Solution

PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Class 10 - Mathematics

Section A

1. **(a)** 3

   Explanation:

   x + ky = 5

   2 + k(1) = 5

   2 + k = 5

   k = 5 - 2

   k = 3

   Therefore, the value of k is 3.

2. **(a)** x = 6, y = 4

   Explanation:

   We have:

   x - y = 2 …(i)

   x + y = 10 …(ii)

   Now, adding (i) and (ii) we get:

   2x = 12

   x = $\frac{12}{2}$

   x = 6

   Putting the value of x in (ii), we get

   6 + y = 10

   y = 10 - 6

   y = 4

3. **(b)** 2

   Explanation:

   It is given that, kx - 3y + 6 = 0 and 4x - 6y + 15 = 0 are two parallel lines.

   i.e., the given lines has no solution

   $\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

   $\Rightarrow \frac{k}{4} = \frac{-3}{-6} \neq \frac{k}{4} = \frac{3}{6} \Rightarrow$ k = 2

4. **(c)** 25

   Explanation:

   25

5. **(a)** all real values except -6

   Explanation:

   For a unique intersecting point, we have $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

   $\therefore \frac{k}{3} \neq \frac{-2}{1} \Rightarrow k \neq -6$

6. **(d)** Parallel

   Explanation:

   $\frac{a_1}{a_2} = \frac{3}{6}$ and $\frac{b_1}{b_2} = \frac{4}{8}$

   $\frac{c_1}{c_2} = \frac{5}{7}$

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

The above lines are parallel.

7.

(c) $\frac{15}{26}$

Explanation:

Let the fraction be $\frac{x}{y}$

According to the question,

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

2x - 2 = y + 2

y = 2x - 4 …(i)

And,

$\frac{(x-7)}{(y-2)} = \frac{1}{2}$

3x - 21 = y - 2

3x = y + 19 …(ii)

Using (i) in (ii)

3x = 2x - 4 + 19

x = 15

Using value of x in (i), we get

y = 2 (15) - 4

y = 30 - 4

y = 26

Therefore, required fraction = $\frac{15}{26}$

8. **(a)** $\frac{33}{2}$

Explanation:

We have, 36x + 24y = 702

and 24x + 36y = 558

Simplifying above equations, we get

6x + 4y = 117 ...(i)

and 4x + 6y = 93 ...(ii)

Multiplying (i) by 3, (ii) by -2 and then adding, we get

18x + 12y - 8x - 12y = 351 -186

$\Rightarrow$10x = 165$\Rightarrow$x = $\frac{165}{10} = \frac{33}{2}$

9.

(c) no solution

Explanation:

Here, $a_1 = 1$, $b_1 = 2$, $c_1 = 5$

$a_2 = -3$, $b_2 = -6$, $c_2 = 1$

So, $\frac{a_1}{a_2} = \frac{1}{-3} = -(\frac{1}{3})$

$\frac{b_1}{b_2} = \frac{2}{-6} = -(\frac{1}{3})$

$\frac{c_1}{c_2} = \frac{5}{1}$

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Therefore, the pair of equations has no solution.

10. **(a)** 1, 2

Explanation:

We have $\frac{2x+5y}{xy}$ = 6 or $\frac{2}{y}$ + $\frac{5}{x}$ = 6 ...(i)

Also, $\frac{4x-5y}{xy}$ = -3 or $\frac{4}{y}$ - $\frac{5}{x}$ = -3 ...(ii)

Let $\frac{1}{y}$ = a and $\frac{1}{x}$ = b
So, (i) and (ii) become
2a + 5b = 6 ...(iii)
and 4a - 5b = -3 ...(iv)
On solving (iii) and (iv), we get
a = $\frac{1}{2}$ and b = 1
$\therefore$ x = 1 and y = 2

11.
(b) $\frac{5}{13}$
Explanation:
Let the fraction be $\frac{x}{y}$.
According to question
x + y = 18 ... (i)
And $\frac{x}{y+2} = \frac{1}{3}$
$\Rightarrow$ 3x = y + 2
$\Rightarrow$ 3x - y = 2 ... (ii)
On solving eq. (i) and eq. (ii), we get
x = 5, y = 13
Therefore, the fraction is $\frac{5}{13}$

12.
(b) 12x + 15y = 45
Explanation:
For coincident lines, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$
i.e., $\frac{4}{12} = \frac{5}{15} = \frac{15}{45} = \frac{1}{3} = \frac{1}{3} = \frac{1}{3}$

13.
(d) 25 years, 20 years, 10 years
Explanation:
Let the present ages of A, B, C and D are x, y, z and t respectively.
Since, present age of D = t = 48 years.
According to question,
x = y + 5
$z = \frac{1}{2}y$
f = 2y + 8
From (iii), 48 = 2y + 8
$\Rightarrow$ From (iii), 48 = 2y + 8
From (ii), z = $\frac{1}{2}$ x 20 = 10 years
From (i), x = 20 + 5 = 25 years
So, present ages of A, B and C are 25 years, 20 years and 10 years respectively.

14. **(a)** 5 and 15
Explanation:
Let the two numbers be x and y
ATQ $\frac{x}{y}$ = $\frac{1}{3}$
$\Rightarrow$ 3x = y ...(i)
Now again
If 5 is added to both numbers then no. becomes x + 5 and y + 5 respectively. AT 2^{nd} Condition.
$\frac{x+5}{y+5} = \frac{1}{2}$.
$\Rightarrow$ 2(x + 5) = y + 5

$\Rightarrow$ 2x + 10 = y + 5
$\Rightarrow$ 2x - y + 10 - 5 = 0
$\Rightarrow$ 2x - y + 5 = 0
By Substitution Method
from. eq. (i) & (ii) we get
2x - 3x + 5 = 0.
-x + 5 = 0.
x = 5
put the value of x in eq. (i) we get
y = 3x
= 3 $\times$ 5
= 15
y = 15
Hence the numbers are 5 and 15.

15.

(c) $k \neq 3$
Explanation:
If the system has a unique solution, then $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
Here $a_1 = 6, a_2 = k, b_1 = -2$
and $b_2 = -1$
$\therefore \frac{6}{k} \neq \frac{-2}{-1} \Rightarrow 3k \neq 6 \Rightarrow k \neq 3$
2k ≠ 6
k ≠ 3

16.

(d) 115^o
Explanation:
Since the sum of the opposite angles of a cyclic quadrilateral is 180^o
$\therefore \angle$A + $\angle$C = 180^o
$\Rightarrow$ 2x - 1 + 2y + 15 = 180^o
$\Rightarrow$ x + y = 83^o ... (i)
And $\angle$B + $\angle$D = 180^o
$\Rightarrow$ y + 5 + 4x - 7 = 180^o
$\Rightarrow$ 4x + y = 182^o ... (ii)
Subtracting eq. (ii) from eq. (i),
we get -3x = -99^o
$\Rightarrow$ x = 33^o
Putting the value of x in eq. (i),
we get 33^o + y = 83^o
$\Rightarrow$ y = 50^o
$\therefore \angle$C = $(2y + 15)^o$ = $(2 \times 50 + 15)^o$ = 115^o

17.

