7

Linear Equations

POINTS TO REMEMBER

1. **Linear Equation :** An equation which involves only one variable with highest power, is called a linear equation.
2. **Solving the Equation**

   To solve an equation means to find the value of the variable which satisfies the equation.
3. **Rules for solving a Linear Equation :**

   The equality of a linear equation is not changed when

(*i*) the same number is added or subtracted from both sides of the equation.

(*ii*) both sides of the equation are multiplied or divided by the same non zero number.

4. **Transposition :**

   When any term of the equation is taken from one side to the other, this process is called transposition.
5. **Cross multiplication**

   If $\frac{a}{b} = \frac{c}{d}$ then $a \times d = b \times c$

   This process is called the cross multiplication.
6. **Word problems** can be solved by means of equation by representing the unknown quantity as x, y, z etc. and then solve the equation so formed by the condition or conditions given in the problem :

EXERCISE 7 (A)

Solve :

Q. 1. $5x - 16 = 19 - 2x$

Sol. $5x - 16 = 19 - 2x$

$\Rightarrow \quad 5x + 2x = 19 + 16$ (By Transposition)

$\Rightarrow \quad 7x = 35$

$\therefore \quad x = \frac{35}{7} = 5$ **Ans.**

Q. 2. $3x - \frac{1}{2}x = 1\frac{1}{2}$

Sol. $3x - \frac{1}{2}x = 1\frac{1}{2}$

$\Rightarrow \quad \frac{6x - x}{2} = \frac{3}{2}$

$\Rightarrow \quad 6x - x = 3 \quad \Rightarrow \quad 5x = 3$

$\therefore \quad x = \frac{3}{5}$ **Ans.**

Q. 3. $3\frac{3}{4}x = 5x - 2\frac{1}{2}$

Sol. $3\frac{3}{4}x = 5x - 2\frac{1}{2}$

$\Rightarrow \quad \frac{15}{4}x = 5x - \frac{5}{2}$

Multiplying by 4, the LCM of 4 and 2

$\frac{15}{4}x \times 4 = 5x \times 4 - \frac{5}{2} \times 4$

$$15x = 20x - 10$$

$\Rightarrow 15x - 20x = -10$ (By transposition)

$\Rightarrow -5x = -10$

$\therefore \quad x = \frac{-10}{-5} = 2$ **Ans.**

Q. 4. $3x - 5 = \frac{2x}{3} + 9$

Sol. $3x - 5 = \frac{2x}{3} + 9$

$\Rightarrow 3x \times 3 - 5 \times 3 = \frac{2x}{3} \times 3 + 9 \times 3$ (Multiplying by 3)

$\Rightarrow 9x - 15 = 2x + 27$

$\Rightarrow 9x - 2x = 27 + 15$ (By transposition)

$\Rightarrow 7x = 42$

$\therefore \quad x = \frac{42}{7} = 6$ **Ans.**

Q. 5. $(x-4)(x+4) = (x+4)(x-7) + 33$

Sol. $(x-4)(x+4) = (x+4)(x-7) + 33$

$\Rightarrow x^2 - 4x + 4x - 16 = x^2 - 7x + 4x - 28 + 33$

$\Rightarrow x^2 - 16 = x^2 - 3x + 5$

$\Rightarrow x^2 - x^2 + 3x = 5 + 16$ (By transposition)

$\Rightarrow 3x = 21$

$\therefore \quad x = \frac{21}{3} = 7$ **Ans.**

Q. 6. $(x-2)(x+3) = (x^2 - 4)$

Sol. $(x-2)(x+3) = x^2 - 4$

$\Rightarrow x^2 + 3x - 2x - 6 = x^2 - 4$

$\Rightarrow x^2 + x - 6 = x^2 - 4$

$\Rightarrow x^2 + x - x^2 = -4 + 6$ (By transposition)

$\Rightarrow x = 2$ **Ans.**

Q. 7. $\frac{(y-4)}{5} + \frac{(y+2)}{2} = 10$

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

Multiplying by 10, the LCM of 5 and 2

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

$\Rightarrow 2(y-4) + 5(y+2) = 100$

$\Rightarrow 2y - 8 + 5y + 10 = 100$

$\Rightarrow 2y + 5y = 100 + 8 - 10$ (By transposition)

$\Rightarrow 7y = 98$

$\Rightarrow y = \frac{98}{7} = 14$

$\therefore \quad y = 14$ **Ans.**

Q. 8. $(x-1) = \frac{3}{4}(x+1) - \frac{1}{2}$

Sol. $(x-1) = \frac{3}{4}(x+1) - \frac{1}{2}$

Multiplying by 4, the L.C.M. of 4 and 2

$4(x-1) = \frac{3}{4}(x+1) \times 4 - \frac{1}{2} \times 4$

$\Rightarrow 4x - 4 = 3x + 3 - 2$

$\Rightarrow 4x - 3x = 3 - 2 + 4$ (By transposition)

$\therefore \quad x = 5$ **Ans.**

Q. 9. $\frac{2}{3}(x-3) = 1 - \frac{5}{6}(3x-4)$

Sol. $\frac{2}{3}(x-3) = 1 - \frac{5}{6}(3x-4)$

Multiplying by 6, the LCM of 3 and 6

$6 \times \frac{2}{3}(x-3) = 1 \times 6 - 6 \times \frac{5}{6}(3x-4)$

$\Rightarrow 4(x-3) = 6 - 5(3x-4)$

$\Rightarrow 4x - 12 = 6 - 15x + 20$

$\Rightarrow 4x + 15x = 6 + 20 + 12$ (By transposition)

$\Rightarrow 19x = 38$

$\therefore \quad x = \frac{38}{19} = 2$ **Ans.**

Q. 10. $\frac{(x+7)}{3} = 1 + \frac{(3x-2)}{5}$

Sol. $\frac{x+7}{3} = 1 + \frac{3x-2}{5}$

Multiplying by 15, the LCM of 3 and 5

$15 \times \frac{(x+7)}{3} = 1 \times 15 + 15 \times \frac{(3x-2)}{5}$

$\Rightarrow 5(x+7) = 15 + 3(3x-2)$

$\Rightarrow 5x + 35 = 15 + 9x - 6$

$\Rightarrow 5x - 9x = 15 - 6 - 35$

$\Rightarrow -4x = -26 \Rightarrow x = \frac{-26}{-4}$

$\therefore x = \frac{13}{2} = 6\frac{1}{2}$ **Ans.**

Q. 11. $\frac{4}{5}\left(x + \frac{5}{8}\right) - \frac{2}{3}\left(x - \frac{1}{4}\right) = 1\frac{1}{9}$

Sol. $\frac{4}{5}\left(x + \frac{5}{8}\right) - \frac{2}{3}\left(x - \frac{1}{4}\right) = 1\frac{1}{9}$

$\Rightarrow \frac{4}{5}\frac{(8x+5)}{8} - \frac{2}{3}\frac{(4x-1)}{4} = \frac{10}{9}$

$\frac{8x+5}{10} - \frac{4x-1}{6} = \frac{10}{9}$

Multiplying by 90, the LCM of 10, 6 and 9,

$90 \times \frac{8x+5}{10} - 90 \times \frac{4x-1}{6} = \frac{10}{9} \times 90$

$\Rightarrow 9(8x+5) - 15(4x-1) = 100$

$\Rightarrow 72x + 45 - 60x + 15 = 100$

$\Rightarrow 72x - 60x = 100 - 45 - 15$

$\Rightarrow 2x = 40$

$\therefore x = \frac{40}{12} = \frac{10}{3} = 3\frac{1}{3}$ **Ans.**

Q. 12. $\frac{(x-2)}{3} + \frac{5x}{2} = 6 - \frac{(x-5)}{6}$

Sol. $\frac{(x-2)}{3} + \frac{5x}{2} = 6 - \frac{x-5}{6}$

Multiplying by 6, the LCM of 3, 2 and 6

$6 \times \frac{x-2}{3} + 6 \times \frac{5x}{2} = 6 \times 6 - 6 \times \frac{x-5}{6}$

$\Rightarrow 2(x-2) + 15x = 36 - (x-5)$

$\Rightarrow 2x - 4 + 15x = 36 - x + 5$

$\Rightarrow 2x + 15x + x = 36 + 5 + 4$

$\Rightarrow 18x = 45$

$\therefore x = \frac{45}{18} = \frac{5}{2} = 2\frac{1}{2}$ **Ans.**

Q. 13. $4\frac{1}{3} - \frac{(3x-4)}{5} = \frac{(x-7)}{3}$

Sol. $\frac{13}{3} - \frac{3x-4}{5} = \frac{x-7}{3}$

Multiplying by 15, the LCM of 3 and 5.

$15 \times \frac{13}{3} - 15 \times \frac{3x-4}{5} = 15 \times \frac{x-7}{3}$

$\Rightarrow 65 - 3(3x-4) = 5(x-7)$

$\Rightarrow 65 - 9x + 12 = 5x - 35$

$\Rightarrow -9x - 5x = -35 - 65 - 12$

(By transposition)

$\Rightarrow -14x = -112$

$\therefore x = \frac{-112}{-14} = 8$ **Ans.**

Q.14. $\frac{(y-2)}{4} + \frac{1}{3} = y - \frac{(2y-1)}{3}$

Sol. $\frac{(y-2)}{4} + \frac{1}{3} = y - \frac{(2y-1)}{3}$

Multiplying 12, the LCM of 4 and 3

$12 \times \frac{y-2}{4} + \frac{1}{3} \times 12 = 12y - 12 \times \frac{2y-1}{3}$

$\Rightarrow 3(y-2) + 4 = 12y - 4(2y-1)$

$\Rightarrow 3y - 6 + 4 = 12y - 8y + 4$

$\Rightarrow 3y - 12y + 8y = 4 + 6 - 4$

(By transposition)

$\Rightarrow -y = 6$

$\therefore y = -6$ **Ans.**

Q. 15. $(7x-1) - \left(x - \frac{1-x}{2}\right) = 5x + \frac{1}{2}$

Sol. $(7x-1) - \left[x - \frac{1-x}{2}\right] = 5x + \frac{1}{2}$

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

Multiplying by 2,

$14x - 2 - 2x + \frac{(1-x)}{2} \times 2 = 10x + \frac{1}{2} \times 2$

$\Rightarrow \quad 14x - 2 - 2x + 1 - x = 10x + 1$

$\Rightarrow \quad 14x - 2x - x - 10x = 1 + 2 - 1$

(By transposition)

$\Rightarrow \quad 14x - 13x = 3 - 1$

$\therefore \quad x = 2$ **Ans.**

Q. 16. $\frac{(5x-7)}{4} - \frac{(2x-5)}{3} = \frac{5x}{6}$

Sol. $\frac{5x-7}{4} - \frac{2x-5}{3} = \frac{5x}{6}$

Multiplying by 12, the LCM of 4, 3 and 6

$12 \times \frac{5x-7}{4} - 12 \times \frac{2x-5}{3} = 12 \times \frac{5x}{6}$

$\Rightarrow \quad 3(5x-7) - 4(2x-5) = 10x$

$\Rightarrow \quad 15x - 21 - 8x + 20 = 10x$

$\Rightarrow \quad 15x - 8x - 10x = 21 - 20$

(By transposition)

$\Rightarrow \quad 15x - 18x = 1$

$\Rightarrow \quad -3x = 1$

$\therefore \quad x = -\frac{1}{3}$ **Ans.**

Q. 17. $\frac{5-4x}{3-2x} = 1\frac{6}{7}$

Sol. $\frac{5-4x}{3-2x} = \frac{13}{7}$

By cross multiplication,

$7(5-4x) = 13(3-2x)$

$\Rightarrow \quad 35 - 28x = 39 - 26x$

$\Rightarrow -28x + 26x = 39 - 35$

(By transposition)

$\Rightarrow \quad -2x = 4$

$\therefore \quad x = \frac{4}{-2} = -2$ **Ans.**

18. $\frac{7}{(x-4)} = \frac{5}{(x+2)}$

Sol. $\frac{7}{x-4} = \frac{5}{x+2}$

By cross multiplication,

$7(x+2) = 5(x-4)$

$\Rightarrow \quad 7x + 14 = 5x - 20$

$\Rightarrow \quad 7x - 5x = -20 - 14 \Rightarrow 2x = -34$

$\therefore \quad x = \frac{-34}{2} = -17$ **Ans.**

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

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

By cross multiplication,

$(x+1)(x-3) = (x-2)(x-2)$

$\Rightarrow x^2 - 3x + x - 3 = x^2 - 2x - 2x + 4$

$\Rightarrow x^2 - 3x + x - x^2 + 2x + 2x = 4 + 3$

(By transposition)

$\Rightarrow \quad 5x - 3x = 7 \Rightarrow \quad 2x = 7$

$\therefore \quad x = \frac{7}{2} = 3\frac{1}{2}$ **Ans.**

Q. 20. $\frac{(2x-3)}{(2x-1)} = \frac{(3x-1)}{(3x+1)}$

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

By cross multiplication,

$(2x-3)(3x+1) = (3x-1)(2x-1)$

$\Rightarrow 6x^2 + 2x - 9x - 3 = 6x^2 - 3x - 2x + 1$

$\Rightarrow 6x^2 + 2x - 9x - 6x^2 + 3x + 2x = 1 + 3$

(By transposition)

$\Rightarrow \quad 7x - 9x = 4$

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

$\therefore \quad x = -2$ **Ans.**

Q. 21. $2 - \frac{(3-x)}{(x-1)} = \frac{(3x+4)}{(x+1)}$

Sol. $2 - \frac{3-x}{x-1} = \frac{3x+4}{x+1}$

$$\Rightarrow \quad \frac{2x-2-3+x}{x-1}=\frac{3x+4}{x+1}$$

$$\Rightarrow \quad \frac{3x-5}{x-1}=\frac{3x+4}{x+1}$$

By cross multiplication,

$(3x-5)(x+1)=(3x+4)(x-1)$

$\Rightarrow 3x^2+3x-5x-5$

$=3x^2-3x+4x-4$

$\Rightarrow 3x^2+3x-5x-3x^2+3x-4x$

$=-4+5$

$\Rightarrow 6x-9x=1$

$\Rightarrow \quad -3x=1$

$\therefore \quad x=-\frac{1}{3}$ **Ans.**

Q. 22. $\frac{4}{(x-3)}+\frac{2}{(x-2)}=\frac{6}{x}$

Sol. $\frac{4}{x-3}+\frac{2}{x-2}=\frac{6}{x}$

$$\Rightarrow \quad \frac{4x-8+2x-6}{(x-3)(x-2)}=\frac{6}{x}$$

$$\Rightarrow \quad \frac{6x-14}{x^2-2x-3x+6}=\frac{6}{x}$$

$$\Rightarrow \quad \frac{6x-14}{x^2-5x+6}=\frac{6}{x}$$

By cross multiplication,

$x(6x-14)=6(x^2-5x+6)$

$\Rightarrow \quad 6x^2-14x=6x^2-30x+36$

$\Rightarrow \quad 6x^2-14x-6x^2+30x=36$

$\Rightarrow \quad 16x=36$

$\Rightarrow \quad x=\frac{36}{16}=\frac{9}{4}$

$\therefore \quad x=2\frac{1}{4}$ **Ans.**

Q. 23. Solve :

$$\frac{5y-11}{4}+\frac{3y-7}{2}=\frac{4y-7}{3}+y-1$$

Sol. $\frac{5y-11}{4}+\frac{3y-7}{2}=\frac{4y-7}{3}+y-1$

Multiplying each by 12, the LCM of 4, 2 and 3

$$\frac{5y-11}{4}\times 12+\frac{3y-7}{2}\times 12$$

$$=\frac{4y-7}{3}\times 12+(y-1)\,12$$

$\Rightarrow 3(5y-11)+6(3y-7)$

$=4(4y-7)+12(y-1)$

$\Rightarrow 15y-33+18y-42$

$=16y-28+12y-12$

$\Rightarrow 15y+18y-16y-12y$

$=-28-12+33+42$

$\Rightarrow \quad 33y-28y=75-40$

$\Rightarrow \quad 5y=35$

$\Rightarrow \quad y=\frac{35}{5}=7$

$\therefore \quad y=7$ **Ans.**

Q. 24. Solve : $\frac{(2-x)}{2}-\frac{(x-3)}{3}=1-x.$

Find y, when $\frac{1}{x}+\frac{1}{y}=2.$

Sol. $\frac{2-x}{2}-\frac{x-3}{3}=1-x$

Multiplying by 6, the LCM of 2 and 3

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

$\Rightarrow \quad 3(2-x)-2(x-3)=6-6x$

$\Rightarrow \quad 6-3x-2x+6=6-6x$

$\Rightarrow \quad -3x-2x+6x=6-6-6$

$\therefore \quad x=-6$

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

$\Rightarrow \quad \frac{1}{-6}+\frac{1}{y}=2 \Rightarrow \frac{1}{y}=2+\frac{1}{6}=\frac{13}{6}$

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

Hence $x=6$, and $y=\frac{6}{13}$ **Ans.**

Q. 25. If $x = (k+1)$, find the value of k, when,

$$\frac{1}{2}(5x-3)-\frac{1}{3}(2+9k)=\frac{1}{4}.$$

Sol. $x = k+1$ ...(*i*)

and $\frac{1}{2}(5x-3)-\frac{1}{3}(2+9k)=\frac{1}{4}$ ...(*ii*)

Substitution the value of x in (*ii*)

$$\frac{1}{2}[5(k+1)-3]-\frac{1}{3}(2+9k)=\frac{1}{4}$$

$$\Rightarrow \quad \frac{5}{2}(k+1)-\frac{3}{2}-\frac{2+9k}{3}=\frac{1}{4}$$

Multiplying by 12, the LCM of 2, 3 and 4.

$$12\times\frac{5}{2}(k+1)-12\times\frac{3}{2}-12\times\frac{2+9k}{3}$$

$$=12\times\frac{1}{4}$$

$$\Rightarrow 30(k+1)-6\times 3-4(2+9k)=3$$

$$\Rightarrow 30k+30-18-8-36k=3$$

$$\Rightarrow 30k-36k=3-30+18+8$$

$$\Rightarrow -6k=29-30=-1$$

$$k=\frac{-1}{-6}=\frac{1}{6}$$ **Ans.**

EXERCISE 7 (B)

Q. 1. Find a number, twice of which decreased by 7 gives 65.

Sol. Let the number $= x$

Now according to the condition,

$2x-7=65$

$2x=65+7=72$

$\therefore \quad x=\frac{72}{2}=36$ **Ans.**

Check : $36\times 2-7=72-7=65$

which is given.

