$ and $9^y = 3^{x-9}$; the value of $x + y$ is:

(a) 18 (b) 21
(c) 24 (d) 27

[Based on FMS, 2010]

34. Two numbers are such that their difference, their sum, and their product are to one another as 1:7:24. The product of the two numbers is:

(a) 6 (b) 12
(c) 24 (d) 48

[Based on FMS, 2010]

35. Thirty-one magazines are arranged from left to right in order of increasing prices. The price of each magazine differs by ₹2 from that of each adjacent magazine. For the price of the magazine at the extreme right a customer can buy the middle magazine and an adjacent one. Then:

(a) The adjacent magazine referred to is at the left of the middle magazine.
(b) The middle magazine sells for ₹36.
(c) The most expensive magazine sells for ₹64
(d) None of the above is correct

[Based on FMS, 2010]

36. In a group of cows and chickens, the number of legs was 14 more than twice the number of heads. The number of cows was:

(a) 5 (b) 7
(c) 10 (d) 12

[Based on FMS, 2011]

37. A boy read three-eighths of a book on one day and four-fifths of the remainder on another day. If there were 30 pages unread, how many pages did the book contain?

(a) 600 (b) 300
(c) 240 (d) None of these

[Based on XAT, 2006]

38. A lady went to the market with a few one-rupee notes and a few 20-paise coins. When she returned, she had as many one-rupee notes as she originally had 20-paise coins and vice versa. She actually came back with about one-third of what she had gone with. How much did she spend in the market?

(a) ₹14.40 (b) ₹14.70
(c) ₹15.50 (d) ₹17.40

39. A brokerage house offers 3 stock portfolios. Portfolio I consists of 2 blocks of common stock and 1 municipal bond. Portfolio II consists of 4 blocks of common stock, 2 municipal bonds and 3 blocks of preferred stock. Portfolio III consists of 2 blocks of common stock, 2 municipal bond and 3 blocks of preferred stock. A customer wants 12 blocks of common stock, 6 municipal bonds and 6 preferred stocks. How many portfolio III should be offered?

(a) 1 (b) 2
(c) 3 (d) None of these

[Based on XAT, 2007]

40. Consider the system of linear equations

$$2x + 3y + 4z = 16$$

$$4x + 4y + 5z = 26$$

$$ax + by + cz = r$$

For $r = 5$ and $a = 1$ then the system of linear equation will have infinite number of solutions, if $c =$

(a) $3/2$ (b) 1
(c) $1/2$ (d) 0

[Based on XAT, 2007]

41. In an examination there are 30 questions. 1 mark is given for each correct answer and 0.25 is deducted for every incorrect answer. Ankur attempted all the questions and scored 13.75. How many incorrect answers did he have?

(a) 10 (b) 11
(c) 12 (d) None of these

[Based on XAT, 2009]

42. A manufacturer produces two types of products—A and B, which are subjected to two types operations, viz, grinding and polishing. Each unit of product A takes 2 hrs of grinding and 3 hrs polishing whereas product B takes 3 hrs of grinding and 2 hrs of polishing. The manufacturer

has 10 grinders and 15 polishers. Each grinder operates for 12 hrs/day and each polisher 10 hrs/day. The profit margin per unit of A and B are ₹5 and ₹7, respectively. If the manufacturer utilises all his resources for producing these two types of items, what is the maximum profit that the manufacture can earn?

- (a) ₹280 (b) ₹294
(c) ₹515 (d) ₹550

[Based on XAT, 2010]

43. Which one of the following conditions must a , b and c satisfy so that the following system of linear simultaneous equations has at least one solution, such that:

$$a + b + c \neq 0$$

$$m + 2n - 3r = a$$

$$2m + 6n - 11r = b$$

$$m - 2n + 7r = c$$

- (a) $5a + 2b + c = 0$ (b) $5a + 2b - c = 0$
(c) $5a - 2b - c = 0$ (d) $5a - 2b + c = 0$

[Based on JMET, 2011]

44. A tells B 'If you give me ₹400, then I shall have 25% more than what you have'. B tells A , 'If you give me ₹200, then I shall have three-and-a-half times as much as you have.' How much does B have?

- (a) ₹1,200 (b) ₹900
(c) ₹800 (d) ₹1,600

45. In a family of husband, wife and a daughter, the sum of the husband's age, twice the wife's age and thrice the daughters age is 85; while the sum of twice the husband's age, four times the wife's age and six times the daughter's age is 170. It is also given that the sum of five times the husband's age, ten times the wife's age and fifteen times the daughter's age equals 450. The number of possible solutions, in terms of the ages of the husband, wife and the daughter, to this problem is:

- (a) 0 (b) 1
(c) 2 (d) Infinitely many

[Based on JMET, 2006]

46. Nikhil's mother asks him to buy 100 pieces of sweets worth ₹100%. The sweet shop has 3 kinds of sweets, *kajubarfi*, *gulabjamun* and *sandesh*. *Kajubarfi* costs ₹10 per piece, *gulabjamun* costs ₹3 per piece and *sandesh* costs 50 paise per piece. If Nikhil decides to buy at least one sweet of each type, how many *gulabjamuns* should he buy?

- (a) 1 (b) 2
(c) 3 (d) 4

[Based on XAT, 2012]

47. How many five digit positive integers that are divisible by 3 can be formed using digits 0, 1, 2, 3, 4 and 5, without any of the digits getting repeating?

- (a) 15 (b) 96
(c) 216 (d) 120

[Based on CAT, 2010]

48. Anita had to do a multiplication. Instead of taking 35 as one of the multipliers, she took 53. As a result, the product went up by 540. What is the new product?

- (a) 1050 (b) 540
(c) 1040 (d) 1590

[Based on CAT, 2001]

49. In a four-digit number, the sum of the first two digits is equal to that of the last two digits. The sum of the first and last digits is equal to the third digit. Finally, the sum of second and fourth digits is twice the sum of the other two digits. What is the third digit of the number:

- (a) 5 (b) 8
(c) 1 (d) 4

[Based on CAT, 2001]

50. P , Q and R are three consecutive odd numbers in ascending order. If the value of three times P is 3 less than two times R , find the value of R :

- (a) 5 (b) 7
(c) 9 (d) 11

[Based on CAT, 1997]

51. A student instead of finding the value of $\frac{7}{8}$ of the number, found the value of $\frac{7}{18}$ of the number. If his answer differed from the actual one by 770, find the number.

- (a) 1584 (b) 2520
(c) 1728 (d) 1656

[Based on CAT, 1997]

52. Two positive integers differ by 4 and sum of their reciprocals is $\frac{10}{21}$. Then, one of the numbers is:

- (a) 3 (b) 1
(c) 5 (d) 21

[Based on CAT, 1995]

53. A shop stores x kg of rice. The first customer buys half of this amount plus half a kg of rice. The second customer buys half of the remaining amount plus half a kg of rice. Then, the third customer also buys half of the remaining amount plus half a kg of rice. Thereafter, no rice is left in the shop. Which of the following best describes the value of x ?