(d) 3
Explanation:
Since, (-3,2) is the solution of 5x + 3/cy = 3. So (-3, 2) satisfies it.
$\therefore$ 5 x (-3) + 3
$\Rightarrow -15 + 6k = 3 \Rightarrow k = \frac{18}{6} = 3$

18.

(c) 78

Explanation:

Let us assume the tens and the unit digits of the required number be x and y respectively

$\therefore$ Required number = (10x + y)

According to the given condition in the question,

we have

x + y = 15 .....(i)

By reversing the digits, we obtain the number = (10y + x)

$\therefore$ (10y + x) = (10x + y) + 9

10y + x - 10x - y = 9

9y - 9x = 9

y - x = 1 .....(ii)

Now, on adding (i) and (ii) we get:

2y = 16

$\therefore$ y = $\frac{16}{8}$ = 8

Putting the value of y in (i), we get:

x + 8 = 15

x = 15 - 8

x = 7

$\therefore$ Required number = (10x + y) = 10 $\times$ 7 + 8 = 70 + 8 = 78

19.

(b) 57

Explanation:

Let the units and tens digits in the number be y and x respectively.

So, the number be 10x + y.

According to the question,

x + y = 12 ...(i)

Also, 10x + y + 18 = 10y + x

$\Rightarrow$ 9x - 9y = -18 $\Rightarrow$ x - y = -2 ...(ii)

Solving (i) and (ii), we get x = 5 and y = 7

$\therefore$ Required number is 57.

20. **(a)** parallel

Explanation:

Given: a_1 = 6, a_2 = 2, b_1 = -3, b_2 = -1, c_1 = 10 and c_2 =9

$a_1 = 6, a_2 = 2, b_1 = -3, b_2 = -1, c_1 = 10 \quad$ and $c_2 = 9$

Here $\frac{a_1}{a_2} = \frac{6}{2} = \frac{3}{1}, \frac{b_1}{b_2} = \frac{-3}{-1} = \frac{3}{1}, \frac{c_1}{c_2} = \frac{10}{9}$

but $\frac{c_1}{c_2} = \frac{10}{9}$

$\because \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Therefore, the lines are parallel.

21. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

22. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Each straight line passes through infinitely many points to cut on x-axis.

23.

(d) A is false but R is true.

Explanation:

We know that the system of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ has infinitely many solutions if $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ and gives a pair of coincident lines.

So, the Reason is correct

For Assertion, we have, $a_1 = 1$, $b_1 = 2$, $c_1 = -3$, $a_2 = 2$, $b_2 = 4$ and $c_2 = 7$

Now, $\frac{a_1}{a_2} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2}$ and $\frac{c_1}{c_2} = \frac{-3}{7} \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

So, the pair of linear equations has no solution and gives a pair of parallel lines.

So, Assertion is not correct.

24.

(d) A is false but R is true.

Explanation:

If the lines are coincident, then it has an infinite number of solutions.

The reason is clearly true.

25. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

On solving given equations, we get x = 0 and y = 0.

26.

(c) A is true but R is false.

Explanation:

For an inconsistent solution, we have $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

So, the A is true but R is false.

27.

(c) A is true but R is false.

Explanation:

Here, $\frac{a_1}{a_2} = \frac{b_1}{b_2}$ as $\frac{2}{1} = \frac{2}{1}$ is condition of non-zero solutions.

But all lines of type ax + by = 0 and cx + dy = 0 do not have non-zero solutions always.

28.

(d) A is false but R is true.

Explanation:

Given system does not have infinitely many solution, it has a unique solution.

29.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation:

Clearly, $\frac{a_1}{a_2} = \frac{2}{1}, \frac{b_1}{b_2} = \frac{3}{5}$ and $\frac{c_1}{c_2} = \frac{8}{6}$, we know that for infinitely many solutions $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

But here, $\frac{a_1}{a_2} = \frac{2}{1}$ and $\frac{c_1}{c_2} = \frac{8}{6}$, clearly $\frac{a_1}{a_2} = \frac{c_1}{c_2}$, so what may be the value of ‘k’ systems will never has infinitely many solutions.

30. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true but R is the correct explanation of A.

Section B

31. 64

Explanation:

Let unit number is y and tenth number is x.

The given number = 10x + y

As per first condition
A number consists of two digits whose sum is 10.
So, x + y = 10.......(i)
The number obtained by interchanging the digits is 10y + x.
As per second condition
If 18 is subtracted from the number, its digits are reversed.
$\Rightarrow$ 10y + x = 10x + y - 18
$\Rightarrow$ 9x - 9y = 18
$\Rightarrow$ x - y = 2............(ii)
Adding (i) and (ii), we get
x + y + x - y = 10 + 2
$\Rightarrow$ 2x = 12
$\Rightarrow$ x = 6
Substituting in (i), we get y = 4.
So, the given number is 10x + y = 10(6) + 4 = 64

32. 58
Explanation:
Let the unit digit is b and ten's digit is a.
So, two digit number is 10a + b.
As per given condition
The sum of the digits of a two digit number is 13.
So, a + b = 13 .....(i)
and the number obtained by interchanging the digits of the given number exceeds the number by 27.
10b + a = (10a + b) + 27
$\Rightarrow$ 9b = 9a + 27
$\Rightarrow$ b = a + 3 .....(ii)
Putting (ii) in (i), we get :
a + a + 3 = 13
$\Rightarrow$ 2a = 10
$\Rightarrow$ a = 5
Putting a = 5 in (ii), we get :
b = 5 + 3 = 8
Two digit number = 10a + b = 5(10) + 8 = 58
Therefore, the number is 58.

33. 200
Explanation:
Let cost price of 1 horse = Rs. x
and cost price of 1 cow = Rs. y
As per given condition
A man bought 4 horses and 9 cows for Rs. 1340.
So, 4x + 9y = 1340 ..... (i)
S.P. of one horse = x + $\frac{10}{100}x = \frac{11}{10}x$
S.P. of one cow = y + $\frac{20}{100}y = \frac{6y}{5}$
$\therefore$ Total selling price = $4 \times \frac{11}{10}x + 9 \times \frac{6y}{5}$
And he sells the horses at a profit of 10% and the cows at a profit of 20% and his whole gain is Rs. 188.
$\frac{44}{10}x + \frac{54y}{5}$ = 1340 + 188
$\Rightarrow$ 44x + 108y = 15280 ....(ii)
eq. (i) $\times$ 12, we get
48x + 108y = 16080 ......(iii)
Subtracting (ii) from (iii), we get
4x = 800
$\Rightarrow$ x = 200
$\therefore$ Cost price of horse = Rs. 200

34. 57

Explanation:

Let the ten's digit of the required number be x and the unit's digit be y.

As per given condition the sum of the digits of a two-digit number is 12.

Then, x + y = 12. ...(i)

Required number = (10x + y).

Number obtained on reversing the digits = (10y + x).

As per given condition the number obtained by interchanging its digits exceeds the given number by 18.

∴ (10y + x) - (10x + y) = 18

⇒10y + x - 10x - y = 18

⇒ 9y -9x = 18

⇒ y -x = 2. ...(ii)

On adding (i) and (ii), we get

(x + y) + (y -x) = 12 + 2

⇒ 2y = 14

⇒ y = 7.

