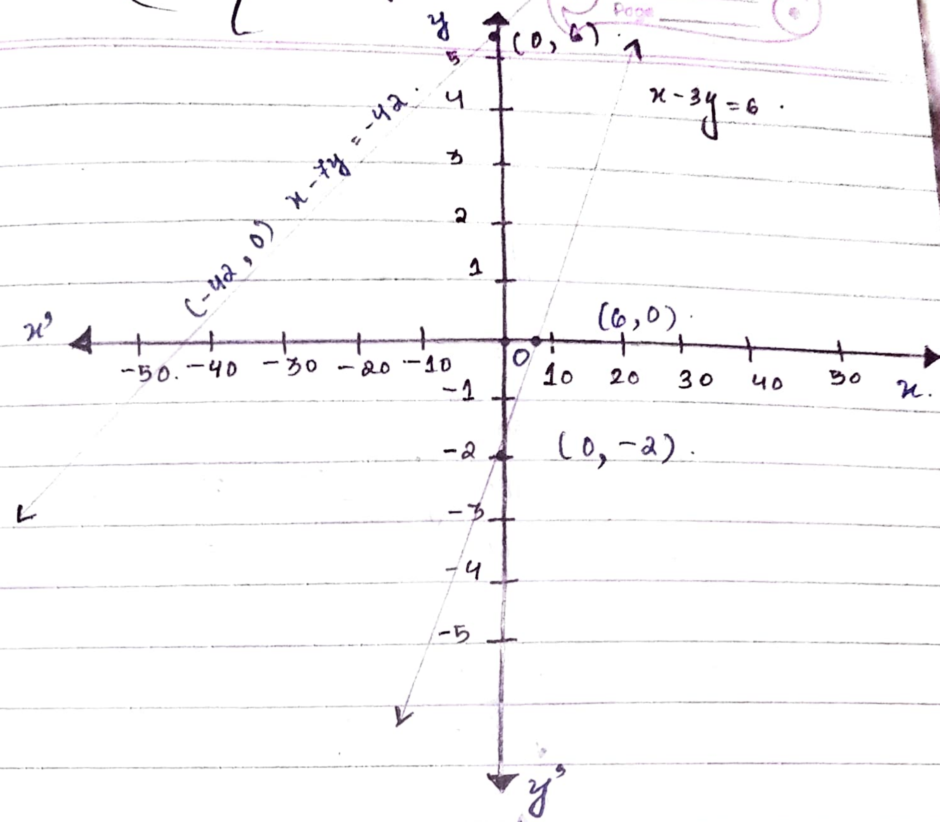
Ch-3.

Pair of Linear Equations In 2 Variables



Exercise -3.1.

Q1. 1^{st} Condition :

7 years ago.

$x - 7 = 7(y - 7)$.

$\Rightarrow x - 7 = 7y - 49$.

$\Rightarrow x - 7y = -42$.

x	0	-42.	-35.
y	6	0	1.

2^{nd} condition :

3 years later,

$x + 3 = 3(y + 3)$

$x + 3 = 3y + 9$.

$x - 3y = 6$.

x	6	0	9
y	0	-2	1.

Thus, the algebraic equations are.

$x - 7y + 42 = 0$ & $x - 3y - 6 = 0$.

Q2. Let the cost of 1 bat be ₹ x & the cost of 1 ball be ₹ y.

$3x + 6y = 3900$. ---(i).

$x + 3y = 1300$. ---(ii)

from equation (i), $y = \frac{3900 - 3x}{6}$.

when $x = 100$ then $y = \frac{3900 - 300}{6} = 600$.

when $x = 300$, $y = \frac{3900 - 900}{6} = 500$.

Q2. when $x = 700$, then $y = \frac{3900 - 2100}{6} = 300$

Thus,

x	100	300	700
y	600	500	300.

(ii) $y = \frac{1300 - x}{3}$.

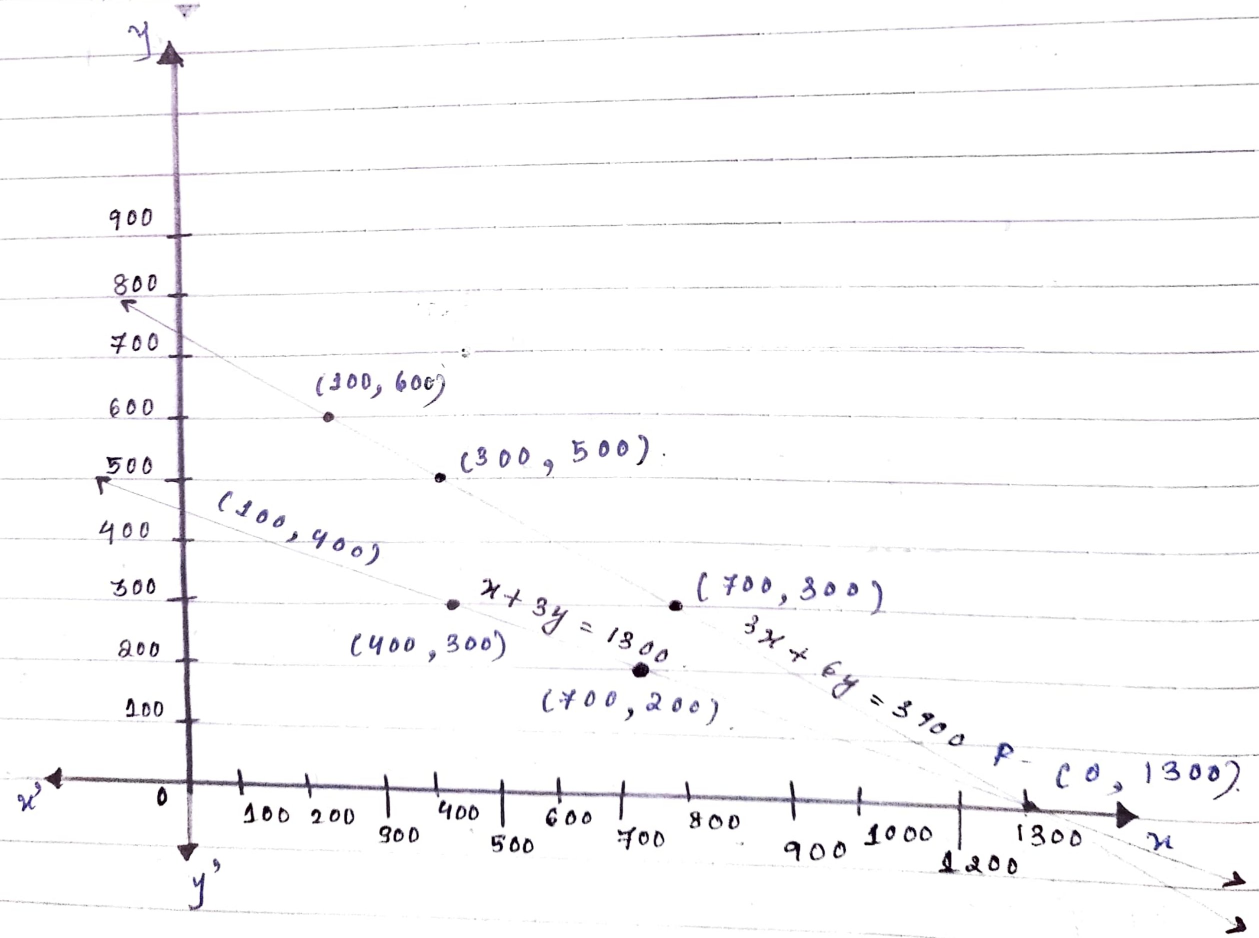
when $x = 100$, $y = \frac{1300 - 100}{3} = 400$

when $x = 400$, $y = \frac{1300 - 400}{3} = 300$.

when $x = 700$, $y = \frac{1300 - 700}{3} = 200$.

Thus,

x	100	400	700
y	400	300	200.



Q3. Let cost of 1kg of apple = ₹ x.
1kg of grapes = ₹ y.

1st condition:

$2x + y = 160$.

(i)

x	80	60	40
y	0	40	80.

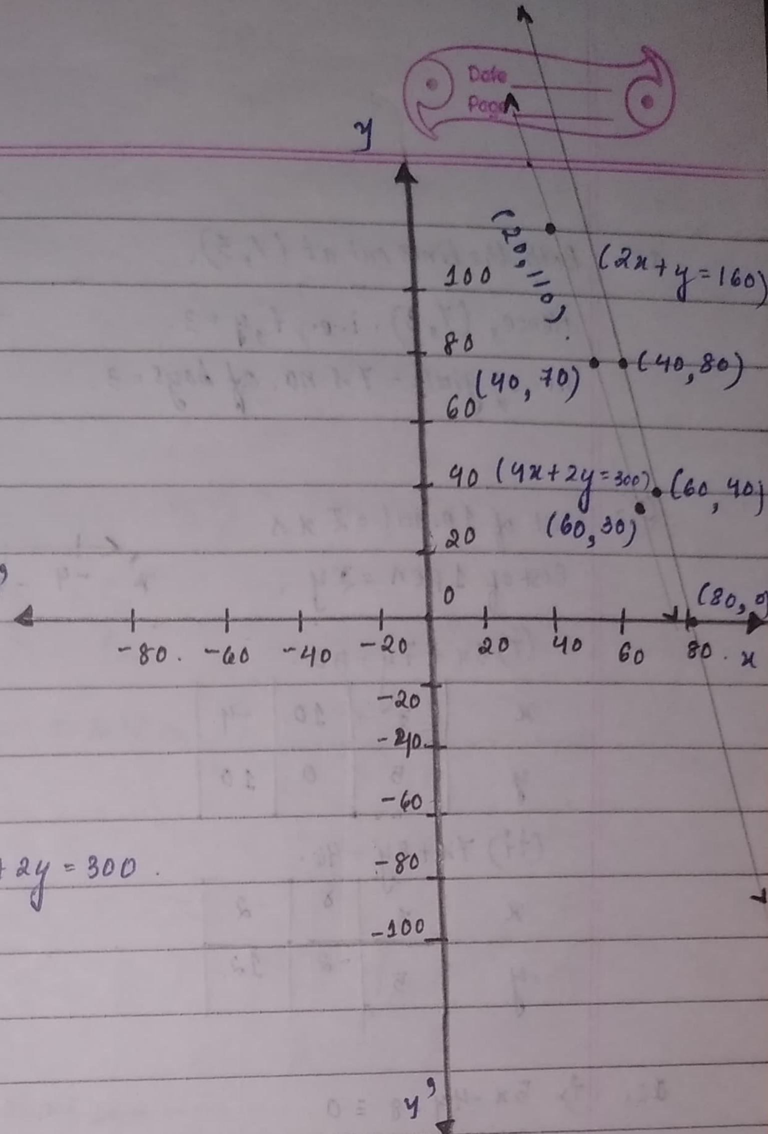
2nd condition:

$4x + 2y = 300$.

