1 Linear Equations in Two Variables

Problem Set - 1

1. Choose correct alternative for each of the following questions

(1) To draw graph of $4x + 5y = 19$, Find y when $x = 1$.

(A) 4 (B) 3 (C) 2 (D) -3

Soln:-

$4x + 5y = 19$

when $x = 1$,

$(4 \times 1) + 5y = 19$

$4 + 5y = 19$

$\therefore \quad 5y = 19 - 4$

$\therefore \quad 5y = 15$

$\therefore \quad y = \frac{15}{5}$

$\therefore \quad \boxed{y = 3}$

Answer = Option (B)

(2) For simultaneous equations in variables x and y, $D_x = 49$, $D_y = -63$, $D = 7$ then what is x ?

(A) 7 (B) -7 (C) $\frac{1}{7}$ (D) $\frac{-1}{7}$

Soln:- $D_x = 49$, $D_y = -63$, $D = 7$

$$\therefore \quad x = \frac{D_x}{D}$$

$$\therefore \quad x = \frac{49}{7}$$

$$\therefore \quad \boxed{x = 7}$$

Answer = option (A)

(3) Find the value of $\begin{vmatrix} 5 & 3 \\ -7 & -4 \end{vmatrix}$

(A) -1 (B) -41 (C) 41 (D) 1

Soln:-

$$\begin{vmatrix} 5 & 3 \\ -7 & -4 \end{vmatrix}$$

$$= (5 \times -4) - (3 \times -7)$$

$$= -20 - (-21)$$

$$= -20 + 21$$

$$= 1$$

$\therefore$ Answer = Option (D)

(4) To solve $x + y = 3$; $3x - 2y - 4 = 0$ by determinant method find D.

(A) 5 (B) 1 (C) -5 (D) -1

Soln:-

$$x + y = 3 \quad - (I)$$

$$3x - 2y - 4 = 0$$

$$\therefore \quad 3x - 2y = 4 \quad - (II)$$

$$\therefore \quad D = \begin{vmatrix} 1 & 1 \\ 3 & -2 \end{vmatrix}$$

$$= (1 \times -2) - (3 \times 1)$$

$$= -2 - 3$$

$$\therefore \quad \boxed{D = -5}$$

$\therefore$ Answer = Option (C)

(5) $ax + by = c$ and $mx + ny = d$ and $an \neq bm$ then these simultaneous equations have -

(A) Only one common solution. (B) No solution.

(C) Infinite number of solutions. (D) Only two solutions.

Soln:-

$$ax + by = c \quad - (I)$$

$$mx + ny = d \quad - (II)$$

$$D = \begin{vmatrix} a & b \\ m & n \end{vmatrix}$$

$$= (a \times n) - (m \times b)$$

$$D = an - bm$$

As, $an \neq bm$

$\therefore \quad D \neq 0$

$\therefore$ These equations will have only one common solution.

$\therefore$ Answer = option (A)

2. Complete the following table to draw the graph of $2x - 6y = 3$

x	-5	☐
y	☐	0
(x, y)	☐	☐

Soln :-

$$2x - 6y = 3$$

i) When $x = -5$

$\therefore \quad (2 \times -5) - 6y = 3$

$\therefore \quad -10 - 6y = 3$

ii) When $y = 0$

$\therefore \quad 2x - (6 \times 0) = 3$

$\therefore \quad 2x - 0 = 3$

$\therefore \quad -6y = 3 + 10$

$\therefore \quad -6y = 13$

$\therefore \quad \boxed{y = \frac{-13}{6}}$

$\therefore \quad 2x = 3$

$\therefore \quad \boxed{x = \frac{3}{2}}$

x	-5	$\frac{3}{2}$
y	$-\frac{13}{6}$	0
(x, y)	$(-5, -\frac{13}{6})$	$(\frac{3}{2}, 0)$