Hence number = 36

Q. 2. One-fifth of a number increased by 8 is equal to 23. Find the number.

Sol. Let number $= x$

According to the condition,

$$\frac{1}{5}x+8=23$$

$$\Rightarrow \quad \frac{1}{5}x=23-8=15$$

$$\therefore \quad x=15\times\frac{5}{1}=75$$

Hence number = 75 **Ans.**

Q. 3. Find a number such that one-fifth of it is less than by one-fourth of it by 3.

Sol. Let number $= x$

According to the condition,

$$\frac{x}{5}=\frac{x}{4}-3$$

$$\Rightarrow \quad \frac{x}{4}-\frac{x}{5}=3$$

$$\Rightarrow \quad \frac{5x-4x}{20}=3 \quad \Rightarrow \quad \frac{x}{20}=3$$

$\therefore x=3\times 20=60$

Hence number = 60 **Ans.**

Q. 4. Twice a number increased by 10 is 14 less than thrice the number. Find the number.

Sol. Let number $= x$

According to the condition,

$2x+10=3x-14$

$3x-2x=10+14 \quad \Rightarrow \quad x=24$

Hence number = 24 **Ans.**

Q. 5. Find three consecutive natural numbers whose sum is 120.

Sol. Let first natural number $= x$

second natural number $= x+1$

and third natural number $= x+2$

According to the condition,

$x+x+1+x+2=120$

$$\Rightarrow \quad 3x+3=120$$

$$\Rightarrow \quad 3x=120-3=117$$

$$\therefore \quad x=\frac{117}{3}=39$$

$\therefore$ first natural number = 39

and other numbers = 40, 41

Hence numbers are 39, 40, 41 **Ans.**

Q. 6. The difference of the squares of two consecutive even natural numbers is 92. Find the numbers.

Sol. Let first even number $= x$

then second even number $= x + 2$

According to the condition,

$$(x+2)^2 - x^2 = 92$$

$$\Rightarrow \quad x^2 + 4x + 4 - x^2 = 92$$

$$\Rightarrow \quad 4x + 4 = 92$$

$$\Rightarrow \quad 4x = 92 - 4 = 88$$

$$\therefore \quad x = \frac{88}{4} = 22$$

Hence First even number $= 22$

and second even number $= 22 + 2$

$= 24$ **Ans.**

Q. 7. Find two consecutive positive odd integers whose sum is 156.

Sol. Let first odd number $= 2x + 1$

Then second odd number $= 2x + 3$

$\therefore$ According to the condition,

$$2x + 1 + 2x + 3 = 156$$

$$\Rightarrow \quad 4x + 4 = 156$$

$$\Rightarrow \quad 4x = 156 - 4 = 152$$

$$\therefore \quad x = \frac{152}{4} = 38$$

$\therefore$ First odd number $= 2x + 1$

$= 2 \times 38 + 1 = 76 + 1 = 77$

and second odd number $= 77 + 2 = 79$

Hence odd numbers are $= 77, 79$ **Ans.**

Q. 8. Find two consecutive positive even integers whose sum is 130.

Sol. Let first even positive integer $= 2x$

then second even number $= 2x + 2$

According to the condition,

$$2x + 2x + 2 = 130$$

$$\Rightarrow \quad 4x + 2 = 130$$

$$\Rightarrow \quad 4x = 130 - 2 = 128$$

$$\therefore \quad x = \frac{128}{4} = 32$$

$\therefore$ First even number $= 2x = 2 \times 32 = 64$

and second number $= 2x + 2 = 64 + 2 = 66$

Hence numbers are 64, 66 **Ans.**

Q. 9. The sum of two numbers is 58 and their difference is 12. Find the numbers.

Sol. Sum of two numbers $= 58$

Let first number $= x$

then second number $= 58 - x$

According to the condition,

$$x - (58 - x) = 12$$

$$\Rightarrow \quad x - 58 + x = 12$$

$$\Rightarrow \quad 2x = 12 + 58$$

$$\Rightarrow \quad 2x = 70$$

$$\therefore \quad x = \frac{70}{2} = 35$$

$\therefore$ First number $= 35$

and second number $= 58 - 35 = 23$

Hence numbers are 35 and 23 **Ans.**

Q. 10. Divide 88 into two parts such that when the larger is divided by the smaller, the quotient is 3 and the remainder is 4.

Sol. Sum of two parts $= 88$

Let larger part $= x$

and smaller part $= 88 - x$

Quotient $= 3$ and remainder $= 4$

We know that Dividend $=$ Divisor $\times$ Quotient + Remainder

$\therefore$ Larger part $=$ smaller part $\times 3 + 4$

$$\Rightarrow \quad x = (88 - x) \times 3 + 4$$

$$\Rightarrow \quad x = 264 - 3x + 4$$

$$\Rightarrow \quad x + 3x = 268 \Rightarrow 4x = 268$$

$$\therefore \quad x = \frac{268}{4} = 67$$

$\therefore$ Larger part $= 67$

and smaller part $= 88 - 67 = 21$ **Ans.**

Q. 11. The ages of A and B are in the ratio 9 : 4 Seven years hence, the ratio of their age will be 5 : 3. Find their present ages.

Sol. Ratio in the present ages of A and B

$= 9 : 4$

Let A's age = $9x$

then B's age = $4x$

7 years hence,

A's age will be = $9x + 7$

and B's age will be = $4x + 7$

According to the condition,

$$\frac{9x+7}{4x+7} = \frac{5}{3}$$

$$\Rightarrow \quad 3(9x+7) = 5(4x+7)$$

$$\Rightarrow \quad 27x + 21 = 20x + 35$$

$$\Rightarrow \quad 7x - 20x = 35 - 21$$

$$\Rightarrow \quad 7x = 14$$

$$\therefore \quad x = \frac{14}{7} = 2$$

$\therefore$ A's present age = $9x = 9 \times 2$

= 18 years

and B's age = $4x = 4 \times 2 = 8$ years **Ans.**

Q. 12. 10 years ago, a man was six times as old as his daughter. After 10 years, he will be twice as old as his daughter. Find their present ages.

Sol. 10 years ago,

Let age of daughter = x years

then age of father = $6x$ years

Present age of daughter = $(x + 10)$ years

and age of father = $(6x + 10)$ years

and 10 years after,

age of daughter = $(x + 10 + 10)$

= $(x + 20)$ years

and age of father = $(6x + 10 + 10)$

= $(6x + 20)$ years

According to the condition,

$$6x + 20 = 2(x + 20)$$

$$\Rightarrow \quad 6x + 20 = 2x + 40$$

$$\Rightarrow \quad 6x - 2x = 40 - 20 \Rightarrow 4x = 20$$

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

$\therefore$ Present age of daughter = $(x + 10)$ years

= $5 + 10 = 15$ years

and age of father = $6x + 10$

= $6 \times 5 + 10 = 30 + 10 = 40$ years

Hence their present ages are 40 years and 15 years **Ans.**

Q. 13. Meena is five times as old as her son Ashish. In 8 years time, Meena will be three times as old as Ashish. Find their present ages.

Sol. Let present age of her son Ashish

= x years

then Meena's age = $5x$ years

After 8 years,

Age of Ashish will be = $(x + 8)$ years

and age of Meena = $(5x + 8)$ years

According to the condition,

$$5x + 8 = 3(x + 8)$$

$$\Rightarrow \quad 5x + 8 = 3x + 24$$

$$\Rightarrow \quad 5x - 3x = 24 - 8$$

$$\Rightarrow \quad 2x = 16 \Rightarrow x = \frac{16}{2} = 8$$

$\therefore$ Ashish's present age = 8 years

and Meena's age = $5x = 5 \times 8$

= 40 years **Ans.**

Q. 14. A number consists of two digits. The digit at ten's place is twice the digit at units place. The number formed by reversing the digits is 27 less than the original number. Find the original number.

Sol. Let digit at unit's place = x

then digit at ten's place = $2x$

$\therefore$ number = $x + (10 \times 2x)$

= $x + 20x = 21x$

By reversing the digits,

the unit's digit = $2x$

and ten's digit = x

$\therefore$ Number = $2x + 10 \times x = 2x + 10x$

= $12x$

According to the condition,

$$12x = 21x - 27$$

$\Rightarrow 12x - 21x = -27 \Rightarrow -9x = -27$

$\therefore \quad x = \frac{-27}{-9} = 3$

$\therefore$ Original number $= 21x = 21 \times 3$

$= 63$ **Ans.**

Q. 15. The ten's digit of a two-digit number exceeds its unit's digit by 5. The number itself is equal to 8 times the sum of the digits. Find the number.

Sol. Let unit's digit of the number $= x$

then ten's digit $= x + 5$

$\therefore$ Number $= x + 10\,(x + 5)$

$= x + 10x + 50 = 11x + 50$

According to the condition,

$11x + 50 = 8\,(x + x + 5) = 8\,(2x + 5)$

$\Rightarrow 11x + 50 = 16x + 40$

$\Rightarrow 11x - 16x = 40 - 50$

$\Rightarrow \quad -5x = -10$

$\therefore \quad x = \frac{-10}{-5} = 2.$

Hence number $= 11x + 50 = 11 \times 2 + 50$

$= 22 + 50 = 72$ **Ans.**

Q. 16. The denominator of a fraction is 4 more than its numerator. If 1 is subtracted from both the numerator and the denominator, the fraction becomes $\frac{1}{2}$. Find the original fraction.

Sol. Let numerator of the fraction $= x$

then its denominator $= x + 4$

$\therefore$ Fraction $= \frac{x}{x+4}$

According to the condition,

$\frac{x-1}{x+4-1} = \frac{1}{2} \Rightarrow \frac{x-1}{x+3} = \frac{1}{2}$

$\Rightarrow \quad 2x - 2 = x + 3$

(By cross multiplication)

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

$\therefore$ Fraction $= \frac{x}{x+4} = \frac{5}{5+4} = \frac{5}{9}$ **Ans.**

Q. 17. The height of a triangle is 3 cm more than its base. If the area of the triangle is 104 cm^2, find the lengths of its base and height.

Sol. Let base of a triangle $(b) = x$ cm

then height $(h) = (x + 3)$ cm

and area (A) $= 104\ cm^2$

According to the condition,

$\frac{1}{2} b \times h = A$

$\Rightarrow \quad \frac{1}{2} x \times (x + 3) = 104$

$\Rightarrow \quad x\,(x + 3) = 208$

$\Rightarrow \quad x^2 + 3x - 208 = 0$

$\Rightarrow x^2 + 16x - 13x - 208 = 0$

$\{\because 3 = 16 - 13$, and $-208 = 16 \times (-13)\}$

$\Rightarrow x\,(x + 16) - 13\,(x + 16) = 0$

$\Rightarrow \quad (x + 16)\,(x - 13) = 0$

Either $x + 16 = 0$, then $x = -16$ which is not possible as it is in negative

or $x - 13 = 0$ then $x = 13$

$\therefore \quad$ Base $= 13$ cm

and height $= 13 + 3 = 16$ cm **Ans.**

Q. 18. Last year the prices of two houses were in the ratio 16 : 23. This year, the price of the first house has risen by 25% and that of the second by Rs. 5200 and the ratio of their new prices is 9 : 11. Find their last year's prices.

Sol. Let the price of first house $= 16x$

then price of second house $= 23x$

This year, the price of first house

$= \frac{16x\,(100 + 25\%)}{100}$

$= 16x \times \frac{125}{100} = 20x.$

and price of second house $= 23x + 5200$

According to the condition,

$\frac{20x}{23x + 5200} = \frac{9}{11}$

By cross multiplication,

$\Rightarrow 11 \times 20x = 9\,(23x + 5200)$

$\Rightarrow 220x = 207x + 46800$

$\Rightarrow 220x - 207x = 46800$

$\Rightarrow 13x = 46800 \Rightarrow x = \dfrac{46800}{13}$

$\therefore \quad x = 3600$

$\therefore$ Price of first house $= 16x = 16 \times 3600$

$= \text{Rs. } 57600$

and price of second house $= 23x$

$= 23 \times 3600$

$= \text{Rs. } 82800$ **Ans.**

Q. 19. There are 100 multiple-choice questions in an engineering enterance examination. A candidate was given 5 marks for every correct answer and penalised 2 marks for every wrong answer. Pankaj answered all the questions and scored 241 marks. How many questions did he answer correctly?

Sol. Let no. of questions answered correctly $= x$

then no. of questions which were wrongly attempted $= 100 - x$

According to the condition,

$x \times 5 - (100 - x) \times 2 = 241$

$\Rightarrow 5x - 200 + 2x = 241$

$\Rightarrow 7x = 241 + 200 = 441$

$x = \dfrac{441}{7} = 63$

$\therefore$ No. of questions, he answered correctly $= 63$ **Ans.**

Q. 20. A worker in a factory is paid Rs. 20 per hour for normal work and Rs. 30 per hour for overtime work. During a week, he worked for 40 hours, out of which x hours was overtime. If he receives Rs. 880 in all, write an equation in x. Solve it and hence find the number of hours of his normal work during the week.

Sol. During a week, working hours $= 40$

No. of hours as overtime $= x$

then no. of hours for normal time $= 40 - x$

Payment is made = Rs. 20 for a normal hour and Rs. 30 for overtime hour.

Total payment received by a worker

$= \text{Rs. } 880$

According to the condition,

$(40 - x) \times 20 + x \times 30 = 880$

$\Rightarrow 20\,(40 - x) + 30x = 880$

$\Rightarrow 800 - 20x + 30x = 880$

$\Rightarrow 10x = 880 - 800 = 80$

$\therefore \quad x = \dfrac{80}{10} = 8$

$\therefore$ No. of hours for overtime $= 8$ hours

and normal hours $= 40 - 8$

$= 32$ hours. **Ans.**

Q. 21. The perimeter of a rectangular park is 80 m. If the length of the park be decreased by 2 m and breadth increased by 2 m, the area will be increased by 36 m^2. Find the original length and breadth of the park.

Sol. Perimeter of a rectangular park $= 80$ m

$\therefore$ Length + breadth $= \dfrac{80}{2} = 40$ m.

Let length of park $= x$ m

then breadth $= (40 - x)$ m

and area $= lb = x\,(40 - x)\ m^2$

According to the condition,

$(x - 2)\,[40 - x + 2] = x\,(40 - x) + 36$

$(x - 2)\,(42 - x) = 40x - x^2 + 36$

$42x - x^2 - 84 + 2x = 40x - x^2 + 36$

$\Rightarrow 42x - x^2 + 2x - 40x + x^2 = 36 + 84$

$\Rightarrow 44x - 40x = 120 \Rightarrow 4x = 120$

$\therefore \quad x = \dfrac{120}{4} = 30$

$\therefore$ Length of park $= 30$ m

and breadth $= 40 - 30 = 10$ m **Ans.**

Q. 22. A man invested Rs. 5000, a part of it at 12% p.a and the rest at 14% p.a. If he received a total interest of Rs. 636, how much did he invest at 14% p.a. ?

