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LINEAR EQUATIONS
MATHEMATICS

SET - 02

MATHEMATICS LINEAR EQUATIONS

Mind Map

Linear Equation in Two variables

General Form

where — $ax+by+c=0$ — Examples

a,b,c are constants, x,y are variables

Examples:
$2x+5y=10$
$7x-2y+11=0$
$y=3x+5$
etc.

Solutions

Values of x and y satisfying the equation

Example

Solutions of $x+2y=7$ are
(i) $x=5$, $y=1$ (iii) $x=6$, $y=\frac{1}{2}$
(ii) $x=3$, $y=2$ (iv) $x=1$, $y=3$
etc.

Number of Solutions — Infinite

Graph

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KEY POINTS

- **Linear equation in one variable** – An equation which can be put in the form ax+b=0, $a \neq 0$ and a, b are real numbers is called a linear equation in one variable.

- **Linear equation in two variables** – Any equation which can be put in the form ax+by+c=0, where a, b, and c are real numbers and a, $b \neq 0$, is called a linear equation in two variables.

  Linear equation in one variable has a unique solution

  $$ax + b = 0 \implies x = -\frac{b}{a}$$

- Linear equation in two variables has infinitely many solutions.

- The graph of every linear equation in two variables is a straight line.

- Every point on the line satisfies the equation of the line.

- Every solution of the equation is a point on the line. Thus, a linear equation in two variables is represented geometrically by a line whose points make up the collection of solutions of the equation.

Graph :

* The pair of values of x and y which satisfies the given equation is called solution of the linear equation in two variables.
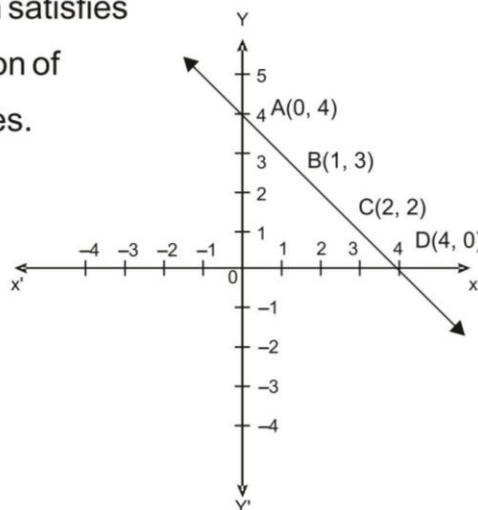
  Example : x + y = 4

  Solutions of equation

  x+y = 4 are

  (0,4) (1,3) (2,2) (4,0)

  and many more

Very Very Short answer type questions   (1 mark)

1. At what point, the graph of 3x+2y=9, cuts the y axis?

2. Let y varies directly as x. If y=15 when x=5, then write a linear equation.

3. Write the point of intersection of the lines x=2 and y=-3

4. What is the distance of the point (3,-7) from x-axis?

5. What is the distance of the point (-5,-4) from y-axis?

6. Express the linear equation $\sqrt{2}x-4=5y$ in the form of ax+by+c=0 and thus indicate the values of a, b and c.

7. Express x in terms of y for the equation 3x+4y=7

8. Express y in the terms of x.

    3y+5x = 9

9. Point (9,0) lie on which axis?

10. Find a solution of x + y = 5 which lies on y-axis

11. Express the equation 5y=9 as linear equation in two variables.

12. Write the linear equation which is parallel to x-axis and is at a distance of 2 units from the origin in upward direction.

13. Check whether (1, —2) is a solution of 2x - y = 6.

14. Check whether x = 2 & y = -2 is a solution of 2x - y = 6.

15. How many solutions are there for equation y = 5x + 2.

16. Find the value of K, if x = —1 & y =1 is a solution of equation Kx —2y = 0.

17. If the graph of equation 2x + Ky = 10 K intersects x-axis at point (5,0), find the value of K.

18. The graph of the linear equation 4x=6 is parallel to which axis?

19. At what point the graph of 2x — y = 6, cuts x-axis?

20. On which side of y — axis, x + 3 = 0 lies?

21. On which side of x-axis, 2y-1=0 lies?

Fill in the blanks

22. The equation of a line parallel to x-axis is _____ = a, where a is any non-zero real number.

23. The equation of a line parallel to y-axis is _____ =a, where a is any non-zero real number.

24. The graph of every linear equation in two variables is a_____.

25. An equation of the form ax+b=0, where a, b are real numbers and a ≠ 0, in the variable x, geometrically represents _____.