Putting y = 7 in (i), we get

x + 7 = 12

⇒ x = 12 - 7 = 5

∴ x = 5 and y = 7.

Hence, the required number is 57.

35. 84

Explanation:

Let digit at unit place = x and digit at tens place = y

So, two digit number is = 10y + x

As per given condition

The result of dividing a number of two digits by the number with the digits reversed is $\frac{7}{4}$.

$\frac{10y+x}{10x+y} = \frac{7}{4}$

⇒ 40y + 4x = 70x + 7y

66x - 33y = 0

⇒ 2x - y = 0 ....(i)

And the sum of the digits is 12.

So, x + y = 12 ......(ii)

Adding eq (i) and (ii), we get

2x - y + x + y = 12 + 0

⇒ 3x = 12

⇒ x = 4

When x = 4, eq. (i) becomes

2(4) - y = 0

⇒ y = 8

∴ Two digit number is = 10(8) + 4 = 80 + 4 = 84

36. 692

Explanation:

Let digit at unit’s place = x and digit at hundred’s place = y

∴ Middle digit =$x + y + 1$

Number = $100y + 10(x + y + 1) + x$

Number obtained by reversing the digits = 100x + 10(x + y + 1) + y

ATQ.,

x + y + (x + y + 1) = 17

⇒ 2x + 2y = 16 ..(i)

and 100x + 10(x + y + 1) = x - 396 .... (ii)

⇒ 99x - 99y = -396

⇒ x - y = -4

By Solving equation (i) and (ii), we get
x = 2, y = 6 and Number = 692

37. 36

Explanation:
Let the tens digit be x and unit place digit be y.
Number = 10x + y
As per given condition
The sum of the digits of a two digit number is 9.
So, x + y = 9........(i)
And the number obtained by reversing the order of digits of the given number exceeds the given number by 27.
10y + x = 10x + y + 27
$\Rightarrow$ -9x + 9y = 27
$\Rightarrow$ -x + y = 3.....(ii)
Adding (i) and (ii), we get
2y = 12
$\Rightarrow$ y = 6
Putting value of y in equation (i), we get
x + 6 = 9
$\Rightarrow$ x = 9 - 6
$\Rightarrow$ x = 3
Two digit number = 10x + y = 10(3) + 6 = 30 + 6 = 36
So, the given number is 36.

38. 36

Explanation:
Let length of the garden = x m and breadth of the garden = y m
A.T.Q. x = y + 12 $\Rightarrow$ x - y = 12 ..... (i) and
$\frac{1}{2}$ Perimeter = 60
$\Rightarrow \frac{1}{2} \times 2(x + y) = 60$
$\Rightarrow$ x + y = 60..... (ii)
Add (i) and (ii)
2x = 72
x = 36
then put x = 36 in (i)
y = 24

39. 5 x - 4 y - 8 = 0

7 x + 6 y - 9 = 0
Here, a_1= 5, b_1 = -4, c_1= 8
a_2= 7, b_2= 6, c_2 = -9
We see that $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
Hence, the lines representing the given pair of linear equations intersect at the point and the equations are consistent having unique solution.

40. No

We may rewrite the equations as
4x + 3y = 6
12x + 9y = 15
Here, $\frac{a_1}{a_2} = \frac{1}{3}, \frac{b_1}{b_2} = \frac{1}{3}$ and $\frac{c_1}{c_2} = \frac{2}{5}$
As $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$, the given equations do not represent a pair of coincident lines.

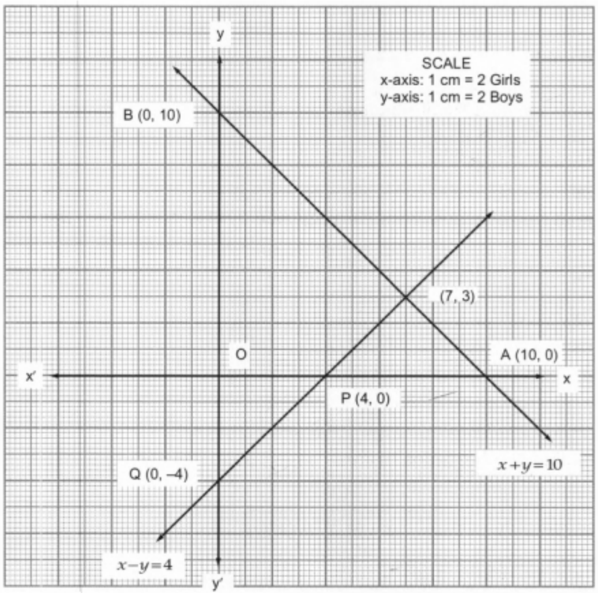
41. Formulation: Let the number of girls be x and the number of boys be y.

It is given that total ten students took part in the quiz.
$\therefore$ Number of girls + Number of boys = 10
i.e. x + y = 10
It is also given that the number of girls is 4 more than the number of boys.

$\therefore$ Number of girls = Number of boys + 4

i.e. x = y + 4

or, x - y = 4



42. let the first number = x

And second number = y

According to given condition

Sum of two numbers is 75.

x + y = 75 ....(1)

And difference of two numbers is 15.

x - y = 15.................. (2)

By solving using substitution method,

x = 75 - y ....(3)

Now using (3) in (2), we get

(75 - y) - y = 15

75 -2y = 15

75 - 15= 2y

2y = 60

y = 30

Put y = 30 in (3), we get

x = 75 - 30

x = 45

So the given numbers are 30 and 45.

43. Let the number of girls = 2x and number of boys = 3x

$\therefore 2x + 3x = 40 \Rightarrow x = 8$

$\therefore$ Number of girls = $2(8) = 16$

and number of boys = $3(8) = 24$

Let out of 5 students, y are boys.

$\therefore$ Number of girls = 5 - y

ATQ.

$\frac{16+5-y}{24+y} = \frac{4}{5}$

$5(21 - y) = 4(24 + y)$

$\Rightarrow 105 - 5y = 96 + 4y$

$9y = 105 - 96$

9y = 9 $\Rightarrow$ y = 1

44. The pair of linear equations are given as:

x + 2y – 4 = 0 ...(i)

2x + 4y – 12 = 0 ...(ii)

We express x in terms of y from equation (i), to get

$x = 4 - 2y$

Now, we substitute this value of x in equation (ii), to get

$2(4 - 2y) + 4y - 12 = 0$

i.e., $8 - 12 = 0$

i.e., $-4 = 0$

Which is a false statement. Therefore, the equations do not have a common solution. So, the two rails will not cross each other.