- (a) $2 \leq x \leq 6$ (b) $5 \leq x \leq 8$
(c) $9 \leq x \leq 12$ (d) $11 \leq x \leq 14$

[Based on CAT, 2008]

54. A man buys a certain quantity of apples, mangoes and bananas. If the mangoes were to cost as same as apples, he would have to forego the bananas to buy the same number of mangoes as he had bought earlier (for the same total amount). The amount spent by him on mangoes and bananas together is 50% more than the amount spent on apple. The total amount spent in the transaction is ₹140. The number of mangoes bought is the same as the number

of bananas. If he wishes to buy the same number of apples as well how much additional amount would have to be spent by him?

- (a) 56 (b) 140
(c) 28 (d) 42

[Based on 2012]

55. The sum of the possible values of x in the equation $|x + 7| + |x - 8| = 16$ is:

- (a) 0 (b) 1
(c) 2 (d) 3
(e) None of the above

[Based on XAT, 2014]

56. Amitabh picks a random integer between 1 and 999, doubles it and gives the results to Sashi. Each time Sashi gets a number from Amitabh, he adds 50 to the number, and gives the result back to Amitabh, who doubles the number again. The first person, whose result is more than 1000, loses the games. Let 'X' be the smallest initial number that results in a win for Amitabh. The sum of the digits of 'X' is:

- (a) 3 (b) 5
(c) 7 (d) 9
(e) None of these

[Based on XAT, 2014]

Answer Keys

DIFFICULTY LEVEL-1

1. (c) 2. (a) 3. (b) 4. (b) 5. (c) 6. (d) 7. (b) 8. (a) 9. (b) 10. (d) 11. (b) 12. (c) 13. (c)
14. (a) 15. (a) 16. (a) 17. (a) 18. (d) 19. (b) 20. (a) 21. (b) 22. (d) 23. (a) 24. (c) 25. (b) 26. (b)
27. (a) 28. (b) 29. (d) 30. (c) 31. (c) 32. (d) 33. (b) 34. (c) 35. (c) 36. (b) 37. (c) 38. (c) 39. (a)
40. (c) 41. (d) 42. (a) 43. (a) 44. (d) 45. (d) 46. (d)

DIFFICULTY LEVEL-2

1. (a) 2. (b) 3. (c) 4. (a) 5. (d) 6. (a) 7. (a) 8. (a) 9. (b) 10. (a) 11. (b) 12. (d) 13. (d)
14. (a) 15. (d) 16. (c) 17. (c) 18. (d) 19. (c) 20. (c) 21. (a) 22. (c) 23. (a) 24. (c) 25. (a) 26. (b)
27. (c) 28. (c) 29. (d) 30. (a) 31. (b) 32. (b) 33. (d) 34. (d) 35. (a) 36. (b) 37. (c) 38. (a) 39. (d)
40. (c) 41. (d) 42. (b) 43. (c) 44. (a) 45. (a) 46. (a) 47. (c) 48. (d) 49. (a) 50. (c) 51. (a) 52. (a)
53. (b) 54. (c) 55. (b) 56. (c)

Explanatory Answers

DIFFICULTY LEVEL-1

1. (c) Let the population of the two villages A and B will be equal after x years.

$$\begin{aligned}\therefore 6800 - 120x &= 4200 + 80x \\ \Rightarrow 200x &= 2600 \\ \Rightarrow x &= 13.\end{aligned}$$

2. (a) Suppose Mohan has ₹ y and Ram has ₹ x

$$\begin{aligned}\therefore 2(x - 30) &= y + 30 \text{ and } x + 10 = 3(y - 10) \\ \Rightarrow 2x - y &= 90 \text{ and } x - 3y = -40 \\ \Rightarrow 6x - 3y &= 270 \text{ and } x - 3y = -40 \\ \Rightarrow 5x &= 310 \Rightarrow x = 62, y = 34.\end{aligned}$$

3. (b) Suppose number of 2-mark questions = x

$$\begin{aligned}\text{Suppose number of 4-mark questions} &= y \\ x + y &= 15 \Rightarrow x = 10, y = 5.\end{aligned}$$

4. (b) $R + P = 90$ and $4R + 2P = 224$

$$\therefore R = 22, P = 68.$$

5. (c) Suppose there were x packages originally.

$$\begin{aligned}\frac{x}{2} - \frac{2x}{5} = 3 &\Rightarrow \frac{5x - 4x}{10} = 3 \Rightarrow \frac{x}{10} = 3 \\ x &= 30.\end{aligned}$$

6. (d)

Mixture	Sulphuric Acid: Water	Quantity taken out
First 40%	2:3	x kg
Second 60%	3:2	y kg

When mixed, we get 20% strong solution

$$\begin{aligned}\Rightarrow \frac{\frac{2}{5}x + \frac{3}{5}y}{x + y + 5} &= \frac{20}{100} \\ \Rightarrow 2x + 3y &= x + y + 5 \text{ or } x + 2y = 5 \quad (1)\end{aligned}$$

Again on adding 5 kg of 80% solution, we get a 70% solution

$$\begin{aligned}\Rightarrow \frac{\frac{2}{5}x + \frac{3}{5}y + 4}{x + y + 5} &= \frac{70}{100} \\ \Rightarrow 4x + 6y + 40 &= 7x + 7y + 35 \\ \Rightarrow 3x + y &= 5 \quad (2)\end{aligned}$$

From (1) and (2), we get $y = 2$ and $x = 1$

\therefore Quantity of 40% solution = 1 kg and quantity of 60% solution = 2 kg.

7. (b) Let x and y be the number of rows and columns initially.

$$\begin{aligned}\text{Given } xy - 5 &= 190, (x + 2)y = 225 \\ \text{Solving, we get } y &= 15 \text{ and } x = 13.\end{aligned}$$

8. (a) Let cost of rice be ₹ x per kg and cost of dal be y per kg.

$$\therefore 5x + 7y = 339 \quad (1)$$

$$\text{and, } 7x + 5y = 321 \quad (2)$$

Adding Eqs. (1) and (2)

$$12x + 12y = 660 \text{ or } x + y = 55 \quad (3)$$

Subtracting Eqs. (2) from (1)

$$-2x + 12y = 18, y - x = 9 \quad (4)$$

Adding Eqs. (3) and (4) we get

$$2y = 64 \text{ or } y = 32, \therefore x = 23.$$

9. (b) Let there are r rows and x students in each row.

$$(x + 4) \times (r - 4) = x \times r$$

$$\begin{aligned}\Rightarrow x \times r - 4x + 4r - 16 &= x \times r \\ \Rightarrow -4x + 4r &= 16 \quad (1)\end{aligned}$$

$$\text{and, } (x - 2) \times (r + 4) = x \times r$$

$$\begin{aligned}\Rightarrow x \times r + 4x - 2r - 8 &= x \times r \\ \Rightarrow 4x - 2r &= 8 \quad (2)\end{aligned}$$