26. The coefficient of x in the linear equation 2(x+y)-x=7 is _____.

Case study based problem

Case Study - I

27. The eco-club of a school decided to develop a garden of the school and planted three types of plants A, B and C Number of plant A is twice that of plant B and number of plant B is same as number of plant C. If total number of plants is 100.


(A) Correct representation of the above situation in linear equation is.

   (a) x+y=100   (b) x+2y=100

   (c) x-y=100   (d) x-2y=100

(B) If number of plants of type A is 50, then number of plant B is

   (a) 10   (b) 20

   (c) 30   (d) None

(C) If number of plants of type A and B together is 75, then number of plant of type C is

   (a) 10   (b) 15

   (c) 20   (d) 25

(D) The graph of linear equation in two variable for the above situation will not pass through :

   (a) (100,0)   (b) (50,50)

   (c) (60,20)   (d) (70,15)

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(E) The number of plants of type C is always.

(a) more than 25   (b) less than 25

(c) less than or equal to 25   (d) more than or equal to 25.

Case Study -II

28. The RWA of a locality is running a lending library to develop the habit of reading books among society. To run this library they charges a fixed amount of ₹10 for first five days for a book and ₹ 3 for each day there after.
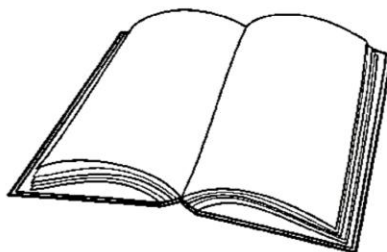
(A) If you borrow the book for 7 days what amount you will have to pay.

(a) ₹ 15   (b) ₹ 16

(c) ₹ 70   (d) ₹ 21

(B) If you borrow two books and you paid total amount as ₹ 40, then number of days for which book was borrowed.

(a) 10 days   (b) 12 days

(c) 15 days   (d) 30 days

(C) The linear equation to represent the condition by taking x as total number fo days (x≥5) and total amount to be paid as ₹y.

(a) 3x-y=5   (b) 3x+y=5

(c) y=3x+10   (d) x=3y+10

(D) In the linear equation (correct option from part C) if x=7 then the value of y is.

(a) -1   (b) 31

(c) -16   (d) 16

(E) The correct option to borrow a book for a number of days and amount paid for it is.

(a) 5 days, ₹ 20   (b) 15 days, ₹ 45

(c) 8 days, ₹ 14   (d) 10 days, ₹ 25

Case Study -III

29. During Covid-19 door to door survey, A frontline health worker recorded the temperature of the family of five members. Their name and age is given below.

Name	Age (in years)
Uma	65
Raj Kumar	40
Savita	37
Rohan	14
Jyoti	10

The linear equation that convert temperature from Fahrenheit (°F) to Celsius (°C) is given by

$$C = \frac{5F - 160}{9}$$

(A) If temperature of Uma is 97.7°F, then her temperature is °C is.

   (a) 36   (b) 36.5

   (c) 37   (d) 37.2

(B) If temperature of Raj Kumar is 37°C, then his temperature is °F is

   (a) 98   (b) 98.2

   (c) 98.4   (d) 98.6

(C) Taking C on x-axis and F an y-axis, if graph of given linear equation is drawn , then from which quadrant it will to pass?

   (a) I   (b) II

   (c) III   (d) IV

(D) If normal temperature of a human body lies between 36.5°C and 37.5°C, then in Fahrenheit it lies between:

   (a) 97.7 and 99.5   (b) 98 and 99.2

   (c) 98.5 adn 99.5   (d) 99 and 100

(E) For which numerical value, the Celsius (°C) and Fahrenheit (°F) temperatures are equal ?