3. Solve the following simultaneous equations graphically.

(1) $2x + 3y = 12$; $x - y = 1$

Soln :-

$2x + 3y = 12$

$3y = 12 - 2x$

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

i) When $x = 0$,

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

$y = \frac{12}{3} = 4 \quad \therefore \boxed{y = 4}$

ii) When $x = 3$

$$\therefore \quad y = \frac{12 - (2 \times 3)}{3}$$

$$y = \frac{12 - 6}{3} = \frac{6}{3} = 2 \qquad \therefore \boxed{y = 2}$$

iii) When $x = -3$,

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

$$= \frac{12 - (-6)}{3}$$

$$= \frac{12 + 6}{3}$$

$$= \frac{18}{3}$$

$$\therefore \boxed{y = 6}$$

x	0	3	-3
y	4	2	6
(x, y)	(0, 4)	(3, 2)	(-3, 6)

Now, $x - y = 1$

$\therefore \quad x = y + 1$

i) When $y = 0$,

$\therefore \quad x = 0 + 1$

$\therefore \quad \boxed{x = 1}$

ii) When $y = -1$,

$\therefore \quad x = -1 + 1$

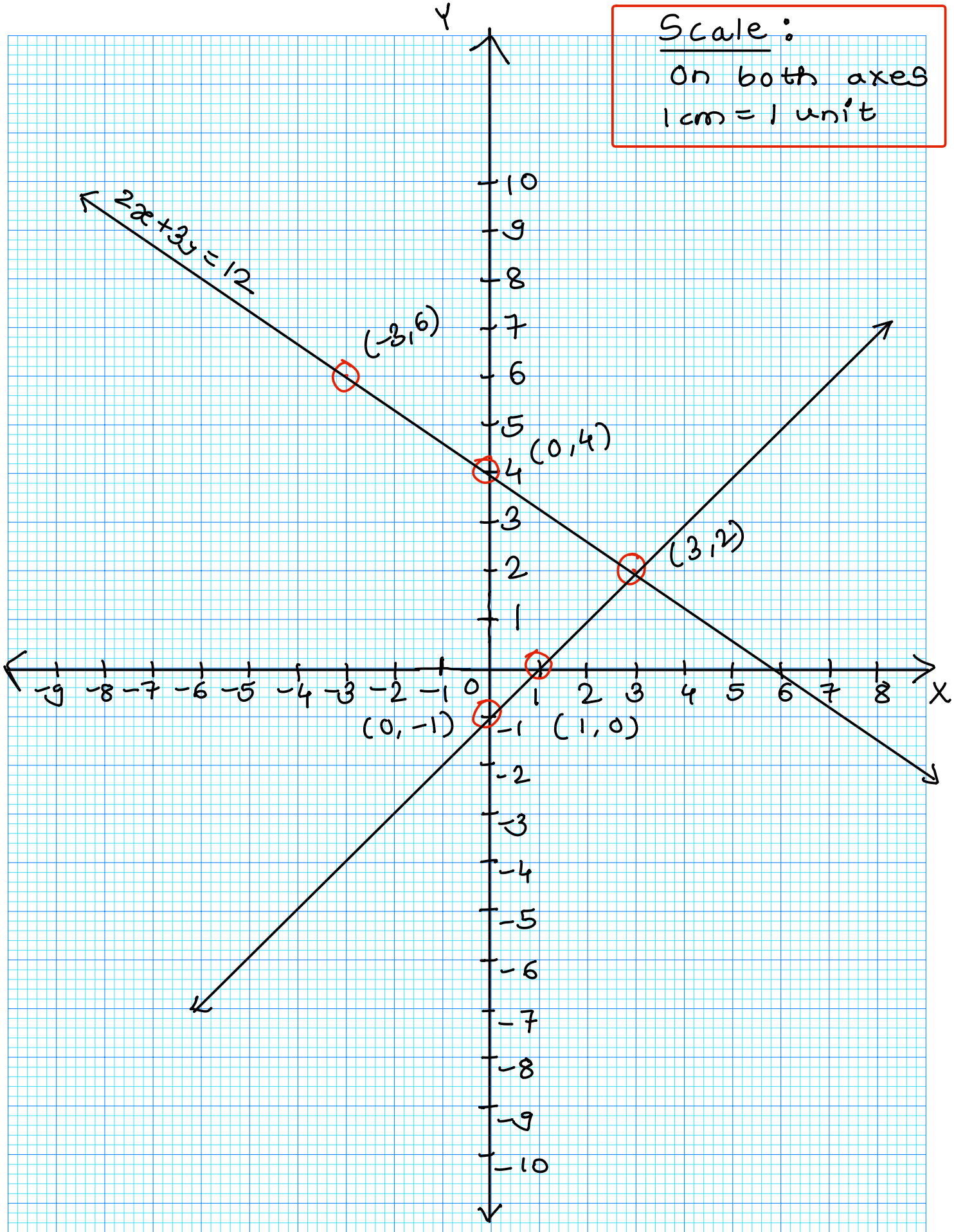
$\therefore \quad \boxed{x = 0}$

iii) When $y = 2$,

$\therefore \quad x = 2 + 1$

$\therefore \quad \boxed{x = 3}$

x	1	0	3
y	0	-1	2
(x, y)	$(1, 0)$	$(0, -1)$	$(3, 2)$



Intersection Point = (3, 2)

∴ Solution = (x, y) = (3, 2).