Adding Eqs. (1) and (2),

$$2r = 24$$

$$\Rightarrow r = 12$$

$$\therefore \text{ From Eq. (2), } 4x - 24 = 8$$

$$\Rightarrow 4x = 32$$

$$\Rightarrow x = 8$$

$$\therefore \text{ Total number of students} = 8 \times 12 = 96.$$

10. (d) Let the capacity of the fuel tank be x litres.

$$\text{Given } \frac{x}{5} + 22 = \frac{3}{4}x$$

$$\therefore \left(\frac{3}{4} - \frac{1}{5}\right)x = 22$$

$$\Rightarrow \frac{11}{20}x = 22$$

$$\Rightarrow x = 40 \text{ litres.}$$

11. (b) Let the total score in the innings be x .

$$\text{Then, highest score} = \frac{2}{9}x$$

$$\text{Next highest score} = \frac{2}{9}\left(x - \frac{2}{9}x\right)$$

$$\therefore \frac{2}{9}x - \frac{2}{9}\left(x - \frac{2}{9}x\right) = 8$$

$$\Rightarrow x - x + \frac{2}{9}x = \frac{8 \times 9}{2}$$

$$\Rightarrow x = \frac{8 \times 9 \times 9}{2 \times 2} = 162.$$

12. (c) Let the total number of packages be x .

$$\therefore \frac{2}{5}x + 3 = \frac{x}{2}$$

$$\Rightarrow \frac{1}{10}x = 3$$

$$\therefore x = 30.$$

13. (c) Let the present population of male and female be x and y respectively.

$$\therefore x + y = 55000 \quad (1)$$

$$\text{and, } \frac{111x}{100} + \frac{120y}{100} = 6330$$

$$\Rightarrow 111x + 120y = 633000 \quad (2)$$

On solving Eqs. (1) and (2), we get

$$y = 2500.$$

14. (a) Let number of postcards and inland letters be x and y respectively.

$$\therefore 0.30x + 1.5y = 66 \quad (1)$$

$$\text{and, } x + y = 60 \quad (2)$$

On solving Eqs. (1) and (2), we get

$$x = 20, y = 40$$

$$\therefore \text{Required cost price} = 0.30 \times 40 + 1.5 \times 20 \\ = 12 + 30 = ₹42.$$

15. (a) Let fix charges of first three days be x and charges of each extra days be ₹ y .

Then,

$$x + 4y = 45 \quad (1)$$

$$\text{and, } x + 2y = 25 \quad (2)$$

Solving Eqs. (1) and (2), we get

$$x = ₹5 \text{ and } y = ₹10.$$

16. (a) Let number of students in rooms A and B be x and y , respectively.

$$\text{Then, } x - 10 = y + 10$$

$$\Rightarrow x = y + 20 \quad (1)$$

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

$$\Rightarrow x = 2y - 60 \quad (2)$$

From Eqs. (1) and (2),

$$y + 20 = 2y - 60$$

$$\Rightarrow y = 80$$

$$\text{and, } x = 100.$$

17. (a) Let the basic fare be ₹ x and reservation charges be ₹ y .

$$\text{Then, } x + y = 216 \quad (1)$$

$$\text{and, } (x + y) + \frac{x}{2} + y = 327$$

$$\Rightarrow \frac{x}{2} + y = 111 \quad (2)$$

From Eqs. (1) and (2),

$$\frac{x}{2} = 105 \Rightarrow x = ₹210.$$

18. (d) Let the Nikhil money = N

Let the Yogesh money = Y

$$\therefore N + Y = 600 \quad (1)$$

$$\text{and, } \frac{N}{4} = \frac{Y}{6} \quad (2)$$

$$\text{From Eq. (2), } N = \frac{2Y}{3}$$

$$\text{From Eq. (1), } \frac{2Y}{3} + Y = 600 \Rightarrow Y = ₹360$$

$$\therefore N = 600 - 360 = ₹240$$

$$\text{So, required difference} = 360 - 240 = ₹120.$$

19. (b) Let per unit cost be ₹ x and fixed cost be ₹ y .

$$540x + y = 1800 \quad (1)$$

$$620x + y = 2040 \quad (2)$$

From Eqs. (1) and (2), $x = ₹3$

$$\text{Then, } y = ₹180$$

$$\therefore 500x + y = 500 \times 3 + 180 = ₹1680.$$

20. (a) A hen has 2 legs while a cow has 4 legs and each animal has one head.

Let he has x number of cows and y number of hens.

$$\text{Then, } x + y = 59 \quad (1)$$

$$\text{and, } 4x + 2y = 190$$

From Eqs. (1) and (2),

$$x = 36.$$

$$21. (b) 3 \text{ Chairs} + 10 \text{ Tables} = ₹9856$$

$$2 \times (3 \text{ Chairs} + 10 \text{ Tables}) = 2 \times 9856$$

$$\Rightarrow 6 \text{ Chairs} + 20 \text{ Tables} = ₹19712.$$

$$22. (d) \text{ Let he should produce atleast } x \text{ units.}$$

$$\text{Then, } (60 - 40)x - 3000 = 1000$$

$$\Rightarrow 20x = 4000$$

$$\therefore x = 200.$$

$$23. (a) \text{ Let the total length of lamp post be } x \text{ m.}$$

$$\therefore x = \frac{x}{2} + \frac{x}{3} + \frac{10}{3}$$

$$\Rightarrow \frac{x}{6} = \frac{10}{3}$$

$$\Rightarrow x = 20 \text{ m.}$$

$$24. (c) \text{ Let the average expenditure per student per day be } ₹x.$$

$$\text{Then, total expenditure per day} = ₹35x$$

$$\text{New total expenditure per day} = ₹(35x + 42)$$

$$\text{New average expenditure} = (x - 1)$$

Given,

$$\frac{35x + 42}{42} = x - 1$$

$$\therefore 35x + 42 = 42x - 42$$

$$\Rightarrow 7x = 42 + 42$$

$$\Rightarrow x = \frac{2 \times 42}{7} = ₹12$$

$$\therefore \text{Original expenditure of mess} = 35 \times 12 = ₹420.$$

$$25. (b) 25T + 20E + 18D + 12S = 1330 \quad (1)$$

$$\text{Given, } 5T = 4E$$

$$\Rightarrow T = \frac{4}{5}E$$

$$12E = 9D$$

$$\Rightarrow D = \frac{12}{9}E$$

$$6D = 8S$$

$$\Rightarrow S = \frac{6}{8}D = \frac{6}{8} \times \frac{12}{9}E = E$$

\therefore From Eq. (1),

$$25 \times \frac{4}{5}E + 20E + 18 \times \frac{12}{9}E + 12E = 1330$$

(2)

$$\therefore 76E = 1330$$

$$\Rightarrow E = ₹17.50.$$

$$26. (b) \text{ Let each son has } 2x \text{ sisters and } x \text{ brothers.}$$

