PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

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SUBJECT : MATHS

INTRODUCTION

- An equation of the form

  $ax + by + c = 0$
- Where a, b and c are real numbers, and a and b are both zero, is called pair of linear equation in two variables x and y.

- The standard form of a pair of a linear equation in two variables x and y is

  - $A_1x + b_1y + c_1 = 0$
  - $A_2x + b_2y + c_2 = 0$
  - Where $a_1, b_1, c_1, a_2, b_2, c_2$ are real numbers.

ALGEBRAIC METHOD OF SOLVING EQUATION

- The graphical method of solving a equation is not always convenient specially when the point representing the solution has non-integral coordinates. So, we have to search alternative method of finding the solution. The algebraic method is used in this case.

- There are three types of method

  - **SUBSTITUTION METHOD**
  - **ELEMINATION METHOD**
  - **CROSS MULTIPLICATION METHOD**

SUBSTITUTION METHOD

- STEP 1 : express y in terms of x from either equation.
- STEP 2 : substitute this value of y in the other equation resulting it to reduce in an equation in x. solve it for x.
- STEP 3 : substitute this value of x in the equation used in step 1 to obtain the value of y and get the value of y.

EXAMPLE

1) $x + y = 17$

$2x - 3y = 11$

$x + y = 17 \longrightarrow (1)$

$2x - 3y = 11 \longrightarrow (2)$

From equation (1)

$y = 7 - x \longrightarrow (3)$

Substitute this value of y in equation (2) we get

$2x - 3(7 - x) = 11$

$2x - 21 + 3x = 11$

$5x - 21 = 11$

$5x = 11 + 21$

$5x = 32$

$x = 32/5$

Substitute this value of y in equation (3)

we get $y = 7 - 32/5$

$y = 35-32/5$

$y = 3/5$

$x = 32/5$

$y = 3/5$

ELEMINATION METHOD

- step 1 : multiply both the equation by the same suitable non-zero constant to make the coefficient of one variable numerically equal.
- STEP 2 : then add or subtract one equation from the other so that one variable gets eliminated.
- STEP 3 : solve the resulting equation in one variable so obtained and get the value.
- STEP 4 : substitute this value of x or y in either of the original equation and get the value of the other variables.

EXAMPLE

(1) $5x + 3y = 70$

$3x - 7y = 60$

$5x + 3y = 70$ → (1)

$3x - 7y = 60$ → (2)

multiplying equation (1) by 3

multiplying equation (2) by 5

$15x + 9y = 210$

$15x - 35y = 300$

subtracting equation (4) from equation (3) we get\

$15x + 9y = 210$

$15x - 35y = 300$

$44y = -90$

$44y = -90$

$y = -90/44$

$y = -45/22$

Substituting this value of y in equation (1) we get

$5x + 3(-45/22) = 70$

$5x - 135/22 = 70$

$5x = 70 + 135/22$

$5x = 1540 + 135/22$

$5x = 1675/22$

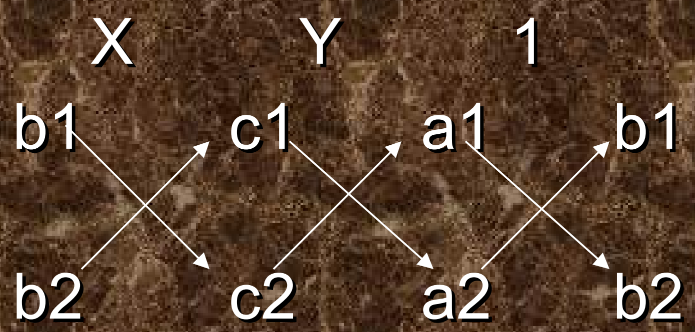
$x = 335/22$

$x = 335/22$

$y = -45/22$

CROSS-MULTIPLICATION METHOD

- STEP 1 : draw a diagram as follow



- STEP 2 : then write the equation as follows

$$\frac{X}{B1c2-b2c1} = \frac{Y}{c1a2-c2a1} = \frac{1}{a1b2-a2b1}$$

- STEP 3 : if a1b2 – a2b1 = 0 find x and y as follows

$X = \frac{}{b1c2-b2c1}$ $\quad Y = \frac{}{c1a2-c2a1}$

EXAMPLE

1) $11x + 15y + 23 = 0$

$7x - 2y - 20 = 0$

X	Y	1	
15	23	11	15
-2	-20	7	-2

$$\frac{X}{(15)(-20)-(-2)(23)} = \frac{Y}{(23)(7)-(120)(11)}$$

$$\frac{1}{(11)(-2)-(7)(15)}$$

$$\Rightarrow \frac{X}{-300+46} = \frac{Y}{161+220} = \frac{1}{-22-105}$$

$$\Rightarrow \frac{X}{-254} = \frac{Y}{381} = \frac{1}{-127}$$

$X = -254/-127 = 2$

$Y = 381/-127 = 3$

$X = 2$

$Y = 3$

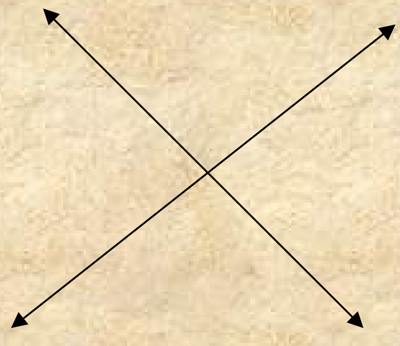
GRAPHICAL METHOD OF SOLVING EQUATION

- graphical representation of linear equation in two variables is a straight line. As a straight line consist of an infinite no of points lying on it.