(2) $x - 3y = 1 \; ; \; 3x - 2y + 4 = 0$

Soln:-

$$x - 3y = 1$$

$$\therefore \quad x = 3y + 1$$

i) When $y = 0$,

$$x = (3 \times 0) + 1$$

$$\therefore \quad x = 0 + 1$$

$$\therefore \quad \boxed{x = 1}$$

ii) When $y = 1$

$$x = (3 \times 1) + 1$$

$$= 3 + 1$$

$$\therefore \quad \boxed{x = 4}$$

iii) When $y = 2$,

$$x = (3 \times 2) + 1$$

$$= 6 + 1$$

$$\therefore \quad \boxed{x = 7}$$

x	1	4	7
y	0	1	2
(x, y)	$(1, 0)$	$(4, 1)$	$(7, 2)$

Now, $3x - 2y + 4 = 0$

$\therefore \quad 3x = 2y - 4$

$\therefore \quad x = \dfrac{2y - 4}{3}$

i) When $y = -1$,

$\therefore \quad x = \dfrac{(2 \times -1) - 4}{3}$

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

$x = \dfrac{-6}{3}$

$\therefore \quad \boxed{x = -2}$

ii) When $y = 5$,

$$x = \frac{(2 \times 5) - 4}{3}$$

$$= \frac{10 - 4}{3}$$

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

$\therefore$ $\boxed{x = 2}$

iii) When $y = 8$,

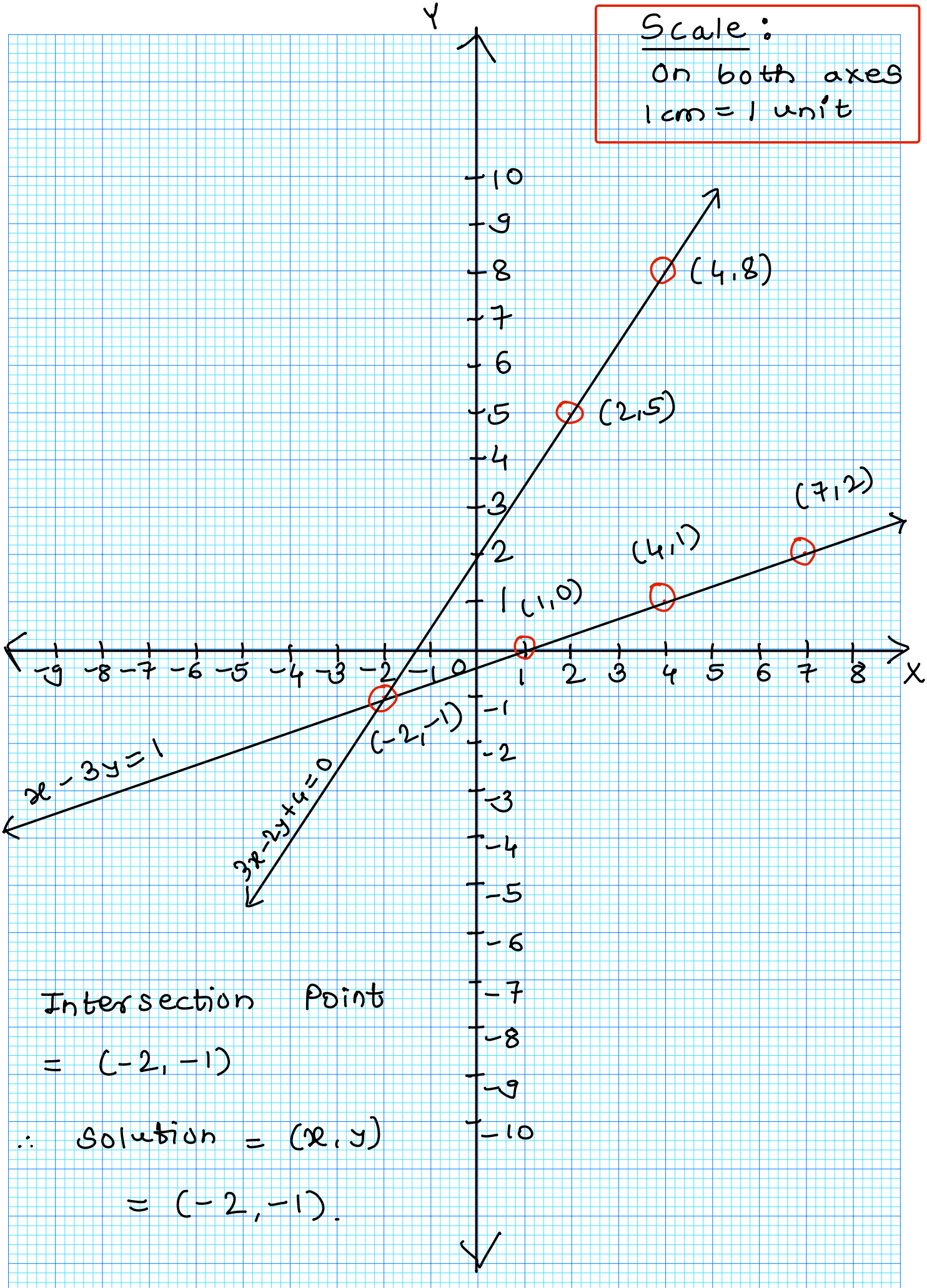
$$x = \frac{(2 \times 8) - 4}{3}$$

$$= \frac{16 - 4}{3}$$

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

$\therefore$ $\boxed{x = 4}$

x	-2	2	4
y	-1	5	8
(x, y)	$(-2, -1)$	$(2, 5)$	$(4, 8)$



Intersection Point

$= (-2, -1)$

$\therefore$ Solution $= (x, y)$

$= (-2, -1)$.