Sol. Total sum invested = Rs. 5000

Let investment at 14% = Rs. x

then investment at 12% = Rs. $(5000 - x)$

Total interest received = Rs. 636

According to the condition,

$$\frac{x \times 14 \times 1}{100} + \frac{(5000 - x) \times 12 \times 1}{100} = 636$$

$$\Rightarrow \frac{14x}{100} + \frac{12(5000 - x)}{100} = 636$$

$$\Rightarrow 14x + 12(5000 - x) = 63600$$

$$\Rightarrow 14x + 60000 - 12x = 63600$$

$$\Rightarrow 14x - 12x = 63600 - 60000$$

$$\Rightarrow 2x = 3600$$

$$\therefore x = \frac{3600}{2} = 1800$$

Hence sum invested on 14% p.a.

= Rs. 1800 **Ans.**

Q. 23. By selling a T.V. set for Rs. 27600, a trader makes a profit of 15%. What is the cost price of the set ?

Ans. Let CP of the T.V. set = Rs. x

Gain = 15%

S.P. = Rs. 27600

According to the condition,

$$SP = \frac{CP(100 + \text{gain}\%)}{100}$$

$$27600 = \frac{x \times (100 + 15)}{100} = \frac{115x}{100}$$

$$\therefore 115x = 27600 \times 100 = 2760000$$

$$x = \frac{2760000}{115} = \text{Rs. } 24000$$

$\therefore$ Cost price of the set = Rs. 24000 **Ans.**

Q. 24. The total cost of a desk and a chair is Rs. 477. If the desk costs 12% more than the chair, find the cost of each.

Sol. Total cost of desk and chair = Rs. 477

Let cost of chair = x

then cost of desk = $\frac{x \times (100 + 12)}{100}$

$$= \frac{112}{100}x$$

According to the condition,

$$x + \frac{112}{100}x = 477$$

$$\Rightarrow 100x + 112x = 47700$$

$$\Rightarrow 212x = 47700$$

$$\Rightarrow x = \frac{47700}{212} = 225$$

$\therefore$ Cost of chair = Rs. 225

and cost of desk = Rs. 477 – 225

= Rs. 252 **Ans.**

Q. 25. Amit walks from his house to school at a speed of 3 kmph and returns back at a speed of 4 kmph. If he takes 42 minutes for the whole journey, find the distance between his house and the school.

Sol. Let the distance between school and house = x km

Total time taken = 42 minutes

$$= \frac{42}{60} \text{ hours}$$

According to the condition,

$$\frac{x}{3} + \frac{x}{4} = \frac{42}{60} \left[\because \text{Time} = \frac{\text{Distance}}{\text{Speed}}\right]$$

$$\Rightarrow \frac{4x + 3x}{12} = \frac{42}{60}$$

$$\Rightarrow \frac{7x}{12} = \frac{42}{60}$$

$$\Rightarrow x = \frac{42}{60} \times \frac{12}{7} = \frac{6}{5}$$

$\therefore$ Distance between his house and school

$$= \frac{6}{5} \text{km} = 1{\cdot}2 \text{ km}$$ **Ans.**

Q. 26. A man covers a distance of 184 km in 3 hours 30 minutes, partly by bus and partly by car. If their speeds be 48 kmph and 60 kmph respectively, find the distance covered by bus.

Sol. Total distance = 184 km.

Total time taken = 3 hour 30 minutes

$$= 3\frac{1}{2} = \frac{7}{2} \text{ hours.}$$

Let the distance covered by bus = x km

then the distance covered by car

$$= (184 - x) \text{ km}$$

According to the condition,

$$\frac{x}{48} + \frac{184 - x}{60} = \frac{7}{2}$$

$$\left[\because \text{Time} = \frac{\text{Distance}}{\text{Speed}}\right]$$

Multiplying by 240, the LCM of 48, 60 and 2

$$240 \times \frac{x}{48} + 240 \times \frac{184 - x}{60} = \frac{7}{2} \times 240$$

$$\Rightarrow 5x + 4\,(184 - x) = 840$$

$$\Rightarrow \quad 5x + 736 - 4x = 840$$

$$\Rightarrow 5x - 4x = 840 - 736$$

$$\Rightarrow \qquad x = 104$$

$\therefore$ Distance covered by bus = 104 km **Ans.**

Q. 27. A steamer goes down stream and covers the distance between two ports in 4 hours white it covers the same distance upstream in 5 hours. If the speed of the stream be 3 kmph, find the speed of the steamer in still water.

Sol. Let the speed of steamer in still water

$$= x \text{ kmph}$$

Speed of stream = 3 kmph

$\therefore$ Speed of down stream = $(x + 3)$ kmph

and speed of upstream = $(x - 3)$ kmph

According to the condition,

$$(x + 3) \times 4 = (x - 3) \times 5$$

$$4x + 12 = 5x - 15$$

$$4x - 5x = -15 - 12$$

$$\Rightarrow \qquad -x = -27$$

$$\therefore \qquad x = 27$$

Hence speed of steamer in still water

$$= 27 \text{ kmph } \textbf{Ans.}$$

Q. 28. How much pure alcohol be added to a 400 ml, 15% solution to make it contain 32% alcohol ?

Sol. Solution = 400 ml.

and alcohol = 15%

$\therefore$ Alcohol in the solution $= \frac{400 \times 25}{100}$

$$= 60 \text{ ml.}$$

Let x ml of alcohol be added to make the solution 32%

According to the condition,

$$\left(\frac{60 + x}{400 + x}\right) \times 100 = 32$$

$$\Rightarrow \frac{60 + x}{400 + x} = \frac{32}{100}$$

$$100\,(60 + x) = 32\,(400 + x)$$

(By cross multiplication)

$$6000 + 100x = 12800 + 32x$$

$$100x - 32x = 12800 - 6000$$

$$68x = 6800$$

$$x = \frac{6800}{68} = 100$$

$\therefore$ 100 ml of alcohol is to be added **Ans.**

Q. 29. In a class room, there are x seats. If each student in the class occupies one seat, then 9 students remain standing and if 2 students occupy one seat, then 7 seats are left un–occupied. Find the number of seats in the class room and the number of students in the class.

Sol. No. of seats = x

If one student occupies one seat then number of students = $x + 9$

If two students occupy one seat then

number of students = 2 $(x-7)$

$\therefore \quad x+9=2(x-7)$

$\Rightarrow 2x-14=x+9$

$\Rightarrow \quad 2x-x=14+9$

$\Rightarrow \qquad x=23$

$\therefore$ No. of seats = 23

and no. of students = $x+9=23+9$

$=32$ **Ans.**

Q. 30. In a shooting competition, a marks man receives Rs. 2 if he hits the mark and pays Re. 1 if he misses it. He tried 60 shots and was paid Rs. 18. How many times did he hit the mark ?

Sol. No. of shots = 60 and amount received

= Rs. 18

Let no. of shots hit by him = x

then no. of shots missed = $60-x$

According to the condition,

$x \times 2-(60-x) \times 1=18$

$2x-60+x=18$

$\Rightarrow 3x=18+60$

$\Rightarrow 3x=78 \Rightarrow x=\frac{78}{3}=26$

$\therefore$ No. of shots he hit = 26 **Ans.**

EXERCISE 7 (C)

Q. 1. Solve the following simultaneous equations :

$x+y-7=0, \quad y+3=x.$

Sol. $x+y-7=0$ ...(*i*)

$y+3=x$ ...(*ii*)

From (*ii*), substitute the value of x in (*i*)

$y+3+y-7=0 \Rightarrow 2y-4=0$

Substituting the value of y in (*i*),

$x+4x-5=0 \Rightarrow 5x-5=0$

$\Rightarrow \quad 5x=5 \Rightarrow x=\frac{5}{5}=1$

Now substituting the value of x in (*iii*),

$y=4 \times 1=4$

Hence $x=1, y=4$ **Ans.**

Q. 2. $x+y-5=0, y-2x=2x.$

Sol. $x+y-5=0$ ...(*i*)

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

From (*ii*)

$y=2x+2x=4x$ ...(*iii*)

$x=1-2 \times (-2)=1+4=5$

Hence $x=5, \quad y=-2$ **Ans.**

Q. 3. $x+2y-1=0, 3x-y-17=0$

Sol. $x+2y-1=0$ ...(*i*)

$3x-y-17=0$ ...(*ii*)

From (*i*) $x=1-2y$ ...(*iii*)

Substituting the value of x in (*ii*),

$3(1-2y)-y-17=0$

$\Rightarrow \quad 3-6y-y-17=0$

$\Rightarrow -7y-14=0 \Rightarrow 7y+14=0$

$\Rightarrow \quad 7y=-14 \Rightarrow y=\frac{-14}{7}=-2$

Substituting the value of y in (*iii*)

$x=1-2 \times -2$

$\Rightarrow x=1+4$

$\Rightarrow x=5$

Hence $x=5, y=-2$ **Ans.**

Q. 4. $5x + 4y - 4 = 0, x - 20 = 12y$

Sol. $5x + 4y - 4 = 0$ ...(*i*)

$x - 20 = 12y$ ...(*ii*)

From (*ii*), $x = 12y + 20$ ...(*iii*)

Substituting the value of x in (*i*)

$$5(12y + 20) + 4y - 4 = 0$$

$$\Rightarrow \quad 60y + 100 + 4y - 4 = 0$$

$$\Rightarrow \quad 64y + 96 = 0 \Rightarrow 64y = -96$$

$$\Rightarrow \qquad y = \frac{-96}{64} = -\frac{3}{2}$$

Substituting the value of y in (*iii*)

$$x = 12 \times \left(\frac{-3}{2}\right) + 20$$

$$= -18 + 20 = 2$$

Hence $x = 2, y = \frac{-3}{2}$ **Ans.**

Q. 5. $x + 2y + 9 = 0, 3x + 4y + 17 = 0$

Sol. $x + 2y + 9 = 0$ ...(*i*)

$3x + 4y + 17 = 0$ ...(*ii*)

From (*i*) $x = -2y - 9$ ...(*iii*)

Substituting the value of x in (*ii*)

$$3(-2y - 9) + 4y + 17 = 0$$

$$\Rightarrow \quad -6y - 27 + 4y + 17 = 0$$

$$\Rightarrow \quad -2y - 10 = 0 \Rightarrow -2y = 10$$

$$\therefore \qquad y = \frac{10}{-2} = -5$$

Substituting the value of y in (*iii*)

$$x = -2(-5) - 9 = +10 - 9 = 1$$

Hence $x = 1, y = -5$ **Ans.**

Q. 6. $2x + 3y = 23, 5x - 20 = 8y$

Sol. $2x + 3y = 23$ ...(*i*)

$5x - 20 = 8y$ ...(*ii*)

From (*ii*), $8y = 5x - 20$

$$y = \frac{5x - 20}{8} \quad \text{...(iii)}$$

Substituting the value of y in (*i*)

$$2x + 3\left(\frac{5x - 20}{8}\right) = 23$$

$$2x + \frac{15x - 60}{8} = 23$$

$$16x + 15x - 60 = 184$$

(Multiplying by 8)

$$31x = 184 + 60 = 244$$

$$x = \frac{244}{31} = 7\frac{27}{31}$$

Substituting the value of x in (*iii*)

$$y = \frac{\left[5 \times \frac{244}{31} - 20\right]}{8} = \frac{\frac{1220}{31} - 20}{8}$$

$$= \frac{1220 - 620}{31 \times 8} = \frac{600}{31 \times 8} = \frac{75}{31}$$

$$= 2\frac{13}{31}$$

Hence $x = 7\frac{27}{31}$ and $y = 2\frac{13}{31}$ **Ans.**

Q. 7. $3x + 7y = 15, 5x - 129 = 23y$

Sol. $3x + 7y = 15$ ...(*i*)

$5x - 129 = 23y$ ...(*ii*)

From (*ii*) $23y = 5x - 129$

$$\Rightarrow \qquad y = \frac{5x - 129}{23} \quad \text{...(iii)}$$

Substituting the value of y in (*i*)

$$3x + 7\left(\frac{5x - 129}{23}\right) = 15$$

$$\Rightarrow \qquad 3x + \frac{35x - 903}{23} = 15$$

$$\Rightarrow \qquad 69x + 35x - 903 = 345$$

(Multiplying by 23)

$$\Rightarrow \qquad 104x = 345 + 903$$

$$\Rightarrow \qquad 104x = 1248$$

$$\Rightarrow \qquad x = \frac{1248}{104} = 12$$

Substituting the value of x in (iii),

$$y = \frac{5 \times 12 - 129}{23} = \frac{60 - 129}{23} = \frac{-69}{23}$$

$$= -3$$

Hence $x = 12$ and $y = -3$ **Ans.**

Q. 8. $3 - (x - 5) = y + 2,\ 2(x + y) = 4 - 3y$

Sol. $3 - (x - 5) = y + 2$

$3 - x + 5 = y + 2$

$8 - x = y + 2 \Rightarrow x + y = 8 - 2$

$\Rightarrow \quad x + y = 6 \qquad ...(i)$

$2(x + y) = 4 - 3y$

$\Rightarrow \quad 2x + 2y = 4 - 3y$

$\Rightarrow 2x + 2y + 3y = 4$

$\Rightarrow \quad 2x + 5y = 4$

$\therefore \quad 2x + 5y = 4 \qquad ...(ii)$

From (1) $\quad x = 6 - y \qquad ...(iii)$

Substituting the value of x in (ii),

$2(6 - y) + 5y = 4$

$12 - 2y + 5y = 4$

$3y = 4 - 12 = -8$

$$y = \frac{-8}{3}$$

Substituting the value of y in (iii),

$$x = 6 - \left(-\frac{8}{3}\right) = 6 + \frac{8}{3}$$

$$= \frac{18 + 8}{3} = \frac{26}{3}$$

Hence $x = \frac{26}{3},\ y = \frac{-8}{3}$ **Ans.**

Q. 9. $2x - \frac{3y}{4} = 3,\ 5x = 2y + 7$

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

$\Rightarrow \quad 8x - 3y = 12$

(Multiplying by 4)

$8x - 3y = 12 \qquad ...(i)$

$5x = 2y + 7 \qquad ...(ii)$

From (ii),

$$x = \frac{2y + 7}{5} \qquad ...(iii)$$

Substituting the value of x in (i),

$$8\left(\frac{2y + 7}{5}\right) - 3y = 12$$

$$\Rightarrow \quad \frac{16y + 56}{5} - 3y = 12$$

$\Rightarrow \quad 16y + 56 - 15y = 60$

(Multiplying by 5)

$\Rightarrow 16y - 15y = 60 - 56$

$y = 4$

Substituting the value of y in (iii),

$$x = \frac{2 \times 4 + 7}{5} = \frac{8 + 7}{5} = \frac{15}{5} = 3$$

Hence $x = 3,\ y = 4$ **Ans.**

Q. 10. $x - \frac{2}{3}y = \frac{8}{3},\ \frac{2x}{5} - y = \frac{7}{5}$

Sol. $x - \frac{2}{3}y = \frac{8}{3} \qquad ...(i)$

$$\frac{2x}{5} - y = \frac{7}{5} \qquad ...(ii)$$

From (i)

$$x = \frac{8}{3} + \frac{2}{3}y = \frac{8 + 2y}{3} \qquad ...(iii)$$

Substituting the value of y in (ii),

$$\frac{2}{5}\left(\frac{8 + 2y}{3}\right) - y = \frac{7}{5}$$

$$\Rightarrow \quad \frac{16 + 4y}{15} - y = \frac{7}{5}$$

$\Rightarrow \quad 16 + 4y - 15y = 21$

(Multiplying by 15, the L.C.M. of 15, 5)

$\Rightarrow \quad -11y = 21 - 16 = 5$

$$y = \frac{-5}{11}$$

Substituting the value of y in (iii),

$$x = \frac{8 + 2\left(\frac{-5}{11}\right)}{3} = \frac{8 - \frac{10}{11}}{3}$$

$$= \frac{88 - 10}{11 \times 3} = \frac{78}{11 \times 3}$$

$$x = \frac{26}{11}$$

Hence $x = \frac{26}{11}, y = \frac{-5}{11}$ **Ans.**

Q. 11. $\frac{3}{5}x - \frac{2}{3}y + 1 = 0, \frac{2}{5}x + \frac{1}{3}y - 4 = 0$

Sol. $\frac{3}{5}x - \frac{2}{3}y + 1 = 0$

$\Rightarrow 15 \times \frac{3}{5}x - 15 \times \frac{2}{3}y + 15 = 0$

(Multiplying by 15, the L.C.M. of 5, 3)

