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Ch-3 Linear Equation in Two Variables

An equation of the form $ax+by+c=0$ where a, b and c are real numbers and x & y are variables is called linear equation in two variables.

$[a \neq 0, \ b \neq 0]$

General Form → $a_1x + b_1y + c_1 = 0$

$a_2x + b_2y + c_2 = 0$

Eg:- $9x + 3y = 12$ — ①

$18x + 6y = 24$ — ②

Relationship between coeficients	Graph	No. of Solutions	Consistency of system
$a_1/a_2 \neq b_1/b_2$	Intersecting lines	Unique sol.	consistent
$a_1/a_2 = b_1/b_2 \neq c_1/c_2$	Parallel lines	No sol.	inconsistent
$a_1/a_2 = b_1/b_2 = c_1/c_2$	Co incident lines	Infinite sol.	consistent

Consistent system:- A system of linear equations is said to be consistent if it has atleast one solution

Inconsistent system:- A system of linear equation is said to be inconsistent if it has no solutions.

Ex 3.1

Q1. Aftab tells his daughter "Seven years ago, I was seven times as old as you were then. Also, three years from now, I shall be three times as old as you will be." Represent this situation algebrically and graphically.

Case I: (7 years age)

Aftab age = $(x-7)$ years

Daughter's age = $(y-7)$ years

Aftab age = 7 (daughter age)

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

$$x-7 = 7y-49$$

$$x-7y = -49+7$$

$$x-7y = -42$$

Present ages
Aftab = x
Daughter = y

Case II (after 3 years)

Aftab age = $(x+3)$ years

Daughter's age = $(y+3)$ years

Aftab age = 3 (daughter's age)

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

$$x+3 = 3y+9$$

$$x-3y = 9-3$$

$$x-3y = 6$$

82. The coach of a cricket team buys 3 bats and 6 balls for ₹3900. Later, she buys another bat and 3 more balls of the same kind for ₹1300. Represent this situation algebrically and ~~graphically~~ geometrical

bat = x
ball = y

Case I $3x + 6y = 3900$

$3(x + 2y) = 3900$

$x + 2y = \frac{3900}{3}$

$x + 2y = 1300 \quad - (1)$

Case II $x + 3y = 1300 \quad - (2)$

Graph

3. The cost of 2kg of apples and 1kg of grape on a day was found to be ₹160. After a month, the cost of 4kg of apples and 2kg of grapes is ₹300. Represent the situation algebrically.

apple = x
grapes = y

Case I $2x + y = 160$

Case II $4x + 2y = 300$

$2(2x + y) = 300$

$2x + y = \frac{300}{2}$

$2x + y = 150$

Ex 3.2

1. Form the pair of linear equations in the following problems, and find their solutions graphically

i) 10 students of class X took part in a Math quiz. If the no. of girls is 4 more than the no. of boys, find the no. of boys and girls who took part in the quiz.

No. of girls = y

No. of boys = x

Case I Total no. of students

$$x + y = 10 \quad -①$$

Case II no. of girls = 4 more than boys

$$y = 4 + x \quad -②$$

$$x + y = 10 \quad -①$$

$$y = 4 + x \quad -②$$

$x + y = 10 \quad -①$

$\Rightarrow x + y = 10$

$x + 4 = 10$

$x = 10 - 4$

$x = 6$

x	6	5
y	4	5

$\Rightarrow x + 5 = 10$

$x = 10 - 5$

$x = 5$

$y = 4 + x \quad -②$

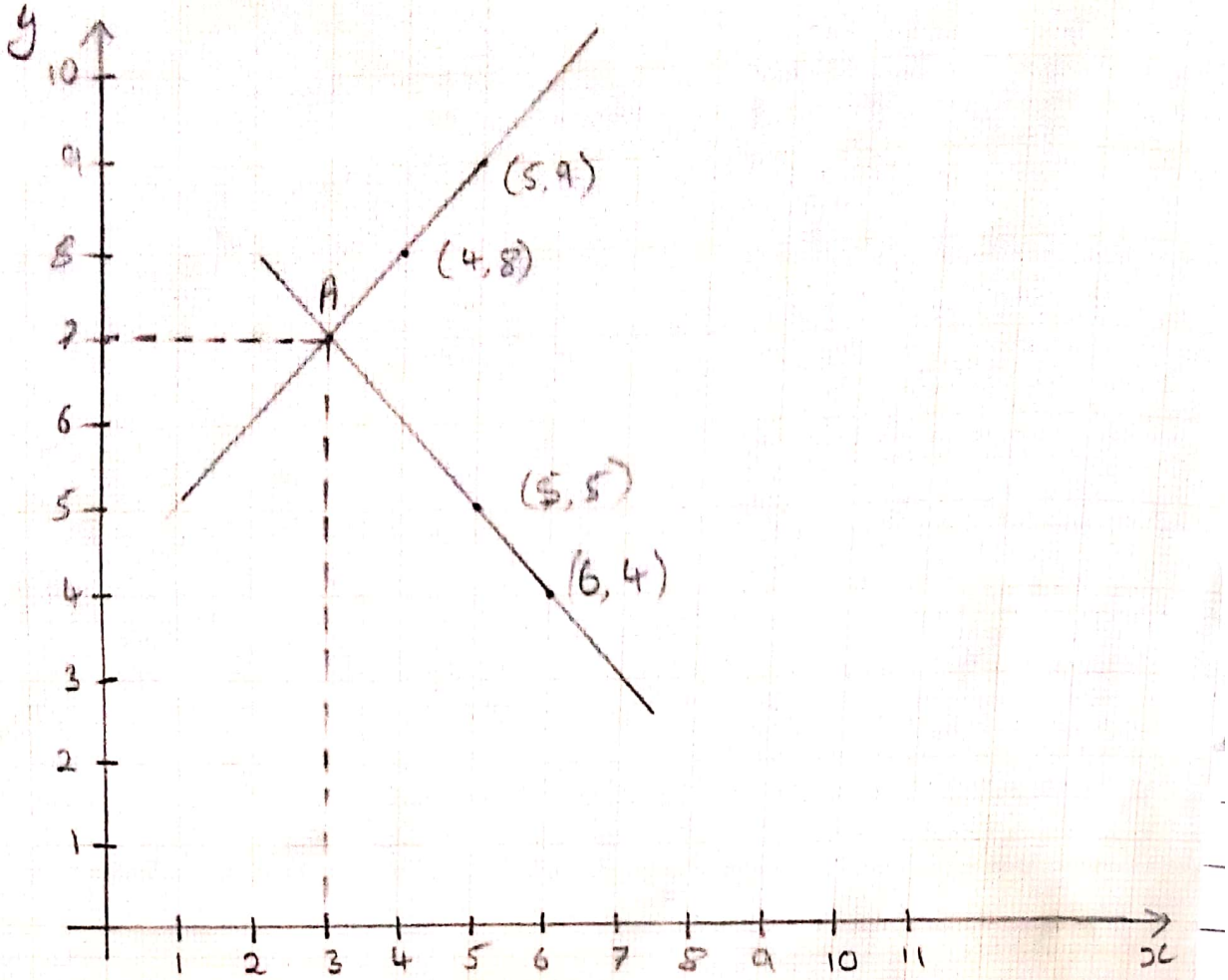
$\Rightarrow y = 4 + 4$

$y = 8$

x	4	5
y	8	9

$\Rightarrow y = 4 + 5$

$y = 9$



Two lines meet at A

A (3, 7)

$\therefore x = 3 \quad y = 7$

no. of boys = 3, no. of girls = 7

ii) 5 pencils and 7 pens together cost ₹50, whereas 7 pencils and 5 pens together cost ₹46. Find the cost of one pencil and one pen.