45. Given pair of linear equations is

$3x - y - 5 = 0$ …(i)

and $6x - 2y - p = 0$ …(ii)

On comparing with standard form, we get

Here, $a_1 = 3$, $b_1 = -1$, $c_1 = -5$;

And $a_2 = 6$, $b_2 = -2$, $c_2 = -p$;

$a_1/a_2 = 3/6 = 1/2$

$b_1/b_2 = 1/2$

$c_1/c_2 = 5/p$

Since, the lines represented by these equations are parallel, then

$a_1/a_2 = b_1/b_2 \neq c_1/c_2$

Taking last two parts, we get $\frac{1}{2} \neq \frac{5}{p}$

So, $p \neq 10$

Hence, the given pair of linear equations are parallel for all real values of p except 10 i.e.,

$p \in R - \{10\}$

46. The given equations are

$3x - 2y = 5$ ....(i)

$2x + y = 7$ ....(ii)

Putting x = 3 and y = 2 in (i), we get

LHS = $3x - 2y$

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

$= 9 - 4$

$= 5$

= RHS .... (iii)

Putting x = 3 and y = 2 in (ii), we get

LHS = $2x + y$

$= (2 \times 3 + 2)$

$= 6 + 2$

$= 8$

$\neq$ RHS............. (iv)

From (iii) and (iv), we observe that the values x = 3, y = 2 do not satisfy (ii).

Hence, x = 3, y = 2 is not a solution of the given system of equations.

47. here we have

$a_1 = \frac{3}{2}$, $b_1 = \frac{5}{3}$, $c_1 = 7$

$a_2 = \frac{3}{2}$, $b_2 = \frac{2}{3}$, $c_2 = 6$

clearly $\frac{a_1}{a_2}$ is not equal to $\frac{b_1}{b_2}$

therefore the given system of equation have unique solution.

Hence the given pair of equations will intersect at a point.

48. Let the cost of each chair be ₹x and that of each table be ₹y.

As per given condition the cost of 8 chairs and 5 tables is ₹10500.

Then, $8x + 5y = 10500$ .... (i)

And cost of 5 chairs and 3 tables is ₹6450.

then, $5x + 3y = 6450$ ....(ii)

On multiplying (ii) by 5 and (i) by 3 and subtracting the results, we get

$25x - 24x = 32250 - 31500$

$\Rightarrow$ x = 750.
Putting x = 750 in (i), we get
8x + 5y = 10500
8 $\times$ 750 + 5y = 10500
$\Rightarrow$ 6000 + 5y = 10500
$\Rightarrow$ 5y = (10500 - 6000) = 4500
$\Rightarrow$ y = 900.
$\therefore$ cost of each chair = ₹750
and cost of each table = ₹900.

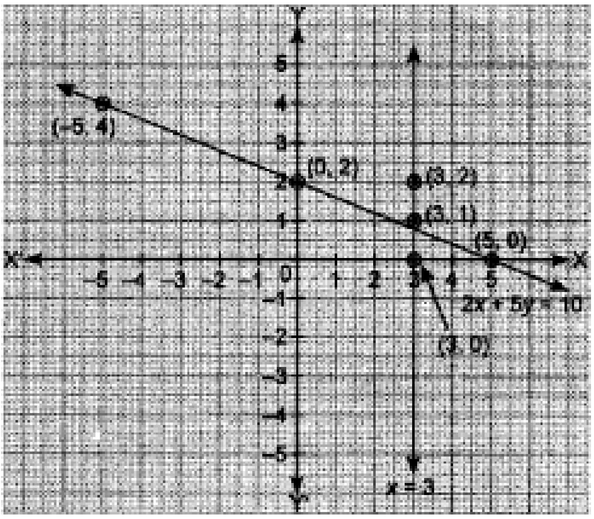
Section C

49. We have,
37x + 41y =70 ....(i)
41x + 37y=86 ....(ii)
Adding equation (i) and (ii), we get
37x + 41y + 41x + 37 =70 + 86
78x + 78y =156
$\Rightarrow$ x +y=2 ....(iii)
Subtracting equation (i) from equation (ii), we get
(37x + 41y) - (41x + 37) =70 - 86
-4x + 4y = -16
4x- 4y = 16
$\Rightarrow$ x -y= 4 ....(iv)
Adding equation (iii) and (iv), we get
x +y + x - y =2 + 4
2x =6
$\Rightarrow$ x =3
Subtracting equation (iii) and (iv), we get
x +y - x + y =2 - 4
2y = - 2
y = -1
Hence, x = 3 and y = -1 is the solution of the given system of equations.
50. The given system of equations is:
$x + 2y = -1$ ...(i)
$2x - 3y = 12$ ...(ii)
From equation (i), we get
$x = -1 - 2y$
Substituting x = -1 - 2y in equation (ii), we get
$2(-1 - 2y) - 3y = 12$
$\Rightarrow -2 - 4y - 3y = 12$
$\Rightarrow -7y = 14$
$\Rightarrow\ y = -2$
Putting y = -2 in x = -1 - 2y, we get
x = -1 - 2 $\times$ (-2) = 3
Hence, the solution of the given system of equations is x=3, y=-2.
51. We have, 2x + 5y = 10
$\Rightarrow$ 2x = 10 - 5y
$\Rightarrow$ x $= \frac{10-5y}{2}$
Table for 2x + 5y = 10 is

x	0	5	-5
y	2	0	4

We have, x - 3 = 0
$\Rightarrow$ x = 3

The graph of 2x + 5y = 10 and x - 3 = 0



From graph we find that lines intersect in one point.

$\therefore$ System of linear equations has unique solution.

52. Let us suppose that the length and breadth of the rectangle be x m and y m respectively.

Then, Area of rectangle = xy meter^2

Now, according to question if length is increased by 7m and the breadth is decreased by 3m, the area remains same

$\therefore$ xy = (x + 7)(y - 3)

$\Rightarrow$ xy = xy - 3x + 7y - 21

$\Rightarrow$ 3x - 7y = -21 ....(i)

Again, according to question when length is decreased by 7m and breadth is increased by 5m, then area remains unaffected

$\therefore$ xy = (x - 7)(y + 5)

$\Rightarrow$ xy = xy + 5x - 7y - 35

$\Rightarrow$ 35 = 5x - 7y

$\Rightarrow$ 5x - 7y = 35 ....(ii)

Subtracting equation (i) from (ii), we get

5x - 7y -(3x- 7y) = 35 - (-21)

or, 5x - 7y -3- + 7y = 35 + 21

$\Rightarrow$ 2x = 56

$\Rightarrow x = \frac{56}{2} = 28$

Put the value of x = 28 in equation (ii), we get

5 $\times$ 28 - 7y = 35

$\Rightarrow$ 140 - 7y = 35

$\Rightarrow$ -7y = 35 - 140

$\Rightarrow$ -7y = -105

$\Rightarrow y = \frac{105}{7} = 15$

Therefore, dimensions of the rectangle are 28m and 15m respectively.

53. Let us denote the number of pants by x and the number of skirts by y.

Then the equations formed are:

y = 2x - 2 ………… (i)

y = 4x - 4………..(ii)

From (i)

When x = 2, then y = 2

When x = 1, then y = 0

x	2	1
y	2	0

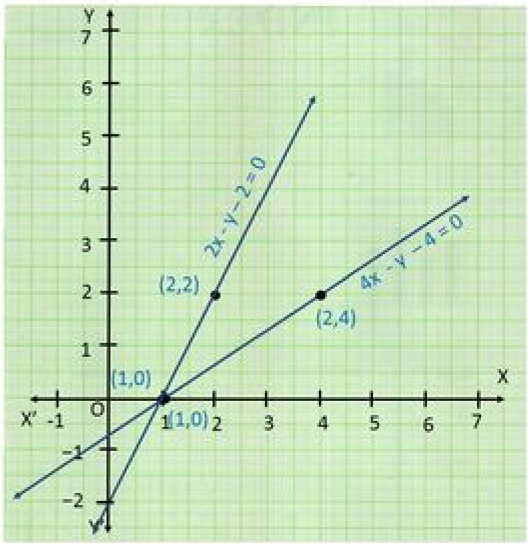
From (ii)

When x = 2, then y = 4

When x = 1, then y = 0

x	2	1
y	4	0

The graphs of two equations of line is shown below.