$\Rightarrow 9x - 10y + 15 = 0$ ...(*i*)

Again $\frac{2}{5}x + \frac{1}{3}y - 4 = 0$

$15 \times \frac{2}{5}x + 15 \times \frac{1}{3}y - 4 \times 15 = 0$

(Multiplying by 15, the L.C.M. of 5, 3)

$6x + 5y - 60 = 0$ ...(*ii*)

Multiply (*i*) by 2 and (*ii*) by 3,

$18x - 20y + 30 = 0$

$18x + 15y - 180 = 0$

$- \quad - \quad +$

Subtracting, we get,

$-35y + 210 = 0 \Rightarrow -35y = -210$

$y = \frac{-210}{-35} = 6$

Substituting the value of y in (*i*),

$9x - 10(6) + 15 = 0$

$\Rightarrow 9x - 60 + 15 = 0$

$\Rightarrow 9x - 45 = 0 \Rightarrow 9x = 45$

$\therefore x = \frac{45}{9} = 5$

Hence $x = 5, y = 6$ **Ans.**

Q. 12. $\frac{x}{7} + \frac{y}{3} = 5, \frac{x}{2} - \frac{y}{9} = 6$

Sol. $\frac{x}{7} + \frac{y}{3} = 5$

Multiplying by 21, the L.C.M. of 7, 3

$21 \times \frac{x}{7} + 21 \times \frac{y}{3} = 21 \times 5$

$3x + 7y = 105$ ...(*i*)

Again $\frac{x}{2} - \frac{y}{9} = 6$

Multiplying by 18, the L.C.M. of 2 and 9,

$18 \times \frac{x}{2} - 18 \times \frac{y}{9} = 6 \times 18$

$9x - 2y = 108$ ...(*ii*)

Multiplying (*i*) by 3 and (*ii*) by 1

$9x + 21y = 315$

$9x - 2y = 108$

$- \quad + \quad -$

Subtracting, we get,

$23y = 207$

$y = \frac{207}{23} = 9$

Substituting the value of y in (*i*),

$3x + 7 \times 9 = 105 \Rightarrow 3x + 63 = 105$

$3x = 105 - 63 = 42$

$x = \frac{42}{3} = 14$

Hence $x = 14, y = 9$ **Ans.**

Q. 13. $\frac{x}{3} + \frac{y}{4} = 11, \frac{5x}{6} - \frac{y}{3} + 7 = 0$

Sol. $\frac{x}{3} + \frac{y}{4} = 11$

Multiplying by 12, the L.C.M. of 3 and 4

$12 \times \frac{x}{3} + 12 \times \frac{y}{4} = 12 \times 11$

$4x + 3y = 132$ ...(*i*)

Again $\frac{5x}{6} - \frac{y}{3} + 7 = 0$

Multiplying by 6, the L.C.M. of 6 and 3

$$6 \times \frac{5}{6}x - 6 \times \frac{y}{3} + 6 \times 7 = 0$$

$$5x - 2y + 42 = 0$$

$$5x - 2y = -42 \quad \ldots(ii)$$

Multiply (i) by 5 and (ii) by 4,

$$20x + 15y = 660$$

$$20x - 8y = -168$$

$$- \quad + \quad +$$

Subtracting, we get,

$$23y = 828$$

$$y = \frac{828}{23} = 36$$

Substituting the value of y in (i),

$$4x + 3 \times 36 = 132$$

$$\Rightarrow \quad 4x + 108 = 132$$

$$\Rightarrow \quad 4x = 132 - 108 = 24$$

$$\Rightarrow \quad x = \frac{24}{4} = 6$$

Hence $x = 6, y = 36$ **Ans.**

Q. 14. $\frac{x}{6} + 6 = y, \ \frac{3x}{4} = 1 + y$

Sol. $\frac{x}{6} + 6 = y \Rightarrow y = \frac{x + 36}{6} \quad \ldots(i)$

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

From (i) and (ii)

$$\frac{x + 36}{6} = \frac{3x}{4} - 1$$

$$\Rightarrow \quad \frac{x + 36}{6} = \frac{3x - 4}{4}$$

By cross multiplication,

$$4(x + 36) = 6(3x - 4)$$

$$4x + 144 = 18x - 24$$

$$4x - 18x = -24 - 144$$

$$\Rightarrow \quad -14x = -168$$

$$x = \frac{-168}{-14} = 12$$

Substituting the value of x in (i),

$$y = \frac{12 + 36}{6} = \frac{48}{6} = 8$$

Hence $x = 12, y = 8$ **Ans.**

Q. 15. $x - y = \frac{9}{10}, \ \frac{11}{2(x + y)} = 1$

Sol. $x - y = \frac{9}{10} \quad \ldots(i)$

$$\frac{11}{2(x + y)} = 1 \Rightarrow 2(x + y) = 11$$

$$x + y = \frac{11}{2} \quad \ldots(ii)$$

Adding (i) and (ii),

$$2x = \frac{9}{10} + \frac{11}{2} = \frac{9 + 55}{10} = \frac{64}{10}$$

$$x = \frac{64}{10 \times 2} = \frac{16}{5}$$

Subtracting (i) from (ii),

$$2y = \frac{11}{2} - \frac{9}{10} = \frac{55 - 9}{10} = \frac{46}{10}$$

$$y = \frac{46}{10 \times 2} = \frac{23}{10}$$

Hence $x = \frac{16}{5}$ and $y = \frac{23}{10}$ **Ans.**

Q. 16. $\frac{x}{2} + y = 0{\cdot}8, \ \frac{7}{x + \frac{y}{2}} = 10$

Sol. $\frac{x}{2} + y = 0{\cdot}8$

$$\Rightarrow \quad x + 2y = 1{\cdot}6 \quad \ldots(i)$$

And $\frac{7}{x + \frac{y}{2}} = 10$

$$\Rightarrow \quad x + \frac{y}{2} = \frac{7}{10} = 0{\cdot}7 \quad \ldots(ii)$$

Subtracting (*ii*) from (*i*)

$$2y - \frac{y}{2} = 1{\cdot}6 - 0{\cdot}7 \Rightarrow \frac{3}{2}y = 0{\cdot}9$$

$$y = \frac{0{\cdot}9 \times 2}{3} = 0{\cdot}6 = \frac{3}{5}$$

Substituting the value of y in (*i*)

$$x + 2 \times \frac{3}{5} = \frac{16}{10} \Rightarrow x + \frac{6}{5} = \frac{8}{5}$$

$$x = \frac{8}{5} - \frac{6}{5} = \frac{2}{5}$$

Hence $x = \frac{2}{5}$ and $y = \frac{3}{5}$ **Ans.**

Q. 17. Solve the following simultaneous equations :

$$4x + \frac{x-y}{8} = 17,\ x + 2y = \frac{y-2}{3} - 2$$

Sol. $4x + \frac{x-y}{8} = 17$

$\Rightarrow 32x + x - y = 136$

$\Rightarrow \quad 33x - y = 136 \quad ...(i)$

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

$\Rightarrow \quad 3x + 6y = y - 2 - 6$

$\Rightarrow 3x + 6y - y = -8$

$\Rightarrow \quad 3x + 5y = -8 \quad ...(ii)$

From (*i*),

$$y = 33x - 136 \quad ...(iii)$$

Substituting the value of y in (*ii*),

$3x + 5(33x - 136) = -8$

$\Rightarrow \quad 3x + 165x - 680 = -8$

$\Rightarrow \quad 168x = -8 + 680 = 672$

$$x = \frac{672}{168} = 4$$

Substituting the value of x in (*iii*),

$y = 33x - 136 = 33 \times 4 - 136$

$= 132 - 136 = -4$

$\therefore \quad x = 4,\ y = -4$ **Ans.**

Q. 18. $\frac{7+x}{5} - \frac{2x-y}{4} = 3y - 5$

$$\frac{4x-3}{6} + \frac{5y-7}{2} = 18 - 5x$$

Sol. $\frac{7+x}{5} - \frac{2x-y}{4} = 3y - 5$

$4(7+x) - 5(2x-y) = 20(3y-5)$

(Multiplying by 20, the L.C.M. of 5 and 4)

$28 + 4x - 10x + 5y = 60y - 100$

$\Rightarrow 4x - 10x + 5y - 60y = -100 - 28$

$\Rightarrow \quad -6x - 55y = -128$

$\Rightarrow \quad 6x + 55y = 128 \quad ...(i)$

and $\frac{4x-3}{6} + \frac{5y-7}{2} = 18 - 5x$

$$6 \times \frac{4x-3}{6} + 6 \times \frac{5y-7}{2} = 6(18 - 5x)$$

(Multiplying by 6, the L.C.M. of 6 and 2)

$(4x-3) + 3(5y-7) = 108 - 30x$

$4x - 3 + 15y - 21 = 108 - 30x$

$4x + 15y + 30x = 108 + 21 + 3$

$\quad 34x + 15y = 132 \quad ...(ii)$

Multiplying (*i*) by 3 and (*ii*) by 11

$18x + 165y = 384$

$374x + 165y = 1452$

$- \quad - \quad -$

Subtracting, we get,

$-356x = -1068$

$$x = \frac{-1068}{-356} = 3$$

Substituting the value of x in (*i*),

$6 \times 3 + 55y = 128$

$\Rightarrow \quad 18 + 55y = 128$

$\Rightarrow \quad 55y = 128 - 18 = 110$

$$\therefore \quad y = \frac{110}{55} = 2$$

Hence $x = 3,\ y = 2$ **Ans.**

Q. 19. $6x + 5y = 7x + 3y + 1 = 2(x + 6y - 1)$

Sol. $6x + 5y = 7x + 3y + 1$

$\Rightarrow 6x + 5y - 7x - 3y = 1$

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

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

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

$\Rightarrow 7x+3y+1=2x+12y-2$

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

$\Rightarrow \quad 5x-9y=-3 \quad ...(ii)$

From (i)

$x=2y-1 \quad ...(iii)$

Substituting the value of x in (ii),

$5(2y-1)-9y=-3$

$\Rightarrow \quad 10y-5-9y=-3$

$\Rightarrow \quad 10y-9y=-3+5$

$\therefore \quad y=2$

Substituting the value of y in (iii),

$x=2\times 2-1=4-1=3$

Hence $x=3, y=2$ **Ans.**

Q. 20. $103x+51y=617, 97x+49y=583$

Sol. $103x+51y=617 \quad ...(i)$

$97x+49y=583 \quad ...(ii)$

Multiplying (i) by 49 and (ii) by 51,

$5047x+2499y=30233$

$4947x+2499y=29733$

$- \quad - \quad -$

Subtracting, $100x=500$

$$x=\frac{500}{100}=5$$

Substituting the value of x in (i),

$103\times 5+51y=617$

$515+51y=617$

$\Rightarrow \quad 51y=617-515$

$\Rightarrow \quad 51y=102 \Rightarrow y=\frac{102}{51}=2$

Hence $x=5, y=2$ **Ans.**

Q. 21. $23x-29y=98, 29x-23y=110$

Sol. $23x-29y=98 \quad ...(i)$

$29x-23y=110 \quad ...(ii)$

Adding (i) and (ii), we get

$52x-52y=208$

$52(x-y)=208 \Rightarrow x-y=\frac{208}{52}$

$x-y=4 \quad ...(i$

Subtracting (ii) from (i)

$-6x-6y=-12 \Rightarrow 6x+6y=12$

$6(x+y)=12 \Rightarrow x+y=\frac{12}{6}$

$x+y=2 \quad ...($

Adding (iii) and (iv), we get,

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

Subtracting (iii) from (iv)

$2y=-2 \Rightarrow \quad y=-1$

Hence $x=3, y=-1$ **Ans.**

Q. 22. $4x+\frac{6}{y}=15, \; 3x-\frac{4}{y}=7$

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

$3x-\frac{4}{y}=7 \quad ...$

Multiplying (i) by 2 and (ii) by 3,

$8x+\frac{12}{y}=30$

$9x-\frac{12}{y}=21$

Adding, $17x=51 \Rightarrow x=\frac{51}{17}=3$

Substituting the value of x in (i),

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

$\Rightarrow \quad 12+\frac{6}{y}=15$

$\Rightarrow \frac{6}{y}=15-12=\frac{3}{1}$

$\Rightarrow 3y=6$ (By cross multiplicat

$\therefore \quad y=\frac{6}{3}=2$

Hence $x=3, y=2$ **Ans.**

Q. 23. $\frac{2}{x}+\frac{2}{3y}=\frac{1}{6}, \frac{3}{x}+\frac{2}{y}=0$

Sol. $\frac{2}{x}+\frac{2}{3y}=\frac{1}{6}$ ...(*i*)

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

Multiplying (*i*) by 3 and (*ii*) by 2,

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

$\Rightarrow \frac{6}{x}+\frac{2}{y}=\frac{1}{2}$

$\frac{6}{x}+\frac{4}{y}=0$

$- \quad - \quad -$

Subtracting, $-\frac{2}{y}=\frac{1}{2}$

$\Rightarrow y=-4$

Substituting the value of y in (*i*),

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

$\Rightarrow \frac{2}{x}+\frac{2}{-12}=\frac{1}{6}$

$\Rightarrow \frac{2}{x}-\frac{1}{6}=\frac{1}{6}$

$\Rightarrow \frac{2}{x}=\frac{1}{6}+\frac{1}{6}=\frac{1}{3}$

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

Hence $x=6, y=-4$ **Ans.**

Q. 24. $\frac{3}{2x}+\frac{2}{3y}=5, \frac{5}{x}-\frac{3}{y}=1$

Sol. $\frac{3}{2x}+\frac{2}{3y}=5$ ...(*i*)

$\frac{5}{x}-\frac{3}{y}=1$ ...(*ii*)

Multiplying (*i*) by 5 and (*ii*) by $\frac{3}{2}$,

$\frac{15}{2x}+\frac{10}{3y}=25$

$\frac{15}{2x}-\frac{9}{2y}=\frac{3}{2}$

$- \quad + \quad -$

Subtracting, we get,

$\frac{10}{3y}+\frac{9}{2y}=25-\frac{3}{2}=\frac{47}{2}$

$\frac{20}{6y}+\frac{27}{6y}=\frac{47}{2} \Rightarrow \frac{47}{6y}=\frac{47}{2}$

$\Rightarrow 6y\times 47=47\times 2$

$\Rightarrow y=\frac{47\times 2}{6\times 47}=\frac{1}{3}$

Substituting the value of y in (*i*),

$\frac{3}{2x}+\frac{3}{3\times\frac{1}{3}}=5 \Rightarrow \frac{3}{2x}+2=5$

$\frac{3}{2x}=5-2=3 \Rightarrow 6x=3$

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

Hence $x=\frac{1}{2}, y=\frac{1}{3}$ **Ans.**

Q. 25. $5x-9=\frac{1}{y}, x+\frac{1}{y}=3$

Sol. $5x-9=\frac{1}{y}$ ...(*i*)

$x+\frac{1}{y}=3$ ...(*ii*)

From (*i*) substituting the value of $\frac{1}{y}$ in (*ii*), we get

$x+5x-9=3 \Rightarrow 6x=3+9$

$\Rightarrow 6x=12 \Rightarrow x=\frac{12}{6}=2$

Substituting the value of x in (*i*),

$$5 \times 2 - 9 = \frac{1}{y} \Rightarrow \frac{1}{y} = 10 - 9 = 1$$

$$\Rightarrow \qquad y = 1$$

Hence $x = 2, y = 1$ **Ans.**

Q. 26. $x + y = 2xy, \quad x - y = 6xy$

Sol. $x + y = 2xy, \quad x - y = 6xy$

Dividing by xy, we get,

$$\frac{x}{xy} + \frac{y}{xy} = \frac{2xy}{xy}, \quad \frac{x}{xy} - \frac{y}{xy} = \frac{6xy}{xy}$$