Let cost of one pencil = Rs x

Cost of one pen = Rs y

Case I $\quad 5x + 7y = 50 \quad -①$

Case II $\quad 7x + 5y = 46 \quad -②$

$\Rightarrow 5x + 7y = 50 \quad -①$

$7y = 50 - 5x$

$y = \frac{50 - 5x}{7}$

x	3	10
y	5	0

$y = \frac{50 - 5(3)}{7} = \frac{50 - 15}{7} = \frac{35}{7} = 5$

$$y = \frac{50 - 5x}{7} = \frac{50 - 5(10)}{7} = \frac{50 - 5}{7} = \frac{0}{7} = 0$$

$\Rightarrow 7x + 5y = 46 \quad - (2)$

$5y = 46 - 7x$

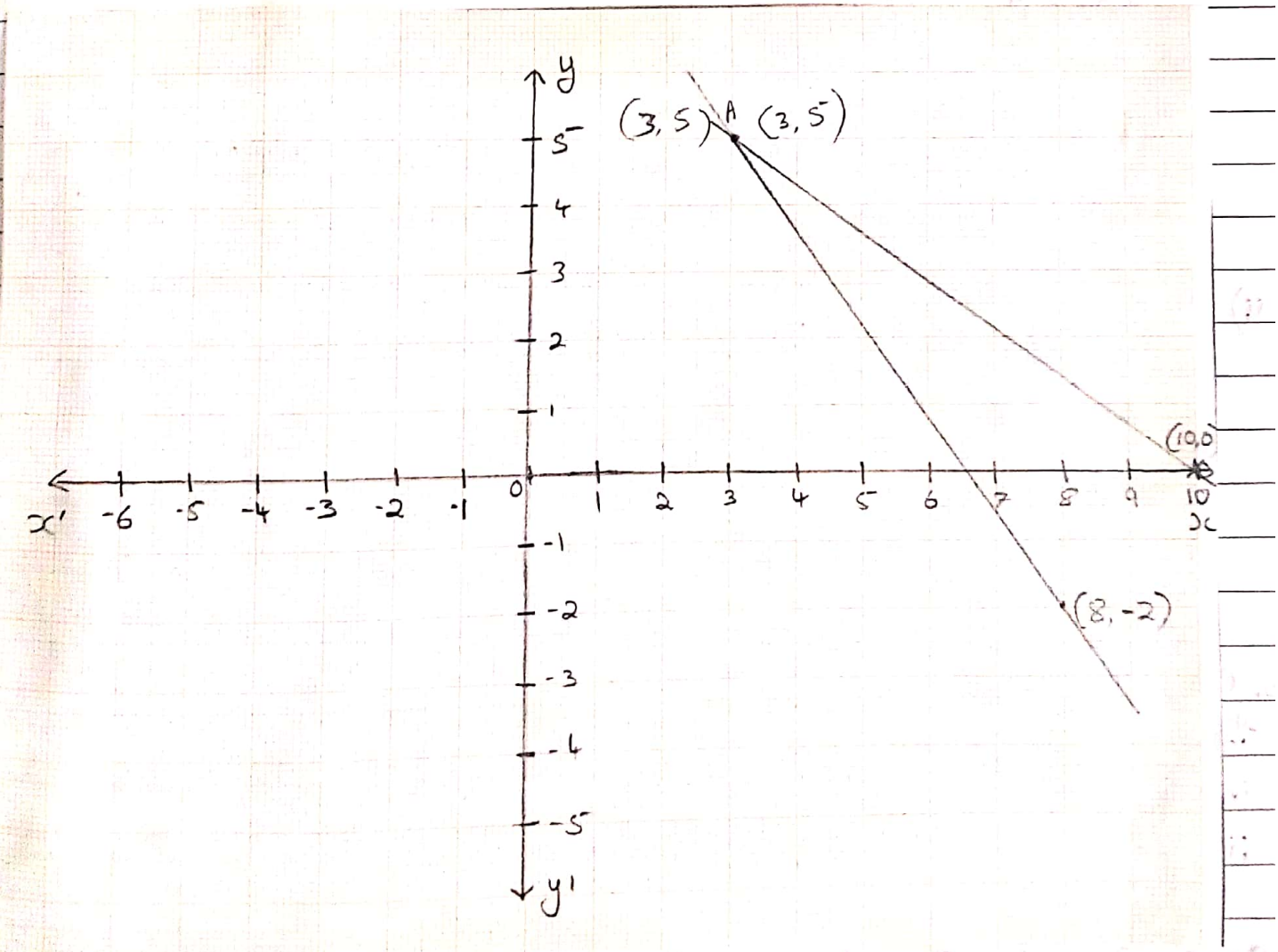
$y = \frac{46 - 7x}{5}$

x	3	8
y	5	-2

$$y = \frac{46 - (7 \times 3)}{5} = \frac{46 - 21}{5}$$

$$y = \frac{25}{5} = 5$$

$$y = \frac{46 - 7x}{5} = \frac{46 - 7x(8)}{5} = \frac{46 - 56}{5} = \frac{-10}{5} = -2$$



Two lines meet at A $\therefore A(3, 5)$

$\therefore x = 3 \quad y = 5$

Cost of one pencil = ₹ 3 Cost of one pen = ₹ 5

2. On comparing the ratios $\frac{a_1}{a_2}$, $\frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the lines representing the following pairs of linear equations intersect at a point, are parallel or coincid

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

$7x + 6y - 9 = 0$

$\frac{a_1}{a_2} = \frac{5}{7}$ $\quad \frac{b_1}{b_2} = \frac{-4}{6} = \frac{-2}{3}$ $\quad \frac{c_1}{c_2} = \frac{8}{9}$

$\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ Intersecting lines.

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

$2x - y + 9 = 0$

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

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

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

$18x + 6y + 24$

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

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ Co incident lines

3. On comparing ratios $\frac{a_1}{a_2}$, $\frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the following pair of linear equations are consistent, o inconsistent.

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

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

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

$\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ Intersecting lines (consistent)

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

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

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ Co incident lines (consistent)

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

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

$\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ Co incident lines (consistent)

4. Which of the following pairs of linear equations are ~~consistent~~ consistent/inconsistent? If consistant, obtain the solution graphically.

i) $x + y = 5 \qquad 2x + 2y = 10$

$\frac{a_1}{a_2} = \frac{1}{2}$, $\frac{b_1}{b_2} = \frac{1}{2}$, $\frac{c_1}{c_2} = \frac{5}{10} = \frac{1}{2}$ [consistant]

