Pair Of Linear Equations In Two Variables

Ex- 8.1

1) Present age of Aftab be x
his daughter $= y$

Seven years ago,
Age of aftab $= x-7$
age of his daughter $= y-7$.

A/q
$(x-7) = 7(y-7)$
$\Rightarrow x-7 = 7y-49$
$\Rightarrow x-7y = -42$ —— (I)

three years after,
Age of aftab $= x+3$
age of his daughter $= y+3$

A/q
$(x+3) = 3(y+3)$
$\Rightarrow x+3 = 3y+9$
$\Rightarrow x-3y = 6$ —— (II)

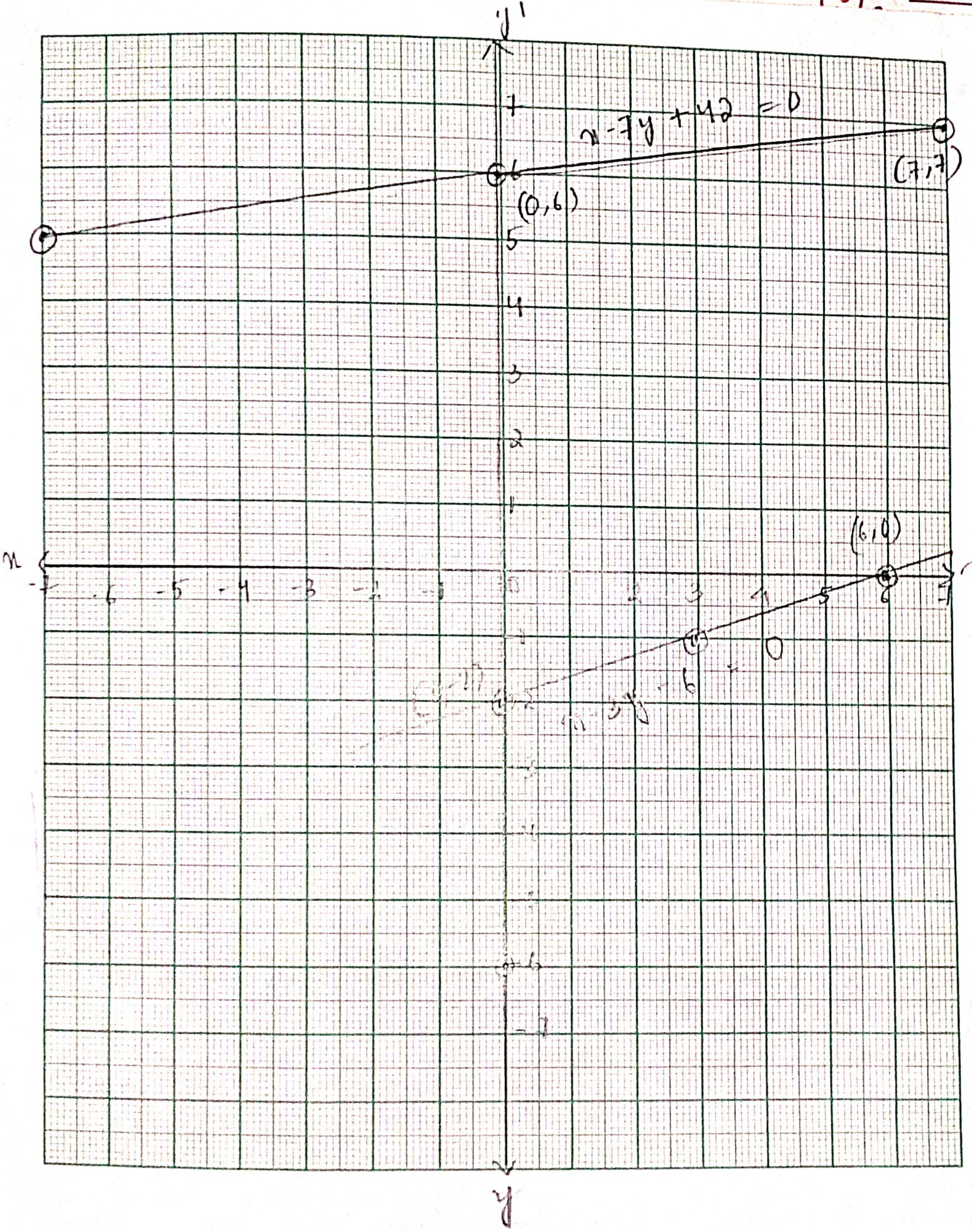
$x-7y = 42 \Rightarrow x = -42+7y$ (1)
$x-3y=6 \Rightarrow x = 6+3y$ (2)

(1)

x	-7	0	7
y	5	6	7

x	6	3	0
y	0	-1	-2

(2)



2) let the cost of the bat be ₹ x
cost of a ball = ₹ y

$3x + 6y = 3900$
$x + 2y = 1300$

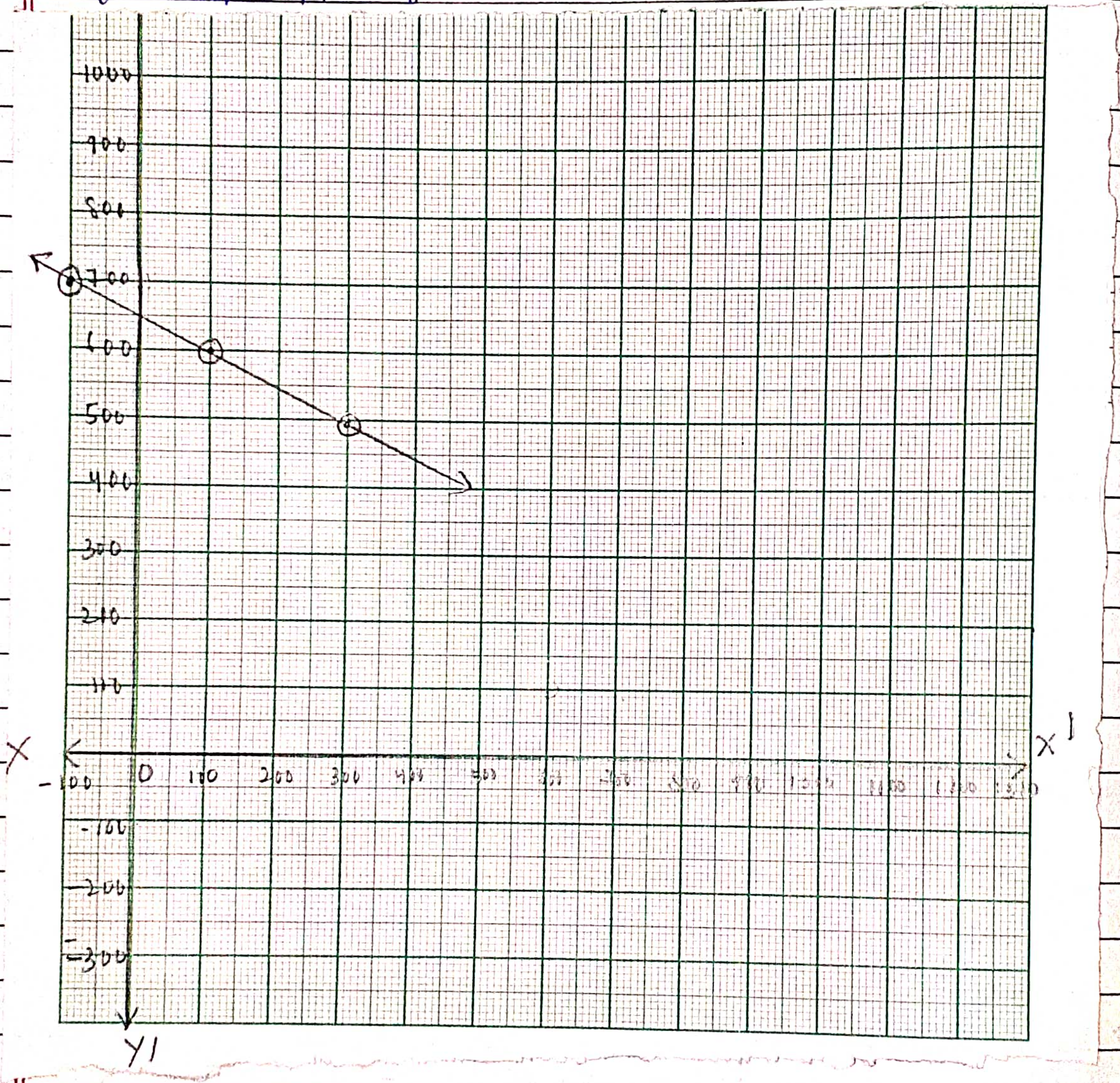
for $3x + 6y = 3900$
$x = \frac{3900 - 6y}{3}$