Thus, algebraic situation are $2x+y=160$ & $4x+2y=300$.

(ii)

x	60	40	20
y	30	70	110.



Exercise 3.2.

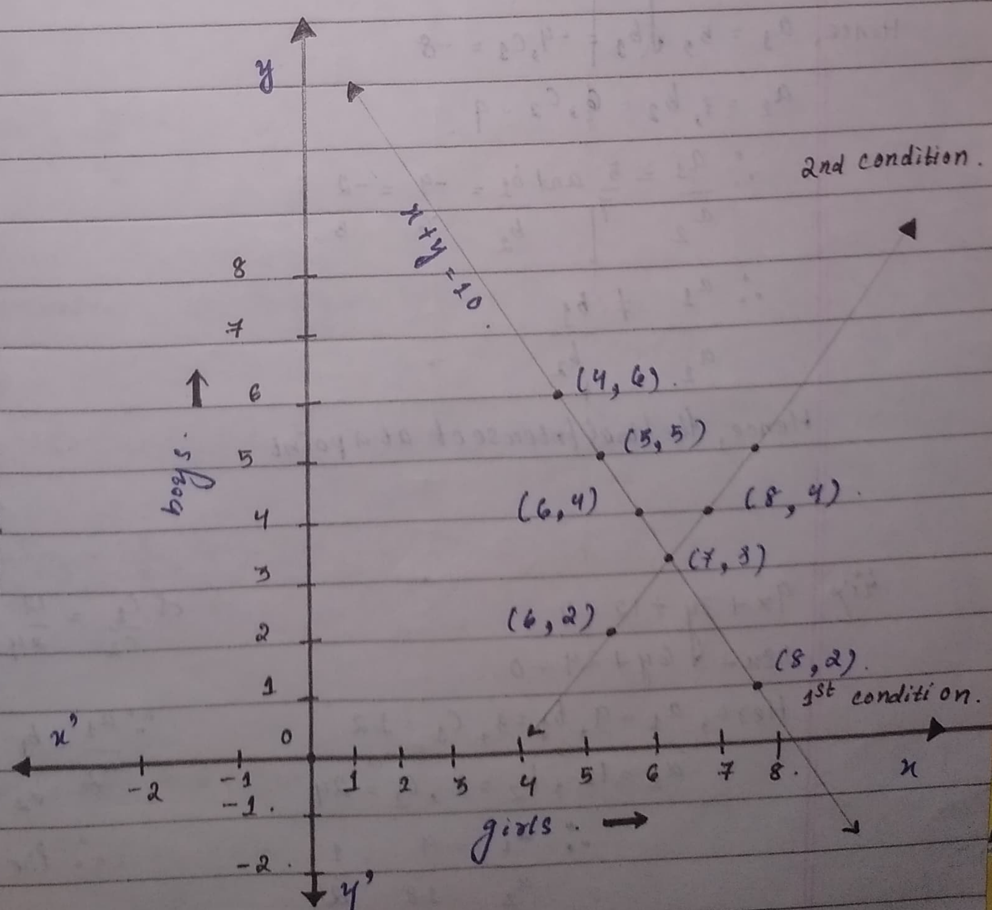
Q1. (i) girls = x
boys = y.

(i) $x+y=10$

x	4	6	5
y	6	4	5

(ii) $x = y+4 \Rightarrow x-y=4$.

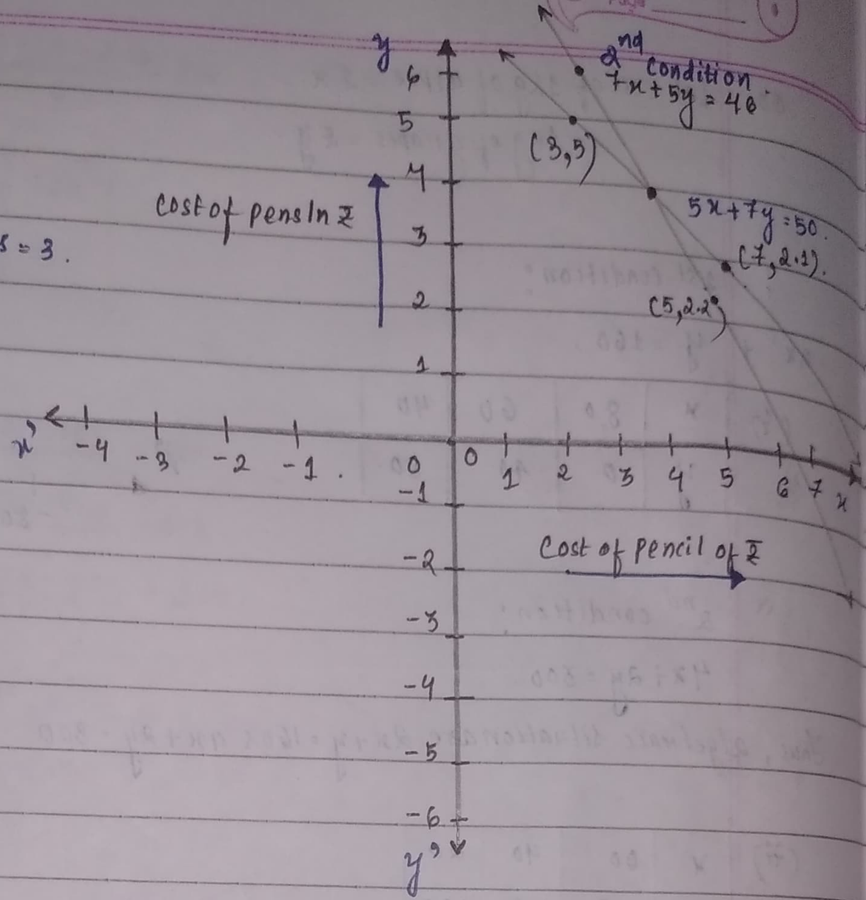
x	8	6	7
y	4	2	3



Q2. Both the lines cut at (7, 3).

Hence, (7, 3). i.e., 7, $y = 3$.

no. of girls - 7 & no. of boys = 3.



(ii) Cost of 1 pencil = ₹ x &

Cost of 1 pen = ₹ y.

(i) $5x + 7y = 50$.

x	3	10	-4
y	5	0	10

(ii) $7x + 5y = 46$.

x	3	8	-2
y	5	-2	12.

Q2. i) $5x - 4y + 8 = 0$.

$7x + 6y - 9 = 0$.

Hence, $a_1 = 5$, & $b_1 = -4$, $c_1 = -8$.

$a_2 = 7$, $b_2 = 6$, $c_2 = 9$.

$\therefore \frac{a_1}{a_2} = \frac{5}{7}$ and $\frac{b_1}{b_2} = \frac{-4}{6} = \frac{-2}{3}$.

$\therefore \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

Hence, the lines intersect at a point.

ii) $9x + 3y + 12 = 0$.

$18x + 6y + 24 = 0$.

Here, $a_1 = 9$, $b_1 = 3$, $c_1 = 12$.

$a_2 = 18$, $b_2 = 6$, $c_2 = 24$

$\therefore \frac{a_1}{a_2} = \frac{9}{18} = \frac{1}{2}$.

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

& $\frac{c_1}{c_2} = \frac{12}{24} = \frac{1}{2}$

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

$\therefore$ the lines are coincident.

iii) $6x - 3y + 10 = 0$.

$2x - y + 9 = 0$.

Here, $a_1 = 6, b_1 = -3, c_1 = 10$.

$a_2 = 2, b_2 = -1, c_2 = 9$.

$\therefore \frac{a_1}{a_2} = \frac{6}{2} = 3$. and, $\frac{c_1}{c_2} = \frac{10}{9}$.

$\frac{a_1}{b_2} = \frac{-3}{-1} = 3$. $\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$.

$\therefore$ the pair of linear equations has no solution.

Q3. i) $3x + 2y = 5, 2x - 3y = 7$.

$\frac{a_1}{a_2} = \frac{3}{2}, \frac{b_1}{b_2} = \frac{2}{-3}, \frac{c_1}{c_2} = \frac{-5}{-7} = \frac{5}{7}$

$\therefore \frac{a_1}{a_2} \neq \frac{a_1}{b_1}$ as $\frac{3}{2} \neq \frac{-2}{3}$.

$\therefore$ Pair of equations Is consistent with unique solution.

ii) $2x - 3y = 8, 4x - 6y = 9$.