   (a) 0   (b) 100

   (c) -40   (d) 40

Very Short Answer Type Question (2 Marks)

30. Find any two solutions of equation

    2x+y=x+5.

31. Find the value of P if x=2, y=3 is a solution of equation 5x+3 Py=4a

32. If the points A (3,5) and B (1,4) lines on the graph of line ax+by=7, find the value of a.

33. Write the coordinates of the point where the graph of the equation 5x+2y=10 intersect both the axes.

34. Write the equations of two lines passing though (3, 10).

35. The cost of coloured paper is 7 more than 1/3 of the cost of white paper. Write this statement in linear equation in two variables.

36. Draw the graph of equation x+y=5.

37. The graph of linear equation 2x-y=6 will pass through which quadrant(s).

38. How many solution of the equation 3x-2=x-3 are there on the

    (i) Number line

    (ii) Cartesian plane....

39. Find the points where the graph of x+y=4 meets line which is

    (i) parallel to x-axis at 3 units from origin in positive direction of y-axis.

    (ii) parallel to y-axis at 2 units on left of origin.

Short Answer Type Questions (3 Marks)

40. If total number of legs in a herd of goats and hens is 40. Represent this situation in the form of a linear equation in two variables.

41. Find the value of a and b, if the line 6ax+by=24 passes through (2,0) and (1,2)

42. Determine the point on the graph of the linear equation 2x+5y=19 whose ordinate is $1\frac{1}{2}$ times its abscissa.

43. Find the points where the graph of the following equation cut the x-axis and y-axis 2x=1-5y

44. Write the equation of the line parallel to x-axis at a distance of 4 units above the origin.

45. If the points A (4,6) and B(1,3) lie on the graph of ax+by=8 then find the value of a and b.

46. Find the value of 'a' if (1, -1) is the solution of the equation 2x+ay=5. Find two more solutions of the equation.

47. Find two solutions of the equation 4x + 5y = 28. Check whether (-2,10) is solution of the given equation.

48. Write the equation of line passing through (3, —3) & (6, -6).

49. If x = 3k — 2, Y=2k is a solution of equation 4x — 7y + 12 =0, then find the value of K.

50. If (m —2, 2m + 1) lies on equation 2x + 3y— 10 = 0, find m.

51. F = (9/5)C + 32.

    (i) If the temperature is 35°C, what is the temperature in Fahrenheit?

    (ii) If the temperature is 30°C, what is the temperature in Fahrenheit?

52. Draw the graph of the linear equation 2x+3y=6. Find out the coordinates of the points where the line intersects at x axis and y-axis.

53. Draw the graph for the linear equations

    3x +4y = 12. If x = 8, find the value of y with the help of graph.

54. Draw the graph of y = x & 2y = —5x on the same graph.

55. Give the geometrical representation of 5x + 7 = 0 as equation.

    (i) in one variable   (ii) in two variables

56. Draw the graph of the linear equations 2y – x = 7. With the help of graph check whether x = 3 and y = 2 is the solution of the equation?

57. Draw the graph of linear equation 3x-y=4. From the graph find the value of p and q if the graph passes through (p,-4) and (3,q)

58. Draw the graph of equations 2x+3y=-5 and x+y=-1 on the same graph. Find the co-ordinate of the point of intersection of two lines.

59. Show that the points A(1,-1) B(2,6) and C(0,-8) lie on the graph of the linear equation 7x-y=8.

Long Answer type questions (5 Marks)

60. Write 3y = 8x in the form of ax+by+c=0. Write x in terms of y. Find any two solutions of the equation. How many solutions you can find out?

61. Rohan and Ramita of Class IX decided to collect ₹ 25 for class cleanliness. Write it in linear equations in two variables. Also draw the graph.

62. Sarika distributes chocolates on the occasion of children's Day. She gives 5 chocolates to each child and 20 chocolates to adults. If number of children is represented by 'x' and total distributed chocolates as 'y'.

    (i) Write it in the form of linear equation in two variables.

    (ii) If she distributed 145 chocolates in total, find number of children?