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

Algebrical eq ① $x + y = 5$

Case I :- $x = 5 - y \leftarrow \boxed{y = 1}$

$x = 5 - 1$

$x = 4$

Case II

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

$x = 3$

x	4	3
y	1	2

Algebrical eq ② $2x + 2y = 10$

$2x = 10 - 2y$

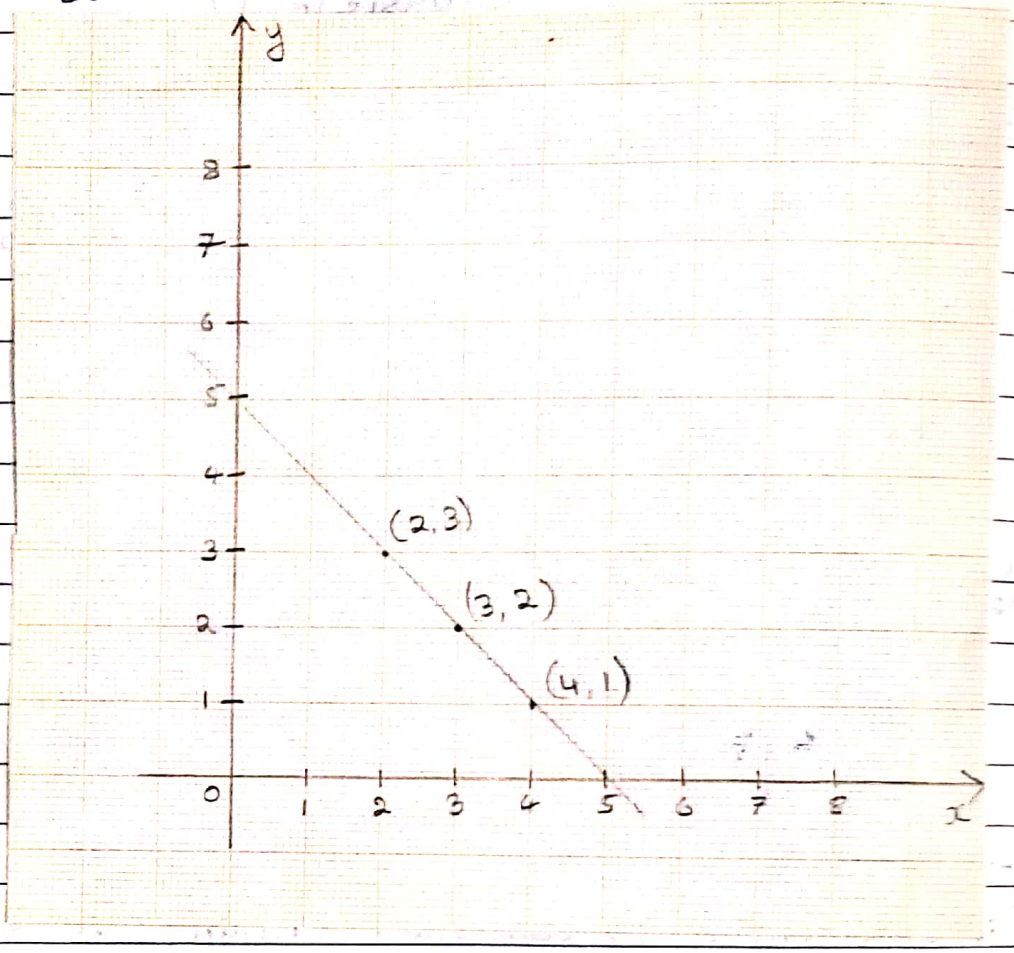
$y = x = \frac{10 - 2y}{2} = x = \frac{10 - 2(1)}{2} = \frac{10 - 2}{2}$ $\boxed{y = 1}$

$x = 4$

x	4	3
y	1	2

$y = 2$

ii) $x = \frac{10 - 2y}{2} \Rightarrow x = \frac{10 - 2(2)}{2} = \frac{10 - 4}{2} = \frac{6}{2} = 3$



b) $x - y = 8$ $\qquad 3x - 3y = 16$

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

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

c) $2x + y - 6 = 0$ $\qquad 4x - 2y - 4 = 0$

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

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

Algebrical eq. ① $2x + y = 6$

$2x = 6 - y$

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

Case I

$x = \frac{6-2}{2} = \frac{4}{2}$ ← $\boxed{y=2}$

$x = 2$

$x = \frac{6-4}{2} = \frac{2}{2}$ $\boxed{y=4}$

$x = 1$

x	2	1
y	2	4

Algebraical eq, ②

$4x - 2y = 4$

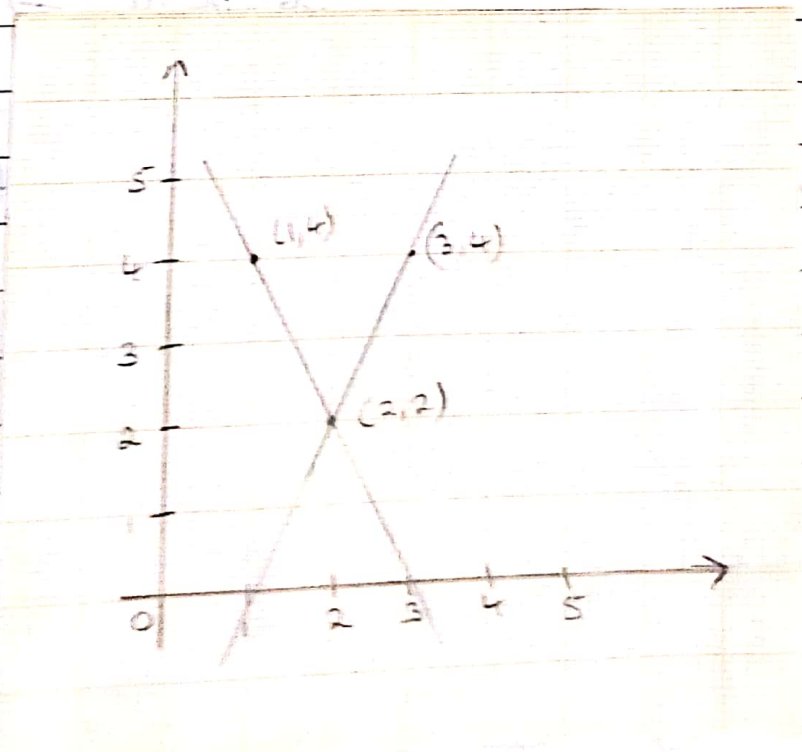
$4x = 4 + 2y$

$x = \frac{4+2y}{4}$

x	2	3
y	2	4

$x = \frac{4+2(2)}{4} = \frac{4+4}{4} = \frac{8}{4} = 2$ $\boxed{y=2}$

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



2 iv) $2x - 2y - 7 = 0$ $\quad 4x - 4y - 5 = 0$

$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$ $\quad \frac{b_1}{b_2} = \frac{-2}{-4} = \frac{1}{2}$ $\quad \frac{c_1}{c_2} = \frac{-7}{-5}$

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

5. Half the perimeter of a rectangular garden, whose length is 4m more than its width, is 36m. Find the dimensions of the garden.

Let length be x

Let width be y

iii)