(3) $5x - 6y + 30 = 0 \; ; \; 5x + 4y - 20 = 0$

Soln:-

$$5x - 6y + 30 = 0$$

$$5x + 30 = 6y$$

$$y = \frac{5x + 30}{6}$$

i) When $x = 0$,

$$y = \frac{(5 \times 0) + 30}{6}$$

$$\therefore \quad y = \frac{30}{6}$$

$$\therefore \quad \boxed{y = 5}$$

ii) When $x = 6$,

$$\therefore \quad y = \frac{(5 \times 6) + 30}{6}$$

$$\therefore \quad y = \frac{30 + 30}{6}$$

$$\therefore \quad y = \frac{60}{6}$$

$$\therefore \quad \boxed{y = 10}$$

iii) When $x = -6$,

$$\therefore \quad y = \frac{(5x-6)+30}{6}$$

$$\therefore \quad y = \frac{-30+30}{6}$$

$$\therefore \quad y = \frac{0}{6}$$

$$\therefore \quad \boxed{y = 0}$$

x	0	6	-6
y	5	10	0
(x, y)	$(0, 5)$	$(6, 10)$	$(-6, 0)$

Now, $5x + 4y - 20 = 0$

$$\therefore \quad 4y = 20 - 5x$$

$$\therefore \quad y = \frac{20-5x}{4}$$

i) When $x = 0$,

$$y = \frac{20 - (5 \times 0)}{4}$$

$$\therefore \quad y = \frac{20}{4}$$

$$\therefore \quad \boxed{y = 5}$$

ii) When $x = 4$,

$$\therefore \quad y = \frac{20 - (5 \times 4)}{4}$$

$$\therefore \quad y = \frac{0}{4}$$

$$\therefore \quad \boxed{y = 0}$$

iii) When $x = -4$,

$$\therefore \quad y = \frac{20 - (5 \times -4)}{4}$$

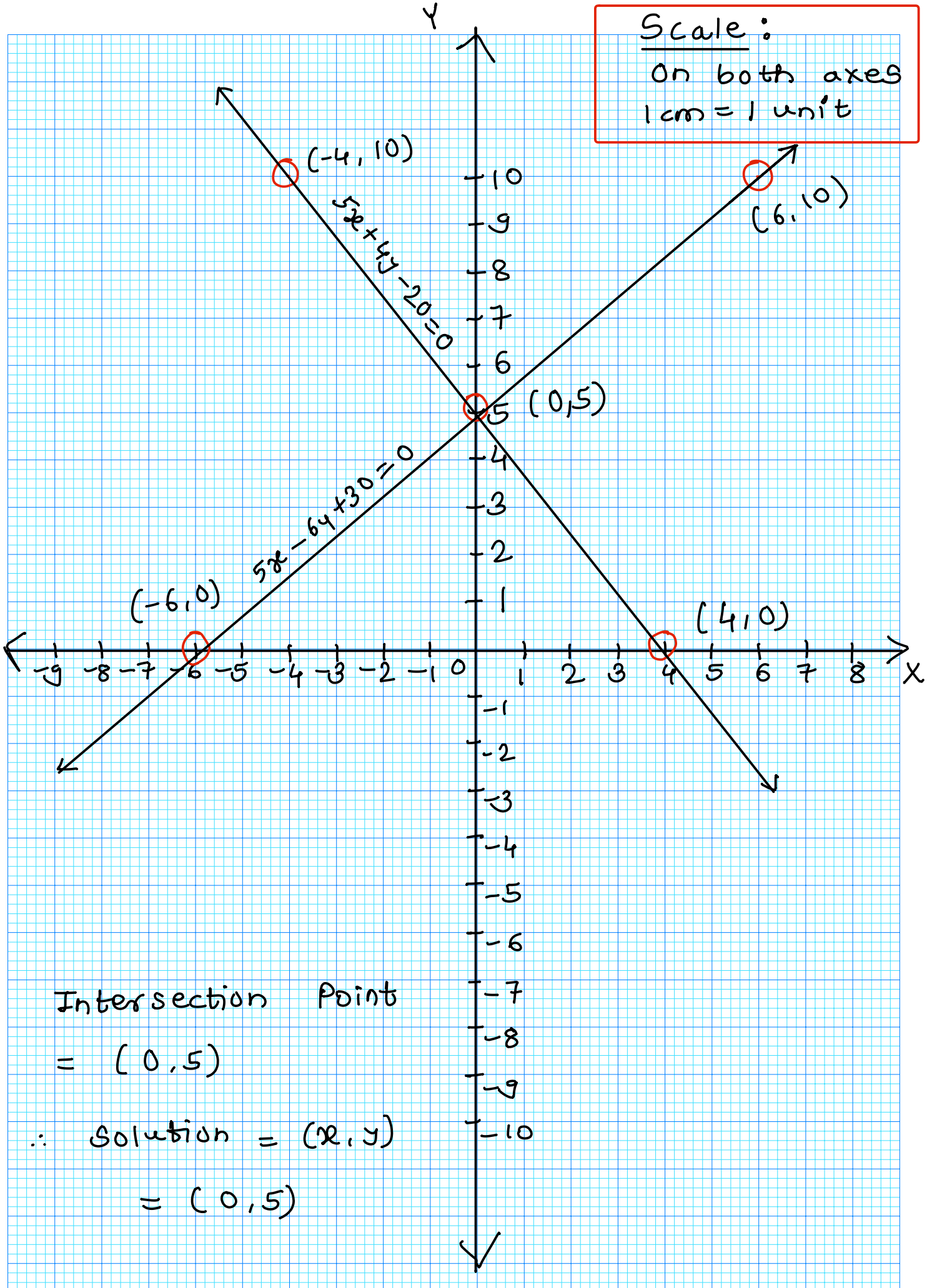
$$\therefore \quad y = \frac{20 - (-20)}{4}$$