$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{-3}{-6} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{8}{9}$

$\therefore \frac{a_1}{a_2} = \frac{a_1}{a_2} \neq \frac{c_1}{c_2}$

$\therefore$ Pair of equations Is Inconsistent, i.e., having no. Solution.

iii) $\frac{3}{2}x + \frac{5}{3}y = 7, 9x - 10y = 14$.

$\frac{a_1}{a_2} = \frac{3}{2 \times 9} = \frac{1}{6}, \frac{b_1}{b_2} = -\frac{5}{3 \times 10} = \frac{-1}{6}, \frac{c_1}{c_2} = \frac{-7}{-14} = \frac{1}{2}$.

$\therefore \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

$\therefore$ Pair of equation is consistent with unique solution.

Q3. iii) $5x - 3y = 11, \; -10x + 6y = -22.$

$\frac{a_1}{a_2} = \frac{5}{-10} = -\frac{1}{2}, \; \frac{b_1}{b_2} = \frac{-3}{6}, = -\frac{1}{2}, \; \frac{c_1}{c_2} = \frac{11}{-22} = -\frac{1}{2}$

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

$\therefore$

Pair of equations Is consistent with Infinitely Many solution.

Q4. i) $x + y - 5, \; 5x + 2y = 10.$

$\frac{a_1}{a_2} = \frac{1}{2}; \; \frac{b_1}{b_2} = \frac{1}{2}; \; \frac{c_1}{c_2} = \frac{-5}{-10} = \frac{1}{2},$

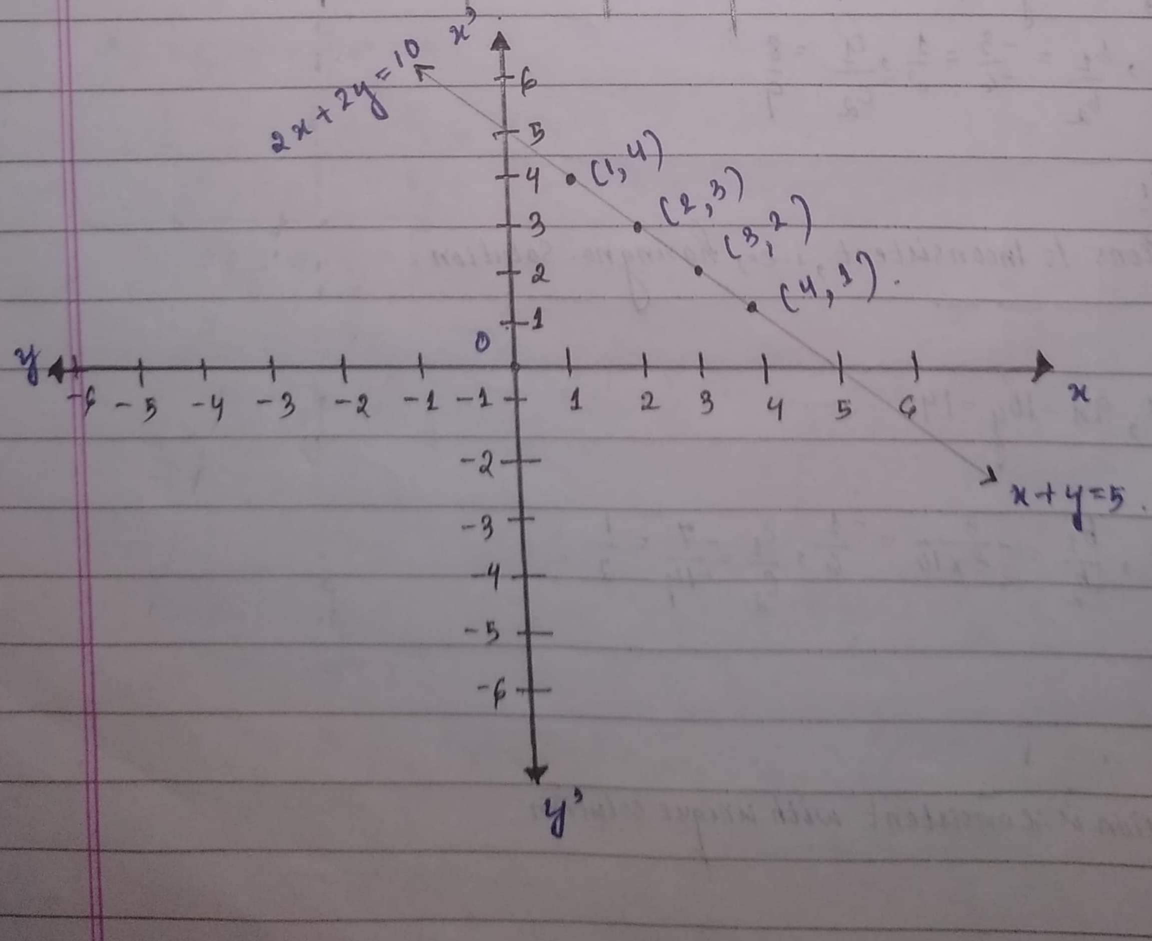
$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

i)

x	1	4	2	3
y	4	1	3	2

ii)

x	1	4	2	3
y	4	1	3	2



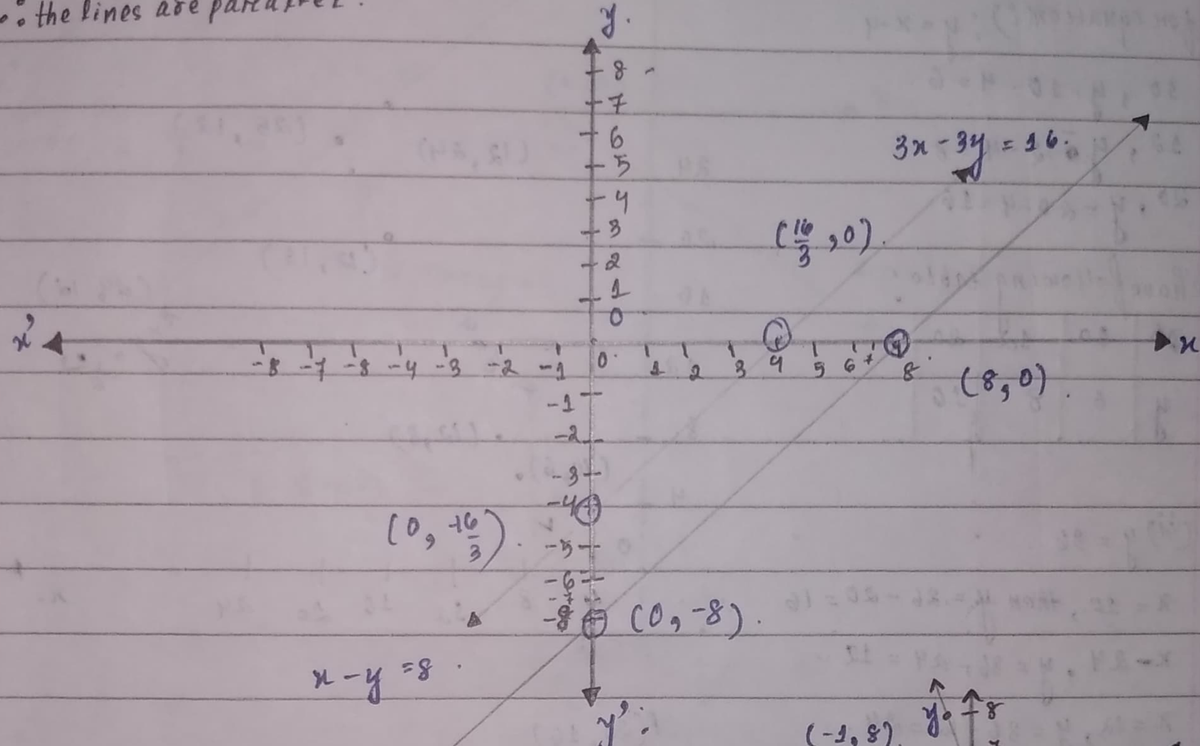
Q4. ii) $x - y = 8,\ 3x - 3y = 16$.

Here $\frac{a_1}{a_2} = \frac{1}{3}$.

$\frac{b_1}{b_2} = \frac{-1}{-3} = \frac{1}{3}$.

$\frac{c_1}{c_2} = \frac{-8}{-16} = \frac{1}{2}$ $\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$.

$\therefore$ the lines are parallel.



iii) $2x + y - 6 = 0,\ 4x - 2y - 4 = 0$.