$$\text{Then, the number of sons in the family} = (x + 1)$$

$$\text{And number of daughters} = 2x$$

$$\text{Now given, } (2x - 1) = (x + 1)$$

$$x = 2$$

$$\therefore \text{Number of sons in the family} = 3.$$

$$27. (a) \text{ Given, } x + y + (y + 20) = 180$$

$$\Rightarrow x + 2y = 160 \quad (1)$$

$$\text{and, } 4x - y = 10 \quad (2)$$

$$\text{Solving Eqs. (1) and (2), we get } y = 70, x = 20$$

$$\therefore \text{Angles of the triangle are } 20^\circ, 70^\circ, 90^\circ. \text{ Hence the } \Delta \text{ is right angled.}$$

$$28. (b) \text{ Let 4 battalions be } w, x, y \text{ and } z.$$

$$\frac{1}{2}w = \frac{2}{3}x = \frac{3}{4}y = \frac{4}{5}z$$

$$\therefore x = \frac{3}{4}w, y = \frac{2}{3}w, z = \frac{5}{8}w$$

$$\text{Also, } w + x + y + z = 7300$$

$$\Rightarrow w + \frac{3}{4}w + \frac{2}{3}w + \frac{5}{8}w = 7300$$

$$\Rightarrow \frac{24w + 18w + 16w + 15w}{24} = 7300$$

$$\Rightarrow w = \frac{7300 \times 24}{73} = 2400$$

$$\therefore \text{Same number of men} = \frac{2400}{2} = 1200.$$

$$29. (d) \text{ Let the length of the side of the property be } x \text{ m and } y \text{ be the number of posts bought. When the space between posts is 8 m, the number of posts}$$

$$= \frac{x}{8} + 1 = y \quad (1)$$

$$\text{When the space between posts is 6 m, the number of posts}$$

$$= \frac{x}{6} + 1 - y + 5 \quad (2)$$

$$\text{From Eqs. (1) and (2),}$$

$$\frac{x}{8} - \frac{x}{6} = -5 \Rightarrow \frac{(3-4)x}{24} = -5$$

$$\Rightarrow \frac{-x}{24} = -5$$

$$\Rightarrow x = 120 \text{ m, } y = 16.$$

$$30. (c) \text{ Let constant expenses of the family be } E \text{ and they buy } x \text{ amount of wheat.}$$

$$\text{Then, } E + x \times 250 = 1000$$

$$\text{and, } E + x \times 240 = 980$$

$$\therefore x = 2$$

$$E = 500$$

$$\text{Total expenses} = 500 + 2 \times 350 = ₹1200.$$

31. (c) Let x number of ball bearings were there in first shipment.

$$\text{Then, } x \times \frac{1}{100} + 2x \times \frac{4.5}{100} = 100$$

$$\Rightarrow x = 1000.$$

32. (d) Suppose the prices of audio and video cassettes are ₹ x and ₹ y respectively.

$$2x + 3y = 425 \quad (1)$$

$$\text{and, } 3x + 2y = 350 \quad (2)$$

Multiplying (1) by 3, (2) by 2 and subtracting,

$$5y = 575 \text{ or } y = ₹115.$$

33. (b) Let the no. of buffaloes be x and the no. of ducks be y .

$$\text{Now, total no. of legs} = 4x + 2y$$

$$\text{Total no. of heads} = x + y$$

According to the question,

$$4x + 2y = 2(x + y) + 24$$

$$\text{or, } 4x + 2y = 2x + 2y + 24$$

$$\therefore x = 12.$$

34. (c) Suppose number of rice bowls = R

Suppose number of broth bowls = B

Suppose number of meat bowls = M

$$\therefore R + B + M = 65 \quad (1)$$

Also with respect to guests

$$2R = 3B = 4M \quad (2)$$

From Eqs. (1) and (2),

$$B = 20, R = 30, M = 15$$

\therefore Total number of guests

$$= 2R = 3B = 4M = 60.$$

35. (c) Let the number be $10x + y$.

$$\therefore x + y = 15$$

$$\text{and, } 10x + y + 9 = 10y + x$$

$$\Rightarrow 9x - 9y = -9$$

$$\Rightarrow x - y = -1$$

$$\therefore x = 7, y = 8$$

\therefore The given number is 78.

36. (b) Suppose number of candidates in room $A = x$ and number of candidates in room $B = y$.

$$\therefore x - 10 = y + 10$$

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

$$= x - y = 20$$

$$x - 2y = -60$$

$$\Rightarrow y = 80, x = 100.$$

37. (c) Suppose cost price of one mixer and one TV are respectively ₹ x and ₹ y .

According to the question,

$$2x + y = 7000 \quad (1)$$

$$x + 2y = 9800 \quad (2)$$

Multiplying (2) by 2 and subtracting it from (1),

$$-3y = -12600$$

$$\text{or, } y = ₹4200.$$

38. (c) Suppose price of scooter and television are respectively ₹ $3x$ and ₹ $2x$.

According to the question,

$$3x - 2x = 6000 \text{ or } x = 6000$$

Hence, price of television = ₹ $2x$

$$= ₹2 \times 6000 = ₹12,000.$$

39. (a) Let number of 100 rupee notes be x and number of 50 rupee notes be y .

$$\therefore x + y = 85$$

$$100x + 50y = 5000$$

$$\Rightarrow x = 15, y = 70$$

\therefore The amount that we had in the denomination of ₹50 = $50y = 50 \times 70 = ₹3,500$.

40. (c) Suppose the number is $10x + y$.

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

$$\Rightarrow 9x - 9y = 9$$

\therefore Required difference $x - y = 1$.

41. (d) $\frac{120}{x}$ of the planned distance.

42. (a) Let the fixed amount be ₹ x and varying amount be ₹ y per unit.

We are given,

$$x + 540y = 1800 \quad (1)$$

$$x + 620y = 2040 \quad (2)$$

On solving Eqs. (1) and (2), we get

$$x = 180 \text{ and } y = 3$$

\therefore Amount of bill for 500 units = $180 + 500 \times 3 = ₹1680$.

43. (a) Let the speed of faster train be x m/s and speed of slower train be y m/s.

We are given,

$$\frac{240}{x-y} = 60$$

$$\Rightarrow x - y = 4 \quad (1)$$

$$\text{and, } \frac{240}{x+y} = 3$$

$$\Rightarrow x + y = 42 \quad (2)$$

On solving Eq. (1) and Eq. (2), we get $x = 42$ m/s and $y = 38$ m/s

\therefore Speed of faster train = 42 m/s.

44. (d) Let number of deers = x
and numbers of ducks = y
Total heads counted = 180
 $\therefore x + y = 180 \quad (1)$
Total legs counted = 448
 $\therefore 4x + 2y = 448$
 $\Rightarrow 2x + y = 224 \quad (2)$

On solving Eqs. (1) and (2), we get $x = 44$ and $y = 136$

\therefore Number of deers = $x = 44$.

45. (d) At X , let men = $2x$ and women = x

\therefore At Y , men = $2x - 10$ and women = $x + 5$

But it is given that at Y , Men = Women

$$\Rightarrow 2x - 10 = x + 5 \Rightarrow x = 15$$

\therefore Passengers at $X = 3x = 45$.