x	300	100	-100
y	500	600	700

$x + 2y = 1300$

$x = 1300 - 2y$

x	300	100	-100
y	500	600	700



3) Let the cost of 1kg of apple be ₹ x and 1kg of grapes be ₹ y

A/q

$2x + y = 160$

$4x + 2y = 300$

for, $2x + y = 160$

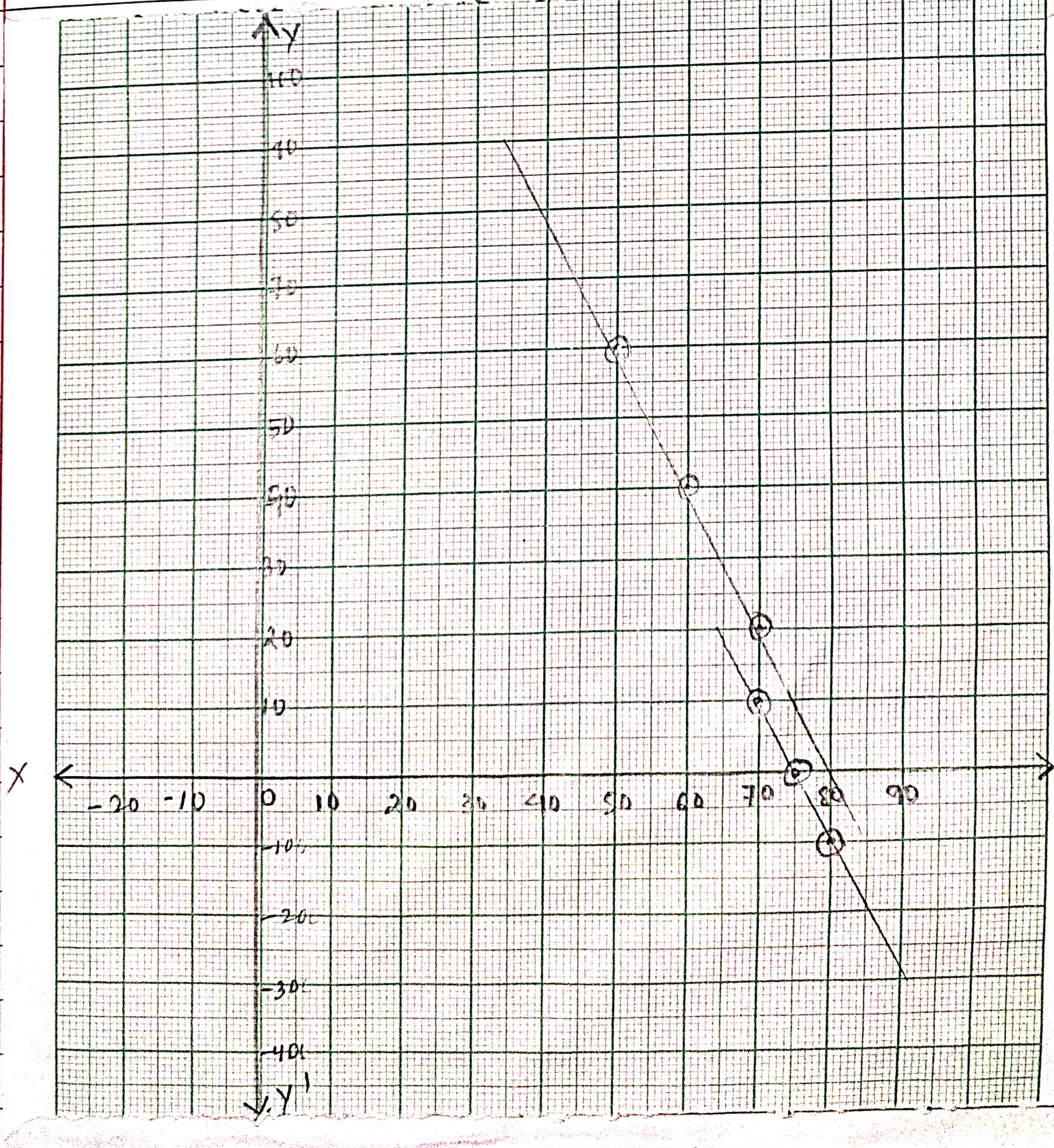
$y = 160 - 2x$

x	50	60	70
y	60	40	20

for, $4x + 2y = 300$

$$y = \frac{300 - 4x}{2}$$

x	70	80	75
y	10	-10	0



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Ex - 3.2

1) let the no. of girls be x and boy be y.

A/q $x + y = 10$

$x - y = 4$

for $x + y = 10$

$x = 10 - y$

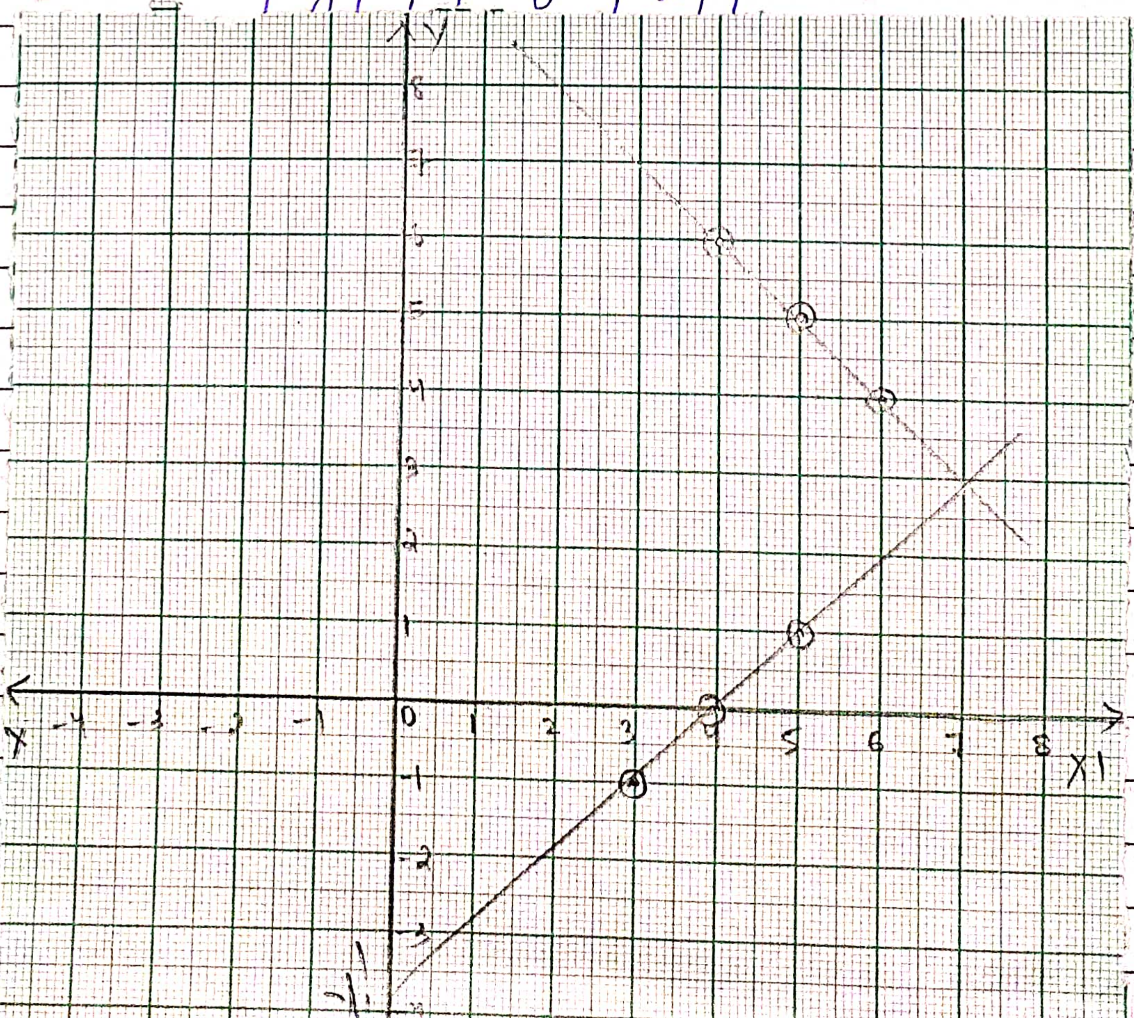
x	5	4	6
y	5	6	4

for ~~boys~~ $x - y = 4$

$x = 4 + y$

~~For~~ ~~boy~~

x	5	4	3
y	1	0	-1



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let the cost of 1 pen be y and 1 pencil be x

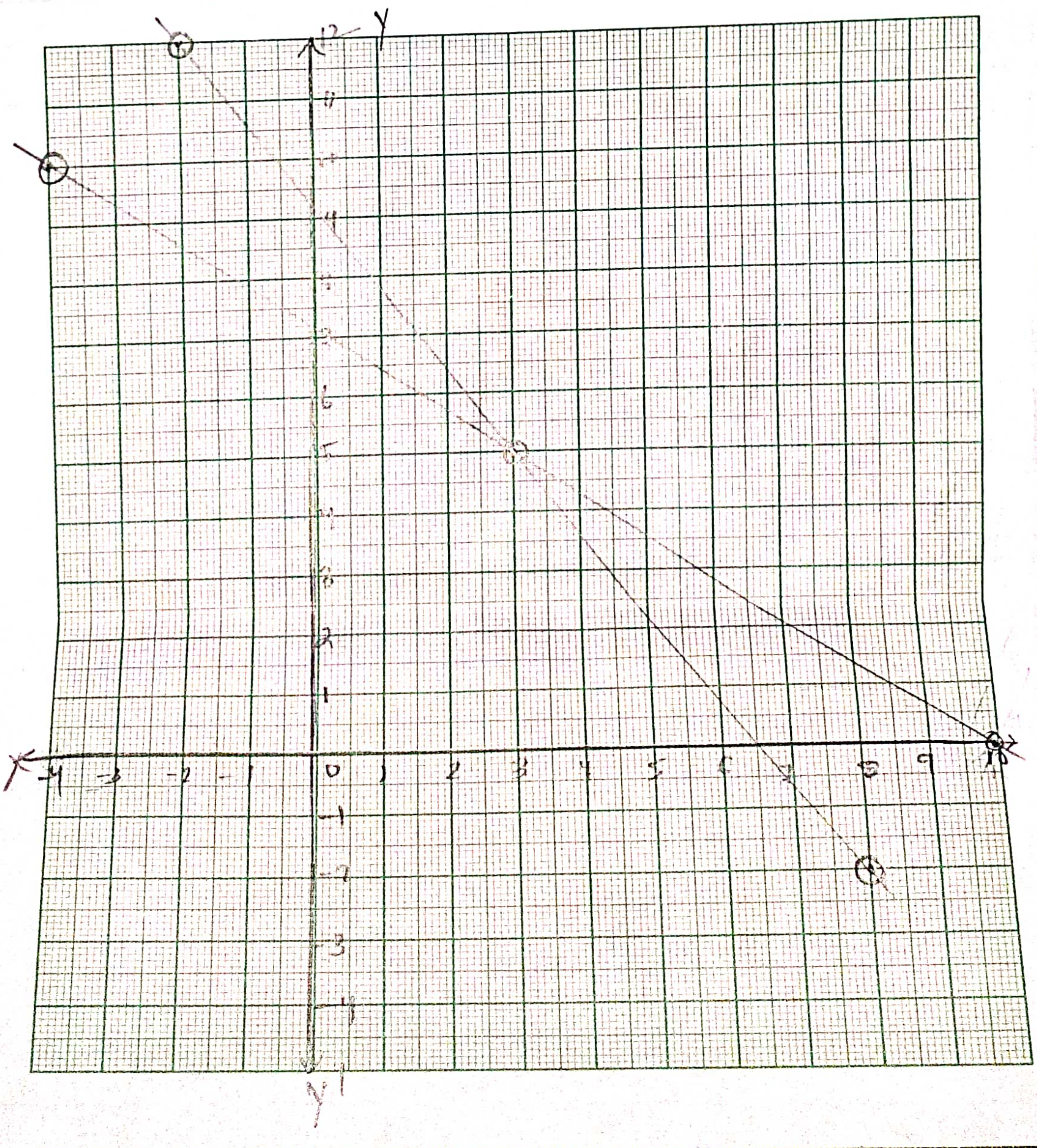
$5y + 7x = 50$
$7y + 5x = 46$

for $5y + 7x = 50$
$\Rightarrow x = \dfrac{50 - 5y}{7}$

x	3	10	-4
y	5	0	10

for, $7y + 5x = 46$
$\Rightarrow x = \dfrac{46 - 7y}{5}$

x	8	3	-2
y	-2	5	12



2) $a_1x + b_1y + c_1 = 0$

$a_2x + b_2y + c_2 = 0$

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

$7x + 6y - 9 = 0$

$a_1 = 5 \quad b_1 = -4 \quad c_1 = 8$

$a_2 = 7 \quad b_2 = 6 \quad c_2 = 9$

$\frac{a_1}{a_2} = \frac{5}{7} \quad \frac{b_1}{b_2} = \frac{-\cancel{4}}{\cancel{6}} = -\frac{2}{3} \quad \frac{9}{8}.$

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

So the given pair of equation will have a unique solution with intersecting lines at one exact point.