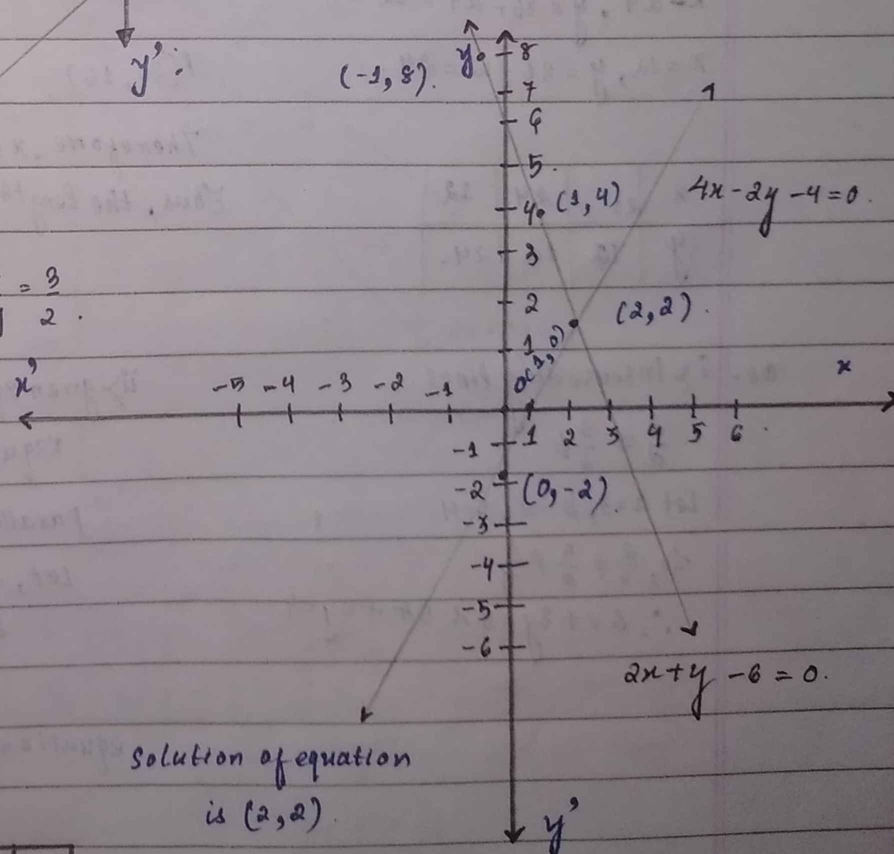
$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2},\ \frac{b_1}{b_2} = \frac{1}{-2},\ \frac{c_1}{c_2} = \frac{-6}{-4} = \frac{3}{2}$.

$\therefore \frac{a_1}{a_2} \neq \frac{a_1}{a_2}$.

$\therefore$ pair of equation is consistent.

$2x + y - 6 = 0$.

x	2	1	-1
y	2	4	8.



Solution of equation is $(2, 2)$.

$4x - 2y - 4 = 0$.

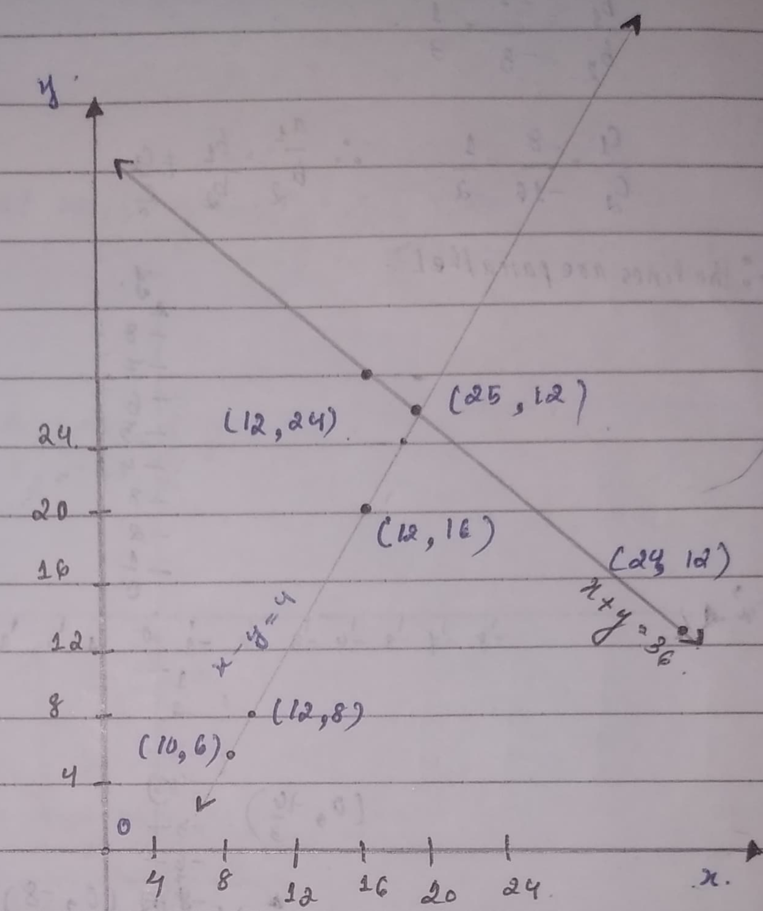
x	1	0	2
y	0	-2	2

Q5. Let of garden be = x m.
breadth = y m.

$x = y + 4$

$\rightarrow x - y = 4$ ---(i)

& $x + y = 36$ ---(ii).



for equation(i): $y = x - 4$.

when $x = 10$, $y = 10 - 4 = 6$.

when $x = 12$, $y = 12 - 4 = 8$.

$x = 20$, $y = 20 - 4 = 16$.

Thus, we have following table:

~~30~~	10	12	20
y	6	8	16

(ii) $y = 36$.

$x = 20$, then $y = 36 - 20 = 16$.

$x = 24$, $y = 36 - 24 = 12$.

$x = 12$, $y = 36 - 12 = 24$.

x	20	24	12
y	16	12	24.

P(20, 16).

Therefore, $x = 20$ & $y = 16$.

Thus, the length of garden is 20 m & b is 16 cm.

Q6. i) Intersecting lines.

$\frac{2}{a} \neq \frac{3}{b} \neq$

Let $a = 3$, $b = 2$, $c = 4$.

So, $\frac{2}{3} \neq \frac{3}{2} \neq \frac{8}{4}$

$\therefore 2v + 3y = 8$ & $3A + 3y = 4$

ii) given equation is $2x + 3y = 8$.

Required $= ax + by = c$.