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

$$\frac{1}{y} - \frac{1}{x} = 6 \qquad ...(ii)$$

Adding we get,

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

$$\Rightarrow \quad y = \frac{2}{8} = \frac{1}{4}$$

Substituting the value of y in (i),

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

$$\Rightarrow \quad \frac{1}{x} = 2 - 4 = -2$$

$$\Rightarrow -2x = 1$$

$$\therefore \quad x = \frac{-1}{2}$$

Hence $x = \frac{-1}{2}, y = \frac{1}{4}$ **Ans.**

Q. 27. $\frac{a}{x} - \frac{b}{y} = 0, \quad \frac{ab^2}{x} + \frac{a^2b}{y} = (a^2 + b^2)$

Sol. $\frac{a}{x} - \frac{b}{y} = 0 \qquad ...(i)$

$$\frac{ab^2}{x} + \frac{a^2b}{y} = (a^2 + b^2) \qquad ...(ii)$$

Multiplying (i) by b^2 and (ii) by 1,

$$\frac{ab^2}{x} - \frac{b^3}{y} = 0$$

$$\frac{ab^2}{x} + \frac{a^2b}{y} = (a^2 + b^2)$$

$$- \qquad - \qquad -$$

Subtracting, we get,

$$-\frac{b^3}{y} - \frac{a^2b}{y} = -(a^2 + b^2)$$

$$-\frac{b}{y}(b^2 + a^2) = -(a^2 + b^2)$$

$$\Rightarrow \quad -\frac{b}{y} = -\frac{a^2 + b^2}{a^2 + b^2} = -1$$

$$\frac{b}{y} = 1 \quad \Rightarrow \quad y = b$$

Substituting the value of y in (i),

$$\frac{a}{x} - \frac{b}{b} = 0 \quad \Rightarrow \quad \frac{a}{x} - 1 = 0$$

$$\Rightarrow \quad \frac{a}{x} = 1 \quad \Rightarrow \quad x = a$$

Hence $x = a, y = b$ **Ans.**

Q. 28. $\frac{3}{x+y} + \frac{2}{x-y} = 3,$

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

Sol. $\frac{3}{x+y} + \frac{2}{x-y} = 3,$

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

Put $x + y = a$ and $x - y = b$, then

$$\frac{3}{a} + \frac{2}{b} = 3 \qquad ...(i)$$

$$\frac{2}{a} + \frac{3}{b} = \frac{11}{3} \qquad ...(ii)$$

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

$$\frac{5}{a} + \frac{5}{b} = \frac{20}{3}$$

$\frac{1}{a}+\frac{1}{b}=\frac{4}{3}$ (Dividing by 5) ...(*iii*)

Subtracting (*ii*) from (*i*),

$$\frac{1}{a}-\frac{1}{b}=-\frac{2}{3} \quad ...(iv)$$

Adding (*iii*) and (*iv*),

$$\frac{2}{a}=\frac{2}{3} \quad \Rightarrow \quad \frac{2}{a}=\frac{2}{3}$$

$$\Rightarrow \quad 2a=6 \quad \Rightarrow \quad a=3$$

Subtracting (*iv*) from (*iii*),

$$\frac{2}{b}=\frac{6}{3} \quad \Rightarrow 6b=6$$

$$\Rightarrow \quad b=1$$

Now substituting the value of a and b,

$$x+y=3 \quad ...(v)$$

$$x-y=1 \quad ...(vi)$$

Adding (*v*) and (*vi*),

$$2x=4 \quad \Rightarrow \quad x=2$$

Subtracting, $2y=2 \quad \Rightarrow \quad y=1$

Hence $x=2, y=1$ **Ans.**

Q. 29. $\frac{22}{x+y}+\frac{15}{x-y}=5, \frac{55}{x+y}+\frac{40}{x-y}=13$

Sol. $\frac{22}{x+y}+\frac{15}{x-y}=5$

$\frac{55}{x+y}+\frac{40}{x-y}=13$

Put $x+y=a$ and $x-y=b$, then

$\frac{22}{a}+\frac{15}{b}=5$ ...(*i*)

$\frac{55}{x}+\frac{40}{b}=13$ ...(*ii*)

Multiplying (*i*) by 5 and (*ii*) by 2,

$\frac{110}{a}+\frac{75}{b}=25$

$\frac{110}{a}+\frac{80}{b}=26$

– – –

Subtracting, we get,

$$-\frac{5}{b}=-1 \quad \Rightarrow \quad \frac{5}{b}=1$$

$\therefore \quad b=5$

Substituting the value of b in (*i*),

$$\frac{22}{a}+\frac{15}{5}=5 \quad \Rightarrow \quad \frac{22}{a}+3=5$$

$$\Rightarrow \quad \frac{22}{a}=5-3=\frac{2}{1} \quad \Rightarrow \quad 2a=22$$

$\therefore \quad a=\frac{22}{2}=11$

Nowing substituting the value of a and b,

$x+y=11$ ...(*iii*)

$x-y=5$ ...(*iv*)

Adding we get,

$$2x=16 \quad \Rightarrow \quad x=\frac{16}{2}=8$$

and subtracting, we get,

$$2y=6 \quad \Rightarrow \quad y=\frac{6}{2}=3$$

Hence $x=8, y=3$ **Ans.**

Q. 30. If $2x+y=32$ and $3x+4y=68$, find the value of (x/y).

Sol. $2x+y=32$ ...(*i*)

$3x+4y=68$ ...(*ii*)

Multiplying (*i*) by 4 and (*ii*) by 1,

$8x+4y=128$

$3x+4y=68$

– – –

Subtracting,

$$5x=60 \quad \Rightarrow \quad x=\frac{60}{5}=12$$

Substituting the value of x in (*i*),

$2 \times 12+y=32$

$\Rightarrow \quad 24+y=32$

$y=32-24=8$

$\therefore \quad \frac{x}{y} = \frac{12}{8} = \frac{3}{2}$ **Ans.**

Q. 31. If $7x = 10y + 4$ and $12x + 18y = 1$, find the values of $(4x + 6y)$ and $(8y + x)$.

Sol. $7x = 10y + 4$

$\Rightarrow \quad 7x - 10y = 4 \qquad ...(i)$

$12x + 18y = 1 \qquad ...(ii)$

Multiplying (i) by 9 and (ii) by 5,

$63x - 90y = 36$

$60x + 90y = 5$

Adding, $123x = 41$

$$x = \frac{41}{123} = \frac{1}{3}$$

Substituting the value of x in (1),

$$7 \times \frac{1}{3} - 10y = 4$$

$$\Rightarrow \quad \frac{7}{3} - 10y = 4$$

$$-10y = 4 - \frac{7}{3} = \frac{5}{3}$$

$$y = -\frac{5}{3 \times 10} = -\frac{1}{6}$$

Now

$$(i)\ 4x + 6y = 4 \times \frac{1}{3} + 6 \times \left(-\frac{1}{6}\right)$$

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

and

$$(ii)\ 8y + x = 8 \times \left(-\frac{1}{6}\right) + \frac{1}{3}$$

$$= -\frac{4}{3} + \frac{1}{3} = \frac{-3}{3} = -1 \quad \textbf{Ans.}$$

Q. 32. The sides of an equilateral triangle are $(x + 3y)$ cm, $(3x + 2y - 2)$ cm and $\left(4x + \frac{1}{2}y + 1\right)$ cm. Find the length of each side.

Sol. $\because$ Triangle is an equilateral.

$\therefore$ Its sides are equal.

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

Taking $x + 3y = 3x + 2y - 2$

$\Rightarrow \quad 3x + 2y - x - 3y = 2$

$\Rightarrow \quad 2x - y = 2 \qquad ...(i)$

Again taking,

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

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

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

$\Rightarrow \quad -2x + 3y = 6$

$\Rightarrow \quad -2x + 3y = 6 \qquad ...(ii)$

Adding (i) and (ii),

$2y = 8$

$\Rightarrow \quad y = \frac{8}{2} = 4$

Substituting the value of y in (i),

$2x - 4 = 2$

$\Rightarrow \quad 2x = 2 + 4$

$\Rightarrow \quad 2x = 6$

$\therefore \quad x = 3$

Now sides of the equilateral triangle are

$(3 + 3 \times 4), (3 \times 3 + 2 \times 4 - 2),$

$\left(4 \times 3 + \frac{1}{2} \times 4 + 1\right)$

or 15, 15, 15 cm. **Ans.**

EXERCISE 7 (D)

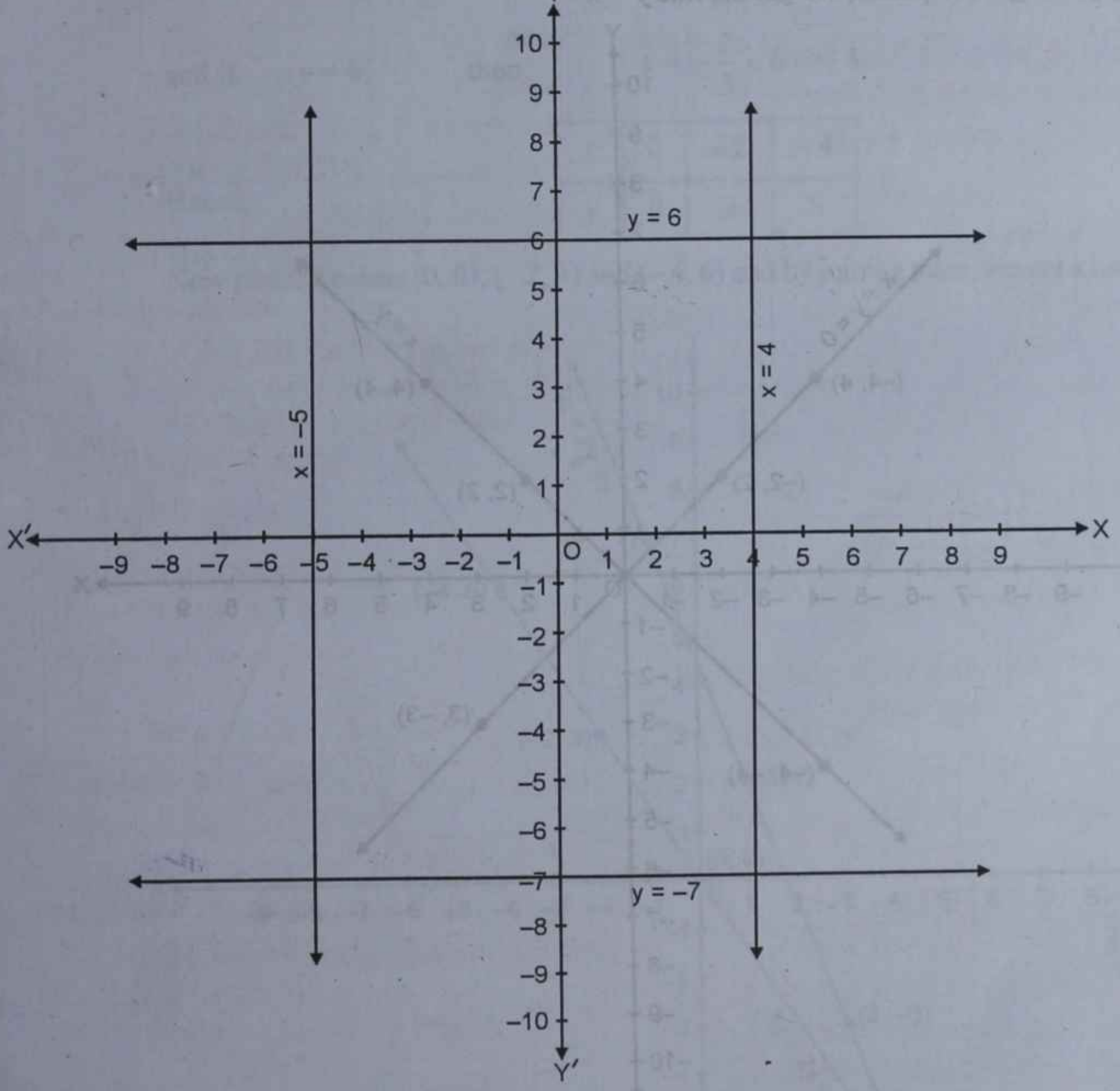
Q. 1. Draw the graph of the line whose equation is :

(*i*) $x = 4$ (*ii*) $x + 5 = 0$ (*iii*) $y = 6$

(*iv*) $x + 7 = 0$ (*v*) $y = x$ (*vi*) $x + y = 0$

Sol. (*i*) $x = 4$

It is a line parallel to y-axis where $x = 4$.



(*ii*) $x + 5 = 0$

$x = -5$

It is a line parallel to y-axis where $x = -5$.

(*iii*) $y = 6$

It is a line parallel to x-axis where $y = 6$.

(*iv*) $y + 7 = 0$

$y = -7$

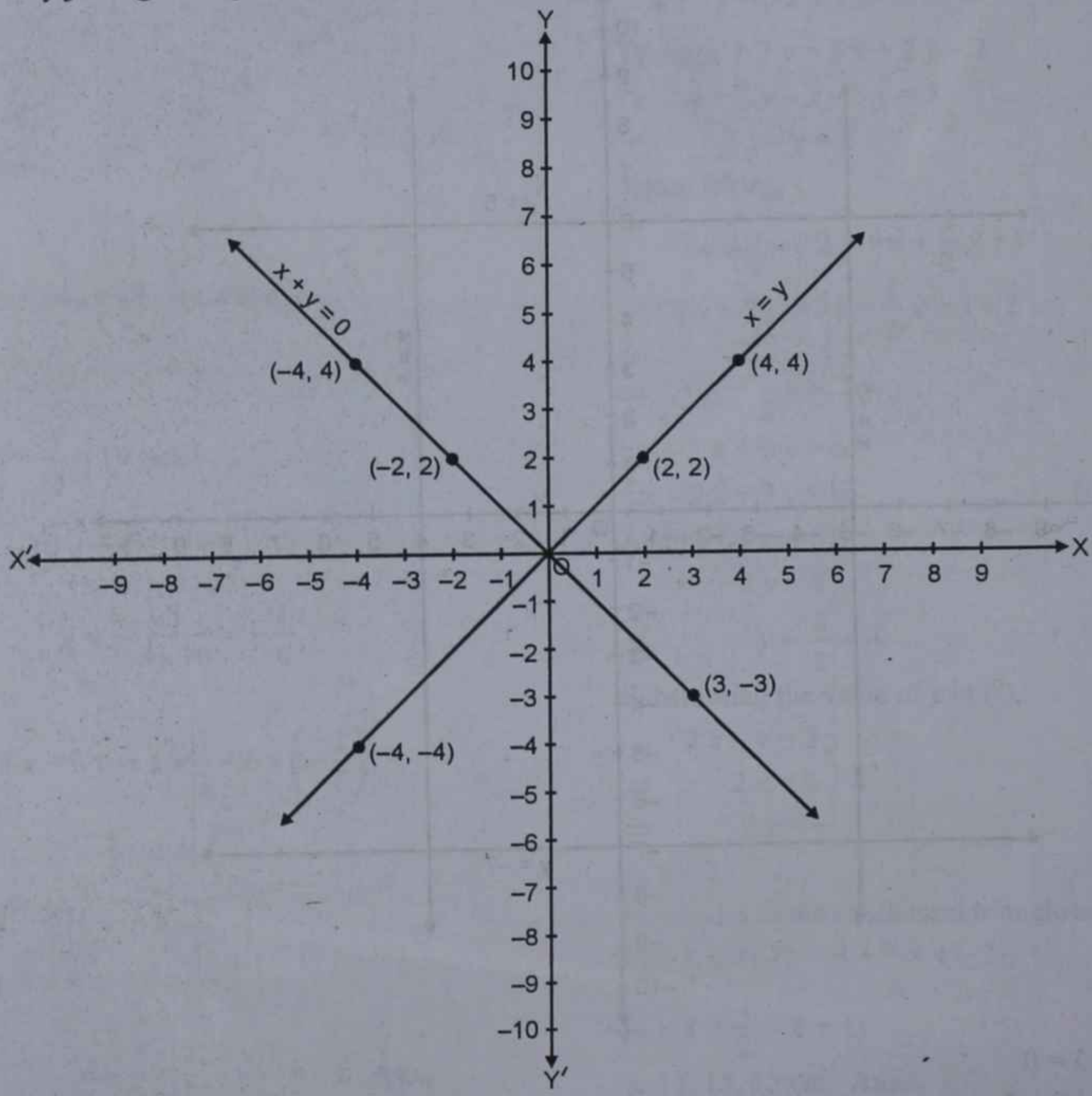
It is a line parallel to x-axis where $y = -7$.

(v) $y = x$

By giving different value to x, we find corresponding values of y as given :

x	2	4	-4
y	2	4	-4

Now we will plot the points as shown in graph below : (2, 2), (4, 4) and $(-4, -4)$ on graph and by joining these points, we get the line $y = x$.



(vi) $x + y = 0 \quad \Rightarrow \quad x = -y$

By giving different values to y, we get corresponding values of x as given

x	-2	-4	3
y	2	4	-3

Now we will plot the points $(-2, 2)$, $(-4, 4)$ and $(3, -3)$ and by joining them, we get the line $x + y = 0$ as shown in graph above.

Q. 2. Draw the graph of :

(*i*) $3x + 2y = 0$ (*ii*) $5x + 2y = 9$ (*iii*) $x - 5y + 4 = 0$ (*iv*) $3x - 5y + 1 = 0$

Sol. (*i*) $3x + 2y = 0 \Rightarrow 3x = -2y \Rightarrow x = \dfrac{-2y}{3}$

Now giving different value to y, we get corresponding values of x. If $y = 0$, then $x = 0$.