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

$18x + 6y + 24 = 0$

$a_1 = 9 \quad b_1 = 3 \quad c_1 = 12$

$a_2 = 18 \quad b_2 = 6 \quad c_2 = 24$

$\frac{a_1}{a_2} = \frac{\cancel{9}}{\cancel{18}} = \frac{1}{2} \quad \frac{b_1}{b_2} = \frac{\cancel{3}}{\cancel{6}} = \frac{1}{2} \quad \frac{c_1}{c_2} = \frac{\cancel{12}}{\cancel{24}} = \frac{1}{2}$

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

So the pair of equation will have infinite sol^n and the graph will represent coincident lines.

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(iii) $6x - 3y + 10 = 0$
$2x - y + 9 = 0$

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

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

So the graph formed will represent parallel lines with no possible solutions.

3) i) $3x + 2y = 5, \quad 2x - 3y = 7$

$\frac{a_1}{a_2} = \frac{3}{2}$ $\quad \frac{b_1}{b_2} = \frac{2}{-3} = \frac{-2}{3}$

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

It's graph will have intersecting lines only at one point with a unique solution. Hence the pair of linear equation is consistent.

(ii) $2x - 3y = 8, \quad 4x - 6y = 9$

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

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

So the graph will have parallel lines with no possible solution. Hence, the equations are inconsistent.

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

$\frac{a_1}{a_2} = \frac{\cancel{3}}{2} \times \frac{1}{\cancel{9}_3} = \frac{1}{6}$ $\frac{b_1}{b_2} = \frac{\cancel{5}}{3} \times \frac{-1}{\cancel{10}_2} = \frac{-1}{6}$

$\frac{c_1}{c_2} = \frac{\cancel{7}}{\cancel{14}} = \frac{1}{2}$

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

So the graph will have intersecting lines with a unique solution. Hence the equation is consistent.

(iv) $5x - 3y = 11$, $-10x + 6y = -22$

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

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

So the graph will have coincident lines and have infinite many solution. Hence the solution is consistent.

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(v) $\frac{4}{3}x + 2y = 8$, $2x + 3y = 12$

ant.

$\frac{a_1}{a_2} = \frac{\cancel{4}}{3} \times \frac{1}{\cancel{2}} = \frac{2}{3}$ $\frac{b_1}{b_2} = \frac{2}{3}$ $\frac{c_1}{c_2} = \frac{\cancel{8}}{\cancel{12}} = \frac{2}{3}$

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

So the graph will have ~~parallel~~ coincident lines with ~~no basis~~ infinite many solution. Hence the solution is consistent.

4) i) $x + y = 5$
$2x + 2y = 10$

$\frac{a_1}{a_2} = \frac{1}{2}$ $\frac{b_1}{b_2} = \frac{1}{2}$. $\frac{c_1}{c_2} = \frac{\cancel{5}}{\cancel{10}} = \frac{1}{2}$.

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

$\therefore$ The equations are coincident and they have infinite number of solution. So the equations are consistent.

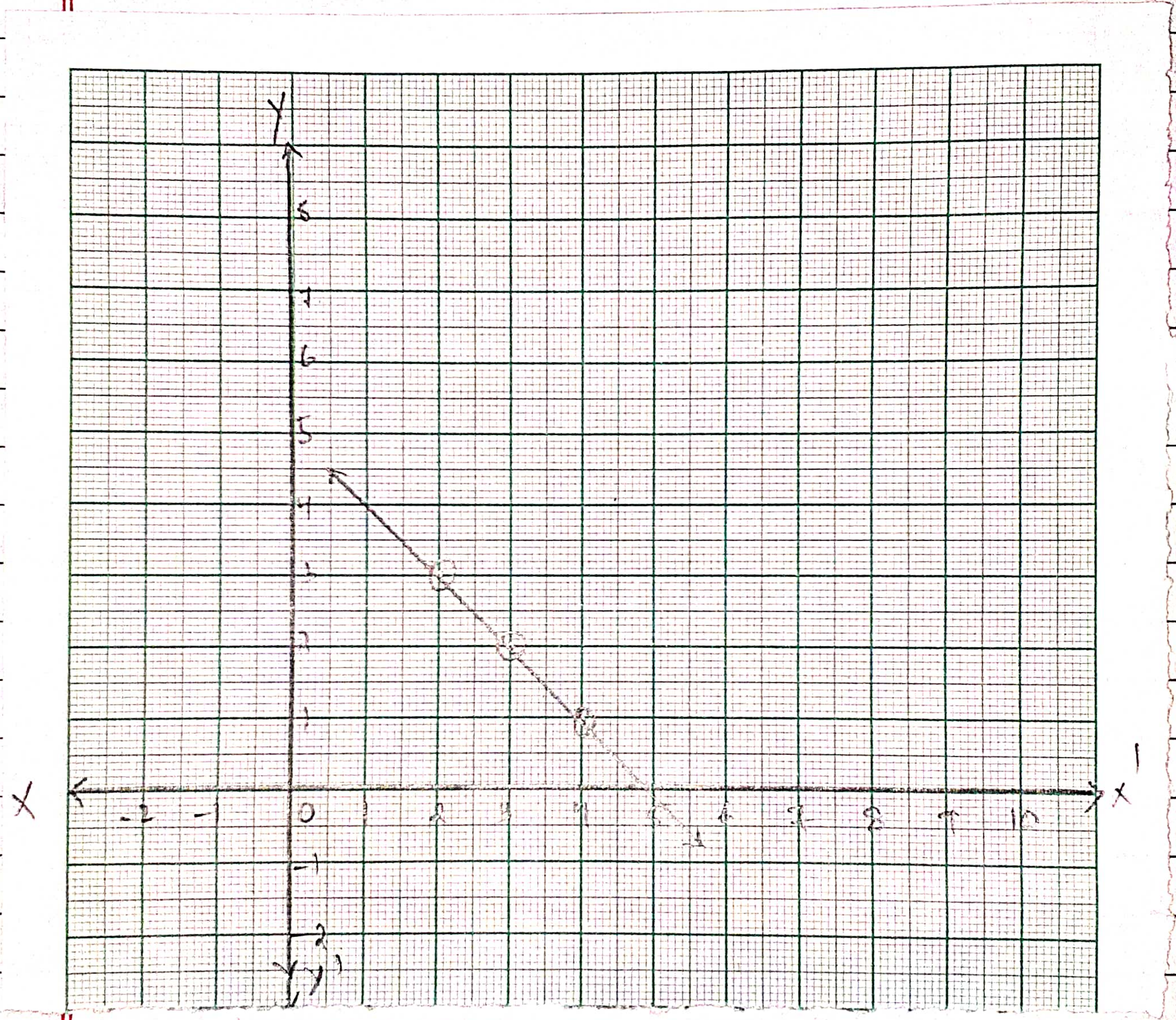
for, $x + y = 5$
$\Rightarrow x = 5 - y$

x	4	3	2
y	1	2	3

for $2x + 2y = 10$

$\Rightarrow x = \frac{10 - 2y}{2}$

x	4	3	2
y	1	2	3



(ii) $x - y = 8$, $3x - 3y = 16$

$\frac{a_1}{a_2} = \frac{1}{3}$ $\frac{b_1}{b_2} = \frac{-1}{-3} = \frac{1}{3}$ $\frac{c_1}{c_2} = \frac{\cancel{8}}{\cancel{16}} = \frac{1}{2}$

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

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The equations are parallel to each other and have no solutions. Hence, the pair of linear equations is inconsistent.