Case I

$x = y + 4 \quad -①$

Case II

$P = 2(x+y)$

$\therefore$ Half of $P = \frac{1}{2} \times 2(x+y)$

$36 = x + y \Rightarrow x + y = 36$

ii) Algebrical eq ①

$x = y + 4$ $\quad (y=1)$

$x = 1 + 4$

$x = 5$

$x = 2 + 4$ $\quad (y=2)$

$x = 6$

x	5	6
y	1	2

3. Algebrical eq ②

$x + y = 36$

$x = 36 - y$ $\quad (y=20)$

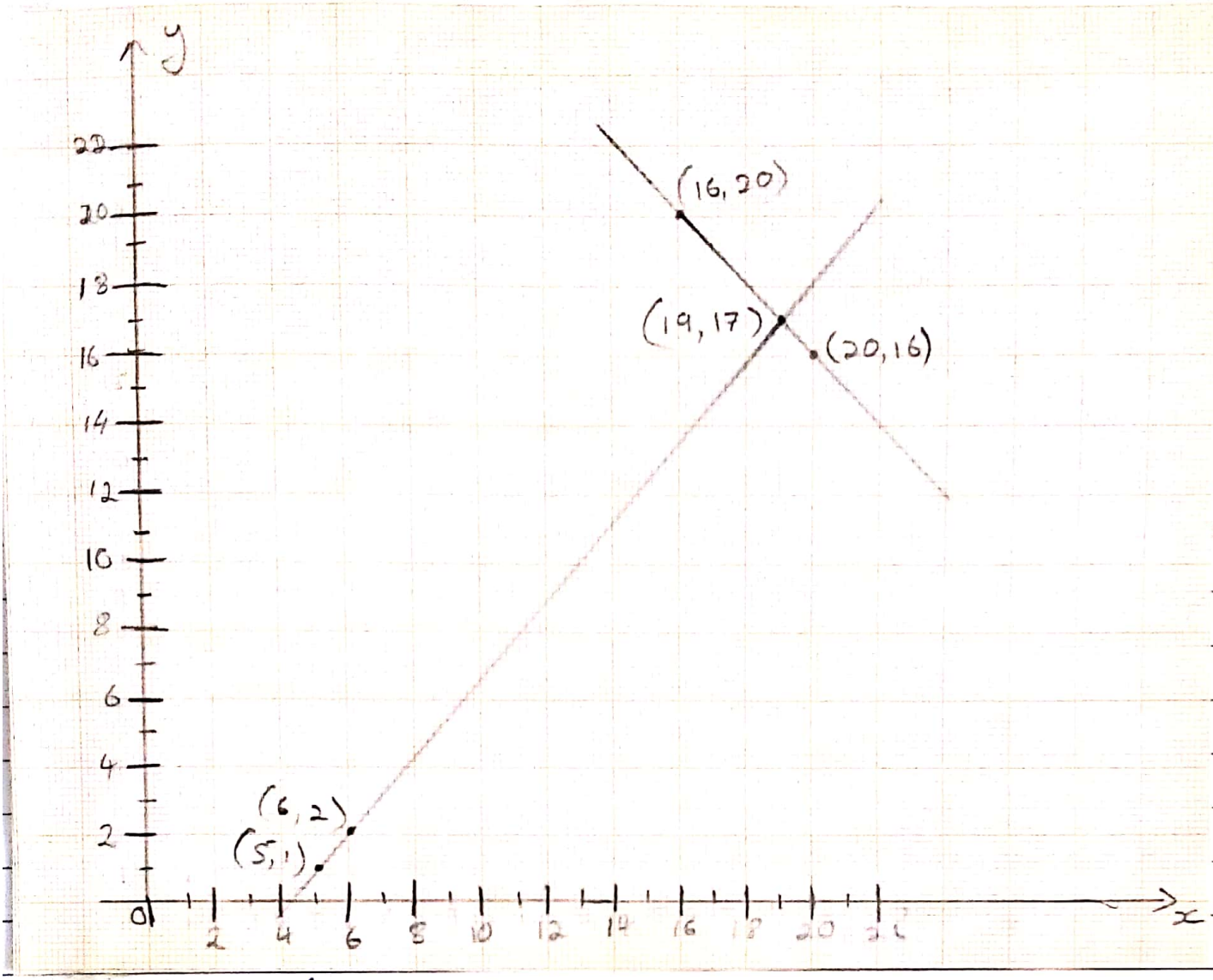
$x = 36 - 20$

$x = 16$

$x = 36 - 16$ $\quad (y=16)$

$x = 20$

x	16	20
y	20	16



$a = x = 19$

$b = y = 17$

6) Given the linear equations $2x + 3y - 8 = 0$, write another linear equation in two variables such that the geometrical representation of the pair so formed is:

a) intersecting lines

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

$2x + 3y = 8$

$7x + 7y = 10$

$\frac{a_1}{a_2} = \frac{2}{7}$ $\quad$ $\frac{b_1}{b_2} = \frac{3}{7}$

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

$\therefore$ They are intersecting lines

b) parallel lines

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

$2x + 3y - 8 = 0$

$4x + 6y - 10 = 0$

$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$ $\quad \frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}$ $\quad \frac{c_1}{c_2} = \frac{-8}{-10} = \frac{4}{5}$

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

$\therefore$ They are parallel lines.

c) Coincident lines

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

$2x + 3y = 8$

$4x + 6y = 16$

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

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

$\therefore$ They are coincident lines.

Q7. Draw the graphs of the equation $x-y+1=0$ and $3x+2y-12=0$. Determine the coordinates of the vertices of the triangle formed by these lines and the x-axis, and shade the triangular region.

$x-y+1=0$

$x-y=-1$

$x=y-1$

$x=0-1$ $\quad y=0$

$x=-1$

x	-1	0
y	0	1

$x=1-1$ $\quad y=1$

$x=0$

$3x+2y-12=0$

$3x=12-2y$

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

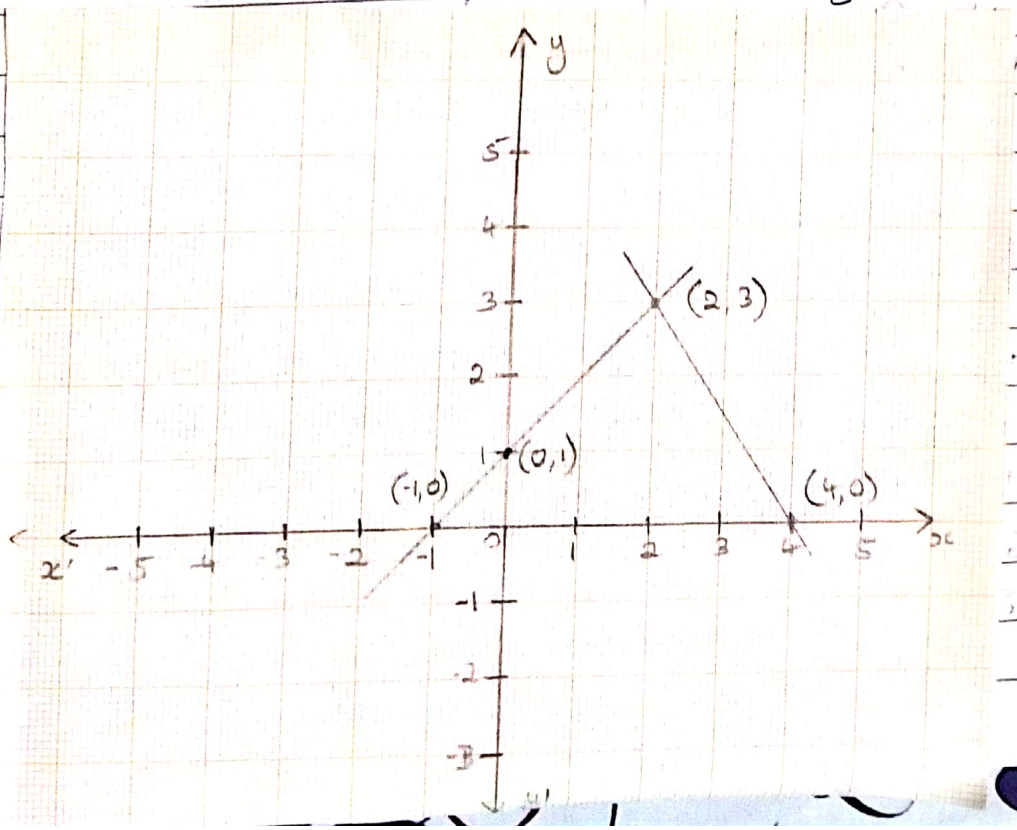
$x=\frac{12-2(0)}{3}$ $\quad y=0$

$x=\frac{12}{3}=4$

x	4	2
y	0	3

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

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



Vertices of the triangle are (2, 3), (-1, 0) and (

Ex 3.3

Q1. Solve the following pair of linear equation by the substitution method.