parallel $= \frac{2}{a} \neq \frac{3}{b} \neq \frac{8}{c}$

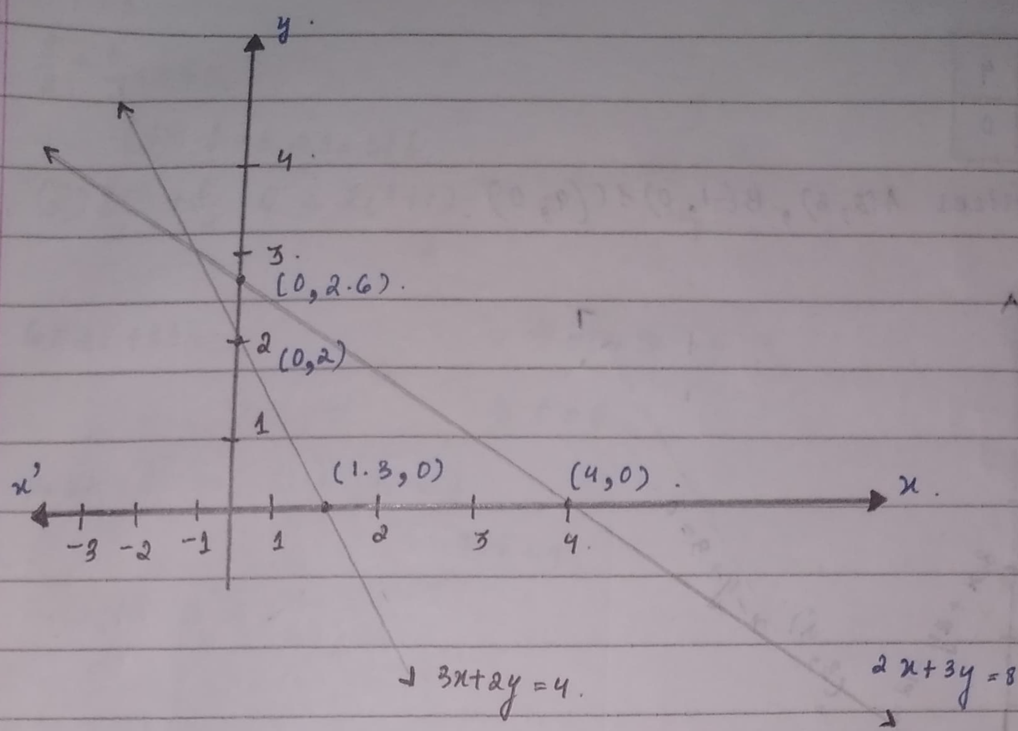
let, $a = 2$

$b = 3$

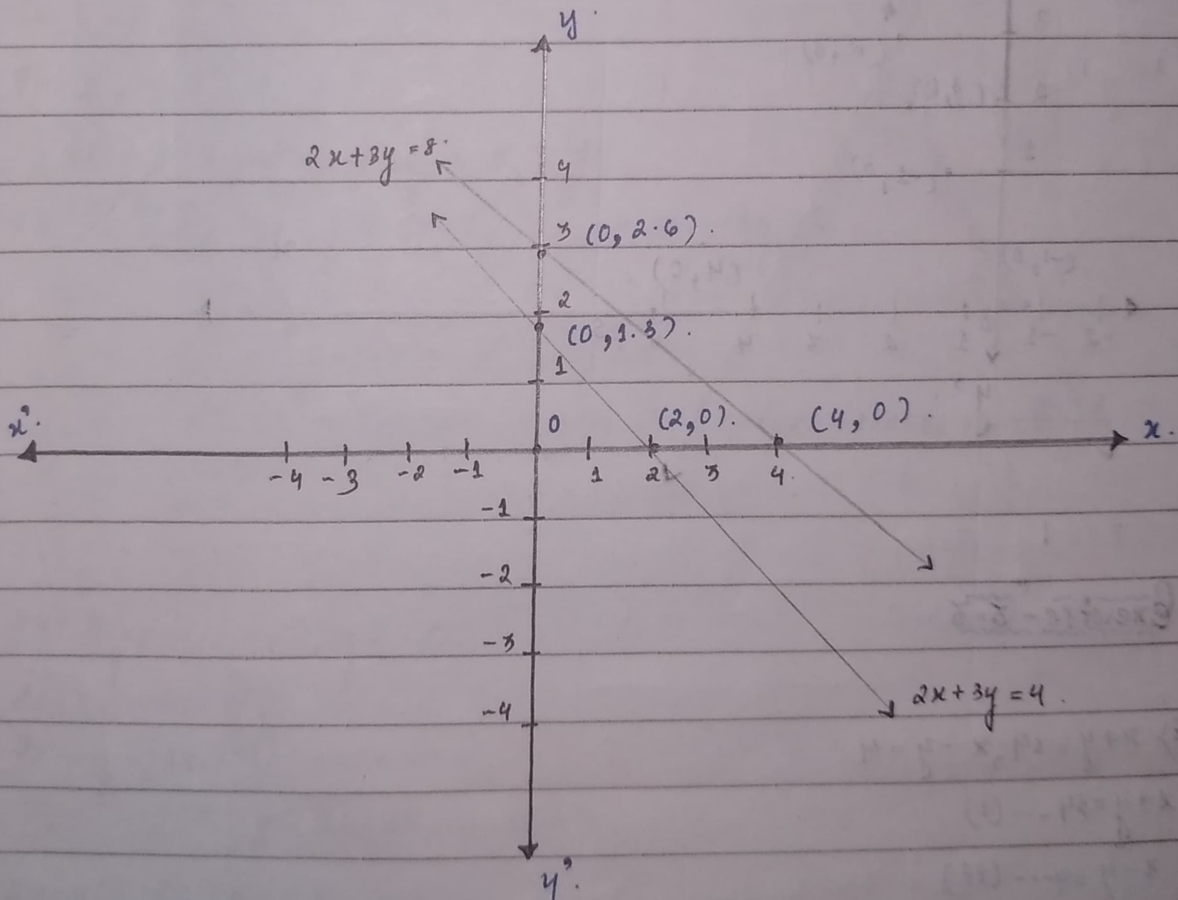
$c = 4$.

equations $2x + 3y = 8$ & $2x + 3y = 4$.

Q6. i)



ii)



Q7. $x - y + 1 = 0$ ---(i)

$3x + 2y - 12 = 0$ ---(ii)

(i) $y = x + 1$

when, $x = 0$, $y = 0 + 1 = 1$

$x = 1$, $y = 1 + 1 = 2$

$x = 3$, $y = 3 + 1 = 4$

$x = -1$, $y = -1 + 1 = 0$

x	0	1	3	-1
y	1	2	4	0

ii) $y = \frac{12 - 3x}{2}$

$x = 0$ $y = \frac{12-0}{2} = 6$

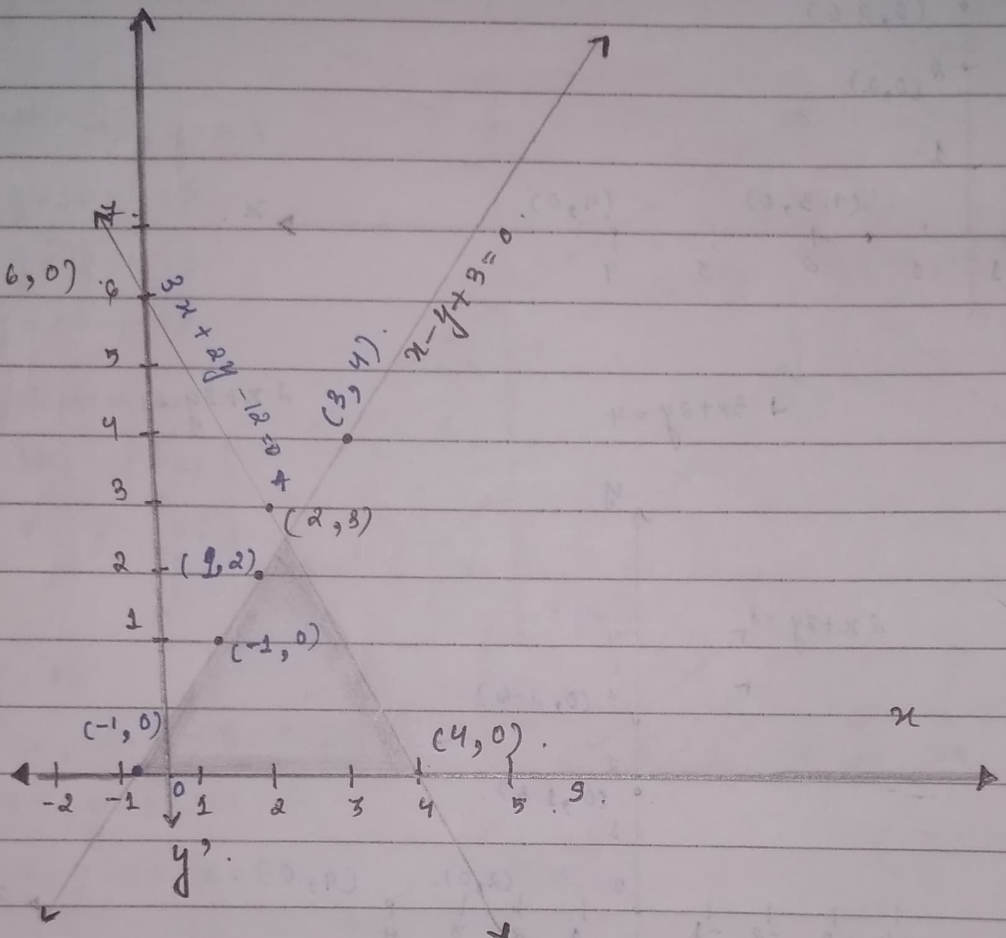
$x = 2$ $y = \frac{12-6}{2} = 3$

$x = 4$ $y = \frac{12-12}{2} = 0$

Q7.

x	0	2	4
y	6	3	0

ABC with vertices A(2, 3), B(-1, 0) & C(4, 0).



Exercise - 3.5.

Q1. i) $x+y=14, x-y=4$

A ⇒ $x+y=14$ ---(i).

$x-y=4$--- (ii).

$y=x-4$ (iii).

$x+x-4=14$

$\Rightarrow 2x=18$

$\Rightarrow x=9$.

$x=9$ in equation (iii), we get: $y=9-4=5$.

Thus, $x=9$ & $y=5$.

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Q> ii) $s - t = 3$.

$\frac{s}{3} + \frac{t}{2} = 6$.

(i) $s - t = 3 \Rightarrow s = 3 + t$.

(ii) $\frac{3+t}{3} + \frac{t}{2} = 6 \Rightarrow \frac{2(3+t) + 3t}{6} = 6$.

$\Rightarrow 6 + 2t + 3t = 36$ $\Rightarrow 5t = 36 - 6$.

$5t = 30$ $\Rightarrow t = 6$.

putting $t = 6$ in equation (i)

$s = 3 + 6 = 9$.

So, $s = 9, t = 6$.

iii) $3x - y = 3$.

$9x - 3y = 9$.

(i) $3x - y = 3 \Rightarrow 3x = 3 + y \Rightarrow x = \frac{3+y}{3}$

(ii) $9\left(\frac{3+y}{3}\right) - 3y = 9 \Rightarrow 3(3+y) - 3y = 9 + 3y - 3y = 9$.

$9 = 9$.

$\therefore y$ can have Infinite real no.

$\therefore x$ can have Infinite real values because $x = \frac{y+3}{3}$.

Q2. $2x + 3y = 11$ & $2x - 4y = -24$.

A> $2x + 3y = 11$ ... (i)

$2x - 4y = -24$ ... (ii)

$y = \frac{11 - 2x}{3}$ ... (iii)

$2x - 4\left(\frac{11 - 2x}{5}\right) = -24$.

$\Rightarrow 2x - \frac{44 - 8x}{3} = -24$.

$\Rightarrow 6x - 44 + 8x = -72$.

$\Rightarrow 14x = -28$.

$\Rightarrow x = -2$.

Substituting $x = -2$ (iii).

$y = \frac{11 - 2(-2)}{3} = \frac{11+4}{3} = 5$.

Q2. Thus, $y = mx + 3$.

$\rightarrow 5 = m(-2) + 3$.

$\rightarrow 2 = -2m$.

$\rightarrow m = -1$.

Q3. i) 1^{st} no $= x$.

2^{nd} no. $= y$.

Let $x > y$.

(i)

$x - y = 26$

(ii)

$x = 3y$

Putting $x = 3y$ in equation (i)

$3y - y = 26 \Rightarrow 2y = 26 \rightarrow y = 13$.

(ii).

$x = 3 \times 13 = 39$.

$\therefore$ 1 no. is 13 & other no. is 39.

ii) $x > y$.

(i)

$x + y = 180^\circ$

(ii)

$x - y = 18^\circ \Rightarrow x = 18^\circ + y$.

$18^\circ + y + y = 180^\circ \Rightarrow 18^\circ + 2y = 180^\circ$

$2y = 162^\circ \Rightarrow y = 81^\circ$.

from (ii) $x = 18^\circ + 81^\circ = 99^\circ \rightarrow x = 99^\circ$

$\therefore$ one angle is 81° & another angle is 99°.

iii) Let cost of 1 bat = ₹ x & cost of 1 ball = ₹ y

(i) $7x + 6y = 3800$

(ii) $3x + 5y = 1750$.

(ii).

Putting $x = \dfrac{1750 - 5y}{3}$ (i)

$$7\left[\frac{1750 - 5y}{3}\right] + 6y = 3800$$

$\rightarrow \dfrac{12250 - 35y}{3} + 6y = 3800$.

