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LINEAR EQUATIONS COMPLETE ASSIGNMENT

CONSISTENCY BASED PROBLEMS

Find the value of k for which each of the following systems of linear equations has an infinite number of solutions:

1. $2x + 3y = 7$
   $(k-1)x + (k+2)y = 3k$ **$[k = 7]$**

2. $2x + (k-2)y = k$
   $6x + (2k-1)y = (2k+5)$ **$[k = 5]$**

3. $kx + 3y = (2k+1)$
   $2(k+1)x + 9y = (7k+1)$ **$[k = 2]$**

4. $5x + 2y = 2k$
   $2(k+1)x + ky = (3k+4)$ **$[k = 4]$**

5. $(k-1)x - y = 5$
   $(k+1)x + (1-k)y = (3k+1)$ **$[k = 3]$**

Find the value of k for which each of the following systems of equations has a unique solution:

6. $2x + 3y - 5 = 0, kx - 6y - 8 = 0.$ **$[k \neq 4]$**
7. $x - ky = 2, 3x + 2y + 5 = 0.$ **$\left[k \neq -\frac{2}{3}\right]$**
8. $5x - 7y - 5 = 0, 2x + ky - 1 = 0.$ **$\left[k \neq -\frac{14}{5}\right]$**
9. $4x + ky + 8 = 0, x + y + 1 = 0.$ **$[k \neq 4]$**

GRAPH BASED PROBLEMS

Solve each of the following systems of equations graphically:

1. $2x + 3y = 2$
   $x - 2y = 8.$ **[$x = 4, y = 2$]**

2. $3x + 2y = 4$
   $2x - 3y = 7$ **[$x = 2, y = 1$]**

3. $2x + 3y = 8$
   $x - 2y + 3 = 0$ **[$x = 1, y = 2$]**

4. $2x - 5y + 4 = 0$
   $2x + y - 8 = 0.$ **[$x = 3, y = 2$]**

5. $3x + 2y = 12$
   $5x - 2y = 4$ **[$x = 2, y = 3$]**

WORD PROBLEMS

TYPE I: AGE RELATED PROBLEMS

1. **Father-Son Age Puzzle:** Ten years from now, a father's age will be twice that of his son. Ten years ago, he was four times his son's age. What are their current ages?
   [Father = 50 years, Son = 20 years]

2. **Family Age Mystery:** A father's age is currently three times the sum of his two sons' ages. In five years, his age will be twice the combined ages of his sons. How old is the father now? **[Father = 45 years, Sons = 10 years and 5 years]**

3. **Mother-Son Age Challenge:** If twice the son's age is added to the mother's age, the total becomes 70 years. If twice the mother's age is added to the son's age, the total becomes 95 years. Find their present ages. **[Mother = 40 years, Son = 30 years]**

4. **Time Travel Age Riddle:** Five years ago, Nuri was three times as old as Sonu. Ten years from now, Nuri will be twice as old as Sonu. What are their current ages?

   [Nuri = 25 years, Sonu = 15 years]

5. **Grandparent-Grandchild Age Trick:** A grandfather's age is four times the age of his grandson. In 12 years, the grandfather's age will be three times his grandson's age. How old are they now? **[Grandfather = 48 years, Grandson = 12 years]**

TYPE II: TWO DIGIT PROBLEMS

1. A two-digit number is 4 times the sum of its digits. If the digits are reversed, the new number is 9 more than the original. Find the number. **[36]**
2. The sum of the digits of a two-digit number is 12. The difference between the number and the number with reversed digits is 18. Find the number. **[57]**
3. A two-digit number is such that the product of its digits is 20. If the digits are reversed, the new number is 9 less than the original. Find the number. **[45]**
4. A two-digit number is 6 more than 3 times the sum of its digits. When the digits are swapped, the new number is 36 less than the original. Find the number. **[84]**
5. A two-digit number is 3 times the sum of its digits. Also, its tens digit is twice the units digit. Find the number. **[36]**