i) $x+y=14$ -① $\quad x-y=4$ -②

From eq ①

$x+y=14$

$x=14-y$ -③

put $x=14-y$ in ②

$x-y=4$

$(14-y)-y=4$

$14-y-y=14$

$14-2y=4$

$-2y=4-14$

$-2y=-10$

$2y=10$

$y=\frac{10}{2}$

$y=5$

put $y=5$ in ③

$x=14-y$

$x=14-5$

$x=9$

∴ solution are $x=9$, $y=5$

ii) $s-t=3$ -① $\quad \frac{s}{3}+\frac{t}{2}=6$ -②

From eq -①

$s-t=3$

$s=3+t$ -③

put ③ in ②

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

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

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

$6+5t=6\times6=36$

$6+5t=36$

$5t=36-6$

$5t=30$

$t=\frac{30}{5}=6$

put $t=6$ in ③

$s=3+t$

$s=3+6$

$s=9$

∴ solution are $s=9$, $t=6$

~~LCM=6~~

iii) $3x - y = 3$ — ①

$9x - 3y = 9$ — ②

$(9x - 3y = 9) \div 3 = 3x - 3y = 3$ — ③

Infinitely many solutions

iv) $0.2x + 0.3y = 1.3$

$0.4x + 0.5y = 2.3$

$(0.2x + 0.3y = 1.3) \times 10 = 2x + 3y = 13$ — ①

$(0.4x + 0.5y = 2.3) \times 10 = 4x + 5y = 23$ — ②

From eq ①

$2x + 3y = 13$

$2x = 13 - 3y$

$x = \frac{13 - 3y}{2}$ — ③

Put ③ in ②

$4x + 5y = 23$

$2 \times \left(\frac{13 - 3y}{2}\right) + 5y = 23$

$2(13 - 3y) + 5y = 23$

$26 - 6y + 5y = 23$

$26 - y = 23$

$-y = 23 - 26$

$-y = -3$

$y = 3$

put $y = 3$ in ①

$2x + 3(3) = 13$

$2x + 9 = 13$

$2x = 13 - 9$

$2x = 4$

$x = \frac{4}{2}$

$x = 2$

∴ solution are $x = 2$ $y = 3$

v) $\sqrt{2}x + \sqrt{3}y = 0$ — ①

$\sqrt{3}x - \sqrt{8}y = 0$ — ②

From eq ①

$\sqrt{2}x + \sqrt{3}y = 0$

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

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

$x = \frac{-\sqrt{3}y}{\sqrt{2}}$ — ③

Put ③ in ②

$\sqrt{3}x - \sqrt{8}y = 0$

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

$\frac{-3y}{\sqrt{2}} - \frac{\sqrt{8}y}{1} = 0$ LCM $= \sqrt{2}$

$\frac{-3y - \sqrt{16}y}{\sqrt{2}} = 0$

$\frac{-3y - 4y}{\sqrt{2}} = 0$

$\frac{-7}{\sqrt{2}} = \frac{0}{1}$

$-7y = 0$

$y = \frac{0}{7}$

$y = 0$

Put $y=0$ in ①

$\sqrt{2}x + \sqrt{3}y = 0$

$\sqrt{2}x + \sqrt{3}(0) = 0$

$\sqrt{2}x + 0 = 0$

$x = \frac{0}{\sqrt{2}}$

$x = 0$

∴ solutions are $x=0$, $y=0$

vi) $\frac{3x}{2} - \frac{5y}{3} = -2$, $\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$

$\frac{3x}{2} - \frac{5y}{3} = -2$ LCM = 6 $\Rightarrow \frac{9x - 10y}{6} \times \frac{-2}{1}$

$\Rightarrow 9x - 10y = -12$ — ①

$\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$ LCM = 6 $\Rightarrow \frac{2x + 3y}{6} = \frac{13}{6}$

$\Rightarrow 2x + 3y = 13$ — ②

From eq ①

$9x - 10y = -12$

$9x = -12 + 10y$

$x = \frac{-12 + 10y}{9}$ — ③

Put ③ in ②

$2x + 3y = 13$

$2\left(\frac{-12+10y}{9}\right) + 3y = 13$

$\frac{-24 + 20y}{9} + \frac{3y}{1} = 13$ LCM = 9

$\frac{-24 + 20y + 27y}{9} = 13$

$\frac{-24 + 47y}{9} = 13$

$-24 + 47y = 13 \times 9$

$-24 + 47y = 117$

$47y = 117 + 24$

$47y = 141$

$y = \frac{141}{47}$

$y = 3$

put $y=3$ in ①

$9x - 10y = -12$

$9x - 10(3) = -12$

$9x + 30 = -12$

$9x^2 = -12 + 30$

$9x = 18$

$x = \frac{18}{9}^2$

$x = 2$

$\therefore$ Solution are $x = 2$ $y = 3$

2. Solve $2x + 3y = 11$ and $2x - 4y = -24$ and hence find the value of 'm' for which $y = mx + 3$

$2x + 3y = 11 \quad - (1)$

$2x - 4y = -24 \quad - (2)$

From eq (1)

$2x + 3y = 11$

$2x = 11 - 3y$

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

Put (3) in (2)

$2x - 4y = -24$

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

$11 - 3y - 4y = -24$

$11 - 7y = -24$

$-7y = -24 - 11$

$-7y = -35$

$y = \frac{-35}{-7}^5$

$y = 5$

Put $y = 5$ in (1)

$2x + 3y = 11$

$2x + 3(5) = 11$

$2x + 15 = 11$

$2x = 11 - 15$

$2x = -4$

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

$y = 5$ & $x = -2$

put $y = 5$ and $x = -2$ in $y = mx + 3$

$5 = -2m + 3$

$5 - 3 = -2m$

$2 = -2m$

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

$m = -1$

3) From the pair of linear equations from the following problems and find their solution by substituting method.

i) The difference between two numbers is 26 and one number is three times the other. Find them.

Let the numbers be x and y

Case I : $x - y = 26$ ... ①

Case II : $x = 3y$ ... ②

put ② in ①

$x - y = 26$

$3y - y = 26$

$2y = 26$

$y = \frac{26}{2}$ 13

$y = 13$

Put $y = 13$ in ②

$x = 3y$

$x = 3 \times 13$

$x = 39$

ii) The larger of two supplementary angles exceeds the smaller by 18 degree. Find them.

Let the larger angle be x

smaller angle be y

Case I.

$x + y = 180°$ ... ① [supplementary angles]

Case II

Larger angle exceeds smaller angle by 18°.

$x = y + 18$ ... ②

Put ② in ①

$x + y = 180°$

$(y + 18) + y = 180$

$2y + 18 = 180°$

$2y = 180 - 18$

$2y = 162$

$y = \frac{162}{2} = 81$

Put $y = 81$ in ②

$x = y + 18$

$x = 81 + 18$

$x = 99°$

∴ The larger angle is 99 and the smaller angle is 81

iii) The coach of a cricket team buys 7 bats and 6 balls for ₹3800. Later, she buys 3 bats and 5 balls for ₹1750. Find the cost of each bat and each ball

Let the cost of one bat $= x$

cost of one ball $= y$

Case I

$7x + 6y = ₹3800$ — ①

Case II

$3x + 5y = ₹1750$ — ②

$3x = \frac{1750 - 5y}{3}$ — ②

put ② in ①

$7x + 6y = 3800$

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

LCM = 3

$\frac{12250 - 35y}{3} + \frac{18y}{3} = 3800$

$\frac{12250 + 13y}{3} = 3800$

$\frac{13y}{3} = 3800 - 12250$

$\frac{13y}{3} = -8450$

$13y = -8450 \times 3$

iv) The taxi charge in a city consist of a fixed charge together with the charge for the distance covered. For a distance of 10 km, the charge paid is ₹105 and for a journey of 15 km, the charge paid is ₹155. What are the fixed charge and the charge per km? How much does does a person have to pay for travelling a distance of 25 km?