$\rightarrow 12250 - 35y + 18y = 11400$

$\rightarrow 12250 - 17y = 11400$

$\rightarrow -17y = 11400 - 12250$

$\rightarrow 17y = 850$

$\rightarrow y = 50$.

iii) Putting value of y in equation (i),

$7x + 6 \times 50 = 3800 \Rightarrow 7x = 3800 - 300$

$\Rightarrow 7x = 3500 \quad \Rightarrow x = 500$

∴ Cost of 1 bat = ₹500 & cost of 1 ball = ₹50.

Putting $x = 1750 - 5y/3$ in equation (i),

cost of one bat = ₹500 & cost of ball = ₹50.

iv) let fixed charges be ₹x & charge for per km be ₹y.

A.T.Q.

(i) $x + 10y = 105$

(ii) $x + 15y = 155$

(i) $x = 105 - 10y$

(ii) $105 - 10y + 15y = 155 \Rightarrow 105 + 5y = 155$

$\Rightarrow 5y = 155 - 105 \Rightarrow 5y = 50 \Rightarrow y = 10$.

Putting = 10 in equation (i).

$x + 10(10) = 105 \Rightarrow x + 100 = 105 \Rightarrow x = 5$.

fixed charges is ₹5 & charges per km is ₹10.

3rd Condition:

for dist. of 25 km.

$x + 25y = 5 + 25(10) = 5 + 250 = 255$

Amount paid for travelling 25 km is ₹255.

v) Let numerator be x & denominator be y.

∴ fraction is x/y.

(i) $\dfrac{x+2}{y+2} = \dfrac{9}{11} \quad \Rightarrow 11x + 22 = 9y + 18$

$\Rightarrow 11x - 9y = -4$.

$11x - 9y = 18 - 22$.

(ii) $\dfrac{x+3}{y+3} = \dfrac{5}{6} \quad \Rightarrow 6x + 18 = 5y + 15 \Rightarrow 6x - 5y = 15 - 18$

v) $6x - 5y = -3$.

(i) $11x = 9y - 4 \Rightarrow x = \frac{9y-4}{11}$.

(ii) $6\left[\frac{9y-4}{11}\right] - 5y = -3 \Rightarrow \frac{54y-24}{11} - 5y = -3$.

$\Rightarrow 54y - 24 - 55y = -33 \qquad \Rightarrow -y = 33 + 24$

$\Rightarrow \qquad -y = -9 \qquad \Rightarrow y = 9$

(i) $\Rightarrow 11x - 9(9) = -4 \qquad \Rightarrow 11x - 81 = 4$.

$\Rightarrow 11x = -4 + 81$. $\qquad \Rightarrow 11x = 77 \Rightarrow x = 7$.

$\therefore \frac{x}{y} = \frac{7}{9}$.

vi) Let present age of Jacob be x years & that of his son be y years.

(i) $x + 5 = 3(y+5) \Rightarrow x + 5 = 3y + 15 \Rightarrow x - 3y = 15 - 5 \Rightarrow x - 3y = 10$.

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

$\Rightarrow x = 7y - 30$.

(i) $7y - 30 - 3y = 10$.

$4y - 30 = 10$

$4y = 40 \; y = 10 \Rightarrow y = 10$.

(i) $x = 7(10) - 30 = 70 - 30 \Rightarrow x = 40$

Hence, the present age of Jacob is 40 years and that of his son is 10 years

Exam questions

Exercise 3.4.

Q1. (i) $x + y = 5$.

& $2x - 3y = 4$

$$\begin{array}{rcl} 2x + 2y &=& 10 \\ 2x - 3y &=& 4 \\ (-) \; (+) & & (-) \\ \hline 5y &=& 6 \end{array}$$

$\Rightarrow \qquad y = \frac{6}{5}$

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Q1, i) (i) $x+\frac{6}{5}=5$.

$x=5-\frac{6}{5}=\frac{25-6}{5} \Rightarrow x=\frac{19}{5}$.

By substitution Method:

$x+y=5$.

$2x-3y=4$

(i) $x=5-y$.

(ii) $2(5-y)-3y=4 \rightarrow 10-2y-3y=4$

$\rightarrow 10-5y=4 \rightarrow 6=5y \Rightarrow y=\frac{6}{5}$.

(i) $x+\frac{6}{5}=5 \Rightarrow x=5-\frac{6}{5}$

$\Rightarrow x=\frac{19}{5}$.

Elimination Method:

ii) $3x+4y=10$ & $2x-2y=2$.

$3x+4y=10$

$4x-4y=4$

$7x=14$

$\Rightarrow x=2$.

(i) $3(2)+4y=10 \rightarrow 6+4y=10$.

$\rightarrow 4y=4 \quad \Rightarrow y=1$.

By substitution Method:

$3x+4y=10$

$2x-2y=2$.

(i) $\Rightarrow x=\frac{10-4y}{3}$.

(ii) $2x-2y=2 \Rightarrow x-y=1$.

$\rightarrow \frac{10-4y}{3}-y=1$

$\rightarrow 10-4y-3y=3 \rightarrow 7=7y \Rightarrow y=1$

$y=1$.

(i) $3x+4\times1=10 \rightarrow 3x=6 \rightarrow x=2$.

iii) Elimination Method:

$3x-5y=4$

$9x-2y=7$.

$9x-2y=7$.

$9x-15y=12$

(-) (+) (-)

$13y=-5$.

$\rightarrow y=\frac{-5}{13}$.

(i) $3x-5\left(\frac{-5}{13}\right)=4 \Rightarrow 3x+\frac{25}{13}=4$

$\Rightarrow 3x=4-\frac{25}{13}=\frac{52-25}{13}$.

$\rightarrow 3x=\frac{27}{13} \Rightarrow x=\frac{9}{13}$.

By substitution Method:

$3x-5y=4$.

$9x-2y=7$.

(i) $x=\frac{4+5y}{3}$.

(ii) $9\left[\frac{4+5y}{3}\right]-2y=7 \quad =3\left[4+5y\right]-2y=7$.

$\rightarrow 12+15y-2y=7$.

$\rightarrow 12+13y=7$.

$\rightarrow 13y=-5. \quad \rightarrow y=\frac{-5}{13}$

Q2. i) $\frac{x}{y}$.

$\rightarrow \frac{x+1}{y-1}=1$

$\rightarrow x+1=y-1$.

$\rightarrow x-y=-2$. and $\frac{x}{y+2}=\frac{1}{2}$

Q2. i) $\Rightarrow 2x = y + 1$.

$\Rightarrow 2x - y = 1$ --- (2)

Subracting equation (1) from equation (2),

$$\begin{array}{r} 2x - y = 1 \\ x - y = -2 \\ (-)\quad (+)\quad (+) \\ \hline x = 3 \end{array}$$

(1), $3 - y = -2$.

$\Rightarrow y = 5$.

Thus, is $\frac{3}{5}$.

ii) Let the present ages of Nuri & Sonu be x years and y years respectively.

Nuri's age was $(x-5)$ years

Sonu's age was $(y-5)$ years

$\Rightarrow x - 5 = 3(y-5)$

$\Rightarrow x - 5 = 3y - 15$.

$\Rightarrow x - 3y = 5 - 15$

$\Rightarrow x - 3y = -10$ ---(1)

10 years later,

Nuri's age $(x+10)$ years.

Sonu's age $(y+10)$ years.

2^{nd} condition,

$x + 10 = 2(y+10)$

$\Rightarrow x + 10 = 2y + 20$

$\Rightarrow x - 2y = 20 - 10$.

$\Rightarrow x - 2y = 10$.

$$\begin{array}{r} x - 2y = 10 \\ x - 3y = -10 \\ (-)\quad (+)\quad (+) \\ \hline \boxed{y = 20} \end{array}$$

(ii) $x - 2 \times 20 = 10$

$\Rightarrow x - 40 = 10$ $\Rightarrow x = 50$

Hence, the present ages of Nuri & Sonu are 50 years & 20 years.

iii) The 2 digit no. $= 10y + x$.

New no. formed on reversing the digits $= 10x + y$.

(i) $x + y = 9$.

2^{nd} condition:

$9 \times (10y + x) = 2(10x + y)$

$\Rightarrow 90y + 9x = 20x + 2y$.

$\Rightarrow 11x = 88y$.

$\Rightarrow x = \frac{88}{11} y$

$\Rightarrow x = 8y$ --- (2).

Substituting the value of x (2) in equation (1):

$8y + y = 9$

$\Rightarrow 9y = 9$

$\Rightarrow y = 1$.

ii) $x = 8 \times 1 = 8$.

Hence, the required no. is $10 \times 1 + 8$.

$= 18$.

Q2 · iv) Let the no. of 50 rupees notes be x and that of ₹100 notes be y.

$x+y=25$ --- (i).

& $50x+100y=2000$.

→ $x+2y=40$ ---- (ii)

Substracting (i) from (ii),

$2y-y=40-25$

→ $y=15$.

Substracting value of y in equation (1),

$x+15=25$.

→ $x=10$.

Hence, the no. of ₹50 note is 10 & of ₹100 notes is 15.

v) Let the fixed charge be ₹x.

additional to question, / additional charge per day ₹y.

$x+4y=27$ --- (1)

$x+2y=21$ --- (2)

$4y-2y=27-21$.

→ $2y=6$.

→ $y=3$.

Substituting $y=3$ in equation (i),

$x+4\times3=27$

→ $x=27-12=15$.

Hence, fixed charge for first 3 days and additional charge per extra day are ₹15 & ₹3.

Exercise 3.5.

Q1. i) $x-3y-3=0$ (i)

$3x-9y-2=0$ (ii)

$a_1=1, b_1=-3, c_1=-3$.

$a_2=3, b_2=-9, c_2=-2$

$\therefore \frac{a_1}{a_2}=\frac{1}{3}, \frac{b_1}{b_2}=\frac{-3}{-9}=\frac{1}{3}$.