$$\therefore \quad y = \frac{20 + 20}{4}$$

$$\therefore \quad y = \frac{40}{4}$$

$$\therefore \quad \boxed{y = 10}$$

x	0	4	-4
y	5	0	10
(x, y)	$(0, 5)$	$(4, 0)$	$(-4, 10)$



Intersection Point

$= (0, 5)$

$\therefore$ Solution $= (x, y)$

$= (0, 5)$

(4) $3x - y - 2 = 0 \; ; \; 2x + y = 8$

Soln:-

$$3x - y - 2 = 0$$

$$\therefore \quad y = 3x - 2$$

i) When $x = 0$,

$$y = (3 \times 0) - 2$$

$$\therefore \quad \boxed{y = -2}$$

ii) When $x = 2$,

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

$$\therefore \quad y = 6 - 2$$

$$\therefore \quad \boxed{y = 4}$$

iii) When $x = -1$,

$$y = (3 \times -1) - 2$$

$$\therefore \quad y = -3 - 2$$

$$\therefore \quad \boxed{y = -5}$$

x	0	2	-1
y	-2	4	-5
(x, y)	$(0, -2)$	$(2, 4)$	$(-1, -5)$

Now, $2x + y = 8$

$\therefore \quad y = 8 - 2x$

i) When $x = 0$,

$\therefore \quad y = 8 - (2 \times 0)$

$\therefore \quad y = 8 - 0$

$\therefore \quad \boxed{y = 8}$

ii) When $x = 1$,

$\therefore \quad y = 8 - (2 \times 1)$

$\therefore \quad y = 8 - 2$

$\therefore \quad \boxed{y = 6}$

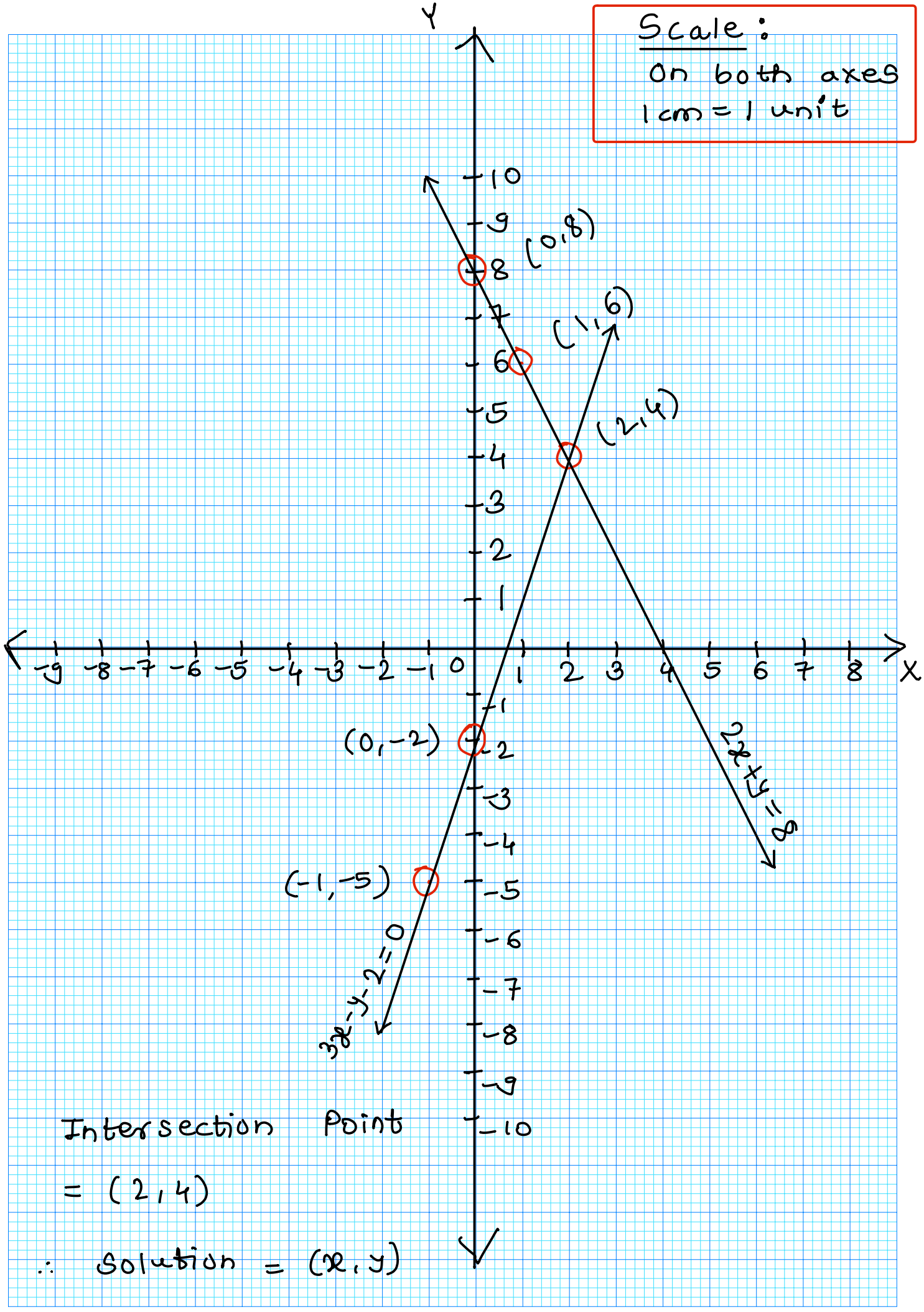
iii) When $x = 2$,

$\therefore \quad y = 8 - (2 \times 2)$

$\therefore \quad y = 8 - 4$

$\therefore \quad \boxed{y = 4}$

x	0	1	2
y	8	6	4
(x, y)	$(0, 8)$	$(1, 6)$	$(2, 4)$



Intersection Point

= (2, 4)

∴ Solution = (x, y)

= (2, 4)