63. Priyanka and Arti decided to donate ₹1600 for the Army widows. Let Priyanka's share as 'x' and Arti share as 'y'.

    (a) Form a linear equation in two variables.

    (b) If Priyanka donates thrice the amount donated by Arti, then find out the amount donated by both.

64. Riya participates in Diwali Mela with her friends for the charity to centre of handicapped children. They donate ₹3600 to the centre from the amount earned in Mela. If each girl donates ₹150 and each boy donates ₹ 200.

    (a) Form the linear equation in two variables.

    (b) If number of girls are 8, find number of boys.

65. Aftab is driving a car with uniform speed of 60 km/hr. Assuming total distance to be y km & time taken as x hours, form a linear equation. Draw the graph. From the graph read the following:

    (i) distance travelled in 90 minutes.

    (ii) Time taken to cover a distance of 150 km.

66. The parking charges of a car in a private parking is ₹ 20 for the first hour and ₹10 for subsequent hours. Taking total parking charges to be y & total parking time as x hours form a linear equation. Write it in standard form hence find, a, b & c. Draw the graph also.

67. We know that C = 2πr, taking π = 22/7, circumference as y units, radius as x units, form a linear equation. Draw the graph. Check whether the graph passes through (0, 0). From the graph read the circumference when radius is 2.8 units.

Hints and Solutions / Answers

1. (4.5,0)
2. y=3x
3. (2,-3)
4. 7 units
5. 5 units
6. √2x-5y-4=0

   a=√2, b=-5, C=-4
7. $x = \frac{7-4y}{3}$
8. $y = \frac{9-5x}{3}$
9. x-axis
10. (0,5)
11. ox+5y=9
12. y=2
13. No
14. Yes
15. Infinitely many solutions
16. K(-1)-2(1)=0

    k=-2
17. 2(5)+k(0)=10k

    k=1
18. Parallel to y-axis
19. (3,0)
20. On left side
21. On right side
22. y
23. x
24. Straight line

25. a point on number line
26. 1
27. (A) (b) x+2y=100

    (B) (d) None

    (C) (d) 25

    (D) (b) (50,50)

    (E) (c) less than or equal to 25
28. (A) (b) ₹ 16

    (B) (c) 15 days

    (C) 3x-y = 5

    (D) (b) 31

    (E) (d) 10 days, ₹ 25
29. (A) (b) 36.5

    (B) (d) 98.6

    (C) (d) IV

    (D) (a) 97.7 and 99.5

    (E) (c) -40
30. (1,4) (0,5)

    [or any other possible solutions]
31. $p= \frac{4a-10}{9}$
32. 3a+5b=7; a+4b=7

    3(7-4b) +5b =7

    b=2

    a=-1
33. x axis = (2,0)

    y axis = (0,5)

34. $3x-y+1=0$; $x+y=13$
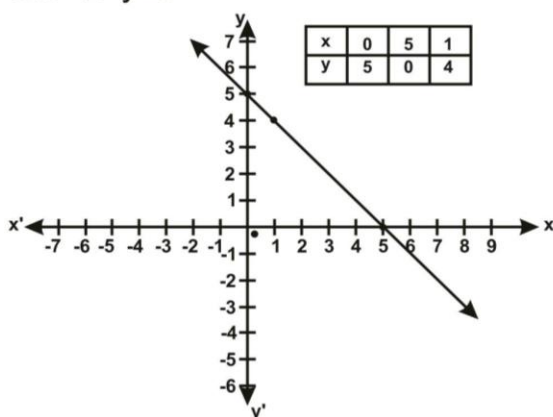
    [or any other possible equation)

35. Let the cost of coloured paper be ₹ x

    Let the cost of white paper be ₹ y

    $3x-y=21$

36. $x+y=5$

x	0	5	1
y	5	0	4

37. I, IV, III

38. (i) one solution

    (ii) Infinitely many solution

39. (i) (1,3)

    (ii) (-2,6)