46. (d) Let the number of students scoring 6, 8 and 20 be x , y and z respectively.

$$\text{So, } 6x + 8y + 20z = 504$$

$$x + 2z = y$$

$$\text{or, } 7y + 4z = 252$$

By hit and trial we get $y = 32$ and $z = 7$

Therefore, $x = 18$

Therefore, total number of students = $32 + 7 + 18 = 57$.

DIFFICULTY LEVEL-2

1. (a) $x + 2y - 3z = p$

$$2x + 5y - 11z = q$$

$$x - 2y + 7z = r$$

Going through the options, we find that

$$5 \times (1) - 2 \times (2) = (3)$$

Thus, equation in choice (a) is satisfied.

2. (a) Let number of standard and deluxe bags produced by companies be s and d respectively.

$$\text{Profit } P = 20s + 30d$$

we have to find the maximum possible value of P for which it meets the machine availability constraints.

$$4s + 5d = 700 \quad (1)$$

$$6s + 10d = 1250 \quad (2)$$

Solving Eqs. (1) and (2), we get

$$s = 75, d = 80.$$

Aliter: The question can also be answered easily by substitution according to options.

3. (c) $5x + 19y = 64$

$$y = \frac{64 - 5x}{19} \quad (1)$$

In Eq. (1) for every integral value of x , we get the corresponding value of y .

Now go through the options.

(a) is wrong because this is possible that $x < 300$ such that $y < 0$.

(b) is also wrong because if $x > 250$ then y may be greater than -100 .

Putting (d) in $5x + 19y = 64$;

If $-59 < y < -56$ i.e., $y = -58, -57$, then x cannot be an integer.

Hence, (d) is also wrong.

Therefore, (c) is true.

4. (a) Here the equations given are

$$p + 5q = 21 \quad (1)$$

$$\text{and, } p - 2q = 7 \quad (2)$$

By solving the two equations, we get $p = 11$ and $q = 2$.

Since the man wants to buy q units, i.e., 2 units at the rate of p , i.e., 11, so amount paid by him = $11 \times 2 = ₹22$.

5. (d) Assume in a kilogram of food A the quantity of fat be x gram and quantity of protein by y gram, then $x + y = 100$ and $y - 2x = 10$

$$\Rightarrow x = 30 \text{ gram and } y = 70 \text{ gram}$$

Hence, the quantity of fat is 30 gram and the quantity of protein is 70 gram.

6. (a) Let number of 100-rupee notes be x and number of 50-rupee notes be y .

$$\therefore x + y = 85 \Rightarrow x = 15, y = 70$$

\therefore The amount that we had in the denomination of ₹50 = $50y = 50 \times 70 = ₹3500$.

7. (a) $P + R + Y = 100 \quad (1)$

$$0.50P + 10R + 50Y = 1000 \quad (2)$$

From Eq. (1) $R = 100 - (P + Y)$

$$\Rightarrow 0.50P + 10(100 - P - Y) + 50Y = 1000$$

$$\text{or, } 0.50P + 1000 - 10P - 10Y + 50Y = 1000$$

$$\text{or, } 9.5P = 40Y$$

$$\text{or, } \frac{P}{Y} = \frac{40}{9.5} = \frac{80}{19}$$

\therefore The florist should use

$$80 \text{ sticks of Pink} = ₹40$$

$$19 \text{ sticks of Yellow} = ₹950$$

$$1 \text{ stick of Red} = ₹10$$

$$100 \text{ sticks} = ₹1000.$$

8. (a) Originally, the lady had, say, x one-rupee notes and y 20-paise coins

On returning, she had y one-rupee notes and x 20-paise coins

$$\text{The balance was } ₹\frac{1}{3}\left(x + \frac{y}{5}\right)$$

$$\therefore \left(x + \frac{y}{5}\right) - \left(y + \frac{x}{5}\right) = \frac{1}{3}\left(x + \frac{y}{5}\right) \quad (1)$$

$$\Rightarrow \frac{x}{y} = \frac{13}{7}$$

If we take $x = 13$ and $y = 7$, then originally she had ₹14.40 with her

\Rightarrow On returning, she had ₹9.60

\therefore The lady spent ₹4.80 or a multiple of ₹4.80, i.e., ₹14.40, which is alternative (a).

$$9. (b) \quad x \times \frac{17}{8} - \frac{x}{178} = 225 \Rightarrow \frac{17x}{8} - \frac{8x}{17} = 225$$

$$\Rightarrow 225x = 136 \times 225$$

$$\Rightarrow x = 136.$$

10. (a) Let A had ₹ x and B had ₹ y in the beginning.

If B gives, ₹400 to A , then

$$x + 400 = \frac{5}{4}(y - 400)$$

$$\Rightarrow 4x - 5y = -3600 \quad (1)$$

If A gives ₹200 to B , then

$$y + 200 = \frac{7}{2}(x - 200)$$

$$\Rightarrow 7x - 2y = 1800 \quad (2)$$

Solving Eqs. (1) and (2), we get

$$x = 600, y = 1200.$$

11. (b) Let there be 100 seats in the theater then initial revenue = 60x

$$\text{Given, } \left(x - \frac{y}{100}\right)100 = 1.1 \times 60x \Rightarrow y = 34x.$$

12. (d) Suppose she had x apples in the beginning.

$$\text{Sold to the first customer} = \frac{x}{2} + \frac{1}{2} = \frac{x+1}{2}$$

$$\begin{aligned} \text{Sold to the second customer} &= \frac{x+1}{4} + \frac{1}{2} \\ &= \frac{2x+6}{8} = \frac{x+3}{4} \end{aligned}$$

$$\begin{aligned} \text{Sold to the third customer} &= \frac{x+3}{8} + \frac{1}{2} \\ &= \frac{2x+6+8}{16} = \frac{x+7}{8} \end{aligned}$$

$$\begin{aligned} \text{Sold to the fourth customer} &= \frac{x+7}{16} + \frac{1}{2} \\ &= \frac{x+15}{16} \end{aligned}$$

$$\therefore x - \left[\frac{x+1}{2} + \frac{x+3}{4} + \frac{x+7}{8} + \frac{x+15}{16}\right] = 15$$

$$\Rightarrow x - \left[\frac{15x+49}{16}\right] = 15$$

$$\Rightarrow x = 240 + 49 = 289.$$

13. (d) The two lines coincide.

14. (a) Let the number of students in halls P and Q be x and y respectively.

Hall P	Hall Q
x	y
$x - 10$	$y + 10$

$$\therefore x - 10 = y + 10$$

$$\Rightarrow x - y = 20 \quad (1)$$

Hall P	Hall Q
$x + 20$	$y - 20$

$$\therefore x + 20 = 2(y - 20)$$

$$\Rightarrow x - 2y = -60 \quad (2)$$

Solving Eqs. (1) and (2), we get

$$x = 100, y = 80.$$

15. (d) Let the fraction be $\frac{x}{y}$

$$\text{Then, } \frac{x+6}{1.5y} = \frac{1}{2}$$

$$\therefore 2x + 12 = 1.5y \Rightarrow 4x - 3y = -24$$

$$\text{Further, } \frac{x \times 4}{y - 8} = 3$$

$$\Rightarrow 4x = 3y - 24 \text{ or } 4x - 3y = -24$$

But the equations are same, hence the exact answer cannot be determined.