(5) $3x + y = 10 \; ; \; x - y = 2$

Soln:-

$$3x + y = 10$$

$$\therefore \quad y = 10 - 3x$$

i) When $x = 1$,

$$\therefore \quad y = 10 - (3 \times 1)$$

$$\therefore \quad y = 10 - 3$$

$$\therefore \quad \boxed{y = 7}$$

ii) When $x = 2$,

$$\therefore \quad y = 10 - (3 \times 2)$$

$$\therefore \quad y = 10 - 6$$

$$\therefore \quad \boxed{y = 4}$$

iii) When $x = 3$,

$$\therefore \quad y = 10 - (3 \times 3)$$

$$\therefore \quad y = 10 - 9$$

$\therefore$ $\boxed{y = 1}$

x	1	2	3
y	7	4	1
(x, y)	$(1, 7)$	$(2, 4)$	$(3, 1)$

Now, $x - y = 2$

$\therefore$ $y = x - 2$

i) When $x = 0$,

$\therefore$ $y = 0 - 2$

$\therefore$ $\boxed{y = -2}$

ii) When $x = 2$,

$\therefore$ $y = 2 - 2$

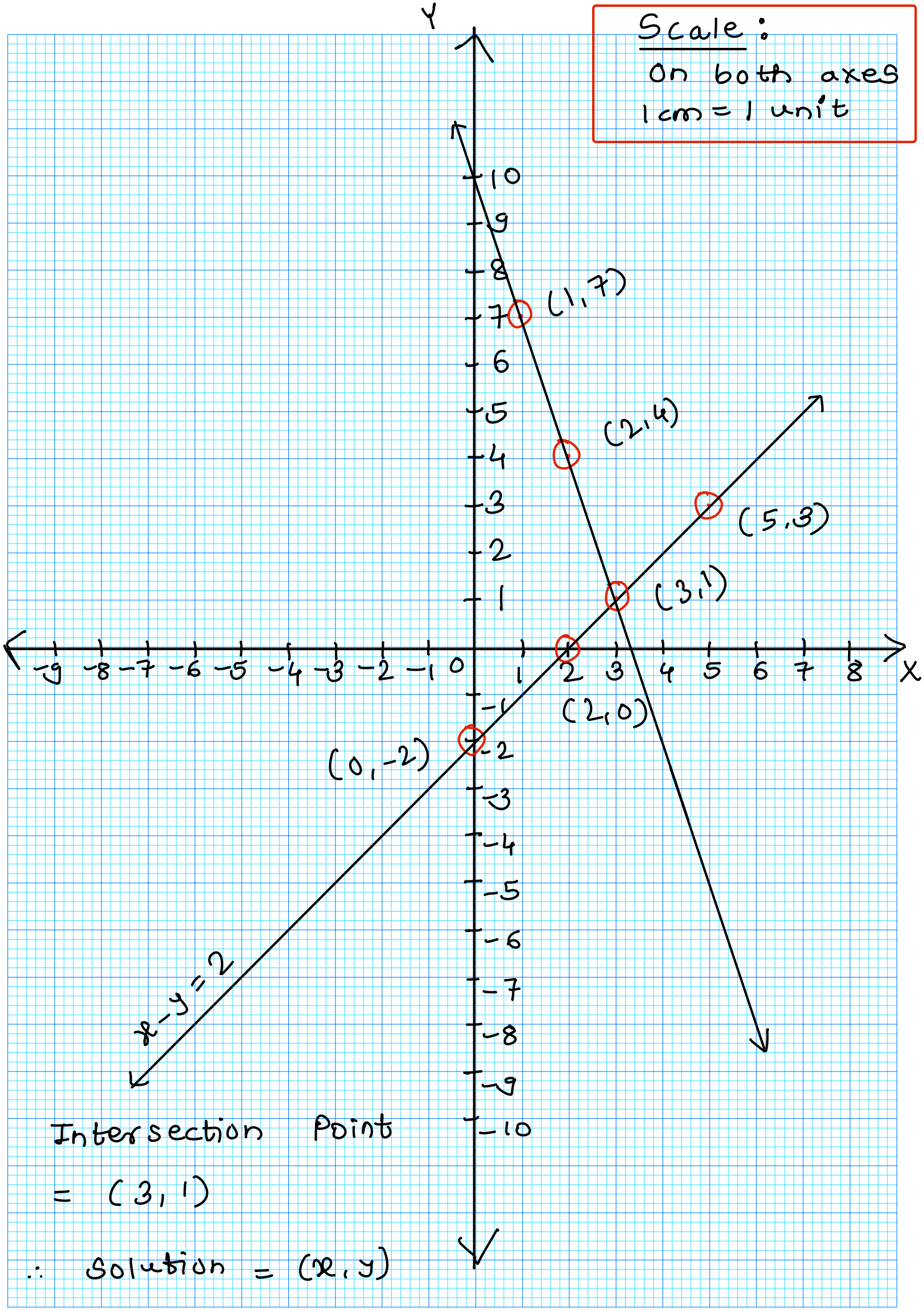
$\therefore$ $\boxed{y = 0}$

iii) When $x = 5$,

$\therefore \quad y = 5 - 2$

$\therefore \quad \boxed{y = 3}$

x	0	2	5
y	-2	0	3
(x, y)	$(0, -2)$	$(2, 0)$	$(5, 3)$



Intersection Point

= (3, 1)

∴ Solution = (x, y)

= (3, 1)