From the graph, the lines intersect at point (1, 0)

Thus, the value of x = 1 and y = 0

Hence, the number of pants she purchased are 2 and the number of skirts she purchased are 0.

54. Let the ten's digit of required number be x and its unit digit be y respectively.

Then, As per given condition

The sum of digits of a two digit number is 15.

x + y = 15 ....(i)

Required number = 10x + y

Number formed on reversing the digits = 10y + x

So, as per given condition, the number obtained by reversing the order of digits of the given number exceeds the given number by 9.

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

$\therefore$ 10y + x - 10x - y = 9

9y - 9x = 9

- x + y = 1.............(ii)

Adding (i) and (ii), we get

$2y = 16$

$\Rightarrow y = \frac{16}{2} = 8$

Putting y = 8 in (i), we get

x + 8 = 15

x = 15 - 8 = 7

Number = 10x + y

= 10 $\times$ 7 + 8

= 70 + 8

= 78

Hence the given two digit number is 78.

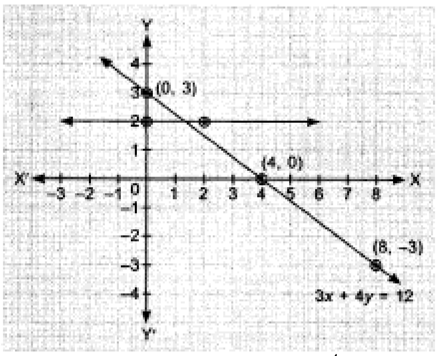
55. Given equations are $3x + 4y = 12$ and $y = 2$

Solution table for $3x + 4y = 12$ is

x	0	4	8
y	3	0	-3

Table for $y = 2$ is

x	0	1	2
y	2	2	2



$\because$ Lines intersect at one point $\left(\frac{4}{3}, 2\right)$

$\Rightarrow$ Pair of linear equations has a unique solution.

56. Let the present age of father be x years and sum of present age of two son's be y years.

According to question,

after five years

x + 5 = 2(y + 5 + 5)

x + 5 = 2y + 20

x - 2y = 15 ....(i)

and x = 3y ....(ii)

$\therefore$ 3y - 2y = 15

or y = 15

$\therefore$ age of father x = 3y

= 3 × 15

= 45 years

57. Let the cost of one Kg of apple is x and one Kg of grapes is y.

According to question,

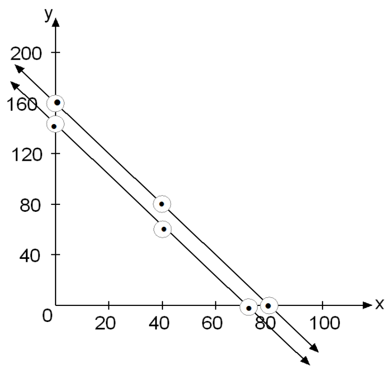
2x + y = 160 and 4x + 2y = 300

2x + y = 160

x	0	80	40
Y	160	0	80

4x + 2y = 300

x	0	75	40
Y	150	0	70



58. We have to solve 2x + 3y = 11 and 2x − 4y = −24 and also we have to find the value of 'm' for which y = mx + 3.

2x + 3y = 11 …. (1)

2x - 4y = −24 …. (2)

Using equation (2), we can say that

2x = −24 + 4y

⇒ x = −12 + 2y

Putting this in equation (1), we get

2 (−12 + 2y) + 3y = 11

⇒ −24 + 4y + 3y = 11

⇒ 7y = 11+ 24

$\Rightarrow 7y = 35$

or, $y = 5$

Putting value of y in equation (1), we get

$2x + 3(5) = 11$

$\Rightarrow 2x + 15 = 11$

$\Rightarrow 2x = 11 - 15 = -4 \Rightarrow x = -2$

Therefore, $x = -2$ and $y = 5$

Putting values of x and y in $y = mx + 3$, we get

$5 = m(-2) + 3$

$\Rightarrow 5 = -2m + 3$

or, $5 - 3 = -2m$

$\Rightarrow -2m = 2 \Rightarrow m = -1$

Section D

59. i. $x + y + 2 = 15$

$x + y = 13$ ...(i)

Area of bedroom + Area of kitchen = 95

$5 \times x + 5 \times x + 5 \times y = 95$

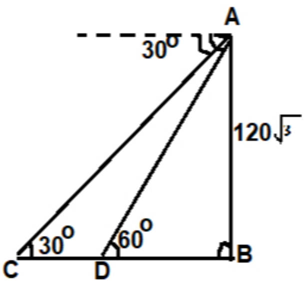
$2x + y = 19$ ...(ii)

In $\triangle ABD$

$\tan 60^o = \frac{120\sqrt{3}}{BD}$

$BD = \frac{120\sqrt{3}}{\sqrt{3}}$

BD = 120 m



In $\triangle ABC$

$\tan 30^o = \frac{AB}{BC}$

$\frac{1}{\sqrt{3}} = \frac{120\sqrt{3}}{BC}$

BC = 360 m

$\therefore$ CD = BC - BD

= 360 - 120

= 240 m

ii. Length of outer boundary

= 12 + 15 + 12 + 15

= 54 m

iii.
$$\begin{array}{r} x + y = 13 \\ 2x + y = 19 \\ - \quad - \quad\quad - \\ \hline -x \quad\quad = -6 \end{array}$$

x = 6

Area of bedroom 1 = $5 \times x$

$= 5 \times 6 = 30 \text{ m}^2$

OR

Area of living room = $(5 \times 2) + (9 \times 7)$

= 10 + 63

$= 73 \text{ m}^2$

60. i. $S = a + bt^2$

At t = 1 sec

180 = a + b ...(i)

At t = 2 sec

132 = a + 4b ...(ii)

from (i) and (ii)

180 - 132 = -3b

48 = -3b

b = -16

Put b = -16, in equation (i)

180 = a + (-16)

a = 196

ii. At t = 0

s = a + b(0)

s = a

s = 196

i.e., The height of Tower of Pisa = 196 feet

iii. $s = a + bt^2$

$0 = 196 - 16t^2$

$-196 = -16t^2$

$196 \div 16 = t$

$t = \frac{14}{4}$

t = 3.5 sec

OR

$s = a + bt^2$

$s = 196 + (-16)(2)^2$

s = 196 - 64

s = 132 feet

61. i. Since, each poor child pays ₹ x

and each rich child pays ₹ y

∴ In batch I, 20 poor and 5 rich children pays ₹ 9000 can be represented as 20x + 5y = 9000

and in batch II, 5 poor and 25 rich children pays ₹ 26,000 can be represented as 5x + 25y = 26,000

ii. As we have 20x + 5y = 9,000 ...(i)

and 5x + 25y = 26,000

or x + 5y = 5,200 ...(ii)