16. (c) Let the 2 numbers be a and b

\therefore The 3 numbers in A.P. are a, A, b and the 3 numbers in G.P. are a, G, b

$$\text{In an A.P., } A = \frac{a+b}{2}$$

$$\text{In a G.P., } G^2 = ab$$

From the first condition, we get

$$a + b = 10, \quad (1)$$

From the second condition, we get

$$A^2 - G^2 = 1$$

$$\therefore \left(\frac{a+b}{2} \right)^2 - ab = 1$$

$$\Rightarrow \frac{a^2 + b^2 + 2ab}{4} - ab = 1$$

$$\Rightarrow a^2 + b^2 + 2ab - 4ab = 4$$

$$\Rightarrow a^2 + b^2 - 2ab = 4$$

$$\therefore (a-b)^2 = 4 \text{ or } a-b = \pm 2$$

If $a-b = 2$, then solving this equation and Eq. (1) simultaneously, we get,

$$a = 6 \text{ and } b = 4$$

If $a-b = -2$, solving this equation and Eq. (1) simultaneously, we get,

$$a = 4 \text{ and } b = 6$$

\therefore The two numbers are 4 and 6.

17. (c) Let the original amount be ₹ x and y paise and into changed amount = ₹ y and x paise

$$3(100x + y) = 100y + x - 50$$

$$y = \frac{299x + 50}{97}$$

By putting the value of x from options we get (2) option is correct.

18. (d) $3^{x+y} = 81$ and $81^{x-y} = 3$

$$\Rightarrow 3^{x+y} = 3^4 \text{ and } 3^{4(x-y)} = 3$$

$$\text{or, } x + y = 4 \text{ and } x - y = \frac{1}{4}$$

$$\text{Solving, we get } x = 2\frac{1}{8}, y = 1\frac{7}{8}$$

19. (c) $x - y + z = 0 \quad (1)$

$$x - 2y + 3z = 0 \quad (2)$$

$$2x - 3y + 4z = 0 \quad (3)$$

From Eq. (1), $x = y - z$. Putting $x = y - z$

$$(y - z) - (y) + 3z = 0$$

$$\Rightarrow y = 2z \quad (4)$$

Putting $x = y - z$ in Eq. (3)

$$2(y - z) - 3y + 4z = 0$$

$$\Rightarrow y = 2z$$

\Rightarrow The system of equations has infinitely many solutions

$$\text{If } y = k, \text{ then } z = \frac{k}{2} \text{ and } x = \frac{k}{2}$$

$$\Rightarrow a:b:c = \frac{k}{2}:\frac{k}{2}:\frac{k}{2}$$

$$\text{or, } a:b:c = 1:1:1$$

20. (c) Let the constant cost be C , the variable cost be K and number of words exceeding 10 be N .

$$\text{The total cost} = C + KN$$

$$\text{Now, } C + 5K = 3 \quad (1)$$

$$\text{and, } C + 10K = 4.25 \quad (2)$$

On solving Eqs. (1) and (2), we get

$$C = 1.75 \text{ and } K = 0.25 \Rightarrow C + 25K = 8.$$

21. (a) We have, $\frac{5x}{8} + \frac{7y}{18} = 6$

$$\Rightarrow 45x + 28y = 432 \quad (1)$$

$$\text{Also, } 2(x - y) = -10$$

$$\Rightarrow 2x - 2y = -10$$

$$\therefore 28x - 28y = -140 \quad (2)$$

Solving Eqs. (1) and (2), we get

$$x = 4 \text{ and } y = 9.$$

22. (c) We have, $(n + 4)/(d + 4) = 2$ and $(n - 6)/(d - 6) = 12$

Solving, $n = 18$ and $d = 7$. Hence, $n + d = 25$.

23. (a) $2g + 5t + 4p = 80 \quad (1)$

$$4g + 3t + 1p = 62 \quad (2)$$

$$\therefore 2 \times (1) - (2) = 7t + 7p = 98$$

$$\text{Hence, } (t + p) = 14.$$

24. (c) Let the two number be x and y

$$\frac{2x}{3} + \frac{3y}{4} = 23; \frac{x}{7} + \frac{y}{5} = 7.$$

25. (a) Let number of standard and deluxe bags produced by companies be s and d respectively

$$\text{Profit } P = 20s + 30d$$

We have to find the maximum possible value of P for which it meets the machine availability constraints

$$4s + 5d = 700 \quad (1)$$

$$6s + 10d = 1250 \quad (2)$$

Solving (1) and (2), we get

$$s = 75, d = 80$$

Aliter: The question can also be answered easily by substitution according to options.

26. (b) Putting $x = 2, 3, 4, 5, 6$ in $y = x^2 - 3x + 2$ we get $y = 0, 2, 6, 12, 20$.

27. (c) Let the man buys x apples, y mangoes and z bananas at the respective price of ₹ A , ₹ M , ₹ B per piece. As it is given that number of mangoes bought is same as number of bananas, hence quantity assumed is same as y . Let the amount spent on apples be ₹ P , then amount spent on mangoes and bananas together is $1.5P$

$$\text{Given, } p + 1.5p = 140$$

$$\Rightarrow 2.5p = 140 \Rightarrow p = 56$$

\therefore Amount spent on apples is ₹56 and amount spent on mangoes and bananas together ₹84

$$\text{Now, } xA = 56, \quad (1)$$

$$yB + yM = 84$$

$$\Rightarrow y(B + M) = 84 \quad (2)$$

Given if mangoes cost the same as apples, no banana can be bought

$$(x + y)A = 140$$

$$xA + yA = 140$$

$$\text{From (1) } yA = 140 - 56 = 84 \quad (3)$$

$$\text{From (2) and (3)}$$

$$yB + yM + yA = 84 + 84 = 168$$

$$y(A + B + M) = 168$$

\therefore Additional amount required to be spent

$$= (168 - 140) = ₹28.$$

28. (c) Let the number of rice bowls be x , number of broth bowls be y

and number of meat bowls be z

$$\therefore x + y + z = 65 \quad (1)$$

$$\text{and, } 2x = 3y = 4z \quad (2)$$

From Eqs. (1) and (2) we get $x = 30, y = 20, z = 15$

Therefore total number of guests

$$= 2R = 3B = 4M = 60.$$

29. (d) Let there are x first class ticket

$$\therefore \text{Total cost} = 10x + (18 - x)3$$

$$\therefore 10x + 54 - 3x = 110$$

$$\Rightarrow 7x = 56$$

$$\Rightarrow x = 8$$

If first class and second class tickets are interchanged, then total cost = $10 \times 10 + 3 \times 8 = 124$.