Let fixed charge be Rs x

Charge per km = Rs y

Case I $\quad x + 10y = 105 \quad -①$

Case II $\quad x + 15y = 155 \quad -②$

From ①

$$x + 10y = 105$$
$$x = 105 - 10y \quad -③$$

Put ③ in ②

$$x + 15y = 155$$
$$105 - 10y + 15y = 155$$
$$105 + 5y = 155$$
$$5y = 155 - 105$$
$$5y = 50$$
$$y = \frac{50}{5} = 10$$

Put $y = 10$ in ③

$$x = 105 - 10y$$
$$x = 105 - 10(10)$$
$$x = 105 - 100$$
$$x = 5$$

∴ The fixed charges are Rs 5 and charge per km is Rs 10

Charge for a distance of 25 km $= x + 25y$

$= 5 + 25(10)$

$= 5 + 250 = ₹255$

v) A fraction becomes $\frac{9}{11}$, if 2 is added to both the numerator and the denominator. If 3 is added to both the numerator and denominator it becomes $\frac{5}{6}$. Find the fraction.

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

Case I $\frac{x+2}{y+2} = \frac{9}{11}$ cross multiply

$$11(x+2) = 9(y+2)$$
$$11x + 22 = 9y + 18$$
$$11x - 9y = 18 - 22$$
$$11x - 9y = -4 \quad \text{---} (1)$$

Case II $\frac{x+3}{y+3} = \frac{5}{6}$ cross multiply

$$6(x+3) = 5(y+3)$$
$$6x + 18 = 5y + 15$$
$$6x - 5y = 15 - 18$$
$$6x - 5y = -3 \quad \text{---} (2)$$

Ex 3.4

1. Solve the following pair of linear equations by the eliminating method and substitution method.

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

$3x+4y=10$ — ①

$2x-2y=2$ — ② $\times 2$

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

$x=14$

$x=2$

Put $x=2$ in eq ①

$3x+4y=10$

$3(2)+4y=10$

$6+4y=10$

$4y=10-6$

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

$y=1$

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

$\frac{x}{2}+\frac{2y}{3}=-1$ — ①

$x-\frac{y}{3}=3$ — ② $\times 2$

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

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

$\frac{x}{2}+2x=5$ LCM = 2

$\frac{x+4x}{2}=5$

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

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

$x = 2$

put $x = 2$ in eq ①

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

$1 + 2y = -3$

$2y = -3 - 1$

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

$y = -3$

i) $x + y = 5$ and $2x - 3y = 4$

$x + y = 5$ — ① $(\times 3)$

$2x - 3y = 4$

$3x + 3y = 15$

$2x - 3y = 4$

$5x = 19$

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

put $x = \frac{19}{5}$ in eq ①

$x + y = 5$

$\frac{19}{5} + \frac{y}{1} = 5$

$\frac{19 + 5y}{5} = 5$

$19 + 5y = 5 \times 5$

$19 + 5y = 25$

$5y = 25 - 19$

$5y = 6$

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

2. Form the pair of linear equations in the following problems, and find their solution by the eliminating method:

i) If we add 1 to the numinator and subract 1 from the denominator, a fraction reduces to 1. It becomes $\frac{1}{2}$ if we only add 1 to the denominator. What is the fraction?

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

Case I $\quad \frac{x+1}{y-1} = 1$

$$x+1 = y-1$$
$$x-y = -1-1$$
$$x-y = -2 \quad -①$$

Case II $\quad \frac{x}{y+1} = \frac{1}{2}$

$$2x = y+1$$
$$2x-y = -1 \quad -②$$

$$x-y = -2 \quad -①$$
$$2x-y = 1 \quad -② \times -1$$
$$x-y = -2$$
$$-2x+y = 1$$
$$-x = -3$$
$$x = 3$$

put $x = 3$ in eq ①

$$3-y = -2$$
$$-y = -2-3$$
$$-y = -5$$
$$y = 5$$

Fraction is $\frac{3}{5}$

ii) Five years ago, Nuri was thrice as old as Sonu. Ten years later, Nuri will be twice as old as Sonu. How old are Nuri and Sonu?

Let Nuri present age = x years

Sonu present age = y years

Case I (5 years ago)

Nuri age = $(x-5)$ years

Sonu age = $(y-5)$ years

Nuri age = 3 [Sonu age]

$$x - 5 = 3[y-5]$$

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

$$x - 3y = -15 + 5$$

$$x - 3y = -10 \quad \text{--- } ①$$

Case II (10 years later)

Nuri age = $(x+10)$ years

Sonu age = $(y+10)$ years

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

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

$$x - 2y = 20 - 10$$

$$x - 2y = 10 \quad \text{--- } ②$$

$x - 3y = -10$ --- ①

$x - 2y = 10$ --- ② $\times -1$

$$x - 3y = -10$$

$$-x + 2y = -10$$

$$-y = -20$$

$$y = 20$$

Put $y = 20$ in eq ①

$$x - 3(20) = -10$$

$$x - 60 = -10$$

$$x = -10 + 60$$

$$x = 50$$

Nuri age = 50

Sonu age = 20

iii) The sum of the digits of a two-digit number is 9. Also, nine times this number is twice the number obtained by reversing the order of the digits. Find the numbers.

Let unit digit be y

Ten's digit be x

number = (y × 1) + (x × 10)

= y + 10x

New number after interchanging the digits:

unit digit = x

Ten's digit = y

New no = (x × 1) + (y × 10)

= x + 10y

Case I $x + y = 9$ — ①

Case II $9(\text{no}) = 2(\text{new number})$

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

$9y + 90x = 2x + 20y$

$90x - 2x = 20y - 9y$

$88x = 11y$

$88x - 11y = 0$ — [÷ 11]

$8x - y = 0$ — ②

$x + y = 9$

$8x - y = 0$

$9x = 9$

$x = 9/9$

$x = 1$

Put $x = 1$ in eq ①

$x + y = 9$

$1 + y = 9$

$y = 9 - 1$

$y = 8$

No = y + 10x

= 8 + 10(1)

= 8 + 10

= 18

7) Meena went to a bank to withdraw ₹2000. She asked the cashier to give her ₹50 and ₹100 notes only. Meena got 25 notes in all. Find how many notes of ₹50 and ₹100 did she received.

Let the number of Rs 50 notes = x

number of Rs 100 notes = y

Total number of notes she recieved = 25

Case I $x + y = 25$ — ①

Case II $50x + 100y = 2000$ $[\div 50]$

$x + 2y = 40$ — ②

$x + y = 25$ — ①

$x + 2y = 40$ — ② $\times -1$

$x + y = 25$

$-x - 2y = -40$

$-y = -15$

$y = 15$

put $y = 15$ in eq ①

$x + y = 25$

$x + 15 = 25$

$x = 25 - 15$

$x = 10$

number of Rs50 notes = 10

number of Rs100 notes = 15

Ex 3.5

2. i) For which value of a and b does the following pair of linear equations have an infinite no of solution?