On subtracting (ii) from (i), we get

19x = 3,800

⇒ x = 200

∴ Monthly fee paid by a poor child = ₹ 200

iii. As we have,

20x + 5y = 9000 ...(i)

and 5x + 25y = 26000

x + 5y = 5200 ...(ii)

On subtracting equation (ii) from (i), we have

19x = 3800

$x = \frac{3800}{19}$

= 200

Put the value of x in equation (ii), we get

200 + 5y = 5200

5y = 5200 - 200

y = 1000

∴ y - x = 1000 - 200

= 800
Hence, difference in the monthly fee paid by a poor child and a rich child is ₹ 800.
OR
Total monthly fee = 10x + 20y
= 10(200) + 20(1,000)
= 2,000 + 20,000
= ₹ 22,000

62. i. Given, prize amount for Hockey ₹ x and ₹ y for cricket per student
$\therefore$ Algebraic equations are
5x + 4y = 9500 ...(i)
and 4x + 3y = 7370 ...(ii)

ii. Given, prize amount for Hockey ₹ x and ₹ y for cricket per student
$\therefore$ Algebraic equations are
5x + 4y = 9500 ...(i)
and 4x + 3y = 7370 ...(ii)
Multiply by 3 in equation (i) and by 4 in equation (ii)
15x + 12y = 28,500 ...(iii)
16x + 12y = 29480 ...(iv)
On subtracting equation (iii) from equation (iv), we get
x = 980
$\therefore$ Prize amount for hockey = ₹ 980

iii. Given, prize amount for Hockey ₹ x and ₹ y for cricket per student
$\therefore$ Algebraic equations are
5x + 4y = 9500 ...(i)
and 4x + 3y = 7370 ...(ii)
Now, put this value in equation (i), we get
$5 \times 980 + 4y = 9500$
$\Rightarrow 4y = 9500 - 4900 = 4600$
$\Rightarrow y = 1150$
$\therefore$ Prize amount for cricket = ₹ 1150
Difference = 1150 - 980 = 170
$\therefore$ Prize amount for cricket is ₹ 170 more than hockey.
OR
Total prize amount for 2 students each from two games
= 2x + 2y
= 2(x + y)
= 2(980 + 1150)
$= 2 \times 2130$
= ₹ 4260

63. i. Mentions that the y-axis represents distance with or without units (in 1,000 nm) and the x-axis represents the number of days
ii. Accept any number between 8000 and 9000 with or without units nm.
iii. No, a distance-time graph cannot be related to a route map.
iv. The relation between speed, time and distance
- The cargo ships' speeds differ in the two routes.
- The westbound cargo ships sail at greater speed.
- The ocean current helps westbound ships to travel faster.

64. i. x + y = 300 ...(i)
150 x + 250 y = 55000 ...(ii)
ii. a. Solving equation (i) and (ii)
Number of children visited park (x) = 200
OR
b. Solving equation (i) and (ii)
Number of adults visited park (y) = 100

iii. Amount collected = 250 $\times$ 150 + 100 $\times$ 250 = ₹ 62500

Section E

65. Let the cost price of the tea set and the lemon set be ₹ x and ₹ y respectively.

Loss on the tea set = ₹ $\frac{5x}{100}$ = ₹ $\frac{x}{20}$

Gain on the lemon set = ₹ $\frac{15y}{100}$ = ₹ $\frac{3y}{20}$

$\therefore$ Net gain = ₹ $\frac{3y}{20} - \frac{x}{20}$

$\frac{3y}{20} - \frac{x}{20} = 7$

$\Rightarrow 3y - x = 140$ ....(i)

Gain on the tea set = ₹ $\frac{5x}{100}$ = ₹ $\frac{x}{20}$

Loss on the lemon set = ₹ $\frac{10y}{100}$ = ₹ $\frac{y}{10}$

$\therefore$Net gain = ₹ $\left(\frac{x}{20} + \frac{y}{10}\right)$

$\frac{x}{20} + \frac{y}{10} = 13$

$\Rightarrow x + 2y = 260$ ......(ii)

By adding equations (i) and (ii), we get

$\Rightarrow 5y = 400$

$\Rightarrow y = 80$

Substituting $y = 80$ in (ii), we get $x = 100$.

$\therefore$ the actual price of the tea set is ₹ 100 and that of the lemon set is ₹ 80.

66. Graph for the equation:

$x + y = 3$

$\Rightarrow 3 - x = y$

or, $y = 3 - x$

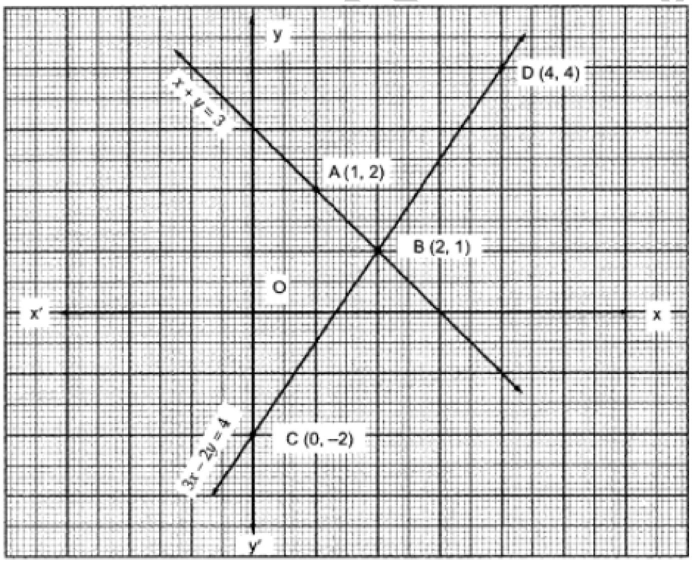
When x=1, we have

y=3 -1 =2

When x=2, we have

y=3 - 2=1

x	1	2
y	2	1



Plotting the points $A(1, 2)$ *and* $B(2, 1)$ and drawing a line joining them, we get the graph of the equation $x + y = 3$ as shown in Fig.

Graph of the equation $3x - 2y = 4$:

We have,

$3x - 2y = 4 \Rightarrow 2y = 3x - 4 \Rightarrow y = \frac{3x-4}{2}$

When, x=0, we have

$y = \frac{3\times0-4}{2} = -2$

When x=4, we have
$y=\frac{3\times4-4}{2}=\frac{12-4}{2}=4$

x	0	4
y	-2	4

Plotting the point C (0, -2) and D (4, 4) on the same graph paper and drawing a line joining them, we obtain the graph of the equation 3x - 2y = 4.

The two lines intersect at point P(2,1).