$$30. (a) \quad x + y = 100 \quad (1)$$

$$3.60x + 2.40y = 312 \quad (2)$$

From Eqs. (1) and (2), we get

$$y = 40.$$

$$31. (b) \quad \frac{3x - y + 1}{3} = \frac{2x + y + 2}{5} = \frac{3x + 2y + 1}{6}$$

By option method, putting the value of $x = 1$ and $y = 1$.

$$32. (b) \quad \therefore \begin{vmatrix} k & -1 \\ 6 & -2 \end{vmatrix} \neq 0 \Rightarrow k \neq 3.$$

$$33. (d) \quad \begin{aligned} 2^x &= 8^{y+1} \\ \Rightarrow 2^x &= (2^3)^{y+1} \\ \Rightarrow x &= 3y + 3 \end{aligned} \quad (1)$$

$$\begin{aligned} 9^y &= 3^{x-9} \\ \Rightarrow (3^2)^y &= 3^{x-9} \\ \Rightarrow 2y &= x - 9 \end{aligned} \quad (2)$$

Solving Eq. (1) and (2) we get,

$$x = 21 \text{ and } y = 6$$

$$\therefore x + y = 21 + 6 = 27.$$

34. (d) Let the numbers be a and b

$$\therefore a - b = x \quad (1)$$

$$\therefore a + b = 7x \quad (2)$$

$$ab = 24x \quad (3)$$

Solving Eqs. (1) and (2) we get,

$$a = 4x \text{ and } b = 3x$$

Substituting the values of a and b in Eq. (3) we get,

$$\therefore ab = 24 \times 2 = 48.$$

35. (a) Let the price of the cheapest magazine, i.e., the one at the extreme left be x .

Difference, between the prices of two adjacent magazines is ₹2

\therefore Price of extreme right or the costliest magazine will be $x + 30 \times 2 = x + 60$

Now, the price of the magazine in middle (the 16th position) = $x + 15 \times 2 = x + 30$

The price of the magazines, adjacent to the one in the middle is $x + 28$ or $x + 32$ depending on whether it is on the left or right of the middle magazine respectively.

$$\text{Suppose } x + 60 = x + 28 + x + 30$$

$$\therefore x + 60 = 2x + 58$$

$$\therefore x = 2$$

$$\text{And if } x + 60 = x + 30 + x + 32$$

$$\therefore 60 = x + 2$$

$\therefore x = -2$ (which is not possible)

So, the adjacent magazine is the one whose price is $x + 28$, i.e., one to the left of the middle magazine.

36. (b) Let the number of cows and chickens = x and y , respectively.

Total number of heads = $x + y$

Total number of legs = $4x + 2y$

Given, $4x + 2y = 2(x + y) + 14$

$$2x = 14 \Rightarrow x = 7$$

So, number of cows = 7.

37. (c) Let total number of pages = x

$$\text{Total read page} = \frac{3x}{8} + \left(x - \frac{3x}{8}\right) \times \frac{4}{5} = \frac{7x}{8}$$

$$\text{Unread remain page} = x - \frac{7x}{8} = \frac{x}{8}$$

$$\therefore \frac{x}{8} = 30$$

$$\Rightarrow x = 240.$$

38. (a) Originally, the lady had, say, x one rupee notes and y 20 paise coins

On returning, she had y one rupee notes and x 20 paise coins

The balance was ₹ $\frac{1}{3}\left(x + \frac{y}{5}\right)$

$$\therefore \left(x + \frac{y}{5}\right) - \left(y + \frac{x}{5}\right) = \frac{1}{3}\left(x + \frac{y}{5}\right) \quad (1)$$

$$\Rightarrow \frac{x}{y} = \frac{13}{7}$$

If we take $x = 13$ and $y = 7$, then originally she had ₹14.40 with her

\Rightarrow On returning, she had ₹9.60

\therefore The lady spent ₹4.80 or a multiple of ₹4.80, i.e., ₹14.40, which is alternative (a).

39. (d) Common Municipal Preferred

I 2 1 $\times x$

II 4 2 3 $\times y$

III 2 2 3 $\times z$

Let customer buy's I, II and III portfolio in number of x , y and z respectively.

$$\therefore 2x + 4y + 2z = 12 \quad (1)$$

$$x + 2y + 2z = 6 \quad (2)$$

$$\text{and, } 3y + 3z = 6 \quad (3)$$

From Eq. (3),

$$y + z = 2$$

From Eq. (2),

$$x + 2(y + z) = 6$$

$$\Rightarrow x = 2$$

From Eqs. (1) and (3)

$$4y + 2z = 8$$

$$y + z = 2 \times 2$$

$$2y = 4 \Rightarrow y = 2$$

Then, $x = 2$, $y = 2$, $z = 0$

\therefore Customer will buy,

2 portfolio-I

2 portfolio-II

0 portfolio-III

40. (c) For $r = 5$ and $a = 1$, the line will have infinite solutions, if it coincides with the other line, which happens when

$$b - \frac{1}{2} = 0 \text{ and } c - \frac{1}{2} = 0, \text{ hence, } c = \frac{1}{2}.$$

41. (d) Let Ankur solved x right questions

$$\therefore \text{His over all score} = x - \frac{(30 - x)}{4}$$

$$\Rightarrow 4x - 30 + x = 13.75 \times 4$$

$$\Rightarrow x = 17$$

\therefore Ankur did 13 wrong questions.

42. (b) Total working time of grinding is 120 hours and of Polishing is 150 hours

Let x no. of items of A has been manufactured and y no. of B have been manufactured.

$$\therefore 2x + 3y = 120$$

$$\therefore 3x + 2y = 150$$

$$\therefore x = 42 \text{ and } y = 12.$$

43. (c) Given that for $a + b + c \neq 0$

$$m + 2n - 3r = a$$

$$2m + 6n - 11r = b$$

$$m - 2n + 7r = c$$

For the above equations to have at least one solution, the equations should not be inconsistent, i.e., the relation between the LHS of three equations must be the same as the RHS of the three equations.

Going from the choices

$$5a = 5m + 10n - 15r, 2b = 4m + 12n - 22r$$

$$\text{and, } c = m - 2n + 7r$$

By observation, we can see that,

$$5a = 2b + c.$$

44. (a) Let A had ₹ x and B had ₹ y in the beginning.

If B gives, ₹400 to A , then

$$x + 400 = \frac{5}{4}(y - 400)$$

$$\Rightarrow 4x - 5y = -3600 \quad (1)$$

If A gives ₹200 to B , then

$$y + 200 = \frac{7}{2}(x - 200)$$

$$\Rightarrow 7x - 2y = 1800 \quad (2)$$

Solving Eqs. (1) and (2), we get

$$x = 600, y = ₹1,200.$$

45. (a) Let the husband's age be x .

Let the wife's age be y .

Let the daughter's age be z .

According to questions,

$$x + 2y + 3z = 85 \quad (1)$$

$$2x + 4y + 6z = 170 \quad (2)$$

$$5x + 10y + 15z = 450 \quad (3)$$

From Eq. (2), $x + 2y + 3z = 85$

From Eq. (3), $x + 2y + 3z = 90$

From Eq. (1), $x + 2y + 3z = 85$

Hence, the above system of equation will give no solution.