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

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

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

The given linear equations are intersecting each other at one point and have only one solution. Hence the pair of linear equations is consistent.

for, $2x + y - 6 = 0$

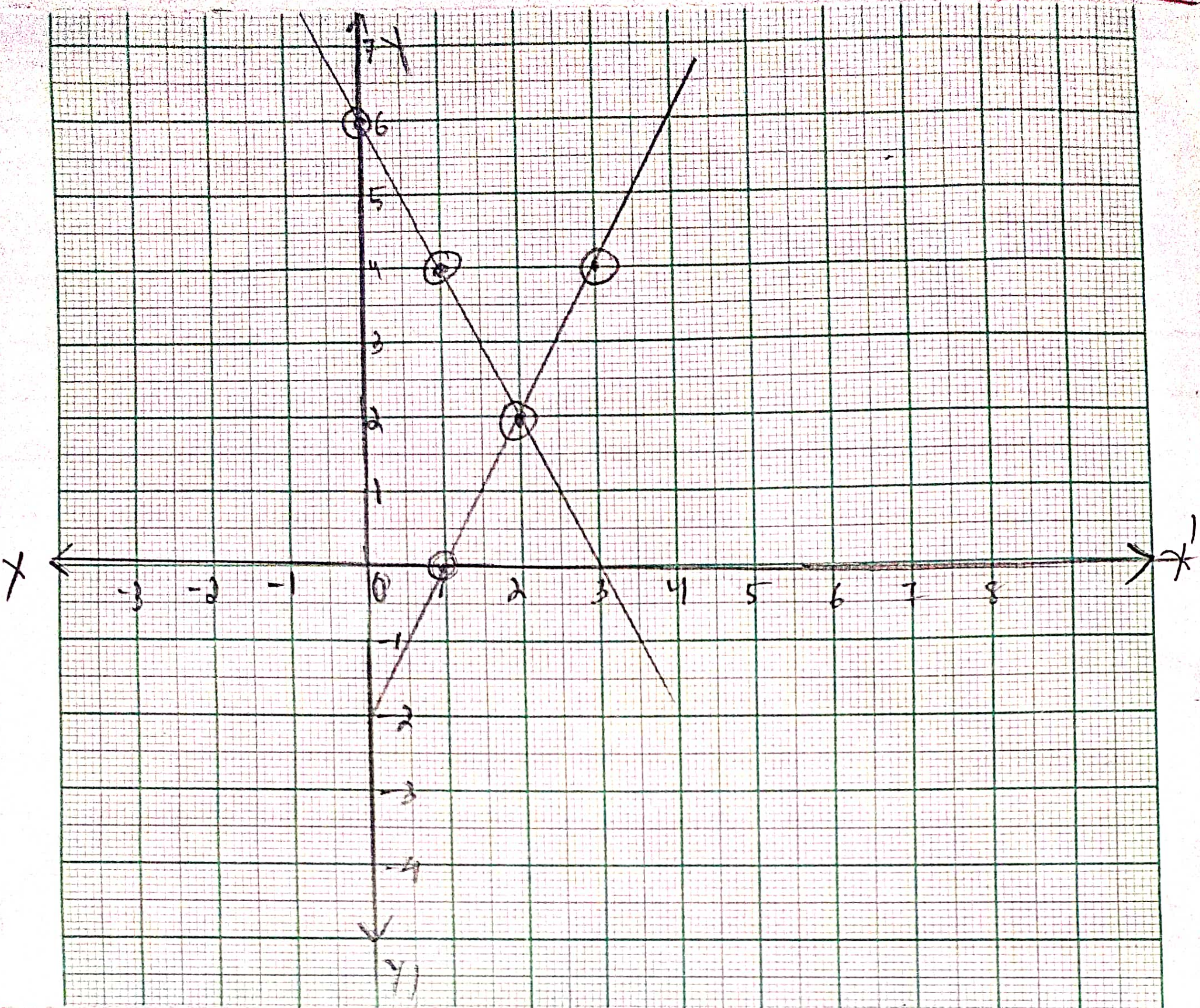
$\Rightarrow y = 6 - 2x$

x	0	1	2
y	6	4	2

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

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

x	1	2	3
y	0	2	4.



(iv) $2x - 2y - 2 = 0$, $4x - 4y - 5 = 0$

$$\frac{a_1}{a_2} = \frac{\cancel{2}}{\cancel{4}} = \frac{1}{2}$$

$$\frac{b_1}{b_2} = \frac{-\cancel{2}}{-\cancel{4}} = \frac{1}{2}$$

$$\frac{c_1}{c_2} = \frac{2}{5}$$

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

Thus, these linear equations have parallel and have no possible solutions. Hence, the pair of linear equations are inconsistent.

5) Let the width be x and length be y of the garden.

A/q

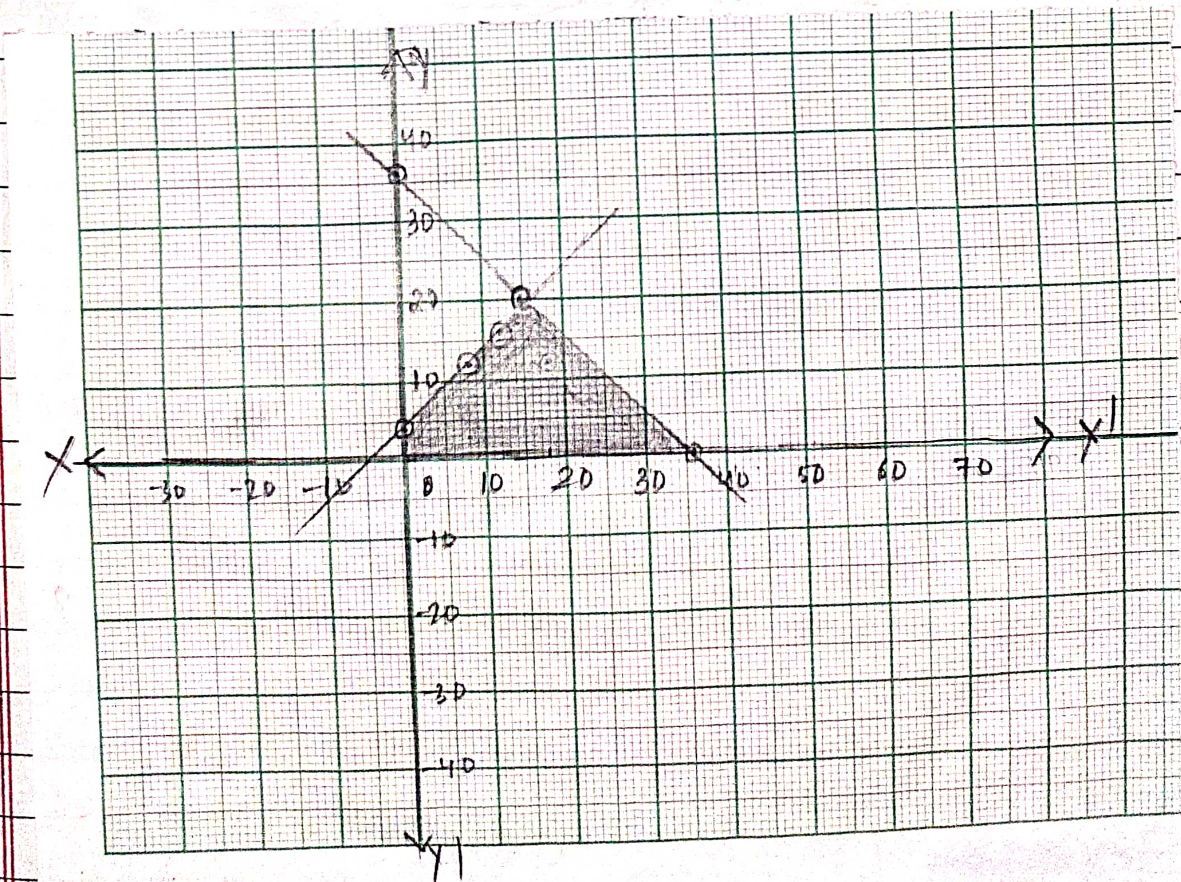
$y - x = 4$ —— (I)
$y + x = 36$ —— (II)

$y - x = 4$

x	0	8	12
y	4	12	16

$y + x = 36$

x	0	36	16
y	36	0	20



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6) i) Given condition

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

So another equation could be $2x - 7y + 9 = 0$

Such that,

$$\frac{a_1}{a_2} = \frac{2}{2} = 1 \qquad \frac{b_1}{b_2} = \frac{3}{-7} = -\frac{3}{7}.$$

$\therefore$ It satisfies the condition.

(ii) Given Condition

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

So another equation could be $6x + 9y + 9 = 0$

Such that

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

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

$\therefore$ It satisfies the condion.

(iii) Given condition,

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

Another equation could be $4x + 6y - 16 = 0$

$$\frac{a_1}{a_2} = \frac{\cancel{2}}{\cancel{4}} = \frac{1}{2} \quad \frac{b_1}{b_2} = \frac{\cancel{3}}{\cancel{6}} = \frac{1}{2} \quad \frac{c_1}{c_2} = \frac{-\cancel{8}}{-\cancel{16}} = \frac{1}{2}$$

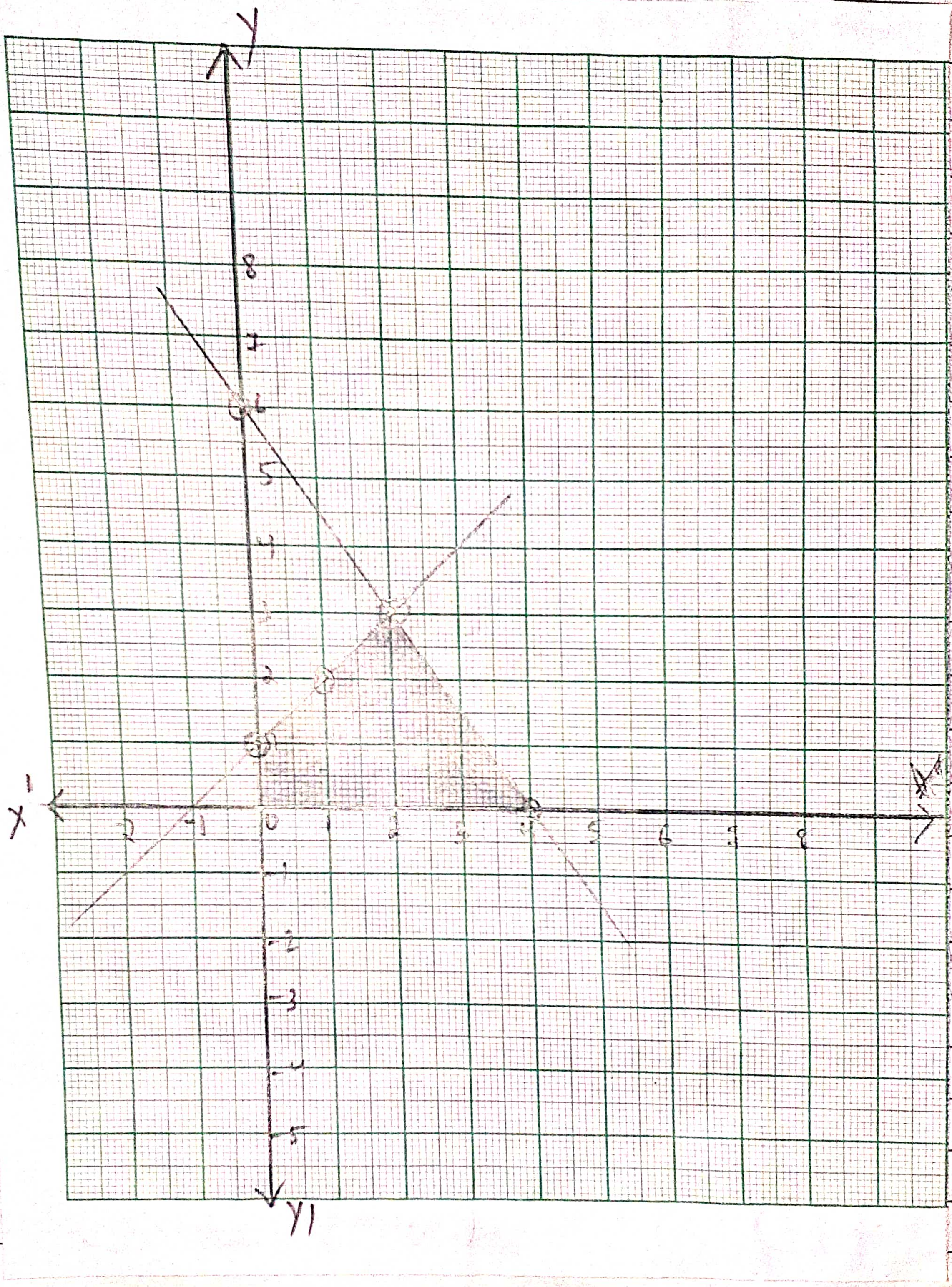
$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

∴ So it satisfies the condition given.