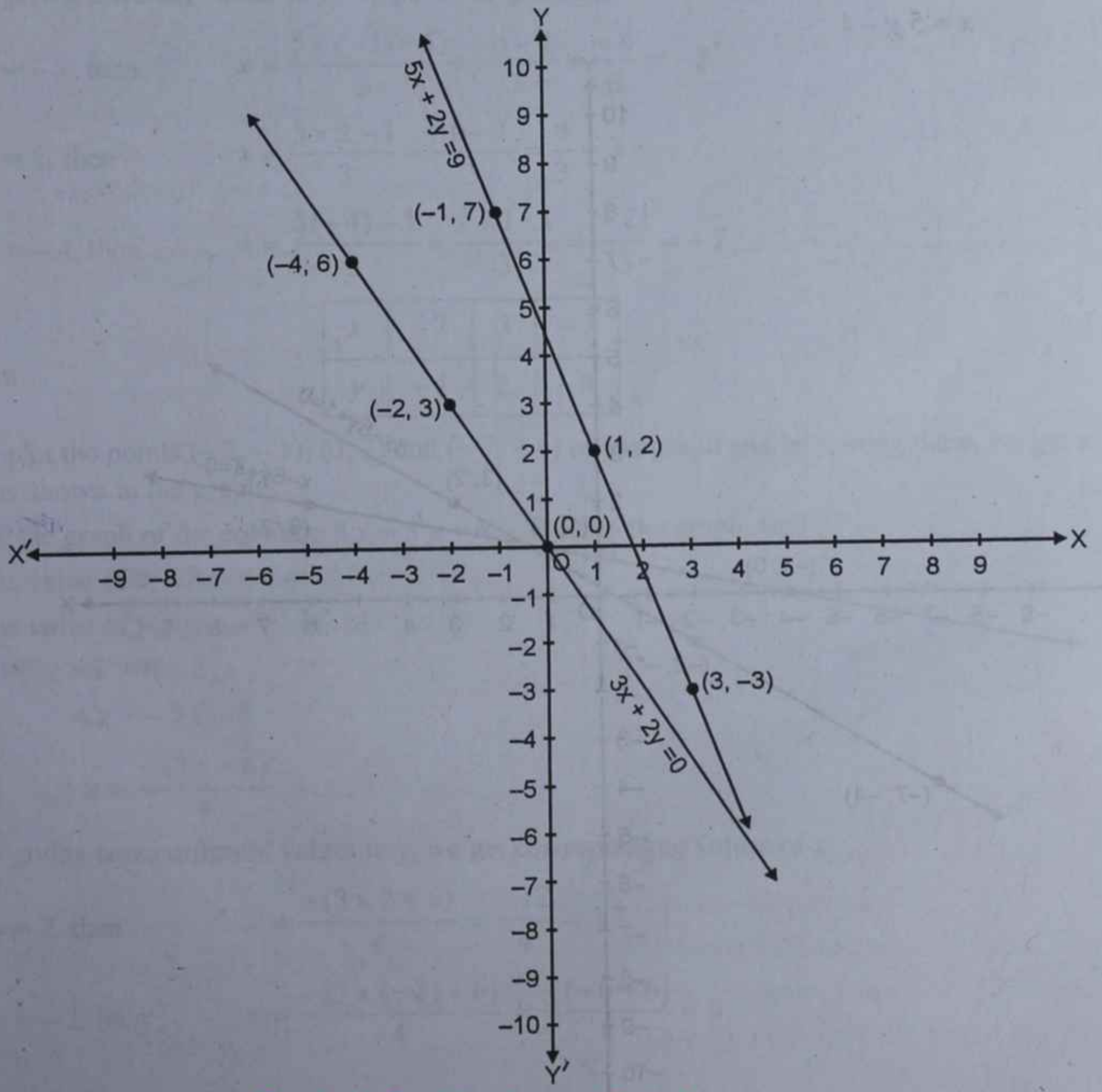
If $y = 3$, then $x = -\dfrac{2}{3} \times 3 = -2$

and if $y = 6$, then $x = -\dfrac{2}{3} \times 6 = -4$

Hence

x	0	-2	-4
y	0	3	6

Now plot the points $(0, 0)$, $(-2, 3)$ and $(-4, 6)$ and by joining them, we get a line as shown below



(*ii*) $5x + 2y = 9 \quad \Rightarrow \quad 5x = 9 - 2y \quad \Rightarrow \quad x = \dfrac{9 - 2y}{5}$

Now giving different values to y, we get corresponding values of x.

If $y = 2$, then $x = \dfrac{9 - 2 \times 2}{5} = \dfrac{9 - 4}{5} = \dfrac{5}{5} = 1$

If $y = 7$, then $x = \dfrac{9 - 2 \times 7}{5} = \dfrac{9 - 14}{5} = \dfrac{-5}{5} = -1$

If $y = -3$, then $x = \dfrac{9 - 2 \times (-3)}{5} = \dfrac{9 + 6}{5} = \dfrac{15}{5} = 3$

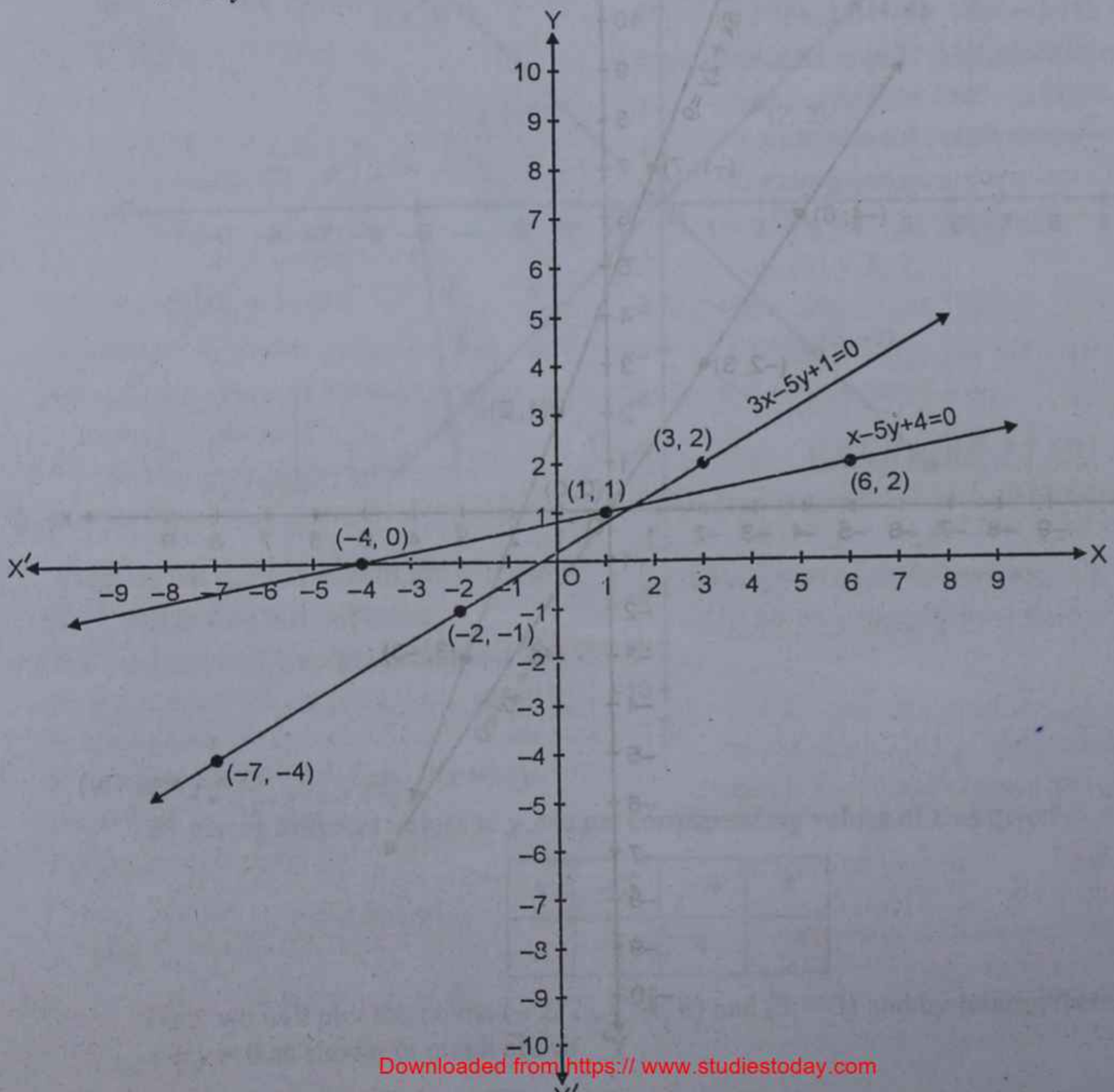
$\therefore$

x	1	-1	3
y	2	7	-3

Now plot the points $(1, 2)$, $(-1, 7)$ and $(3, -3)$ or the graph and by joining them, we get a line as shown in the graph.

(*iii*) $x - 5y + 4 = 0$

$x = 5y - 4$



By giving different values to y, we get corresponding values of x.

If $y = 1$, then $x = 5 \times 1 - 4 = 5 - 4 = 1$

If $y = 0$, then $x = 5 \times 0 - 4 = 0 - 4 = -4$

If $y = 2$, then $x = 5 \times (2) - 4 = 10 - 4 = 6$

Hence

x	1	-4	6
y	1	0	2

Now plot the points $(1, 1)$, $(-4, 0)$ and $(6, 2)$ and by joining them, we get a line as shown in the graph.

(*iv*) $3x - 5y + 1 = 0$

$\Rightarrow \quad 3x = 5y - 1$

$$x = \frac{5y - 1}{3}$$

Now giving different values to y, we get corresponding values of x.

If $y = -1$, then $x = \dfrac{5 \times (-1) - 1}{3} = \dfrac{-5 - 1}{3} = \dfrac{-6}{3} = -2$

If $y = 2$, then $x = \dfrac{5 \times 2 - 1}{3} = \dfrac{10 - 1}{3} = \dfrac{9}{3} = 3$

If $y = -4$, then $x = \dfrac{5(-4) - 1}{3} = \dfrac{-20 - 1}{3} = \dfrac{-21}{3} = -7$

Hence

x	-2	3	-7
y	-1	2	-4

Now plot the points $(-2, -1)$, $(3, 2)$ and $(-7, -4)$ on the graph and by joining them, we get a line as shown in the graph.

Q. 3. Draw the graph of the equation $4x + 3y + 6 = 0$. From the graph, find :

(*i*) y_1, the value of y, when $x = 6$.

(*ii*) y_2, the value of y, when $x = -6$.

Sol. $4x + 3y + 6 = 0$

$4x = -3y - 6$

$$x = \frac{-(3y + 6)}{4}$$

Now giving some different values to y, we get corresponding values of x.

If $y = 2$, then $x = \dfrac{-(3 \times 2 + 6)}{4} = \dfrac{-12}{4} = -3$

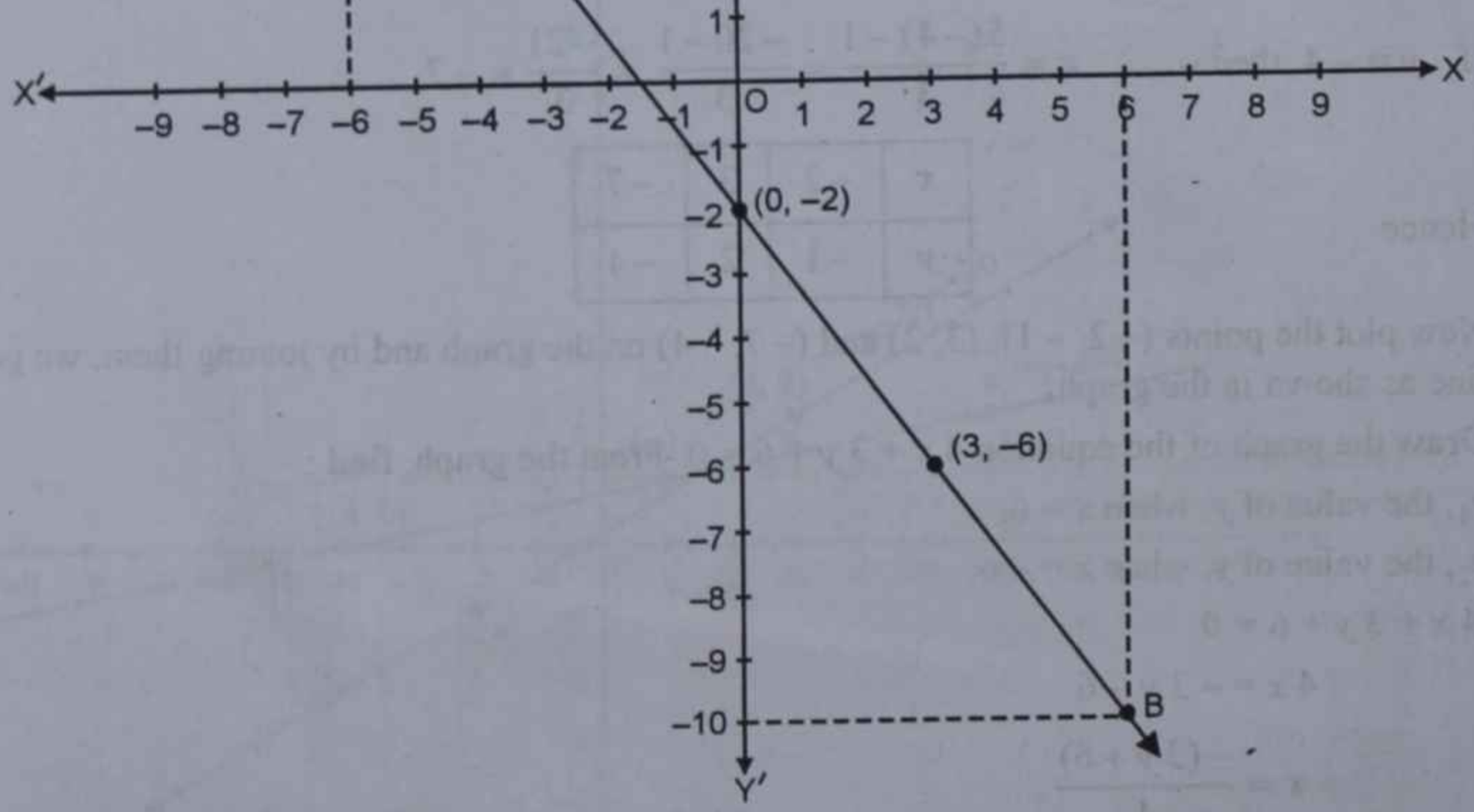
If $y = -2$, then $x = \dfrac{-[3 \times (-2) + 6]}{4} = \dfrac{-[-6 + 6]}{4} = 0$

If $y = -6$, then $x = -\left[\dfrac{3 \times (-6) + 6}{4}\right] = -\dfrac{(-18+6)}{4} = \dfrac{-(-12)}{4} = \dfrac{12}{4} = 3$

Hence

x	-3	0	3
y	2	-2	-6

Now plot these points $(-3, 2)$, $(0, -2)$ and $(3, -6)$ on the graph and by joining them, we get a line as shown.



From the graph,

(*i*) If $x = 6$, then value of y *i.e.* y_1 will be $= -10$.

(*ii*) If $x = -6$, then value of y *i.e.* y_2 will be $= 6$.

Q. 4. Draw the graph of the equation $2x - 3y = 5$. From the graph, find :

(*i*) x_1, the value of x, when $y = 7$.

(*ii*) x_2, the value of x, when $y = -5$.

Sol. $2x - 3y = 5 \quad \Rightarrow \quad 2x = 3y + 5$

$\Rightarrow \quad x = \dfrac{3y+5}{2}$

Now giving some different values to y, we get the corresponding values of x.