46. (a) Let he buys K pieces of *Kajuburfi*, G pieces of *Gulabjamun* and S pieces of *Sandesh*.

$$K + G + S = 100$$

$$\text{and, } 10K + 3G + \frac{S}{2} = 100$$

$$\Rightarrow S = 100 - K - G$$

$$\text{and, } S = 200 - 20K - 6G$$

$$\text{or, } 200 - 20K - 6G = 100 - K - G$$

$$\text{or, } 100 = 19K + 5G$$

$$\text{or, } G = \frac{100 - 19K}{5}$$

$$\Rightarrow K = 5 \text{ and } G = 1$$

$$S = 100 - 5 - 1 = 94$$

47. (c) There are six digits viz, 0, 1, 2, 3, 4 and 5. To form five-digit numbers we need exactly 5 digits. So, we should not be using one of the digits.

The sum of all the digits 0, 1, 2, 3, 4 and 5 is 15. We know that any number is divisible by 3 if and only if the sum of its digits are divisible by 3.

Combining the two criteria that we use only 5 of the 6 digits and pick them in such a way that the sum is divisible by 3, we should not use either 0 or 3 while forming the five digits numbers.

Case 1 If we do not use 0, then the remaining 5 digits can be arranged in $5!$ ways = 120 numbers.

Case 2 If we do not use 3, then the arrangements should take into account that 0 cannot be the first digit as a 5 digit number will not start with 0.

The first digit can be any of the 4 digits 1, 2, 4 or 5.

Then, the remaining 4 digits including 0 can be arranged in the other 4 places in $4!$ ways.

So, there will be $4 \times 4!$ number = $4 \times 24 = 96$ numbers.

Combining Case 1 and 2, there are a total of $120 + 96 = 216$ five-digit numbers divisible by 3 that be formed using the digits 0 to 5.

48. (d) $53x - 35x = 540$

$$\Rightarrow 18x = 540 \text{ or, } x = 30$$

Therefore, new product = $53 \times 30 = 1590$.

49. (a) Let the first, second, third and fourth digits be a, b, c and d , respectively

Then,

$$a + b = c + d \quad (1)$$

$$a + d = c \quad (2)$$

$$b + d = 2(a + c) \quad (3)$$

From Eqs (1) and (2), $a + b = a + 2d \Rightarrow b = 2d$

From Eq (3), $2d + d = 2(a + a + d)$

$$\Rightarrow 3d = 2(2a + d) \Rightarrow d = 4a \text{ or, } a = \frac{d}{4}$$

$$\text{Now from Eq. (ii), } a + d = \frac{d}{4} + d = \frac{5d}{4} = c$$

$$\text{or, } c = \frac{5}{4}d$$

The value of d can be either 4 or 8. If $d = 4$, then $c = 5$. If $d = 8$, then $c = 10$. But the value of c should be less than 10. Hence, value of c would be 5.

50. (c) P, Q and R are three consecutive odd numbers, hence

$$Q = P + 2 \quad \text{and} \quad R = P + 4$$

$$\text{Given: } 3P = 2(P + 4) - 3$$

$$\Rightarrow P = 5.$$

$$\text{Hence, } R = 5 + 4 = 9.$$

51. (a) $\frac{7}{8}x - \frac{7}{18}x = 770 \Rightarrow \left(\frac{126 - 56}{144}\right)x = 770$

$$\Rightarrow x = 1584.$$

52. (a) Let one number be x , then second number will be $(x + 4)$.

$$\therefore \frac{1}{x} + \frac{1}{(x + 4)} = \frac{10}{21}$$

$$\text{or } \frac{x + x + 4}{x(x + 4)} = \frac{10}{21}$$

$$\Rightarrow \frac{2x + 4}{x(x + 4)} = \frac{10}{21}$$

$$\Rightarrow x = 3.$$

53. (b) Quantity of rice left after the first transaction

$$= x - \left(\frac{x}{2} + \frac{1}{2} \right) = \frac{x}{2} - \frac{1}{2}$$

Quantity of rice left after second transaction

$$= \left(\frac{x}{2} - \frac{1}{2} \right) - \left(\frac{x}{4} - \frac{1}{4} + \frac{1}{2} \right) = \frac{x}{4} - \frac{3}{4}$$

Quantity of rice left after third transaction

$$= \left(\frac{x}{4} - \frac{3}{4} \right) - \left(\frac{x}{8} - \frac{3}{8} + \frac{1}{2} \right) = \frac{x}{8} - \frac{7}{8}$$

Given, $\frac{x}{8} - \frac{7}{8} = 0 \Rightarrow x = 7.$

54. (c) Let the man buys x apples, y mangoes and z bananas at the respective price of ₹A, ₹M, ₹B, for each unit respectively

As it is given that number of mangoes bought is same as the number as of bananas, hence quantity assumed is same as y

Let the amount spent on apples be ₹P

Therefore, the amount spent on mangoes and bananas together is $1.5P$

Now, $P + 1.5P = 140$ or, $2.5P = 140$ or $P = 56$

Amount spent on apples is ₹56 and the amount spent on mangoes and bananas together is ₹84

Again, $x A = 56$ (1)

and, $y B + y M = 84$

or, $y (B + M) = 84$ (2)

If mangoes cost the same as apples, no bananas can be bought. i.e., $(x + y)A = 140$

or $x A + y A = 140$

From (1), $y A = 140 - 56 = 84$ (3)

From (2) and (3), we have

or, $y B + y M + y A = 84 + 84 = 168$

$y (A + B + M) = 168$

Additional amount required to be spent

$= (168 - 140) = ₹28.$

55. (b) We have, $|x + 7| + |x - 8| = 16$

Put $x + 7 = 0 \Rightarrow x = -7$

Also put $x - 8 = 0 \Rightarrow x = 8$



Case-I: When $x \leq -7$, then

$|x + 7| + |x - 8| = 16$

$\Rightarrow -x - 7 - x + 8 = 16$

$\Rightarrow x = -7.5$

Case-II: When $-7 < x < 8$, then

$|x + 7| + |x - 8| = 16$

$\Rightarrow x + 7 - x + 8 = 16$

$\Rightarrow 15 = 16$, which is not possible

Case-II: When $x \geq 8$, then

$|x + 7| + |x - 8| = 16$

$\Rightarrow x + 7 + x - 8 = 16$

$\Rightarrow x = 8.5.$

Hence, sum of the possible values of $x = -7.5 + 8.5 = 1.$

56. (c) Smallest number = X

Step	Amitabh	Sashi
1	$2X$	$2X + 50$
2	$4X + 100$	$4X + 150$
3	$8X + 300$	$8X + 350$
4	$16X + 700$	$16X + 750$
5	$32X + 1500$	$32X + 1550$

Amitabh has to win and X is the least possible number in the range 1-999

\therefore Step 4 has to be the last step

$\Rightarrow 16X + 170 > 1000$

The least possible value of $X = 16$

Sum of the digit = $1 + 6 = 7.$