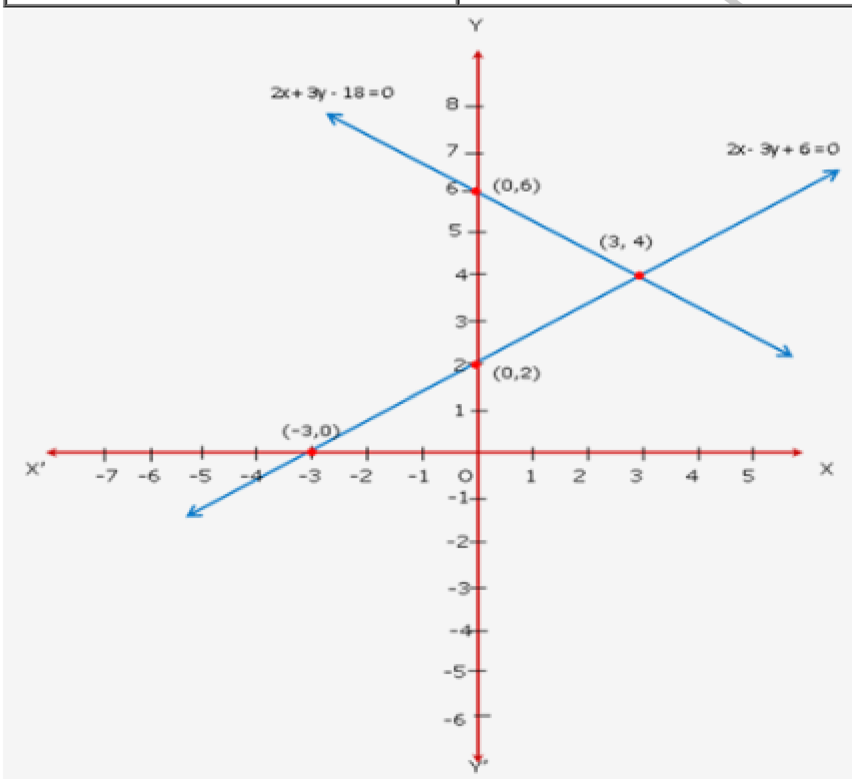
Hence, x = 2, y = 1 is the solution of the given system.

67. $2x-3y+6=0$
$\Rightarrow y=\frac{2x+6}{3}$

x	-3	0
y	0	2

$2x+3y-18=0$
$\Rightarrow y=\frac{18-2x}{3}$

x	0	3
y	6	4



Thus, the two graph lines intersect at (3, 4)

∴ x = 3 and y = 4 is the solution of given system of equations

The vertices of the triangle formed by these lines and y - axis are (3, 4), (0, 6) and (0, 2)

So, height of the triangle

= distance from (3, 4) to y-axis

= 3 units

Also base = 4 units

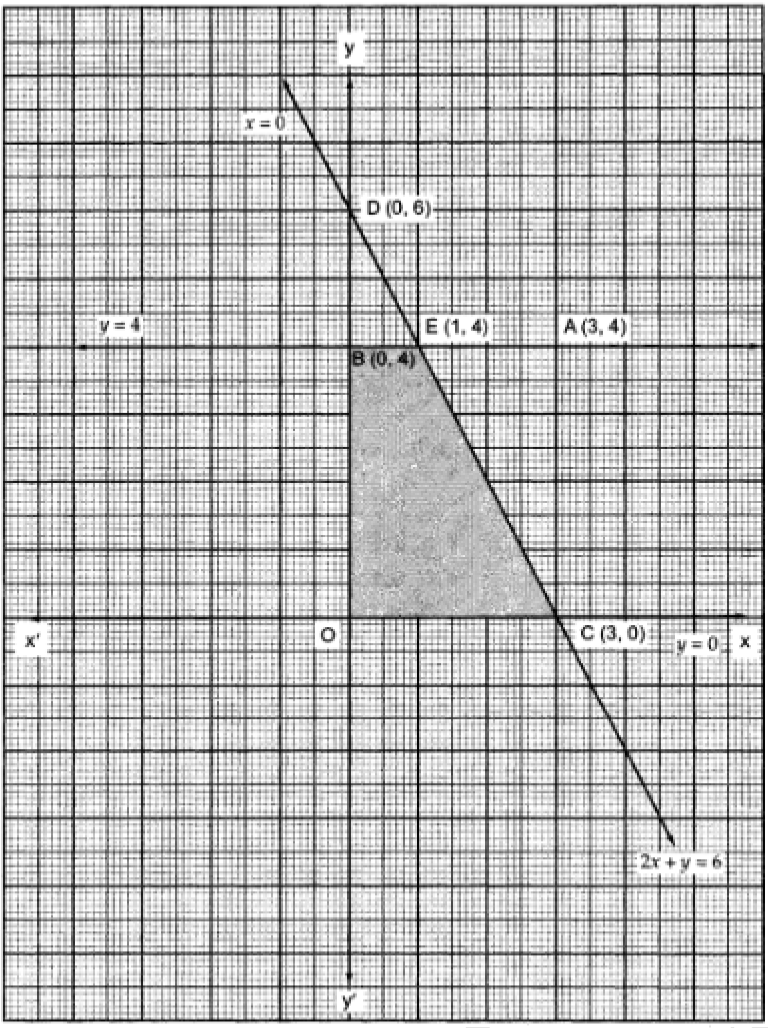
Area of the triangle = $\frac{1}{2}\times$ base $\times$ height

$=\frac{1}{2}\times4\times3$

= 6 sq. units

68. x = 0, y = 0, y = 4 and 2x + y = 6

Graph of the equation y = 4:



$2x + y = 6$:

We have $2x + y = 6$

When y = 0, we get x = 3 and x = 0 gives y = 6.

Thus, we obtain the following table giving coordinates of two points on the line represented by the equation $2x + y = 6$.

x	3	0
y	0	6

The coordinates of its vertices are $O(0,0), C(3,0), E(1,4)\ and\ B(0,4)$.

Area of trapezium OCEB $= \frac{1}{2}(OC + BE) \times OB = \frac{1}{2}(3+1) \times 4 = 8\text{sq.}\ units$

69. Let the fraction be $\frac{x}{y}$

ATQ $\frac{x+2}{y+1} = \frac{3}{4}$

$\Rightarrow 4x - 3y = -5$ ...(i)

Also, $\frac{x-2}{y-1} = \frac{1}{2}$|

$2x - y = 3$ ...(ii)

Solving (i) and (ii) to get

y = 11 and x = 7

$\Rightarrow$ fraction is $\frac{7}{11}$

70. Let length of given rectangle be x and breadth be y

$\therefore$ area of rectangle = xy

According to the first condition

(x - 5)(y + 3) = x y - 9

or, xy + 3x - 5 y - 15 = xy - 9

or, xy + 3x - 5y - xy = 15 - 9

or, 3x - 5y = 6........(i)

According to the second condition,

(x +3)(y +2) = xy + 67

or, xy + 2x + 3y + 6 = xy + 67

or, xy + 2x + 3y - xy = 67 - 6

or, 2x + 3y = 61 ...(ii)

Multiplying eqn. (i) by 3 and eqn. (ii) by 5 and then adding,

9x-15y = 18

10x + 15y = 305

or, 19x = 323

$\therefore x = \frac{323}{19} = 17$

Substituting this value of x in eqn. (i),

3(17)-5y = 6

51 - 5y = 6

or, 5y = 51 - 6

∴ y = 9

Hence, perimeter = 2(x + y) = 2(17 + 9) = 52 units.