& $\frac{c_1}{c_2}=\frac{-3}{-2}=\frac{3}{2}$.

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

Therefore, the pair of linear equation has no solution.

iii) $2x + y - 5 = 0$ --(i)

$3x + 2y - 8 = 0$ --(ii)

Here, $a_1 = 2,\ b_1 = 1,\ c_1 = -5.$

$a_2 = 3,\ b_2 = 2,\ c_2 = -8.$

$\frac{a_1}{a_2} = \frac{2}{3}$ & $\frac{b_1}{b_2} = \frac{1}{2}$. Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

Therefore, the pair of linear equations has a unique solution.

$$\frac{x}{\begin{matrix} 1 & -5 \\ 2 & -8 \end{matrix}} = \frac{y}{\begin{matrix} -5 & 2 \\ -8 & 3 \end{matrix}} = \frac{1}{\begin{matrix} 2 & 1 \\ 3 & 2 \end{matrix}}.$$

$$= \frac{x}{-8-(-10)} = \frac{y}{-15-(-16)} = \frac{1}{4-3}. \Rightarrow \frac{x}{-8+10} = \frac{y}{-15+16} = \frac{1}{1}.$$

$\Rightarrow \frac{x}{2} = \frac{y}{1} = \frac{1}{1}$. Taking $\frac{x}{2} = \frac{1}{1}$ & $\frac{y}{1} = \frac{1}{1}$, $x = 2$ & $y = 1$.

Hence, the required solution is $x = 2$ & $y = 1$.

iv) $x - 3y - 7 = 0$ (i)

$3x - 3y - 15 = 0$ (ii).

Here, $a_1 = 1,\ b_1 = -3,\ c_1 = -7.$

$a_2 = 3,\ b_2 = -3,\ c_2 = -15.$

$\frac{a_1}{a_2} = \frac{1}{3}$ & $\frac{b_1}{b_2} = \frac{-3}{-3} = 1$. Since, $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$.

Therefore the pair of linear equations has a unique solution.

$$\Rightarrow \frac{x}{\begin{matrix} -3 & -7 \\ -3 & -15 \end{matrix}} = \frac{y}{\begin{matrix} -7 & 1 \\ -15 & 3 \end{matrix}} = \frac{1}{\begin{matrix} 1 & -3 \\ 3 & -3 \end{matrix}}$$

$$\Rightarrow \frac{x}{45-21} = \frac{y}{(-21)-(-15)} = \frac{1}{-3-(-9)}.$$

iv) Q1. $\Rightarrow \frac{x}{24} = \frac{y}{-6} = \frac{1}{6}$.

Taking $\frac{x}{24} = \frac{1}{6}$ & $\frac{y}{-6} = \frac{1}{6}$.

$x = 4$ & $y = -1$.

Hence, the required solution is $x = 4$ and $y = -1$.

Q1. i) Equations are.

$$2x + 3y = 7$$

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

for infinitely many solutions,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Rightarrow \frac{2}{a-b} = \frac{3}{a+b} \Rightarrow \frac{7}{3a+b-2}.$$

now, oncomparing,

$$\frac{2}{a-b} = \frac{3}{a+b} \Rightarrow 2(a+b) = 3(a-b) \Rightarrow 2a + 2b = 3a - 3b.$$

$\Rightarrow 9a + 3b - 6 = 7a + 7b \Rightarrow 2a - 4b = 6$.

$\Rightarrow a - 2b = 3$

By cross Multiplication Method :-

$$\begin{array}{cccc} -5 & 0 & 1 & -5 \\ -2 & 3 & 1 & -2 \end{array}$$

$$\frac{a}{-15-0} = \frac{b}{0-3} = \frac{-1}{-2+5} \Rightarrow \frac{a}{-15} = \frac{b}{-3} = \frac{-1}{3} \Rightarrow a = 5 \text{ \& } b = 1.$$

$3x + y = 1$ and $(2K-1)x + (K-1)y = 2K+1$.

for no Solution :-

$$\frac{3}{2K-1} = \frac{1}{K-1} \neq \frac{1}{2K+1}. \quad \rightarrow 3(K-1) = 2K-1.$$

$\Rightarrow 3K - 3 = 2K - 1$. $\quad \rightarrow K = 2$.

$$\frac{1}{K-1} \neq \frac{1}{2K+1}. \quad \rightarrow 2K+1 \neq K-1 \rightarrow K \neq -2.$$

$K = 2$ & $K \neq -2$.

Q3. $8x + 5y = 9$ (i)
$3x + 2y = 4$ (ii)

Substitution Method:

$16x - 15x = 18 - 20$

$\Rightarrow x = -2.$

Substituting $x = -2$

$8(-2) + 5y = 9.$

$\Rightarrow -16 + 5y = 9$

$\Rightarrow 5y = 25.$

$\Rightarrow y = 5.$

Thus, the required solution is $x = -2$ & $y = 5$.

Cross Multiplication Method:

$8x + 5y - 9 = 0$
$3x + 2y - 4 = 0$

$$\frac{x}{\begin{matrix}5 & -9\\ 2 & -4\end{matrix}} = \frac{y}{\begin{matrix}-9 & 8\\ -4 & 3\end{matrix}} = \frac{1}{\begin{matrix}8 & 5\\ 3 & 2\end{matrix}}$$

$$\Rightarrow \frac{x}{-20-(-18)} = \frac{y}{-27-(-32)} = \frac{1}{16-15}$$

$$\Rightarrow \frac{x}{-2} = \frac{y}{5} = \frac{1}{1}.$$

Taking $\frac{x}{-2} = \frac{1}{1}$ and $\frac{y}{5} = \frac{1}{1}$.

$x = -2$ and $y = 5.$ Thus, the required solution is $x = -2$ and $y = 5$.

Q4. i) fixed monthly hostel charges = and charges per day = ₹y.

A.T.Q.

As per condition of student A.

$x + 20y = 1000.$

As per condition of student B.

$x + 26y = 1180.$

By cross Mulplication.

$$\begin{matrix} & x & & y & & -1 & \\ 20 & & 1000 & & 1 & & 20 \\ 26 & & 1180 & & 1 & & 26\end{matrix}$$

$$\frac{x}{23600 - 26000} = \frac{y}{1000 - 1180} = \frac{-1}{26 - 20}.$$

$$\Rightarrow \frac{x}{-2400} = \frac{y}{-180} = \frac{-1}{6} \rightarrow x = \frac{2400}{6} = 400 \Rightarrow x = 400.$$

Q4) i) $y = \frac{180}{6} = 30$. $\Rightarrow y = 30$.

$\therefore$ fixed monthly hostel charges = ₹400 and charges per day is ₹30.

ii) Let the numerator = x & denominator = y

$\therefore \frac{x}{y}$.

(i) $\frac{x-1}{y} = \frac{1}{3} \Rightarrow 3x - 3 = y = 3x - y = 3$

(ii) $\frac{x}{y+8} = \frac{1}{4} \Rightarrow 4x = y + 8$.

$\Rightarrow 4x - y = 8$.

(i) and (ii) for x and y.

$$\begin{array}{cccccccc} & x & & y & & -1 & \\ -1 & & 3 & & 3 & & 1 \\ -1 & & 8 & & 4 & & 1 \end{array}$$

$\Rightarrow \frac{x}{-8+3} = \frac{y}{12-24} = \frac{-1}{-3+4} \Rightarrow \frac{x}{-5} = \frac{y}{-12} = \frac{-1}{1} \Rightarrow x = 5$ & $y = 12$.

$\therefore \frac{5}{12}$.

iii) Let no. of right ans. = x.
Let no. of wrong ans = y.
$x + y$.

i) $3x - y = 40$.
ii) $4x - 2y = 50$.

$$\begin{array}{cccccccc} & x & & y & & -1 & \\ -1 & & 40 & & 3 & & -1 \\ -2 & & 50 & & 4 & & -2 \end{array}$$

$\frac{x}{-50+80} = \frac{y}{160-150} = \frac{-1}{-6+4} \Rightarrow \frac{x}{30} = \frac{y}{10} = \frac{-1}{-2}$.

$\Rightarrow x = 15$ & $y = 5$. $\therefore 15 + 5 = 20$.

Example & Exercise Question - 3.6

Q1. i) $\frac{1}{2x} + \frac{1}{3y} = 2$ ..(1)

$\frac{1}{3x} + \frac{1}{2y} = \frac{13}{6}$ ---(2).

$\frac{1}{x} = u$ & $\frac{1}{y} = v$.

$\Rightarrow \frac{u}{2} + \frac{v}{3} = 2$ ---(3).

$\Rightarrow \frac{u}{3} + \frac{v}{3} = \frac{13}{6}$ ---(4).

$\Rightarrow 3u + 2v = 12$ ---(5)

$2u + 3v = 13$ --(6).

$9u + \cancel{6v} = 36$

$4u + \cancel{6v} = 36$

(-) (-) (-).

$5u = 10$ ..

$\Rightarrow u = \frac{10}{5} = 2$

$u = 2$ (5) $\Rightarrow 6 + 2v = 12$

$\Rightarrow 2v = 6$

$\Rightarrow v = 3$.

But, $\frac{1}{x} = u$ $\rightarrow \frac{1}{x} = 2$ $\Rightarrow x = \frac{1}{2}$.

& $\frac{1}{y} = v$ $\Rightarrow \frac{1}{y} = 3$. $\Rightarrow y = \frac{1}{3}$.

Thus, x is $\frac{1}{2}$ & $y = \frac{1}{3}$.

ii) $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$ (i).