- Given a pair of linear equation in two variables representing two straight lines taken together, only one of the following three possibilities can occur

  - The two lines intersect at one point.
  - The two lines are parallel.
  - The two lines are coincident.

- The two lines intersects at one point



- the two lines are parallel

- the two lines are coincident

EXAMPLE

1) Sangeeta has socks and hand kerchiefs which are together 40 in no. If she has 5 less handkerchiefs and 5 more socks, the number of socks becomes four times the number of hand kerchiefs. Represent this situation in algebraically and graphically.

X + y = 40 → (1)

X + 5 = 4(y -5)

X + 5 = 4y – 20

X – 4y = -25 → (2)

For equation (1)

X + y = 40

Y = 40 – x

X	20	40
Y	20	0

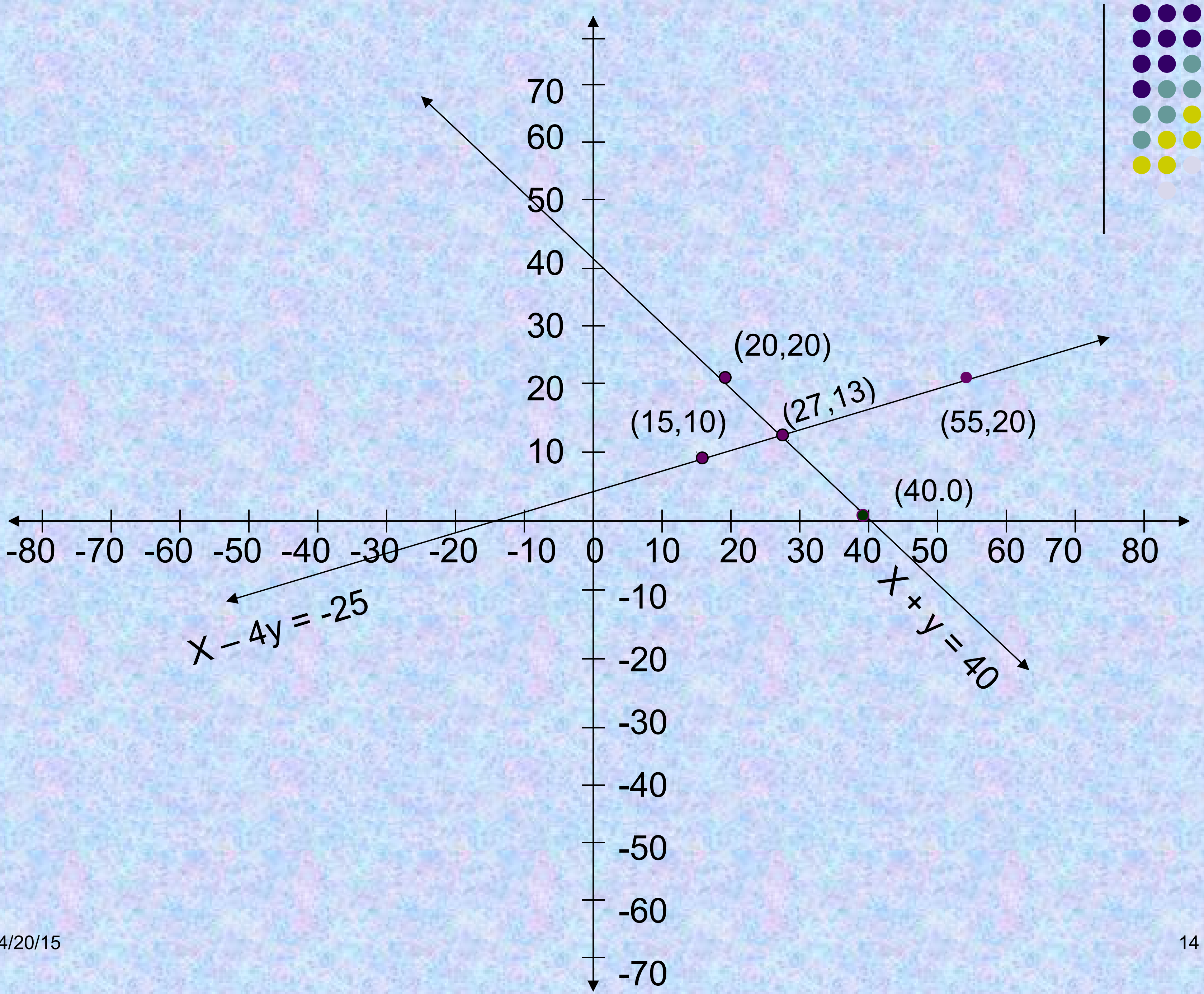
For equation (2)

X – 4y = -25

4y = x + 25

y = x + 25/4

X	15	55
Y	10	20


70
60
50
40
30
20
10
-80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80
-10
-20
-30
-40
-50
-60
-70
(20,20)
(27,13)
(15,10)
(55,20)
(40.0)
X – 4y = -25
X + y = 40

THE END