TYPE III: FRACTION BASED PROBLEMS

1. The sum of the numerator and the denominator of a fraction is 20 . If the numerator is decreased by 4 , the fraction becomes $\frac{3}{5}$. Find the fraction. $\left[\frac{10}{10} = 1\right]$
2. If 2 is added to both the numerator and the denominator of a fraction, the result is $\frac{5}{6}$. But if 2 is subtracted from both, the result becomes $\frac{3}{4}$. Find the original fraction. $\left[\frac{4}{5}\right]$
3. In a given fraction, if the denominator is tripled and the numerator is decreased by 2 , the result is $\frac{1}{3}$. If the numerator is increased by 6 and the denominator is increased by 4 , the result becomes $\frac{3}{5}$. Find the fraction. $\left[\frac{6}{7}\right]$
4. In a given fraction, if the numerator is multiplied by 2 and the denominator is reduced by 5 , we get $\frac{6}{5}$. But if the numerator of the given fraction is increased by 8 and the denominator is doubled, we get $\frac{2}{5}$. Find the fraction. $\left[\frac{12}{25}\right]$
5. If 1 is added to both the numerator and denominator of a given fraction, it becomes $\frac{4}{5}$. If however, 5 is subtracted from both the numerator and denominator, the fraction becomes $\frac{1}{2}$. Find the fraction. $\left[\frac{7}{9}\right]$

TYPE IV and V: SPEED,DISTANCE AND TIME BASED PROBLEMS

1. A train covered a certain distance at a uniform speed. If the train had been 6 kmph faster, it would have taken 4 hours less than the scheduled time. And, if the train were slower by 6 kmph , it would have taken 6 hours more than the scheduled time. Find the length of the journey. **[720 km]**

2. A train covered a certain distance at a uniform speed. If the train had been 5 kmph faster, it would have taken 3 hours less than the scheduled time. And, if the train were slower by 4 kmph , it would have taken 3 hours more than the scheduled time. Find the length of the journey. **[1080 km]**
3. Abdul travelled 300 km by train and 200 km by taxi taking 5 hours 30 minutes. But, if he travels 260 km by train and 240 km by taxi, he takes 6 minutes longer. Find the speed of the train and that of the taxi. **[100 km/h and 80 km/h]**
4. Places A and B are 160 km apart on a highway. One car starts from A and another from B at the same time. If they travel in the same direction, they meet in 8 hours. But, if they travel towards each other, they meet in 2 hours. Find the speed of each car. **[50 km/h and 30 km/h]**
5. A man travels 370 km, partly by train and partly by car. If he covers 250 km by train and the rest by car, it takes him 4 hours. But, if he travels 130 km by train and the rest by car, he takes 18 minutes longer. Find the speed of the train and that of the car. **[100 km/h and 80 km/h]**

TYPE VI: RE-ARRANGEMNT TYPE PROBLEMS

1. The students of a class are made to stand in rows. If 4 students are extra in each row, there would be 2 rows less. If 4 students are less in each row, there would be 4 rows more. Find the number of students in the class. **[96 students]**
2. The students of a class are made to stand in rows. If 3 students are extra in a row, there would be 1 row less. If 3 students are less in a row, there would be 2 rows more. Find the number of students in the class. **[36 students]**
3. A and B each has some money. If A gives Rs. 30 to B then B will have twice the money left with A. But if B gives Rs. 10 to A then A will have thrice as much as is left with B. How much money does each have? **[A has ₹ 62 and B has ₹ 34]**
4. There are two classrooms A and B. If 10 students are sent from A to B, the number of students in each room becomes the same. If 20 students are sent from B to A, the

number of students in A becomes double the number of students in B. Find the number of students in each room. **[100 in A and 80 in B]**

5. There are two containers, X and Y. If 8 liters of water are poured from X to Y, both containers hold the same amount of water. If 16 liters are poured from Y to X, X holds twice the amount of water as Y. How much water was originally in each container? **[X had 80 liters and Y had 64 liters]**
6. Two friends, Raj and Anil, have a certain amount of money. If Raj gives ₹50 to Anil, both have the same amount. If Anil gives ₹100 to Raj instead, Raj's money becomes twice Anil's. How much money did each have originally? **[₹500 and ₹400]**

TYPE VII: PROFIT, LOSS, EXPENSES AND COSTS TYPE PROBLEMS, DISCOUNT

1. A man sold a chair and a table together for ₹1520, thereby making a profit of 25% on chair and 10% on table. By selling them together for ₹ 1535 , he would have made a profit of 10% on the chair and 25% on the table. Find the cost price of each. **[₹600 and ₹700]**
2. On selling a tea set at 5% loss and a lemon set at 15% gain, a crockery seller gains ₹ 7. If he sells the tea set at 5% gain and the lemon set at 10% gain, he gains ₹ 13. Find the actual price of each of the tea set and the lemon set. **[tea set = 100, lemon set = ₹80]**