$\rightarrow \frac{1}{\sqrt{x}} = u$ & $\frac{1}{\sqrt{y}} = v$.

(i) & (ii)

& $\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$ (ii)

$6u + \cancel{9v} = 6$

$4u - \cancel{9v} = -1$

$10u = 5$.

$\rightarrow 2u + 3v = 2$. (iii)

$\rightarrow 4u - 9v = -1$. (iv).

$\rightarrow u = \frac{5}{10} = \frac{1}{2}$.

$\rightarrow 2 \times \frac{1}{2} + 3v = 2$.

$\rightarrow 3v = 2 - 1$.

$\rightarrow v = \frac{1}{3}$.

ii) But $u = \frac{1}{\sqrt{x}} = \frac{1}{2}$.

$\Rightarrow \sqrt{x} = 2$. $\Rightarrow x = 4$.

& $v = \frac{1}{\sqrt{y}} = \frac{1}{3}$.

$\Rightarrow \sqrt{y} = 3$. $\Rightarrow y = 9$.

$\therefore$ The solution is $x = 4$ & $y = 9$.

iii) $\frac{4}{x} + 3y = 14$ (i)

$\frac{3}{x} - 4y = 23$ (ii)

$\Rightarrow \frac{1}{x} = u$. (i) & (ii)

$4u + 3y = 14$. (iii).

$3u - 4y = 23$. (iv).

we get.

$16u + \cancel{12y} = 56$

$9u - \cancel{12y} = 69$ $\Rightarrow u = 5$.

$25u = 125$.

(iii) $4 \times 5 + 3y = 14$ But here, $5 \Rightarrow \frac{1}{x} = 5 \Rightarrow x = \frac{1}{5}$.

$\Rightarrow 3y = 14 - 20 = -6$.

$\Rightarrow y = \frac{-6}{3} = -2$.

$\therefore$ the solution is $x = \frac{1}{5}$ & $y = -2$.

iv) $\frac{5}{x-1} + \frac{1}{y-2} = 2$ (i)

Let $\frac{1}{x-1} = u$ and $\frac{1}{y-2} = v$.

$\Rightarrow \frac{6}{x-1} - \frac{3}{y-2} = 1$ (ii)

$\Rightarrow 5u + v = 2$ (iii).

$\Rightarrow 6u - 3v = 1$. (iv).

Q1) iv) $15u + \cancel{3v} = 6$

$6u - \cancel{3v} = 1$

$21u = 7$.

$\Rightarrow u = \frac{7}{21} = \frac{1}{3}$.

$\Rightarrow u = \frac{1}{3}$ $\therefore 5 \times \frac{1}{3} + v = 2$.

$\Rightarrow v = 2 - \frac{5}{3} = \frac{6-5}{3} = \frac{1}{3}$. $\therefore$ But $u = \frac{1}{x-1}$.

$\Rightarrow \frac{1}{x-1} = \frac{1}{3}$. $= x - 1 = 3$. $\Rightarrow x = 4$

and,

$v = \frac{1}{y-2} = \frac{1}{3}$. $\Rightarrow y - 2 = 3 \Rightarrow y = 5$.

$\therefore x = 4$ & $y = 5$.

Q v) $\frac{7x - 2y}{xy} = 5$.

$\Rightarrow \frac{7x}{xy} - \frac{2y}{xy} = 5$. $\Rightarrow \frac{7}{y} - \frac{2}{x} = 5$.

$\Rightarrow -\frac{2}{x} + \frac{7}{y} = 5$ (i).   & $\frac{8x - 7y}{xy} = 15$.

$\Rightarrow \frac{8x}{xy} + \frac{7y}{xy} = 5$. $\Rightarrow \frac{8}{y} + \frac{7}{x} = 15$ $\Rightarrow \frac{7}{x} + \frac{8}{y} = 15$. (ii).

$\Rightarrow \frac{49}{y} + \frac{16}{y} \Rightarrow 35 + 30$. $\Rightarrow \frac{65}{y} = 65$. $y = 1$.

$y = 1$.

$\Rightarrow -\frac{2}{x} + \frac{7}{1} = 5$.

$\Rightarrow -\frac{2}{x} = 5 - 7$. $\Rightarrow -\frac{2}{x} = -2$. $\Rightarrow x = 1$.

Q vi) $6x + 3y = 6xy$.

$\Rightarrow \frac{6x}{xy} + \frac{3y}{xy} = \frac{6xy}{xy}$. $\Rightarrow \frac{6}{y} + \frac{3}{x} = 6$.

vi) $\frac{6}{y} + \frac{3}{x} = 6.$ $\Rightarrow \frac{1}{x} + \frac{2}{y} = 2.$ (i) $\&\ 2x + 4y = 5xy.$

$\Rightarrow \frac{2x}{xy} + \frac{4y}{xy} = \frac{5xy}{xy}$ $\Rightarrow \frac{2}{y} + \frac{4}{x} = 5.$ $\Rightarrow \frac{4}{x} + \frac{2}{y} = 5$ (ii).

$\Rightarrow \frac{4}{x} - \frac{1}{x} = 5 - 2.$ $\Rightarrow \frac{3}{x} = 3.$ $(x = 1)$

$\frac{1}{1} + \frac{2}{y} = 2.$

$\Rightarrow \frac{2}{y} = 1.$

$\Rightarrow y = 2.$

Q vii) $\frac{10}{x+y} + \frac{2}{x-y} = 4.$ (i).

$\Rightarrow u = \frac{1}{x+y}.$

$v = \frac{1}{x-y}.$

$\frac{15}{x+y} - \frac{5}{x-y} = -2$ (ii).

$10u + 2v = 4.$ (iii)

$15u - 5v = -2.$ (iv).

$$\begin{aligned} 50u + \cancel{10v} &= 20 \\ 30u - \cancel{10v} &= -4. \\ \hline 80u &= 16. \end{aligned}$$

$\Rightarrow u = \frac{16}{80} = \frac{1}{5}.$

$u = \frac{1}{5}$ $\Rightarrow 10 \times \frac{1}{5} + 2v = 4.$

$\Rightarrow 2v = 2.$

$\Rightarrow v = 1.$ Thus, $v = 1\ \&\ u = \frac{1}{5}.$

$u = \frac{1}{x+y}$ $\Rightarrow \frac{1}{x+y} = \frac{1}{5} \Rightarrow x + y = 5$ (v).

$V = \frac{1}{x-y}$ $\Rightarrow \frac{1}{x-y} = 1.$ $\Rightarrow x - y = 1$ (vi)

$\Rightarrow 2x = 6$ $= x = 3.$

$\Rightarrow 2x = 6$ $\Rightarrow x = 3.$ $\therefore 3 + y = 5$, hence $y = 2.$

$\therefore$ $x = 3\ \&\ y = 2.$

Q2. i) Ritu's speed In still water $= x$ Km/h.
Current speed $= y$ km/h.

downstream speed $= (x+y)$ Km/h.
upstream speed $= (x-y)$ Km/h.

(i) $x+y = \frac{20}{2} = x+y = 10$.
(ii) $x-y = \frac{4}{2} \Rightarrow x-y = 2$.
(i & ii) $2x = 12 \Rightarrow x = 6$.
$x = 6$.

$6+y = 10 \Rightarrow y = 4 \Rightarrow x = 6$ Km/h and $y = 4$ km/h.
∴ Ritu's speed in still water $= 6$ km/h.

Speed of current $= 4$ Km/h.

ii) Let time taken by 1 woman to finish work $= x$ day & time taken by 1 man to finish the work $= y$ days.

(i) $\frac{2}{x} + \frac{5}{y} = \frac{1}{4}$.
(ii) $\frac{3}{x} + \frac{6}{y} = \frac{1}{3}$.

(i) x 3 − (ii) x 2.
$\frac{6}{x} + \frac{15}{y} = \frac{3}{4}$.

$\frac{6}{x} + \frac{12}{y} = \frac{2}{3}$.
(−) (−) (−)
$\frac{3}{y} = \frac{3}{4} - \frac{2}{3}$. ∴ $\frac{3}{y} = \frac{9-8}{12}$ ∴ $\frac{3}{y} = \frac{1}{12} \Rightarrow y = 36$ days.

Putting $y = 36$.
$\frac{2}{x} + \frac{5}{36} = \frac{1}{4} \Rightarrow \frac{2}{x} = \frac{1}{4} - \frac{5}{36} \Rightarrow \frac{2}{x} = \frac{9-5}{36} \Rightarrow \frac{2}{x} = \frac{4}{36} \Rightarrow x = 18$ days

Time taken by 1 woman to finish work $= 18$ days.
Time taken by 1 man to finish work $= 36$ days.

iii) Let speed of train = x km/h & speed of bus = y km/h.

total dist. = 300 km.

(i) $\frac{60}{x} + \frac{240}{y} = 4$.

(ii) $\frac{100}{x} + \frac{200}{y} = 4 + \frac{10}{60} \Rightarrow \frac{100}{x} + \frac{200}{y} = \frac{25}{6}$

(i) $\times$ 100 − eq. (ii) $\times$ 60.

$\frac{6000}{x} + \frac{24000}{y} = 400$

$\frac{6000}{x} + \frac{12000}{y} = 250$.

(−) (−) (−).

$\frac{12000}{y} = 150$. $\Rightarrow y = \frac{12000}{150} \Rightarrow y = 80 \Rightarrow y = 80$ km/h.

$y = 80$ (i).

$\frac{60}{x} + \frac{240}{80} = 4 \Rightarrow \frac{60}{x} + 3 = 4 \Rightarrow \frac{60}{x} = 1 \Rightarrow x = 60$ km/h.

$\therefore$ Speed of train = 60 km/h.

Speed of bus = 80 km/h.