$2x+3y=7$

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

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

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

$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{k_1}{c_2}$ then infinite many solutions when in this or

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

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

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

$2a+2b-3a+3b=0$

$-a+5b=0$ — (1)

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

$3(3a+b-2) = 7(a+b)$

$9a+3b-6 = 7a+7b$

$9a+3b-6-7a-7b=0$

$2a-4b=6 \quad (\div 2)$

$a-2b=3$ — (2)

$-a+5b=0$ — (1)

$a-2b=3$ — (2)

$3b=3$

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

$b=1$

put $b=1$ in eq (2)

$a-2b=3$

$a-2(1)=3$

$a-2=3$

$a=3+2$

$\underline{a=5}$

ii) For which value of k will the following pair of linear equations have no solution ?

$3x+y=1$

~~(a+b)x+(a+b)y~~

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

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

$\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$ {no solutions}

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

$\Rightarrow \frac{3}{2k-1}\not=\frac{1}{k-1}$

$3(k-1)=1(2k-1)$

$3k-3=2k-1$

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

$\underline{k=2}$

3. Solve the following pair of linear equations by the substitution and cross multiplication method.

$8x + 5y = 9$ — ① $(\times 2)$

$3x + 2y = 4$ — ② $(\times -5)$

$16x + 10y = 18$

$-15x - 10y = -20$

$x = -2$

put $x = -2$ in eq ①

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

$-16 + 5y = 9$

$5y = 9 + 16$

$5y = 25$

$y = \frac{25}{5}$

$y = 5$

$\therefore x = -2$ and $y = 5$

4. Form the pair of linear equations in the following problems and find their solutions by an algebrical method.

i) A part of monthly hostel charge is fixed and the remaining depends on the number of days one has taken food in the mess. When a student H takes food for 20 days she has to pay ₹1000 as hostel charges where as student B who takes food for 26 days, pays ₹1180 as hostel charge. Find the fixed charges and the cost of food per day.

Let fixed charges = Rs x

Cost of food/day = Rs y

Case I (20 days → Rs 1000)

$x + 20y = 1000$ — ①

Case II (26 days → Rs 1180)

$x + 26y = 1180$ — ②

$x + 20y = 1000$ — ①

$x + 26y = 1180$ (x-1) — ②

$$\begin{array}{r} x + 20y = 1000 \\ -x - 26y = -1180 \\ \hline -6y = -180 \end{array}$$

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

$y = 30$

put $y = 30$ in eq ①

$x + 20(30) = 1000$

$x + 600 = 1000$

$x = 1000 - 600$

$x = 400$

ii) A fraction becomes $\frac{1}{3}$ when 1 is subtracted from the numerator and it becomes $\frac{1}{4}$ when 8 is added to the denominator. Find the fraction.

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

Case I $\quad \frac{x-1}{y} = \frac{1}{3}$

$3(x-1) = 1y$

$3x - 3 = y$

$3x - y = 3 \quad -①$

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

$4x = 1(y+8)$

$4x = y + 8$

$4x - y = 8 \quad -②$

$3x - y = 3 \quad -①$

$4x - y = 8 \quad -②$

$-3x - y = -3$

$-4x + y = -8$

$-x = -5$

$x = 5$

put $x = 5$ in eq ①

$3(5) - y = 3$

$15 - y = 3$

$-y = 3 - 15$

$-y = -12$

$y = 12$

Fraction is $\frac{5}{12}$

iii) Yash scored 40 marks in a test, getting 3 marks for each right answers and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks been deducted for each incorrect answer, Then Yash would have scored 50 marks. How many questions were there in the test,

Let no. of right answers = x

no. of wrong answers = y

Case I $\quad 3x - y = 40 \quad \rightarrow ① \quad (\times -2)$

Case II $\quad 4x - 2y = 50 \quad \rightarrow ②$

$$-6x + 2y = -80 \quad \rightarrow ③$$
$$4x - 2y = 50 \quad \rightarrow ②$$

$$-2x = -30$$
$$x = \frac{30}{2}$$
$$x = 15$$

put $x = 15$ in eq ①

$$3(15) - y = 40$$
$$45 - y = 40$$
$$-y = 40 - 45$$
$$-y = -5$$
$$y = 5$$

No. of right answers = 15

No. of wrong answers = 5

Total no. of questions = 20

iv) Place A and B are 100km apart on a highway. One car star from A and another from B at the same time. If the cars travel in the same direction at different speeds they meet in 5 hrs. If they t towards each other, they meet in 1 hour. What are the speeds of

Let speed of car starting from A = x km/hr two c
speed of car starting from B = y km/hr

Case I [Same direction]

time = 5 hrs, distance = 100 km, Speed = (x-y) km/

$$\text{speed} = d/t$$
$$x-y = \frac{100}{5}$$
$$x-y = 20 \quad -①$$

Case II [oppo. direction]

t = 1 hr, d = 100 km, Speed = (x+y) km/

$$\text{Speed} = d/t$$
$$x+y = \frac{100}{1}$$
$$x+y = 100 \quad -②$$

$$x-y = 20$$
$$x+y = 100$$
$$2x = 120$$
$$x = \frac{120}{2}$$
$$x = 60$$

put x = 60 in eq ②

$$60+y = 100$$
$$y = 100-60$$
$$y = 40$$

Speed of car starting from A = 60 km/hr
B = 40 km/hr

) The area of a rectangle gets reduced by 9 square units, if its length reduced by 5 units and breath is increased by 3 units. If we increase the length by 3 units and the breath by 2 units, the area increases by 67 square units. Find the dimensions of the rectangle.

Let length = x

breath = y

Area = $l \times b$

$= xy$

Case I (Area reduce by 9) = (length - 5) (Breath + 3)

$$xy - 9 = (x-5)(y+3)$$
$$xy - 9 = x(y+3) - 5(y+3)$$
$$xy - 9 = xy + 3x - 5y - 15$$
$$-9 = 3x - 5y - 15$$
$$-9 + 15 = 3x - 5y$$
$$6 = 3x - 5y \quad -①$$

Case II $(A + 67) = (l+3)(b+2)$

$$xy + 67 = (x+3)(y+2)$$
$$xy + 67 = x(y+2) + 3(y+2)$$
$$xy + 67 = xy + 2x + 3y + 6$$
$$67 = 2x + 3y + 6$$
$$67 - 6 = 2x + 3y$$
$$61 = 2x + 3y \quad -②$$

$3x - 5y = 6 \quad -①$ $(\times 3)$

$2x + 3y = 61 \quad -②$ $(\times 5)$

$$9x - 15y = 18$$
$$\underline{10x + 15y = 305}$$
$$19x = 323$$
$$x = \frac{323}{19} = 17$$