7) $x - y + 1 = 0$
$3x + 2y - 12 = 0$

x	0	1	2
y	1	2	3

x	4	2	0
y	0	3	6


Y
8
7
6
5
X'
0
X
Y'

Exercise 3.3

1) (i) $x + y = 14$ ——— (1)
$x - y = 4$ ——— (2)

From equation (1)

$x + y = 14$
$\Rightarrow x = 14 - y$ ——— (3)

Substituting the value of x in equation (2)

$x - y = 4$
$\Rightarrow 14 - y - y = 4$
$\Rightarrow 14 - 2y = 4$
$\Rightarrow 2y = 10$
$\Rightarrow y = \frac{10}{2}$

$\Rightarrow y = 5$

By putting the value in equation (3)

$x = 14 - 5$
$\Rightarrow x = 9$

$\boxed{x = 9,\ y = 5}$

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(ii) $s - t = 3$ —— (1)

$\frac{s}{3} + \frac{t}{2} = 6$ —— (11)

from equation (1)

$s = 3 + t$ —— (3)

substituting the value of s in (ii)

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

$$\Rightarrow \frac{6+2t+3t}{6} = 6$$

$\Rightarrow 6 + 2t + 3t = 6 \times 6$

$\Rightarrow 5t = 36 - 6$

$\Rightarrow 5t = 30$

$\Rightarrow t = \frac{30}{5}$

$\Rightarrow t = 6$

putting the value of t in equation (3)

$s = 3 + t$

$= 3 + 6$

$= 9$

$\boxed{t = 6,\ s = 9}$

(iii) $3x - y = 3$ ——→ (1)

$9x - 3y = 9$ ——→ (2)

from equation (1)

$x = \frac{3+y}{3}$ —— (3)

Substituting the value of x in equation (2)

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

$$\Rightarrow \frac{27+9y}{3} - 3y = 9$$

$$\Rightarrow 27 + 6y = 27$$

$$\Rightarrow y = \frac{27-27}{6}$$

$$\Rightarrow y = 0$$

putting the value in equation (3)

$$x = \frac{3+y}{3}$$

$$= \frac{3+0}{3}$$

$$= \frac{3}{3}$$

$$= 1$$

$$\boxed{x = 1, y = 0}$$

(iv) $0.2x + 0.3y = 1.3$ —— (1)

$0.4x + 0.5y = 2.3$ —— (11)

from ~~substitution~~ equation (1)

$$x = \frac{1.3 - \cancel{00}\, 0.3y}{0.2} \quad \text{—— (3)}$$

Substituting the value of x equation ②

$$0.4\left(\frac{1.3-0.3y}{0.2}\right)+0.5y=2.3$$

$\Rightarrow 2.6-0.6y+0.5y=2.3$

$\Rightarrow 2.6-2.3=0.1y$

$\Rightarrow 0.3=0.1y$

$\Rightarrow y=3$

Putting the value of y in equation ③

$$x=\frac{1.3-0.3\times 3}{0.2}$$

$$=\frac{1.3-0.9}{0.2}$$

$$=2.$$

(v) $\sqrt{2}x+\sqrt{3}y=0$ ——— ①

$\sqrt{3}x-\sqrt{8}y=0$ ——— ②

from equation ①

$$x=-\frac{\sqrt{3}y}{\sqrt{2}}$$

Substituting the value of x in equation ②

$$\sqrt{3}\left(-\frac{\sqrt{3}y}{\sqrt{2}}\right)-\sqrt{8}y=0$$

$$-\frac{3y}{\sqrt{2}}-2\sqrt{2}y=0$$

$$\Rightarrow y\left(-\frac{3}{\sqrt{2}}-2\sqrt{2}\right)=0$$

$\Rightarrow y = 0$

putting value of y in equation (3)

$$x = \frac{-\sqrt{3}y}{\sqrt{2}}$$

$$= -\frac{\sqrt{3}\times 0}{\sqrt{2}}$$

$$= 0.$$

$\boxed{x = 0, \ y = 0}$

(vi) $\frac{3x}{2} - \frac{5y}{3} = -2$ —— (1)

$\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$ —— (2)

from equation (1)

$\cancel{8}\ 9x - 10y = -12$

$\Rightarrow x = \frac{-12 + 10y}{9}$ —— (3)

Substituting the value of x in equation (2)

$$\frac{\frac{-12+10y}{9}}{3} + \frac{y}{2} = \frac{13}{6}$$

$$\Rightarrow \frac{-24 + 20y + 27y}{54} = \frac{13}{6}$$

$\Rightarrow 47y = 117 + 24$

$\Rightarrow 47y = 141$

$\Rightarrow y = 3$

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putting the value of y in equation (3)

$$x = \frac{-12+10\times 3}{9} - \frac{18}{9} = 2.$$

$$\boxed{x = 2, \ y = 3}$$

(2) $2x + 3y = 11$ ——— (1)
$2x - 4y = -24$ ——— (2)

from equation (1)

$$x = \frac{11-3y}{2} \text{ —— (3)}$$

putting the value of x in equation (2)

$$2\left(\frac{11-3y}{2}\right) - 4y = -24$$

$\Rightarrow 11 - 3y - 4y = -24$
$\Rightarrow -7y = -35$
$\Rightarrow y = \frac{-35}{-7}$

$\Rightarrow y = 5$

Putting the value of y in equation (3)

$$x = \frac{11-3y}{2}$$

$$= \frac{11-3\times 5}{2}$$

$$= \frac{-4}{2} = -2.$$

$$\boxed{x = -2,\ y = 5}$$

Now,

$$y = mx + 3$$

$$\Rightarrow 5 = -2m + 3$$

$$\Rightarrow -2m = 2$$

$$\Rightarrow m = \frac{2}{-2}$$

$$\Rightarrow m = -1$$

(3) i) let smallest no. be y
greatest no. = x

A/q

$$x - y = 26 \quad \text{--- (1)}$$

and $x = 3y$

$$\Rightarrow x - 3y = 0 \quad \text{--- (2)}$$

from equation (1) and (2)

$$
\begin{array}{rcrcl}
x & - & y & = & 26 \\
x & - & 3y & = & 0 \\
(-) & & (+) & & (-) \\
\hline
 & & 2y & = & 26 \\
 & & y & = & 13
\end{array}
$$

from equation,

$$x - y = 26$$

$$\Rightarrow x - 13 = 26$$

$$\Rightarrow x = 39.$$

So the no. are 13, 39

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(ii) let two angles are x and y

A/q

$x+y=180$ —— ①
$x-y=18$ —— ②

Adding equation ① and (II)

$$\begin{aligned} x+y &= 180 \\ x-y &= 18 \\ (+)\ (-) & \quad (+) \\ \hline 2x &= 198 \\ \Rightarrow x &= \frac{198}{2} \\ \Rightarrow x &= 99 \end{aligned}$$

From equation ①

$x+y=180$
$\Rightarrow 99+y=180$
$\Rightarrow y = 81$

So two angles are 81° and 99°

(iii) let cost of 1 bat $= x$
cost of 1 ball $= y$

$7x+6y = 3800$ —— ①
$3x+5y = 1750$ —— (II)

Eq(1) $\times 5$ $=$ $35x+30y = 19000$
Eq (2) $\times 6$ $=$ $18x+30y = 10500$
$(-)\quad(-)\quad(-)$

$17x = 8500$

$\Rightarrow x = \frac{8500}{17} = 500$

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from equation ① $7 \times 500 \times 6y = 3800$

$\Rightarrow 3500 \times 6y = 3800$

$\Rightarrow y = \frac{3800 - 3500}{6}$

$\Rightarrow y = 50$

(iv) let fair for 1Km = ₹ x
and fixed charge = ₹ y

A/q $10x + y = 105$ —— ①
$15x + y = 155$ —— ②
(−) (−) (−)

$-5x = -50$

$\Rightarrow x = 10.$

from equation ① $10 \times 10 + y = 105$

$\Rightarrow 100 + y = 105$

$\Rightarrow y = 105 - 100$

$\Rightarrow y = 5.$

So fair for km is ₹ 10 and fixed Charge is ₹ 5.

(v) let the numerator be x
denominator be y.

$\frac{x+2}{y+2} = \frac{9}{11}$ $11x + 22 = 9y + 18$
$11x - 9y + 4 = 0$ —— ①

$\frac{x+3}{y+3} = \frac{5}{6}$ $6x + 18 = 5y + 15$
$\Rightarrow 6x - 5y + 3 = 0$ —— ⑪

$11x - 9y + 4 = 0$ —— (I)
$6x - 5y + 3 = 0$ —— (II)

Eq (1) × 6 = $66x - 54y + 24 = 0$
Eq (2) × 11 = $66x - 55y + 33 = 0$
$y = 9$

From equation (II) $6x - 5y + 3 = 0$
$6x - 5 \times 9 + 3 = 0$
$\Rightarrow x = \frac{42}{6} = 7$

so, fraction is $\frac{7}{9}$.

(vi) Let the age of jacob be x
his son be y.