If $y = 1$, then $\quad x = \dfrac{3\times 1+5}{2} = \dfrac{3+5}{2} = \dfrac{8}{2} = 4$

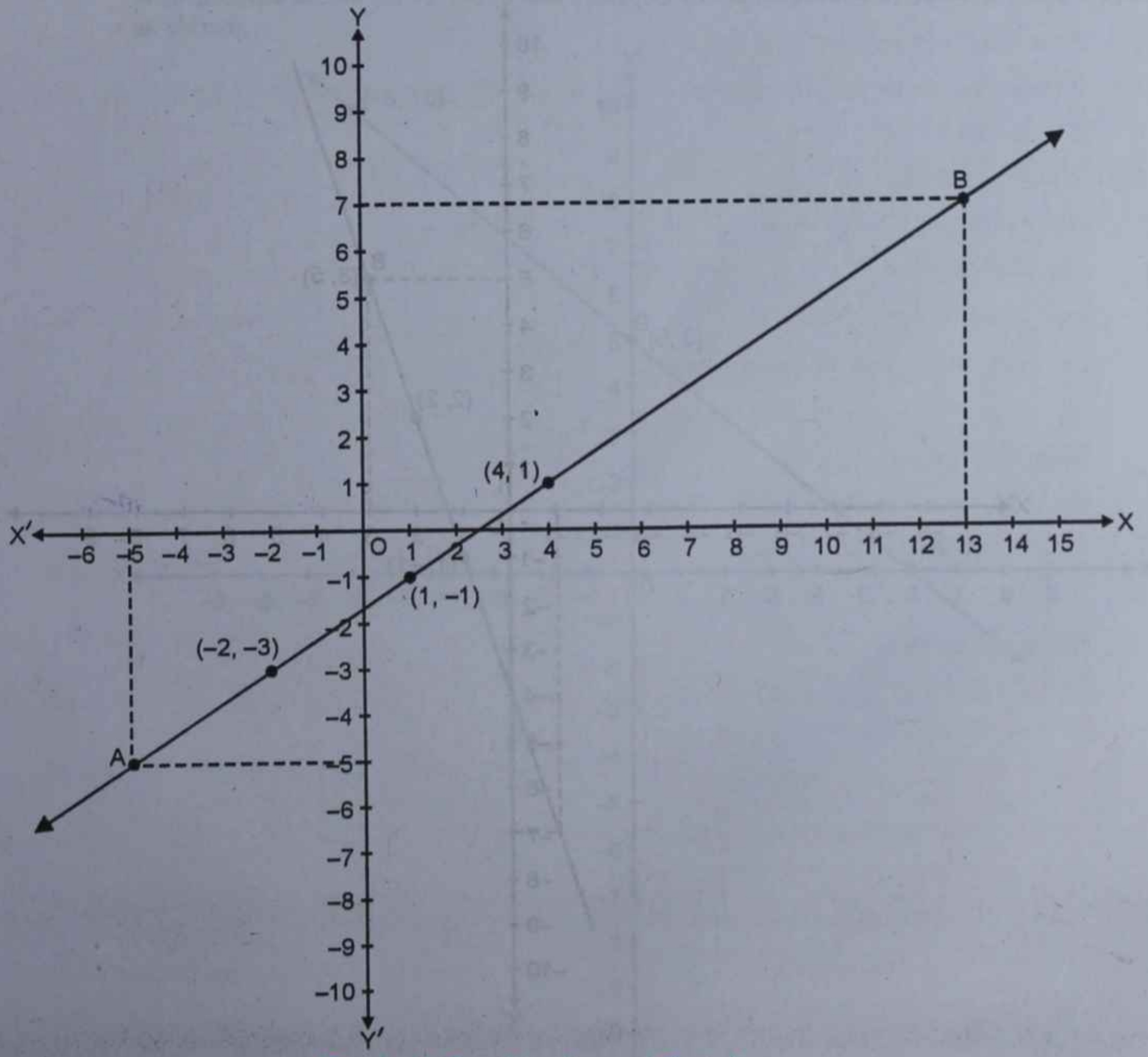
If $y = -1$, then $\quad x = \dfrac{3\times(-1)+5}{2} = \dfrac{-3+5}{2} = \dfrac{2}{2} = 1$

If $y = -3$, then $\quad x = \dfrac{3\times(-3)+5}{2} = \dfrac{-9+5}{2} = \dfrac{-4}{2} = -2$

Hence

x	4	1	-2
y	1	-1	-3

Now plot the points (4, 1), (1, – 1) and (– 2, – 3) on the graph and by joining them, we get the line as shown.



From the graph (*i*) If $y = 7$, then the value of x will be $x_1 = 13$.

(*ii*) If $y = -5$, then the value of x will be $x_2 = -5$.

Q. 5. Draw the graph of the equation $3x - y = 4$. Find graphically :

(*i*) the value of y, when $x = -1$. (*ii*) the value of x, when $y = 5$.

Sol. $3x - y = 4 \quad \Rightarrow \quad 3x = y + 4 \quad \Rightarrow \quad x = \dfrac{y+4}{3}$

Now giving some different values to y, we get corresponding values of x.

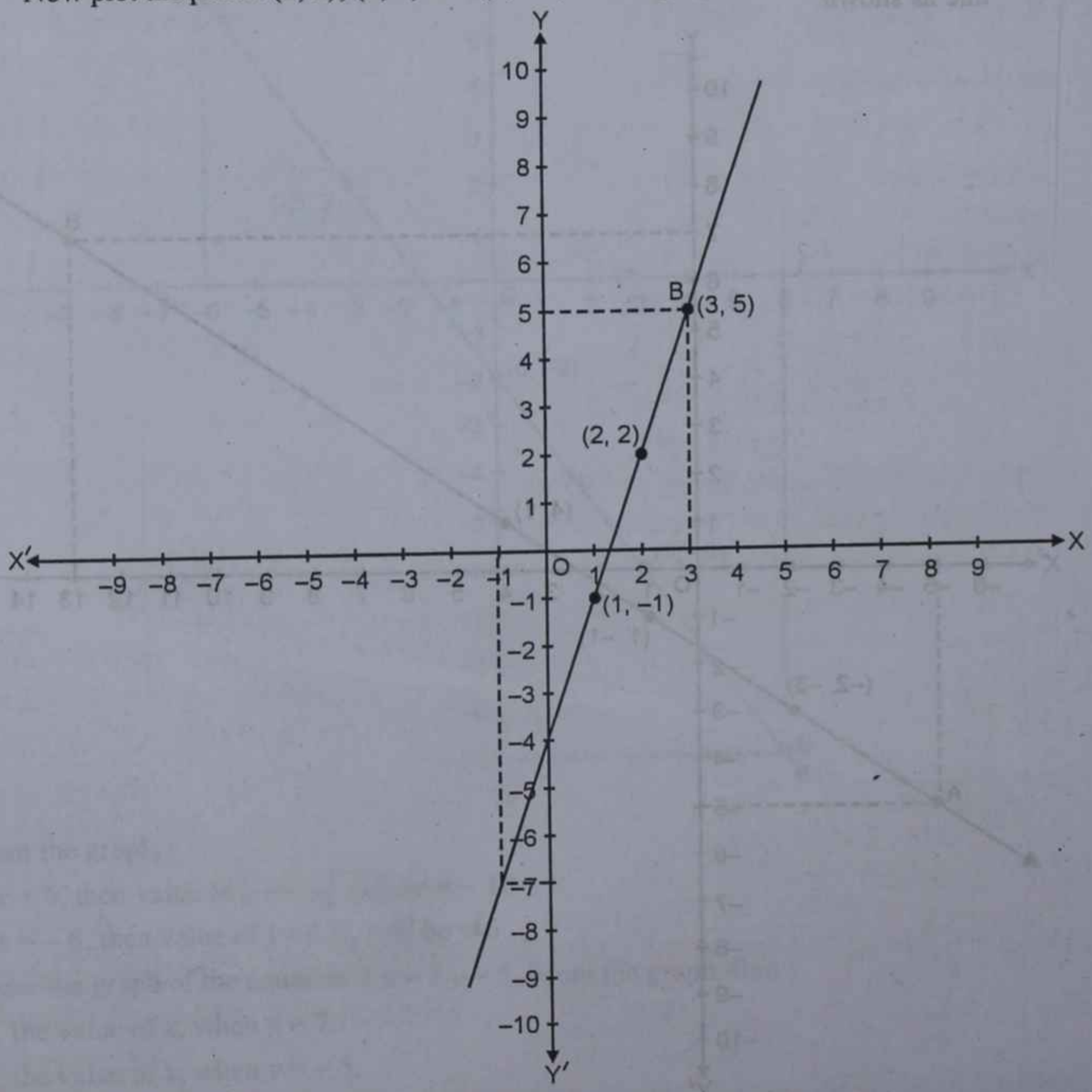
If $y = 2$, then $x = \dfrac{2+y}{3} = \dfrac{6}{3} = 2$ If $y = 5$, then $x = \dfrac{5+4}{3} = \dfrac{9}{3} = 3$

If $y = -1$, then $x = \dfrac{-1+4}{3} = \dfrac{3}{3} = 1$

Hence

x	2	3	1
y	2	5	-1

Now plot the points (2, 2), (3, 5) and (1, – 1) on the graph and by joining them, we get the line



From the graph, When $x = -1$, then the value of y will be $= -7$

and when $y = 5$, then the value of x will be $= 3$.

Q. 6. Draw the graph of the line given by the equation $5x + 6y = 30$. Use this graph to find the area of the triangle formed by the line and the co-ordinate axes.

Sol. $5x + 6y = 30 \quad \Rightarrow \quad 5x = 30 - 6y \quad \Rightarrow \quad x = \dfrac{30 - 6y}{5}$

Giving some different values to y, we get corresponding values of x.

If $y = 0$, then $\quad x = \dfrac{30 - 6 \times 0}{5} = \dfrac{30 - 0}{5} = \dfrac{30}{5} = 6$

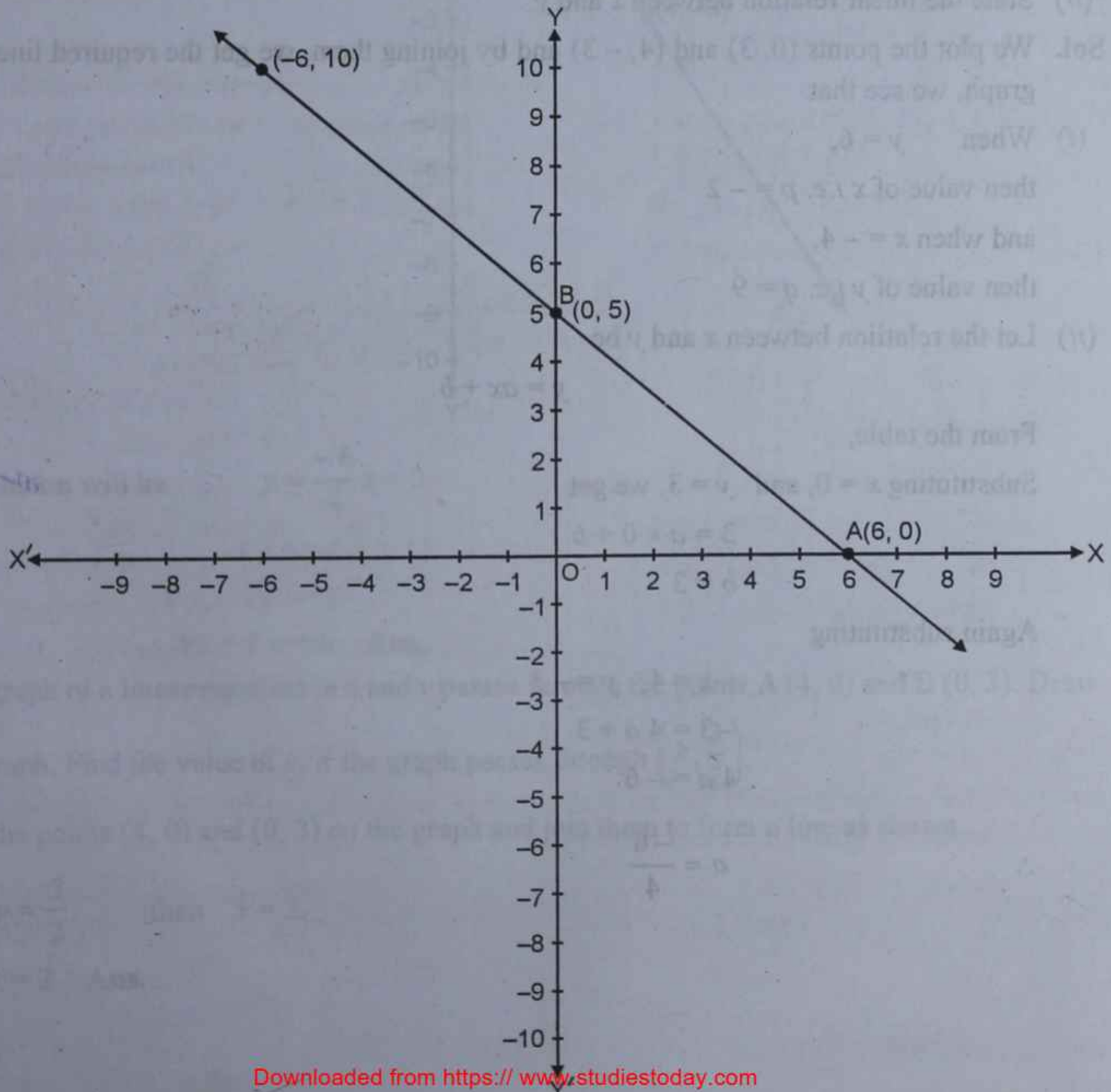
If $y = 5$, then $\quad x = \dfrac{30 - 6 \times 5}{5} = \dfrac{30 - 30}{5} = 0$

If $y = 10$, then $\quad x = \dfrac{30 - 6 \times 10}{5} = \dfrac{30 - 60}{5} = \dfrac{-30}{5} = -6$

Hence

x	6	0	-6
y	0	5	10

Now plot the points (6, 0), (0, 5) and (– 6, 10) on the graph and by joining them, we get the line as shown.



This line intersects x-axis at 6 at A (6, 0) and y-axis at 5 *i.e.* at B (0, 5).

ΔAOB is formed by the line and the axes.

$\therefore$ Area of right ΔAOB

$$= \frac{1}{2} \times OA \times OB$$

$$= \frac{1}{2} \times 6 \times 5$$

$= 15$ square units **Ans.**

Q. 7. Draw the graph from the table given below :

x	0	4	p	-4
y	3	-3	6	q

(*i*) From the graph, find the values of p and q.

(*ii*) State the linear relation between x and y.

Sol. We plot the points (0, 3) and (4, – 3) and by joining them, we get the required line. From the graph, we see that