40. Let number of goats = x

    number of hens = y

    $4x+2y=40$

    or $2x+y=20$

41. $6a(2) + b(0) =24$

    $12a = 24$

    $a= 2$

    $6(2)(1) + b(2) = 24$

    $12+2b=24$

    $2b=12$

    $b = 6$

42. abscissa =2

ordinate = 3

point (2,3)

43. Points cuts x axis $(\frac{1}{2},0)$

    Points cut y axis $(0,\frac{1}{5})$

44. $y=4$

45. $4a+6b = 8$

    or $2a+3b=4$

    $a+3b=8$

    $a=-4$ and $b=4$

46. $2(1)+a(-1)=5$

    $-a=3$

    $a=-3$

    $2x-3y=5$, any two solutions

47. (2,4); (7,0)

    [or any other possible solution]

    No, (-2,10) is not a solution

48. $x+y=0$

49. $4[3k-2]-7[2k]+12=0$

    $12k-8-14k+12=0$

    $k=2$

50. $2[m-2]+3[2m+1]-10=0$

    $2m-4+6m+3-10=0$
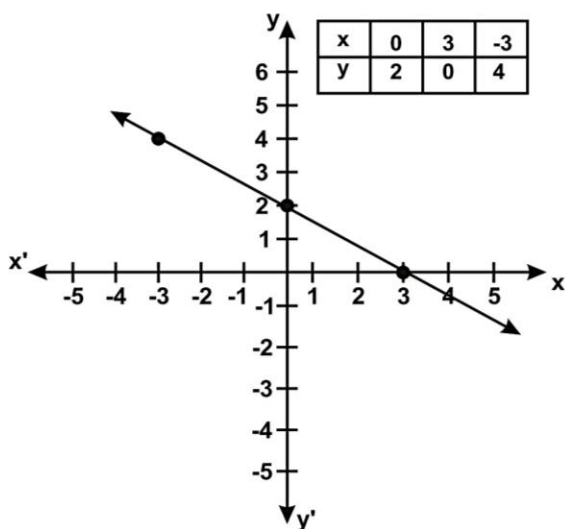
    $m=\frac{11}{8}$

51. (i) 95°F

    (ii) 86°F

52. $2x+3y=6$

x	0	3	-3
y	2	0	4

x-axis co-ordinates (3,0)

y-axis co-ordinates (0,2)

53. $y=-3$

55. $x=\dfrac{-7}{5}$ or $x=-1.4$

(i)

(ii)

x	-1.4	-1.4	-1.4
y	0	1	2
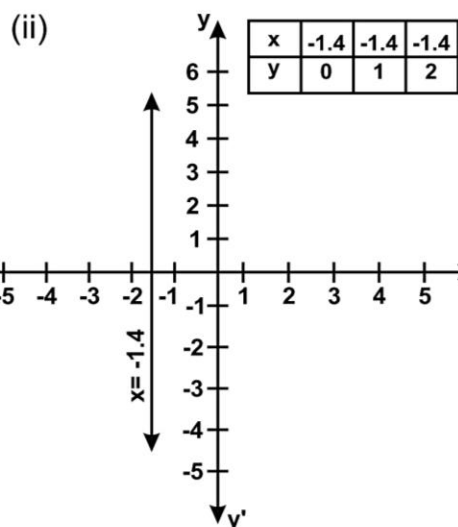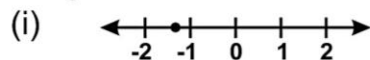
56. No

57. $p=0$; $q=5$

58. Point of intersection (2,-3)

60. $8x-3y+0=0$; $x=\dfrac{3y}{8}$

(0,0) (3x8)

Infinitely many solutions.

61. $x+y=25$

62. (i) $5x+20=y$

(ii) 25

63. (a) $x+y=1600$

(b) Priyanka= ₹ 1200

Arti = ₹400

64. (a) $150x+200y=3600$

(b) Number of boy = 12

65. $y=60x$

(i) 90km

(ii) 2 hours 30 min.

66. $10x+10=y$

$10x-y+10=0$

$a=10$; $b=-1$; $c=10$

67. $y=2\pi x$

yes

when r=2.8 units

c=17.6 units