A/q

$(x+5) = 3(y+5)$
$\Rightarrow x - 3y = 10$ —— (1)

$(x-5) = 7(y-5)$
$\Rightarrow x - 7y = -30$ —— (2)

from Equation (1)

$x = 3y + 10$ —— (3)

Substituting the value of x in equation (2)

$3y + 10 - 7y = -30$
$\Rightarrow -4y = -40$
$\Rightarrow y = 10$.

Substituting the value of y in equation (3)

$x = 3 \times 10 + 10$
$= 40.$

So Jacob's age is 40 years
His son's age is 10 years.

Exercise 3.4

1) (i) $x + y = 5$ —— (I)
$2x - 3y = 4$ —— (II)

$eq(i) \times 2 = 2x - 2y = 10$
$(-) 2x \underset{(+)}{-} 3y = \underset{(-)}{4}$

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

$x + \frac{6}{5} = 5$

$\Rightarrow x = \frac{19}{5} \quad y = \frac{6}{5}$

by substitution

$x = 5 - y$

$2(5-y) - 3y = 4$
$-5y = -6$
$y = \frac{6}{5}$

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$x = 5 - \frac{6}{5} = \frac{19}{5}$

(ii) $3x + 4y = 10$ ——— (I)
$2x - 2y = 2$ ——— (II)

equation(II) × 2 $\quad 4x - 4y = 4$

$$\begin{aligned} 4x - 4y &= 4 \\ 3x + 4y &= 10 \\ \hline 7x &= 14 \end{aligned}$$

$\Rightarrow x = \frac{14}{7}$

$x = 2$

$3 \times 2 + 4y = 10$

$\Rightarrow 6 + 4y = 10$

$\Rightarrow 4y = 4$

$\Rightarrow y = \frac{4}{4}$

$\Rightarrow y = 1$

By substitution

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

$3(1+y) + 4y = 10$

$7y = 7$

$y = 1$

$\boxed{\text{So } x = 2,\ y = 1}$

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(iii) $3x - 5y - 4 = 0$ ——— (I)
$9x - 2y - 7 = 0$ ——— (II)

Equation (I) $\times 3$ = $9x - 15y - 12 = 0$
$\underline{(-)9x \underset{(+)}{-} 2y \underset{(+)}{-} 7 = 0}$
$-13y = 5$
$\Rightarrow y = \frac{-5}{13}$.

$3x \times -5 \times \frac{-5}{13} - 4 = 0$

$\Rightarrow 3x = \frac{27}{13}$

$\Rightarrow x = \frac{9}{13}$

By substitution,

$x = \frac{5y+4}{3}$

$9\left(\frac{5y+4}{3}\right) - 2y - 7 = 0$

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

$x = \frac{5\left(-\frac{5}{13}\right) + 4}{3} = \frac{9}{13}$

$\boxed{\text{So } x = \frac{9}{13},\ y = \frac{-5}{13}}$

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(iv) $\frac{x}{2} + \frac{2y}{3} = -1$

$\Rightarrow 3x + 4y = -6$ ——— (1)

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

$\Rightarrow 3x - y = 9$ ——— (2)

$3x - y = 9$
$-3x \pm 4y = -6$
$5y = \cancel{25}-15$
$\Rightarrow y = \frac{-15}{5}$

$\Rightarrow y = -3.$

$3x - 12 = -6$
$x = 2.$

By substitution

$x = \frac{y+9}{3}$

$3\left(\frac{y+9}{3}\right) + 4y = -6$

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

$x = \frac{-3+9}{3} = 2$

$\boxed{\text{So, } x = 2,\ y = -3}$

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(2)(i) let the fraction be $\frac{x}{y}$

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

$\Rightarrow$ $x - y = -2$ —— (1)

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

$\Rightarrow$ $2x = y + 1$ —— (2)

$$x - y = -2$$
$$2x - y = 1$$
$$(-) \quad + \quad (-)$$
$$x = 3$$

$$3 - y = -2$$
$\Rightarrow -y = -5$
$\Rightarrow y = 5$.

fraction is $\frac{3}{5}$.

(ii) Age of Nuri $= x$
Age of Sonu $= y$

A/q
$$(x-5) = 3(y-5)$$
$$x - 3y = -10 \quad \text{—— (1)}$$
$$(x+10) = 2(y+10)$$
$$x - 2y = 10 \quad \text{—— (11)}$$

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$x - 2y = 10$
$\underset{(-)}{x} \underset{(+)}{-} 3y = \underset{(+)}{-}10$

$y = 20$

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

So age of Nuni is 50 and age of sonu is 20.

(iii) Let the unit digit and tens digit of a no. be x and y

$10y + x = 9$

No's after reversing the digits $= 10x + y$

A/q

$x + y = 9$ —— (1)
$9(10y + x) = 2(10x + y)$
$88y - 11x = 0$
$\Rightarrow -x + 8y = 0$ —— (11)

Adding equ^n (1) and (11)
$9y = 9$
$\Rightarrow y = 1$, $x = 8$

So the no. is $10 \times 1 + 8 = 18$.

$x - 2y = 10$
$x - 3y = -10$
$\quad (-) \quad (+) \quad (+)$

$y = 20$

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

So age of Nikki is 50 and age of sonu is 20.

(iii) Let the unit digit and tens digit of a no. be x and y

$10y + x = 9$

No's after reversing the digits $= 10x + y$

A/q
$x + y = 9$ —— (1)
$9(10y + x) = 2(10x + y)$
$88y - 11x = 0$
$\Rightarrow -x + 8y = 0$ —— (11)

Adding equ^n (1) and (11)
$9y = 9$
$\Rightarrow y = 1, \quad x = 8$

So the no. is $10 \times 1 + 8 = 18$.

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(iv) let the no. of ₹50 notes be x and ₹100 notes be y.

$$x + y = 25 \text{ ———— (I)}$$
$$50x + 100y = 2000 \text{ ———— (II)}$$

equation (I) × 50 = $50x + 50y = 1250$

$$50x + 100y = 2000$$
$$(-) \quad (-) \quad (-)$$
$$-50y = -750$$
$$\Rightarrow y = \frac{-750}{-50}$$
$$\Rightarrow y = 15$$

Putting the value of y in the equation — (I)

$$x + y = 25$$
$$\Rightarrow x + 15 = 25$$
$$\Rightarrow x = 25 - 15$$
$$\Rightarrow x = 10.$$

(V) let the fixed charges for 30 days be x & additional charges be y.

A/q,

$$x + 4y = 27 \text{ ———— (I)}$$
$$x + 2y = 21 \text{ ———— (II)}$$
$$(-) \quad (-) \quad (-)$$
$$2y = 6$$
$$\Rightarrow y = \frac{6}{2}$$
$$\Rightarrow y = 3$$

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putting the Value of y in equation (1)

$~~x+2y=~~$ $x+4y=27$

$\Rightarrow x+4\times3=27$

$\Rightarrow x+12=27$

$\Rightarrow x=27-12$

$\Rightarrow x=15.$

Hence,
The fixed charge is ₹ 15
and additional charge is ₹ 3

Exercise - 3.5

1)(i) $x-3y-3=0$ ——— (I)
$3x-9y-2=0$ ——— (II)

$\frac{a_1}{a_2}=\frac{1}{3}$ $\quad \frac{b_1}{b_2}=\frac{-\cancel{3}}{-\cancel{9}}=\frac{1}{3}$ $\quad \frac{c_1}{c_2}=\frac{-3}{-2}=\frac{3}{2}.$

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

So, no solution will be formed.

(ii) $2x+y=5$
$3x+2y=8$

$\frac{a_1}{a_2}=\frac{2}{3}$ $\quad \frac{b_1}{b_2}=\frac{1}{2}$ $\quad \frac{c_1}{c_2}=\frac{5}{8}$

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

∴ So there will be a unique solution.

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

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

$$\Rightarrow \frac{x}{2} = 1, \quad \frac{y}{1} = 1$$

$$\Rightarrow \boxed{x = 2, \quad y = 1}$$

(iii) $3x - 5y = 20$
$6x - 10y = 40$

$$\frac{a_1}{a_2} = \frac{\cancel{3}}{\cancel{6}} = \frac{1}{2} \qquad \frac{b_1}{b_2} = \frac{-\cancel{5}}{-\cancel{10}} = \frac{1}{2} \qquad \frac{c_1}{c_2} = \frac{\cancel{20}}{\cancel{40}} = \frac{1}{2}$$

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

∴ So there will be infinite many solutions.

(iv) ~~x~~ $x - 3y - 7 = 0$
$3x - 3y - 15 = 0$

$$\frac{a_1}{a_2} = \frac{1}{3} \qquad \frac{b_1}{b_2} = \frac{-3}{-3} = 1 \qquad \frac{c_1}{c_2} = \frac{-7}{-15} = \frac{7}{15}$$

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

$\therefore$ So, There will be a unique solution

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

$$\Rightarrow \frac{x}{24} = \frac{y}{-6} = \frac{1}{6}$$

$$\Rightarrow \frac{x}{24} = \frac{1}{6}, \quad \frac{y}{-6} = \frac{1}{6}$$

$$\Rightarrow x = \frac{24}{6}, \quad y = \frac{-6}{6}$$

$$\Rightarrow \boxed{x = 4, \ y = -1}$$

2) (i) $2x + 3y = 7$

$(a-b)x + (a+b)y = 3a+b-2$.

$$\frac{a_1}{a_2} = \frac{2}{a-b}, \quad \frac{b_1}{b_2} = \frac{3}{a+b}, \quad \frac{c_1}{c_2} = \frac{7}{(3a+b-2)}$$

$$\Rightarrow \frac{2}{a-b} = \frac{7}{3a+b-2}$$

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

$a - 9b = -4$ ——— (1)

$$\frac{2}{a-b} = \frac{3}{a+b}$$

$2a+2b = 3a-3b$

$a-5b=0$ —— (II)

Subtracting (I) from (II)

$4b = 4$

$\Rightarrow b = \frac{4}{4}$

$\Rightarrow b = 1$

Substituting the value of b in equation (II)

$a-5b=0$

$\Rightarrow a-5\times 1=0$

$\Rightarrow a-5=0$

$\Rightarrow a=5$

So, $\boxed{a=5,\ b=1}$

(b) $3x+y=1$

$(2k-1)x + (k-1)y = 2k+1$

$$\frac{a_1}{a_2} = \frac{3}{2k-1} = \frac{b_1}{b_2} = \frac{1}{k-1} \neq \frac{c_1}{c_2} = \frac{1}{2k+1}$$

$$\frac{3}{2k-1} = \frac{1}{k-2}$$

$3k - 3 = 2k - 1$

$\Rightarrow 3k - 2k = -1 + 3$

$\Rightarrow k = 2$

(3) $8x + 5y = 9$ ——— (1)

$3x + 2y = 4$ ——— (2)

From equation (2)

$3x + 2y = 4$

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

putting the value of x in equation (1)

$8x + 5y = 9$

$\Rightarrow 8\frac{(4-2y)}{3} + 5y = 9$

$\Rightarrow 32 - 16y + 15y = 27$

$\Rightarrow -y = -5$

$\Rightarrow y = 5$ ——— (4)

putting ~~the~~ value of y in equation (2)

$3x + 2y = 4$

$\Rightarrow 3x + 2 \times 5 = 4$

$\Rightarrow 3x = 4 - 10$

$\Rightarrow 3x = -6$

$\Rightarrow x = \frac{-6}{3}$

$\Rightarrow x = -2$.