71. Let the present age of Sagar be x years and the age of Tiru be y year.

5 years ago, Sagar's age = $(x-5)$years and Tiru's age =$(y-5)$years

According to given condition,

$(x-5) = 2(y-5)$

$\Rightarrow x-5 = 2y-10 \Rightarrow x-2y+5 = 0$

After 10 yr, Sagar's age = $(x+10)$yrs and Tiru's age =$(y+10)$yrs

According to the given question,

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

$\Rightarrow x+10 = y+20 \Rightarrow x-y-10 = 0$

Thus, we get following pair of linear equations

$\Rightarrow x-2y+5 = 0$ ....(i)

$\Rightarrow x-y-10 = 0$ ...(ii)

Now, Let us draw the graphs of Eqs.(i) and (ii) , by finding atleast two solutions of each of the above equations. The solutions of equations are given in the following tables.

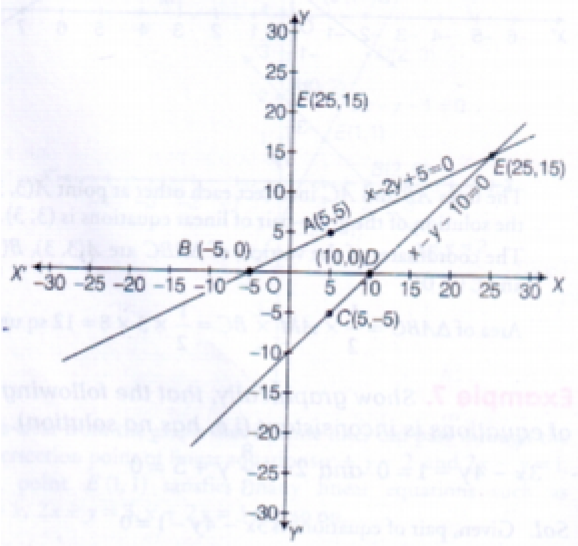
Table for $x-2y+5=0$

x	5	-5
$y = \frac{x+5}{2}$	5	0
Points	A(5,5)	B(-5,0)

Table for $x-y-10=0$

x	5	10
y = x - 10	-5	0
Points	C(-5,5)	D(10,0)

Plot the points A(5,5) and B(-5,0) on a graph paper and join them to get the line AB. Similarly, plot the points C(-5,5) and D(10,0) on the same graph paper and join them to get line CD.



It is clear from the graph that, lines AB and CD intersect each other at point E(25,15).

So, $x = 25$ and $y = 15$ is the required solution.

Hence, Sagar's present age = 25 yr and Tiru's present age = 15 yr

72. Let the digits of number be x and y

$\therefore$ number = 10x + y

According to the question,

10x + y = 8(x+y) - 5

10x +y = 8x + 8y -5

10x - 8x + y - 8y + 5 = 0

or, 2x - 7y + 5 = 0 ....(i)

also 16(x - y) + 3 = 10x + y

or, 16x - 16y + 3 = 10x + y

or, 16x - 16y + 3 - 10x -y = 0

$\Rightarrow$ 6x - 17y + 3 = 0 ....(ii)

On comparing the equation with ax + by + c = 0 we get

$a_1 = 2, b_1 = -7, c_1 = 5$

$a_2 = 6, b_2 = -17, c_2 = 3$

$\frac{x}{b_2c_1 - b_1c_2} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{c_1b_2 - a_2b_1}$

$\frac{x}{(-17)(5)-(-7)(3)} = \frac{y}{(5)(6)-(3)(2)}$

$= \frac{1}{(5)(-17)-(6)(-7)}$

or, $\frac{x}{85-21} = \frac{y}{30-6} = \frac{1}{-34+42}$

or, $\frac{x}{64} = \frac{y}{24} = \frac{1}{8}$

or, $\frac{x}{8} = \frac{y}{3} = 1$

Hence, x=8, y=3

So required number = 10 $\times$ 8 + 3 = 83.

73. Let the cost price of a saree be ₹ x and the list price of a sweater be ₹ y.

We know that, Selling Price is given by :

$S \cdot P \cdot = C \cdot P \cdot \left(1 + \frac{profit\ percentage}{100}\right)$

$\Rightarrow$ S.P. of saree at 8% profit = $x(1 + \frac{8}{100})$

$= \left(x + \frac{8x}{100}\right) = \left(\frac{108x}{100}\right)$

Also, Selling Price is given by:

$S.P. = L.P. (1 - \frac{discount\ percentage}{100})$

$\Rightarrow$ S.P. of sweater at 10% discount $= \left(y - \frac{10y}{100}\right) = \left(\frac{90y}{100}\right)$

According to question,

$\frac{108x}{100} + \frac{90y}{100} = 1008$

$\Rightarrow$ 108x + 90y = 100800 ...(i)

Now, S.P. of saree at 10% profit $= \left(x + \frac{10x}{100}\right) = \left(\frac{110x}{100}\right)$

S.P. of sweater at 8% discount $= \left(y - \frac{8y}{100}\right) = \left(\frac{92y}{100}\right)$

According to question,

$\frac{110x}{100} + \frac{92y}{100} = 1028$

$\Rightarrow$ 110x + 92y = 102800 ...(ii)

Subtracting equation (i) from equation (ii), we get ;

(110x + 92y) -(108x + 90y)=102800 -100800.

$\Rightarrow$ x + y = 1000

$\Rightarrow$ x = 1000 - y ...(iii)

Substituting x = 1000 - y from equation (iii) in equation (i), we get

108(1000 - y) + 90y = 100800

$\Rightarrow$ -18y = -7200

$\Rightarrow$ y = 400

Putting value of y in equation (iii)

$\Rightarrow$ x = 1000 - 400 = 600

Thus, the cost price of saree is x = ₹ 600

and the list price of sweater is y = ₹ 400.

74. x - y = 1

or, y = x - 1

When x = 2, we have y = 1

When x = 3, we have y = 2

When x= -1, we have y = -2

x	2	3	- 1
y	1	2	-2

2x + y = 8

or y = 8 - 2x

When x = 2, we have y = 4

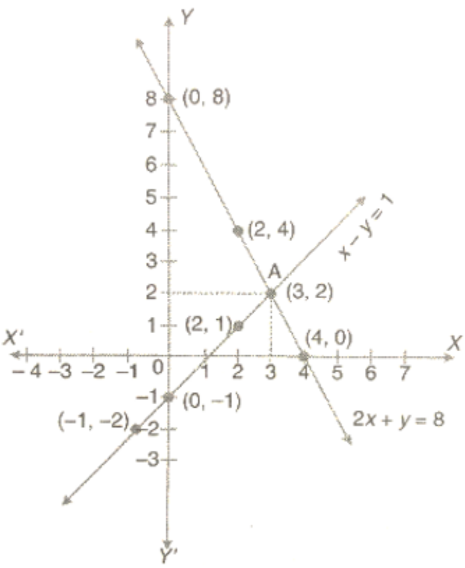
When x = 4, we have y = 0

When x = 0 , we have y = 8

x	2	4	0
y	4	0	8

Plotting the above points and drawing a line joining them, we get the graphical representation

Therefore, required graph is shown below:



The two lines intersect at point A (3, 2).

$\therefore$ Solution of given equations is $x = 3$, $y = 2$.

Again, $x - y = 1$ intersects y-axis at $(0, -1)$ and $2x + y = 8$ intersects y-axis at $(0,8)$.