put $x = 17$ in eq ①

$6 = 3(17) - 5y$

$6 - 51 = -5y$ $\quad -5y = -45$ $\quad y = 9$

∴ length = 17

breath = 9

Ex 3.6

1. Solve the following pairs of equations by reducing them to a pair of linear equations.

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

$$\frac{6}{\sqrt{x}} + \frac{9}{\sqrt{y}} = 6$$

$$\frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1$$

$$\frac{10}{\sqrt{x}} = \frac{5}{1}$$

$$5\sqrt{x} = 10$$

$$\sqrt{x} = \frac{10}{5}$$

$$\sqrt{x} = 2$$ squaring on both sides

$$(\sqrt{x})^2 = (2)^2$$

$$x = 4$$

put $\sqrt{x} = 2$ in eq ①

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

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

$$1 + \frac{3}{\sqrt{y}} = 2$$

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

$$\frac{3}{\sqrt{y}} = \frac{1}{1}$$

$$\sqrt{y} = 3$$

squaring on both sides

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

$$y = 9$$

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

$\frac{15}{x-1} + \frac{3}{y-2} = 6$

$\frac{6}{x-1} - \frac{3}{y-2} = 1$

$\frac{21}{x-1} = \frac{7}{1}$

$7(x-1) = 21$

$7x - 7 = 21$

$7x = 21 + 7$

$7x = 28$

$x = 4$

put $x = 4$ in eq ②

$\frac{6}{x-1} - \frac{3}{y-2} = 1$

$\frac{6}{4-1} - \frac{3}{y-2} = 1$

$\frac{6^2}{3_1} - \frac{3}{y-2} = 1$

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

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

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

$2y - 7 = y - 2$

$2y - y = -2 + 7$

$y = 5$

v) $\frac{7x - 2y = 5}{xy} = 7x - 2y = 5xy \quad -① \times 7$

$\frac{8x + 7y = 15}{xy} = 8x + 7y = 15xy \quad -② \times 2$

$49x - 14y = 35xy \quad -①$

$16x + 14y = 30xy \quad -②$

$65x = 65xy$

$y = 1$

put $y = 1$ in eq ①

$7x - 2y = 5xy$

$7x - 2(1) = 5x(1)$

$7x - 2 = 5x$

$7x - 5x = 2$

$2x = 2$

$x = 1$

---

vii) $\frac{10}{x+y} + \frac{2}{x-y} = 4 \quad -① \times 5$

$\frac{15}{x+y} + \frac{5}{x-y} = -2 \quad -② \times 2$

$\frac{50}{x+y} + \frac{10}{x-y} = 20 \quad -①$

$\frac{30}{x+y} - \frac{10}{x-y} = -4 \quad -②$

$\frac{80}{x+y} = 16$

$16(x+y) = 80$

$x+y = \frac{80}{16}$

$x+y = 5 \quad -③$

$x = 5 - y \quad -③$

put $x = 5-y$ in eq ①

$$\frac{10}{5y-y} + \frac{2}{5-y-y} = 4$$

$$\frac{10^{2}}{\cancel{5}_{1}y} + \frac{2}{5-2y} = 4$$

$$2 + \frac{2}{5-2y} = 4$$

$$\frac{2}{5-2y} = 4-2$$

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

$$2(5-2y) = 2 \times 1$$

$$5-2y = 1$$

$$-2y = 1-5$$

$$-2y = -4$$

$$y = 2$$

put $y = 2$ in eq ③

$$x = 5-y$$

$$x = 5-2$$

$$x = 3$$

*

2. Formulate the following problems as pair of equations and hence find their solutions:

i) Ritu can row downstream 20km in 2 hours, and up 4km in 2hrs. Find her speed of rowing in still water and the speed of the current.

Let speed of rowing in still water = x km/hr

speed of current = y km/hr

Case I (downstream)

$d = 20$km, $t = 2$hrs

Speed = $(x+y)$ km/hr

$\text{Speed} = \frac{d}{t}$

$x+y = \frac{20}{2}$

$x+y = 10$ — (1)

Case II (upstream)

$d = 4$km, $t = 2$hs

Speed = $(x-y)$ km/hr

$\text{Speed} = \frac{d}{t}$

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

$x-y = 2$ — (2)

$x+y = 10$

$x-y = 2$

$2x = 12$

$x = 6$

put $x = 6$ in eq (1)

$x+y = 10$

$6+y = 10$

$y = 10-6$

$y = 4$

Speed of still water = 6 km

Speed of current = 4 km

ii) 2 women and 5 men can together finish an embroidery work in 4 days, while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone to finish the work, and also that taken by 1 man.

Let 1 man finish the work in x days

1 woman finish the work in y days

So, 1 man 1 days work = $1/x$

1 woman 1 days work = $1/y$

Case I [2 women + 5 men = 4 days]

$$2 \times \frac{1}{y} + 5 \times \frac{1}{x} = 4 \text{ days}$$

$$\frac{2}{y} + \frac{5}{x} = \frac{1}{4} \text{ days} \quad - (1) \times 3$$

Case II [3 women + 6 men = 3 days]

$$3 \times \frac{1}{y} + 6 \times \frac{1}{x} = 3 \text{ days}$$

$$\frac{3}{y} + \frac{6}{x} = \frac{1}{3} \text{ days.} \quad - (2) \times -2$$

$$\frac{6}{y} + \frac{15}{x} = \frac{3}{4}$$

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

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

$$\frac{3}{x} = \frac{3 \times 3 - 2 \times 4}{12}$$

$$\frac{3}{x} = \frac{9 - 8}{12}$$

$$\frac{3}{x} = \frac{1}{12}$$

$$x = 36$$

put $x = 36$ in eq ②

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

$$\frac{3}{y} + \frac{6}{36} = \frac{1}{3}$$

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

$$\frac{3}{y} = \frac{1}{3} - \frac{1}{6}$$

$$\frac{3}{y} = \frac{2-1}{6}$$

$$\frac{3}{y} = \frac{1}{6}$$

$$y = 18$$

time Iman works = 36 hrs

time 1 man works = 18 hrs

iii) Rooki travels 300km to her home partly by train and partly by bus. She takes 4 hours if she travels 60km by train and the remaining by bus. If she travels 100km by train and the remaining by bus, she takes 10 mins longer. Find the speed of the train and the bus separately.

Let speed of the train = x km/hr

speed of the bus = y km/hr

Total distance she travels = 300km

Case I

$t = 4$ hrs

distance traveled by train = 60km

distance traveled by bus = $300 - 60 = 240$

time $= \frac{\text{distance}}{\text{speed}}$

$$4 = \frac{60}{x} + \frac{240}{y} \quad [\div 4]$$

$$1 = \frac{15}{x} + \frac{60}{y} \quad - (1)$$

Case II

$t = 4$ hrs 10 mins $= 4\left(\frac{10}{60}\right)$ hrs $= 4\frac{1}{6} = \frac{25}{6}$

distance traveled by train = 100 km

distance traveled by bus = $300 - 100 = 200$ km

$t = \frac{d}{s}$

$$\frac{25}{6} = \frac{100}{x} + \frac{200}{y} \quad [\div 25]$$

$$\frac{1}{6} = \frac{4}{x} + \frac{8}{y} \quad - (2)$$

$$1 = \frac{15}{x} + \frac{60}{y} \quad - ① \quad (\times 4)$$

$$\frac{1}{6} = \frac{4}{x} + \frac{8}{y} \quad - ② \quad (\times -15)$$

$$4 = \frac{60}{x} + \frac{240}{y}$$

$$\frac{-15}{6} = \frac{-60}{x} - \frac{120}{y}$$

$$4 - \frac{15}{6} = \frac{120}{y}$$

$$\frac{24-15}{6} = \frac{120}{y}$$

$$\frac{9^3}{6_2} = \frac{120}{y}$$

$$\frac{3}{2} = \frac{120^{40}}{y}$$

$$y = 80$$

put $y = 80$ in eq ②

$$\frac{1}{6} = \frac{4}{x} + \frac{8}{y}$$

$$\frac{1}{6} = \frac{4}{x} + \frac{8^1}{80_{10}}$$

$$\frac{1}{6} = \frac{4}{x} + \frac{1}{10}$$

$$\frac{1}{6} - \frac{1}{10} = \frac{4}{x}$$

$$\frac{10-6}{60} = \frac{4}{x}$$

$$\frac{4^1}{60} = \frac{4}{x}$$

$$x = 60$$

Speed of train = 60 km/hr

Speed of bus = 80 km/hr