TYPE VIII: UPSTREAM AND DOWNSTREAM TYPE PROBLEMS

1. A boat goes 30 km upstream and 44 km downstream in 10 hours. In 13 hours, it can go 40 km upstream and 55 km down-stream. Determine the speed of the stream and that of the boat in still water. **[8 km/h and 3 km/h]**
2. A boat goes 16 km upstream and 24 km downstream in 6 hours. Also, it covers 12 km upstream and 36 km downstream in the same time. Find the speed of the boat in still water and that of the stream. **[8 km/h and 4 km/h]**
3. A man can row downstream 20 km in 2 hours, and upstream 4 km in 2 hours. Find his speed of rowing in still water. Also, find the speed of the current. **[6 km/h and 4 km/h]**

TYPE IX: GEOMETRY BASED PROBLEMS

1. Find the four angles of a cyclic quadrilateral $ABCD$ in which $\angle A = (2x - 1)°, \angle B = (y + 5)°, \angle C = (2y + 15)°$ and $\angle D = (4x - 7)°$. **[$\angle A = 65°, \angle B = 55°, \angle C = 115°$ and $\angle D = 125°$]**

2. The area of a rectangle gets reduced by 8 m^2, when its length is reduced by 5 m and its breadth is increased by 3 m . If we increase the length by 3 m and breadth by 2 m , the area is increased by 74 m^2. Find the length and the breadth of the rectangle. **[length = 19 m, breadth = 10 m]**

3. The area of a rectangle gets reduced by 67 square metres, when its length is increased by 3 m and breadth is decreased by 4 m . If the length is reduced by 1 m and breadth is increased by 4 m , the area is increased by 89 square metres. Find the dimensions of the rectangle. **[length = 28 m, breadth = 19 m]**

4. In a $\triangle ABC, \angle A = x°, \angle B = (3x - 2)°, \angle C = y°$ and $\angle C - \angle B = 9°$. Find the three angles. **[$\angle A = 25°, \angle B = 73°, \angle C = 82°$]**

5. In cyclic quadrilateral ABCD, $\angle A = (3x - 5)°$, $\angle C = (2x + 25)°$, and $\angle B = (4y + 10)°$, $\angle D = (y + 50)°$. Find the values of x and y, then calculate all four angles.
$$\begin{bmatrix} \angle A = 91° \\ \angle B = 106° \\ \angle C = 89° \\ \angle D = 74° \end{bmatrix}$$

TYPE X: WORK AND PORTIONS RELATED PROBLEMS

1. 8 men and 12 boys can fi nish a piece of work in 5 days, while 6 men and 8 boys can fi nish it in 7 days. Find the time taken by 1 man alone and that by 1 boy alone to finish the work. **[70 and 140 days resp.]**

2. 2 men and 7 boys can do a piece of work in 4 days. The same work is done in 3 days by 4 men and 4 boys. How long would it take one man and one boy to do it alone. **[60 days and 15 days]**

3. 2 women and 5 men can together finish an embroidery work in 4 days, while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone to finish the work, and also that taken by 1 man alone. **[18 days and 36 days]**

4. 8 men and 12 boys can finish a piece of work in 10 days while 6 men and 8 boys finish it in 14 days. Find the time taken by one man alone and by one boy alone to finish the work. **[280 days and 140 days]**

TYPE XI: MISCELLANEOUS PROBLEMS

1. If 45 is subtracted from twice the greater of two numbers, it results in the other number. If 21 is subtracted from twice the smaller number, it results in the greater number. Find the numbers. **[37,29]**
2. If three times the larger of two numbers is divided by the smaller, we get 4 as the quotient and 8 as the remainder. If five times the smaller is divided by the larger, we get 3 as the quotient and 5 as the remainder. Find the numbers. **[20,13]**
3. A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Mona paid ₹ 27 for a book kept for 7 days, while Tanvy paid ₹ 21 for the book she kept for 5 days. Find the fixed charge and the charge for each extra day. **[₹ 15, ₹3 per day]**
4. The monthly incomes of *A* and *B* are in the ratio 8: 7 and their expenditures are in the ratio 19 : 16. If each saves ₹ 5000 per month, find the monthly income of each. **[₹24,000 and ₹21,000]**
5. A part of monthly hostel charges in a school is fixed and the remaining depends on the number of days one has taken food in the mess. When a student A takes food for 22 days, he has to pay ₹ 4250 as hostel charges, whereas a student B, who takes food for 28 days, pays ₹5150 as hostel charges. Find the fixed charges and the cost of food per day. **[₹950 and ₹150]**