So, $\boxed{x = -2, \; y = 5}$

By cross Multiplication.

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

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

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

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

$$\Rightarrow x = -2, \quad y = 5$$

$\therefore$ So $\boxed{x = -2, y = 5}$

(4)(i) Let the fixed charges be x and the cost of food per day be y.

A/q

$$x + 20y = 1000 \longrightarrow (1)$$
$$x + 26y = 1180 \longrightarrow (2)$$

Subtracting (I) from (II)

$$
\begin{array}{rcl}
x + 26y & = & 1180 \\
x + 20y & = & 1000 \\
(-) \quad (-) & & (-) \\
\hline
6y & = & 180
\end{array}
$$

$$\Rightarrow y = \frac{180}{6}$$

$$\Rightarrow y = 30$$

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$x + 20 \times 30 = 1000$

$\Rightarrow x = 1000 - 600$

$\Rightarrow x = 400$

So the fixed charge is ₹400 and the cost of food is ₹30.

(ii) Let the fraction be $\frac{x}{y}$

A/q

$\frac{x-1}{y} = \frac{1}{3}$

$\Rightarrow 3x - 3 = y$

$\Rightarrow 3x - 3 - y = 0$

$\Rightarrow 3x - y = 3$ —— (1)

$\frac{x}{y+8} = \frac{1}{4}$

$\Rightarrow 4x = y + 8$

$\Rightarrow 4x - y = 8$ —— (2)

Subtracting (1) from (2)

$$\begin{array}{rcl} 4x - y & = & 8 \\ 3x - y & = & 3 \\ (-) \quad (+) & & (-) \\ \hline x & = & 5 \end{array}$$

Putting the value of x in equation (1)

$\cancel{3x - y = 40}$

$\Rightarrow \cancel{3 \times 15 - y = 40}$

$\Rightarrow \cancel{3y = 40 - 45}$

$\Rightarrow \cancel{-y = -5}$

$\Rightarrow \cancel{y = 5}$.

$3 \times 5 - y = 3$

$\Rightarrow 15 - y = 3$

$\Rightarrow -y = 3 - 15$

$\Rightarrow -y = -12$

$\Rightarrow y = 12$.

So, So the fraction is $\frac{5}{12}$.

(iii) Let the no. of right questions be x and wrong question be y,

A/q

$3x - y = 40$ ——— (1)

$4x - 2y = 50$

$\Rightarrow 2x - y = 25$ ——— (2)

Subtracting (2) from (1)

$3x - y = 40$

$2x - y = 25$

$(-) \quad (+) \quad (-)$

$x = 15$

Putting the value of x in equation (1)

$3x - y = 40$

$\Rightarrow 3 \times 15 - y = 40$

$\Rightarrow -y = 40 - 45$

$\Rightarrow -y = -5$

$\Rightarrow y = 5$.

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∴ So no. of right questions is 15 and no. of wrong questions is 5. And total no. of question is 20.

(iv) Let the speed of one car be x and another be y.

A/q

$$5x - 5y = 100$$
$$\Rightarrow x - y = 20 \quad \text{--- (1)}$$

$$x + y = 100 \quad \text{--- (2)}$$

Adding equation (1) and (2)

$$x - y = 20$$
$$x + y = 100$$
$$(+)\ (+)\quad (+)$$
$$2x = 120$$
$$\Rightarrow x = \frac{120}{2}$$
$$\Rightarrow x = 60 \text{ Km/hr.}$$

Putting the value of x in equation (1)

$$x - y = 20$$
$$\Rightarrow 60 - y = 20$$
$$\Rightarrow -y = 20 - 60$$
$$\Rightarrow -y = -40$$
$$\Rightarrow y = 40 \text{ Km/hr.}$$

So the speed are 60Km/hr and 40Km/hr.

(V) let the length be x
breadth be y

A/q

$$(x-5)(y+3) = xy-9$$
$$\Rightarrow \cancel{xy}+3x-5y-15 = \cancel{xy}-9$$
$$\Rightarrow 3x-5y-6=0 \quad \text{--- (1)}$$

$$(x+3)(y+2) = xy+67$$
$$\Rightarrow \cancel{xy}+2x+3y+6 = \cancel{xy}+67$$
$$\Rightarrow 2x+3y-61=0.$$

By cross Multiplication Method.

$$\frac{x}{305-(-18)} = \frac{y}{-12-(-183)} = \frac{1}{9-(-10)}$$

$$\Rightarrow \frac{x}{305+18} = \frac{y}{-12+183} = \frac{1}{9+10}$$

$$\Rightarrow \frac{x}{323} = \frac{y}{171} = \frac{1}{19}$$

$$\Rightarrow \frac{x}{323} = \frac{1}{19}, \quad \frac{y}{171} = \frac{1}{19}$$

$$\Rightarrow x = \frac{323}{19}, \quad y = \frac{171}{19}$$

$$\Rightarrow x = 17, \quad y = 9.$$

So length is 17unit and breadth is 9 units respectively.

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Exercise - 3.6

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

let $\frac{1}{x} = p$, $\frac{1}{y} = q$ let $\frac{1}{x} = p$, $\frac{1}{y} = q$

$\frac{p}{2} + \frac{q}{3} = 2$ $\frac{p}{3} + \frac{q}{2} = \frac{13}{6}$

$3p + 2q - 12 = 0$ —— (I) $2p + 3q - 13 = 0$ —— (II)

By cross multiplication method.

$\frac{p}{-26-(-36)} = \frac{q}{-24-(-39)} = \frac{1}{9-4}$

$\frac{p}{10} = \frac{q}{15} = \frac{1}{5}$

$\frac{p}{10} = \frac{1}{5}$, $\frac{q}{15} = \frac{1}{5}$

$p = \frac{\cancel{10}}{\cancel{5}}$, $q = \frac{\cancel{15}}{\cancel{5}}$

$p = 2$, $q = 3$

So, $\frac{1}{x} = 2$, $\frac{1}{y} = 3$

(ii) $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2$ $\qquad$ $\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$

$\frac{1}{\sqrt{x}} = p, \frac{1}{\sqrt{y}} = q$ $\qquad$ $\frac{1}{\sqrt{x}} = p, \frac{1}{\sqrt{y}} = q$

$2p + 3q - 2 = 0$ —— (1) $\qquad$ $4p - 9q + 1 = 0$ —— (11)

Adding equation (1) and (11)

$$\begin{aligned}
eq(i) \times 3 \quad & 6p + 9q - 6 = 0 \\
eq(ii) \times 1 \quad & 4p - 9q + 1 = 0 \\
\hline
& 10p - 5 = 0 \\
\Rightarrow & p = \frac{5}{10} \\
\Rightarrow & p = \frac{1}{2}
\end{aligned}$$

Putting the value of p in equation (1)

$$2 \times \frac{1}{2} + 3q - 2 = 0$$

$\Rightarrow \cancel{3q}$

$$\begin{aligned}
\Rightarrow & 3q - 1 = 0 \\
\Rightarrow & q = \frac{1}{3}
\end{aligned}$$

$\frac{1}{\sqrt{x}} = \frac{1}{2}$ $\qquad$ $\frac{1}{\sqrt{y}} = \frac{1}{3}$

$\Rightarrow (\sqrt{x})^2 = (2)^2$ $\qquad$ $\Rightarrow (\sqrt{y})^2 = (3)^2$

$\Rightarrow x = 4$ $\qquad$ $\Rightarrow y = 9$

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(iii) $\frac{4}{x} + 3y = 14$ $\frac{3}{x} - 4y = 23$

$\frac{1}{x} = p$ $\frac{1}{x} = p$

$4p + 3y - 14 = 0$ —— (I) $3p - 4y - 23 = 0$ —— (II)

By Cross Multiplication Method,

$\frac{p}{-69-56} = \frac{y}{-42-(-92)} = \frac{1}{-16-9}$

$\Rightarrow \frac{p}{-125} = \frac{y}{50} = \frac{1}{-25}$

$\Rightarrow \frac{p}{-125} = \frac{-1}{25}$, $\frac{y}{50} = \frac{-1}{25}$

$\Rightarrow p = \cancel{-5}\,5$, $y = -2$

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

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

(iv) $\frac{5}{x-1} + \frac{1}{y-2} = 2$ $\frac{6}{x-1} - \frac{3}{y-2} = 1$

$\frac{1}{x-1} = p$, $\frac{1}{y-2} = q$ $\left(\frac{1}{x-1}\right) = p$, $\left(\frac{1}{y-2}\right) = q$

$= 5p + q = 2$ —— (I) $= 6p - 3q = 1$ —— (II)

Adding equation (I) and (II)

Equation (I) $\times 3$ $\quad 15p + 3q = 6$

Equation (II) $\times 1$ $\quad 6p - 3q = 1$

$\quad (+) \quad (-) \quad (+)$

$21p = 7$

$\Rightarrow p = \frac{7}{21}$

$\Rightarrow p = \frac{1}{3}.$

putting the value of p in equation (II)

$\cancel{6} \times \frac{1}{\cancel{3}} - 3q = 1$

$\Rightarrow 2 - 3q = 1$

$\Rightarrow -3q = 1 - 2$

$\Rightarrow -3q = -1$

$\Rightarrow q = \frac{-1}{-3}$

$\Rightarrow q = \frac{1}{3}$

$\frac{1}{x-1} = \frac{1}{3}$ $\qquad \frac{1}{y-2} = \frac{1}{3}$

$\Rightarrow x-1 = 3$ $\qquad \Rightarrow y-2 = 3$

$\Rightarrow x = 3+1$ $\qquad \Rightarrow y = 3+2$

$\Rightarrow x = 4$ $\qquad \Rightarrow y = 5.$

So, $\boxed{x=4 \quad , y=5}$

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(v) $\frac{7x-2y}{xy} = 5$ $\qquad$ $\frac{8x-7y}{xy} = 15$

$\Rightarrow \frac{7}{y} - \frac{2}{x} = 5$ $\qquad$ $\frac{8}{y} - \frac{7}{x} = 15$

$\Rightarrow \frac{1}{x} = p, \frac{1}{y} = q$ $\qquad$ $\Rightarrow \frac{1}{x} = p, \frac{1}{y} = q$

$-2p + 7q = 5$ —— (I) $\qquad$ $7p + 8q = 15$ —— (II)

By Cross Multiplication Method,

$$\frac{p}{-105-(40)} = \frac{q}{-35-30} = \frac{1}{-16-49}$$

$$\Rightarrow \frac{p}{-65} = \frac{q}{-65} = \frac{1}{-65}$$

$$\Rightarrow \frac{p}{-65} = \frac{1}{-65}, \quad \frac{q}{-65} = \frac{1}{-65}$$

$\Rightarrow p = 1, \quad q = 1$

$\frac{1}{x} = 1, \quad \frac{1}{y} = 1$

$\Rightarrow x = 1 \quad y = 1$

(vi) $6x + 3y = 6xy$ $\qquad$ $2x + 4y = 5xy$

$\Rightarrow \frac{6}{y} + \frac{3}{x} = 6$ $\qquad$ $\Rightarrow \frac{2}{y} + \frac{4}{x} = 5$

$\frac{1}{x} = p$, $\frac{1}{y} = q$ $\qquad$ $\frac{1}{x} = p$, $\frac{1}{y} = q$

$3p + 6q = 6$ —— (I) $\qquad$ $4p + 2q = 5$ —— (II)

By cross, Multiplication Method.

$$\frac{p}{-30-(-12)} = \frac{q}{-24-(-15)} = \frac{1}{6-24}$$

$$\Rightarrow \frac{p}{-18} = \frac{q}{-9} = \frac{1}{-18}$$

$$\Rightarrow \frac{p}{-18} = \frac{1}{-18} , \quad \frac{q}{-9} = \frac{1}{-18}$$

$$\Rightarrow p = 1 , \quad q = \frac{1}{2}$$

$$\frac{1}{x} = 1 , \quad y = \frac{1}{2}$$

$$\Rightarrow x = 1 \qquad y = 2.$$

(vii) $\frac{10}{x+y} + \frac{2}{x-y} = 4$ $\qquad$ $\frac{15}{x+y} - \frac{5}{x-y} = -2.$

$= \frac{1}{x+y} = p$, $\frac{1}{x-y} = q$ $\qquad$ $= \frac{1}{x+y} = p$, $\frac{1}{x-y} = q$

$= 10p + 2q = 4$ —— (I) $\qquad$ $= 15p - 5q = -2$ —— (II)

Adding equation (I) and (II)

Equation (I) $\times 5$ $\quad 50p + 10q = 20$

Equation (II) $\times 2$ $\quad 30p - 10q = -4$

$\quad (+) \quad (-) \quad (-)$

$$80p = 16$$

$$\Rightarrow p = \frac{16}{80}$$

$$\Rightarrow p = \frac{1}{5}$$

Putting the value of p in equation (I)

$$\cancel{10} \times \frac{1}{\cancel{5}} + 2q = 4$$

$$\Rightarrow 2 + 2q = 4$$

$$\Rightarrow 2q = 4 - 2$$

$$\Rightarrow q = \frac{2}{2}$$

$$\Rightarrow q = 1.$$

Now,

$$\frac{1}{x+y} = \frac{1}{5} \qquad \frac{1}{x-y} = 1$$

$$\Rightarrow x + y = 5 \text{ --- (III)}, \qquad x - y = 1 \text{ --- (IV)}$$

~~x & y~~ Adding ~~Subtracting~~ equation (I) and (II)

$$x + y = 5$$

$$x - y = 1$$

$(+) \quad (-) \quad (+)$

$$2x = 6$$

$$\Rightarrow x = \frac{6}{2}$$

$$\Rightarrow x = 3$$

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Putting the value of x in equation (III)

$$x + y = 5$$

$$\Rightarrow 3 + y = 5$$

$$\Rightarrow y = 5 - 3$$

$$\Rightarrow y = 2.$$

(viii) $\frac{1}{3x+y} + \frac{1}{3x-y} = \frac{3}{4}$ $\qquad$ $\frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = \frac{-1}{8}$

$\frac{1}{3x+y} = p$, $\frac{1}{3x-y} = q$ $\qquad$ $\frac{1}{3x+y} = p$, $\frac{1}{3x-y} = q$

$p + q = \frac{3}{4}$ —— (I) $\qquad$ $\frac{p}{2} - \frac{q}{2} = \frac{-1}{8}$

$$\Rightarrow p - q = \frac{-1}{4} \text{ —— (II)}$$

Adding Equation (I) and (II)

$$2p = \frac{3}{4} - \frac{1}{4}$$

$$\Rightarrow 2p = \frac{1}{2}$$

$$\Rightarrow p = \frac{1}{4}$$

putting the value of p in equation (I)

$$\frac{1}{4} + q = \frac{3}{4}$$

$$\Rightarrow q = \frac{3}{4} - \frac{1}{4}$$

$$\Rightarrow q = \frac{2}{\cancel{4}} = \frac{1}{2}$$

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Now,

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

$$\frac{1}{3x-y} = \frac{1}{2}$$

$3x+y = 4$ —— (III)

$\Rightarrow 3x-y = 2$ —— (IV)

Adding Equation (III) and (IV)

$$3x + y = 4$$
$$3x - y = 2$$
$$(+) \quad (-) \quad (+2)$$
$$6x = 6$$
$$\Rightarrow x = \frac{6}{6}$$
$$\Rightarrow x = 1$$

Putting the value of x in equation (3)

$$3 \times 1 + y = 4$$
$$\Rightarrow 3 + y = 4$$
$$\Rightarrow y = 4-3$$
$$\Rightarrow y = 1$$

So, $\boxed{x = 1, \ y = 1}$

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(2)(i) Let Speed of Ritu in still water $= x$ km/hr.
Speed of stream $= y$ km/hr.

Now, Speed of Ritu during,

⇒ up stream $= x-y$ km/hr
down stream $= x-y$ km/hr

A/q

$2(x+y) = 20$
$\Rightarrow x+y = 10$ ——— (1)

$2(x-y) = 4$
$\Rightarrow x-y = 2$ ——— (2)

Adding Equation (1) and (2)

$x+y = 10$
$x-y = \cancel{00}\, 2$
(+) (−) (+)

$2x = 12$
$\Rightarrow x = 6$

Putting the value of x in equation (1)

$x+y = 10$
$\Rightarrow 6+y = 10$
$\Rightarrow y = 4.$

Hence, Speed of Ritu in still water is 6 km/hr.
Speed of stream is 4 km/hr.

(ii) Let the no. of days taken by women to finish the work be x

No. of days taken by men to finish the work $= y$.

work done by women in one day $= \frac{1}{x}$

work done by men in one day $= \frac{1}{y}$

A/q

$$4\left(\frac{2}{x} + \frac{5}{y}\right) = 1$$

$$\Rightarrow \frac{2}{x} + \frac{5}{y} = \frac{1}{4}$$

And,

$$3\left(\frac{3}{x} + \frac{6}{y}\right) = 1$$

$$\Rightarrow \frac{3}{x} + \frac{6}{y} = \frac{1}{3}$$

Now, $\frac{1}{x} = p$, $\frac{1}{y} = q$.

$$2p + 5n = \frac{1}{4}$$

$$\Rightarrow 8p + 20q = 1 \quad \text{——— (1)}$$

$$3p + 6q = \frac{1}{3}$$

$$\Rightarrow 9p + 18q = 1 \quad \text{——— (2)}$$

By cross multiplication method

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$$\frac{p}{20-18} = \frac{q}{9-8} = \frac{1}{180-144}$$

$$\Rightarrow \frac{p}{2} = \frac{q}{1} = \frac{1}{36}$$

$$\Rightarrow \frac{p}{2} = \frac{1}{36}, \quad \frac{q}{1} = \frac{1}{36}$$

$$\Rightarrow p = \frac{1}{18}, \quad q = \frac{1}{36}$$

$$\Rightarrow x = 18, \quad y = 36.$$

Hence, no. of days taken by women to finish the work = 18 days.
No. of days taken by men to finish the work = 36 days.

(iii) Let the speed of the train = x km/hr
the speed of bus = y km/hr.

A/q

$$\frac{60}{x} + \frac{240}{y} = 4 \quad \text{——— (1)}$$

$$\frac{100}{x} + \frac{200}{y} = \frac{25}{6} \quad \text{——— (2)}$$

now, $\frac{1}{x} = p$ and $\frac{1}{y} = q$

$$60p + 240q = 4 \quad \text{——— (3)}$$

$$100p + 200q = \frac{25}{6}$$

$\Rightarrow 600p + 1200q = 25$ —— (4)

Again,

equation 3 $\times$ (10) $= 600p + 2400q = 40$ —— (5)

Subtracting equation (4) from (5)

$$\begin{array}{rcl} 600p + 2400q &=& 40 \\ 600p + 1200q &=& 25 \\ (-) \quad\; (-) & & (-) \\ \hline 1200q &=& 15 \end{array}$$

$\Rightarrow q = \dfrac{15}{1200}$

$\Rightarrow q = \dfrac{1}{80}$

Substituting the value of q in equation (III)

$60p + \dfrac{240 \times 1}{80} = 4$

$\Rightarrow 60p + 3 = 4$

$\Rightarrow 60p = 1$

$\Rightarrow p = \dfrac{1}{60}$.

$\Rightarrow \dfrac{1}{x} = \dfrac{1}{60}$

$\Rightarrow x = 60$

$y = \dfrac{1}{q} = \dfrac{1}{80}$

$\Rightarrow y = 80$

Therefore,

Speed of the train is = 60km/hr.
Speed of the bus = 80km/hr.

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