(*i*) When $y = 6$,

then value of x *i.e.* $p = -2$

and when $x = -4$,

then value of y *i.e.* $q = 9$

(*ii*) Let the relatiion between x and y be

$$y = ax + b$$

From the table,

Substituting $x = 0$, and $y = 3$, we get

$$3 = a \times 0 + b$$

$$b = 3$$

Again substituting

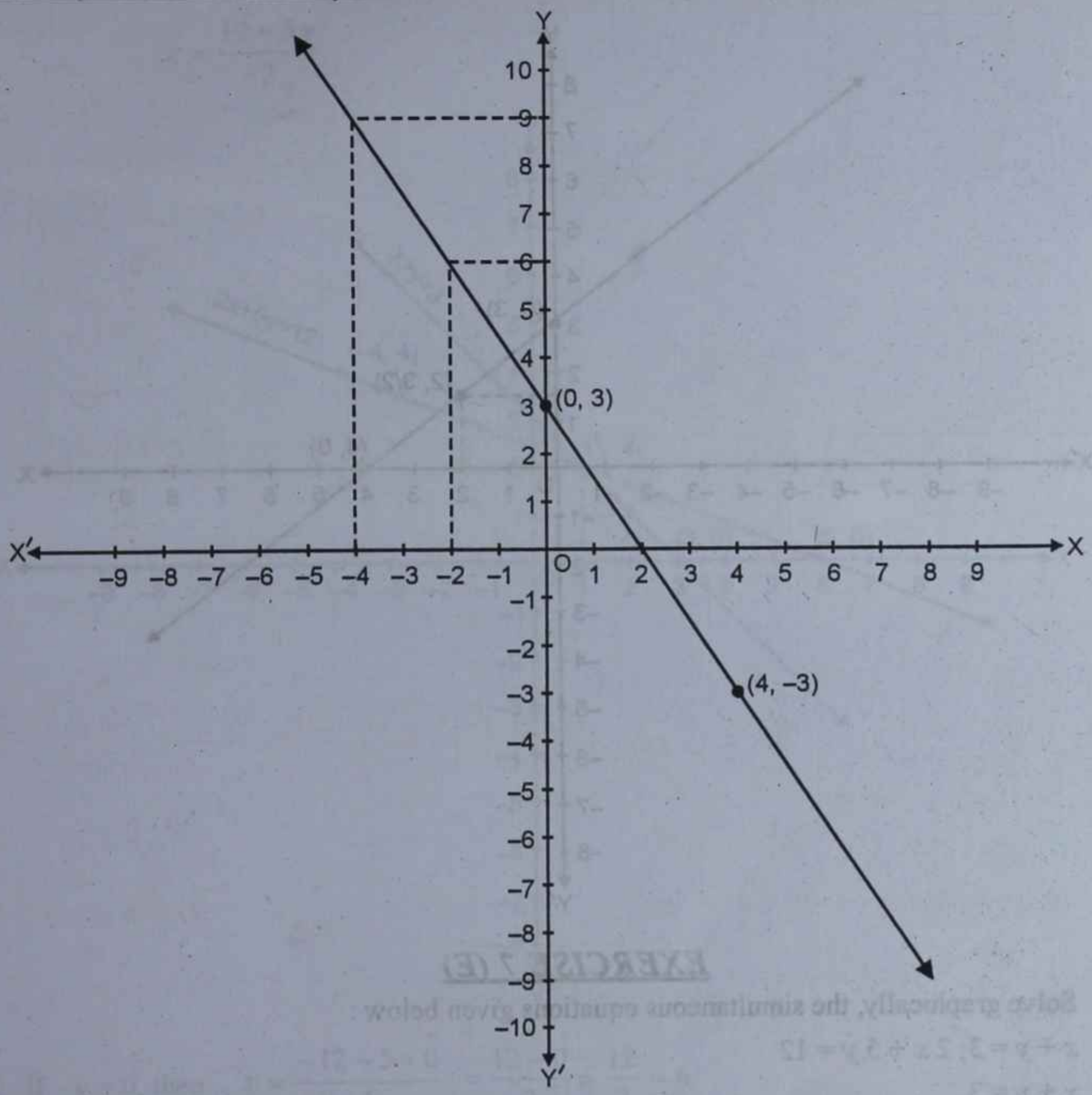
$$x = 4, \quad y = -3$$

$$-3 = 4a + 3$$

$$4a = -6$$

$\therefore$

$$a = \frac{-6}{4}$$



$\therefore$ Relation will be $y = \frac{-6}{4}x + 3$

$\Rightarrow$ $4y = -6x + 12$

$\Rightarrow$ $6x + 4y = 12$

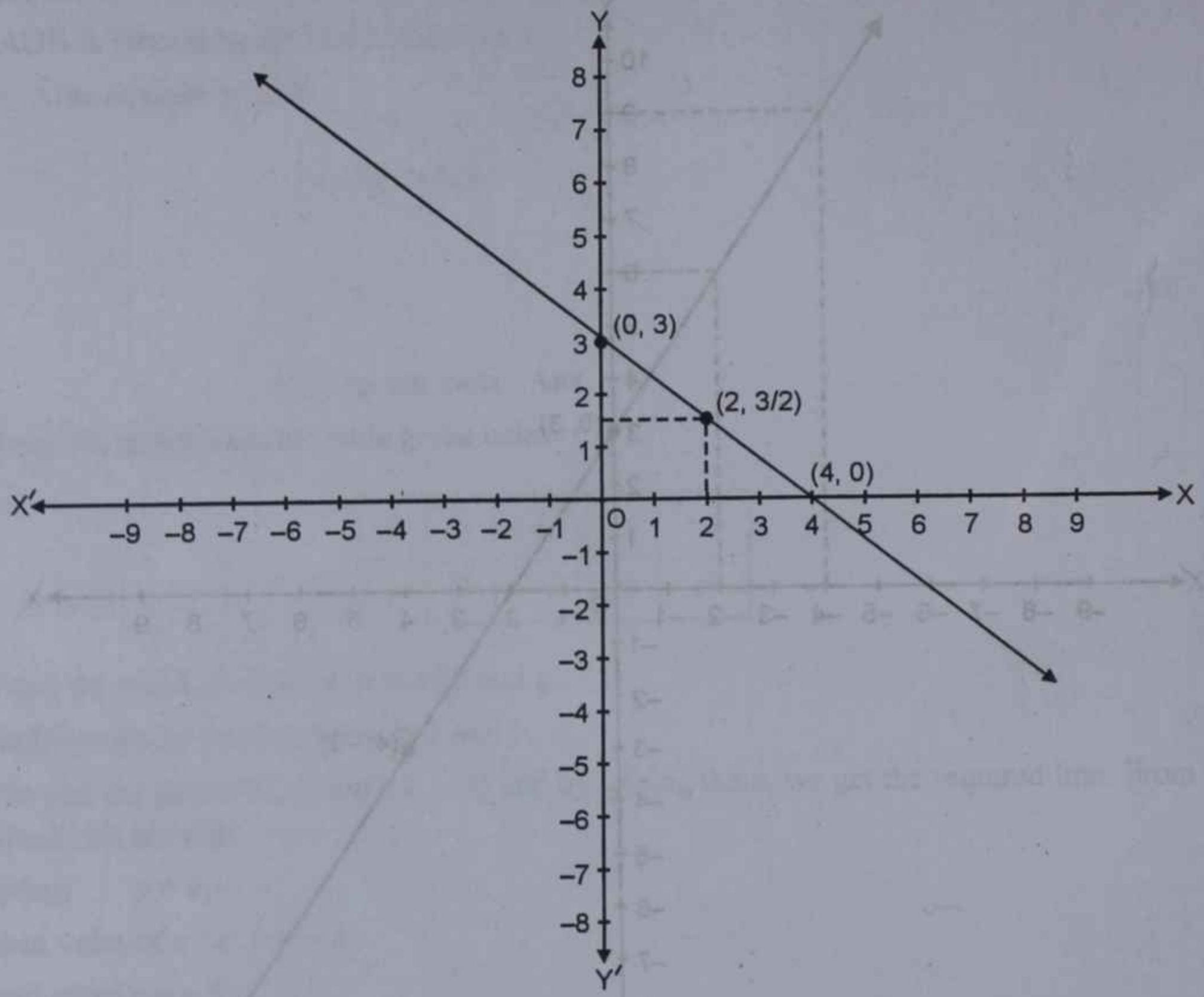
$\Rightarrow$ $3x + 2y = 6$ **Ans.**

Q. 8. The graph of a linear equation in x and y passes through the points A (4, 0) and B (0, 3). Draw the graph. Find the value of k, if the graph passes through $\left(k, \frac{3}{2}\right)$.

Sol. Plot the points (4, 0) and (0, 3) on the graph and join them to form a line as shown.

If $y = \frac{3}{2}$, then $x = 2$.

$\therefore$ $k = 2$ **Ans.**



EXERCISE 7 (E)

Solve graphically, the simultaneous equations given below :

Q. 1. $x + y = 3, 2x + 5y = 12$

Sol. $x + y = 3$

$x = 3 - y$

If $y = 0$, then $x = 3 - 0 = 3$

If $y = 1$, then $x = 3 - 1 = 2$

and if $y = 2$, then $x = 3 - 2 = 1$

Hence

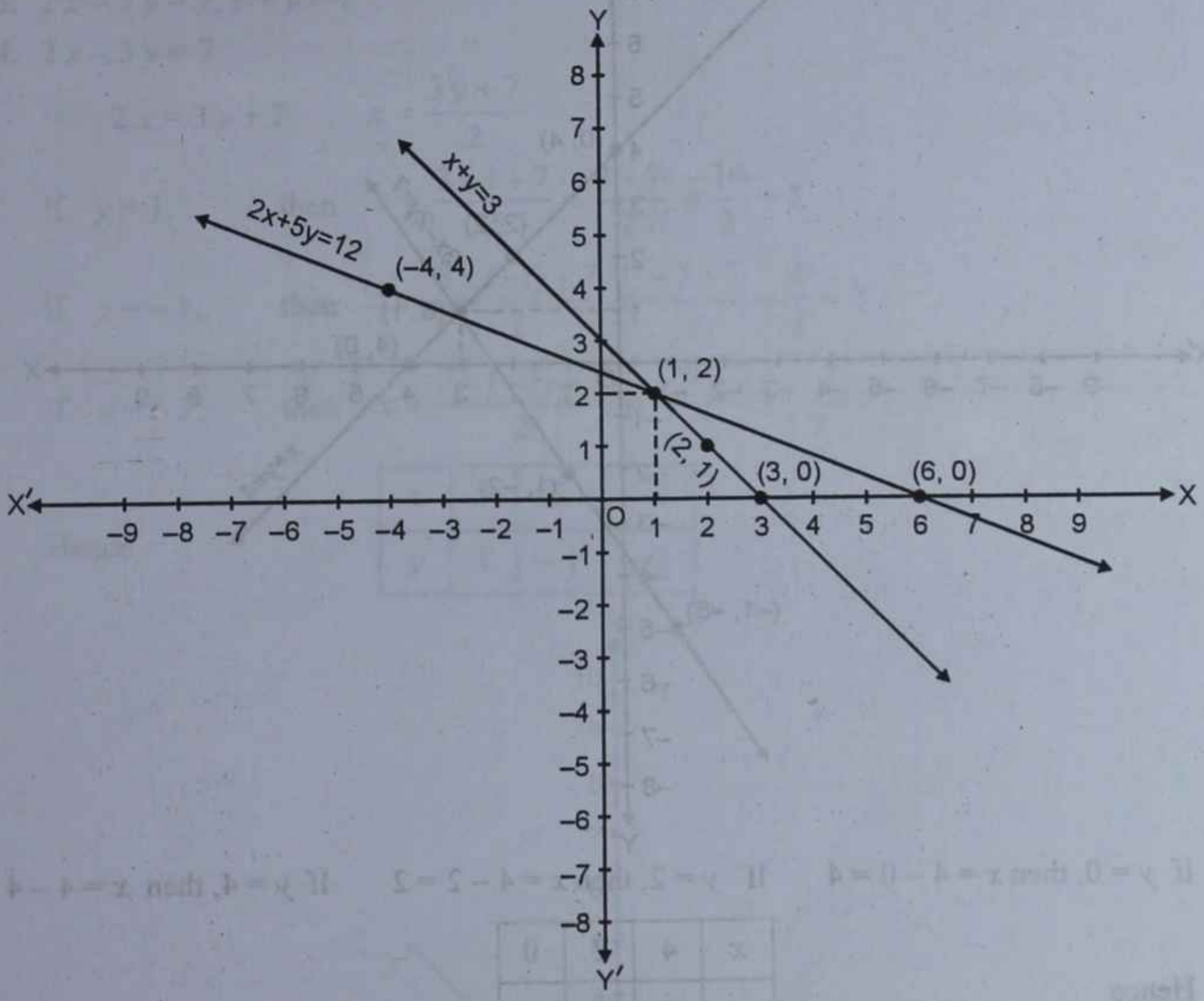
x	3	2	1
y	0	1	2

Taking scale 2 cm = 1 unit on both the axes, we plot the points (3, 0), (2, 1) and (1, 2) on the graph. Join them to form a line as shown.

Again $2x + 5y = 12$

$2x = 12 - 5y$

$$x = \frac{12 - 5y}{2}$$



If $y = 0$, then $x = \dfrac{-12 - 5 \times 0}{2} = \dfrac{12 - 0}{2} = \dfrac{12}{2} = 6$

If $y = 2$, then $x = \dfrac{12 - 5 \times 2}{2} = \dfrac{12 - 10}{2} = \dfrac{2}{2} = 1$

If $y = 4$, then $x = \dfrac{12 - 5 \times 4}{2} = \dfrac{12 - 20}{2} = \dfrac{-8}{2} = -4$

Hence

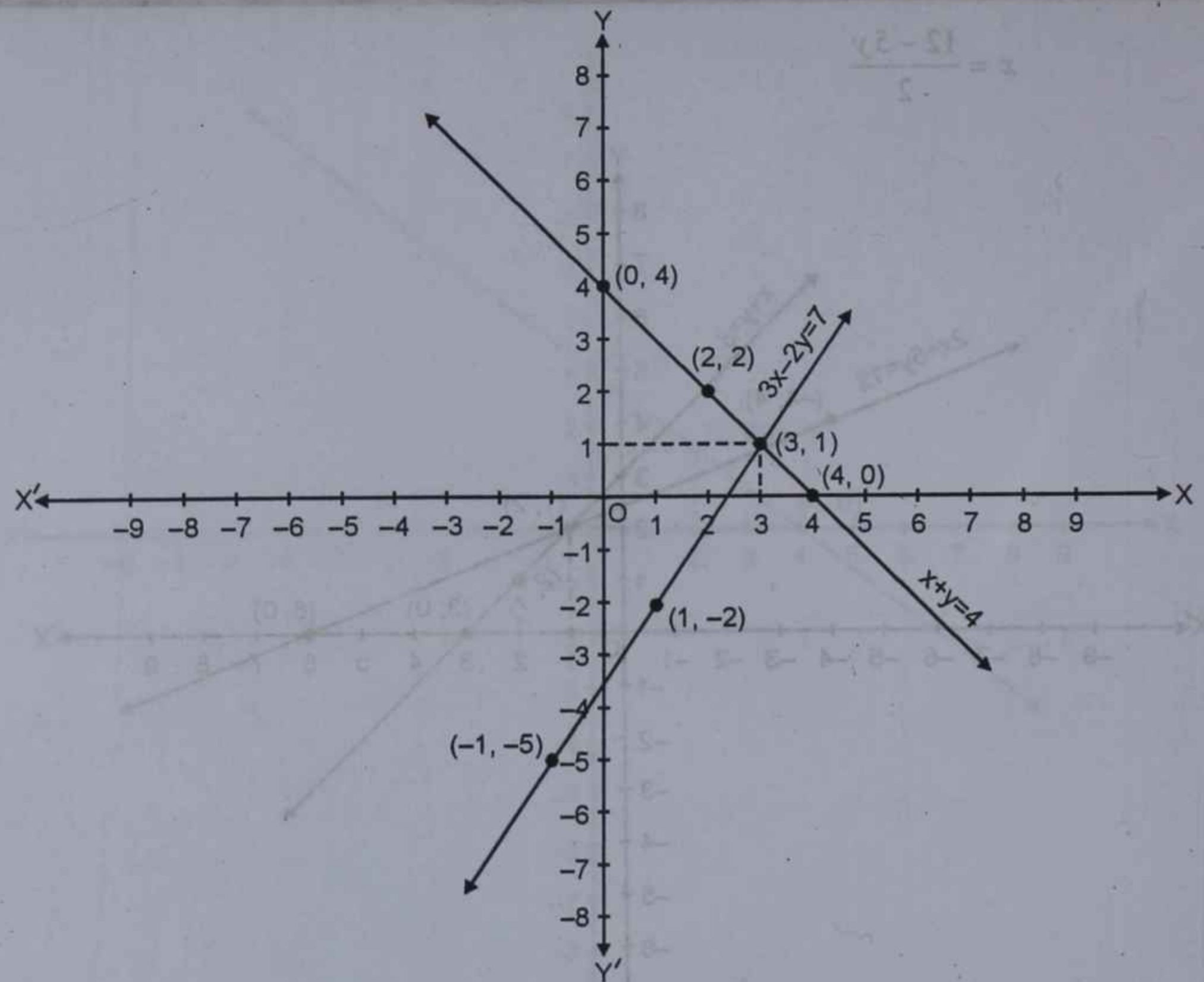
x	6	1	-4
y	0	2	4

We plot the points (6, 0), (1, 2) and (– 4, 4) and join them to form an other line. We see that these two lines intersect each other at (1, 2).

$\therefore$ Solution is $x = 1, y = 2$ **Ans.**

Q. 2. $x + y = 4, 3x - 2y = 7$

Sol. $x + y = 4 \quad \Rightarrow \quad x = 4 - y$



If $y = 0$, then $x = 4 - 0 = 4$ If $y = 2$, then $x = 4 - 2 = 2$ If $y = 4$, then $x = 4 - 4 = 0$

Hence

x	4	2	0
y	0	2	4

Now we plot the points (4, 0), (2, 2) and (0, 4) on the graph and join them to form a line.

Again, $3x - 2y = 7$

$$3x = 7 + 2y \qquad x = \frac{7 + 2y}{3}$$

If $y = 1$, then $x = \frac{7 + 2 \times 1}{3} = \frac{7 + 2}{3} = \frac{9}{3} = 3$

If $y = -2$, then $x = \frac{7 + 2 \times (-2)}{3} = \frac{7 - 4}{3} = \frac{3}{3} = 1$

If $y = -5$, then $x = \frac{7 + 2(-5)}{3} = \frac{7 - 10}{3} = \frac{-3}{3} = -1$

Hence

x	3	1	–1
y	1	–1	–5

Now we plot the points (3, 1), (1, – 1) and (– 1, – 5) on the graph and join them to form a line. We see that these two lines intersect each other at (3, 1). Hence, solution is $x = 3, y = 1$. **Ans.**

Q. 3. $2x - 3y = 7, x + y = 1$

Sol. $2x - 3y = 7$

$$2x = 3y + 7 \qquad x = \frac{3y + 7}{2}$$

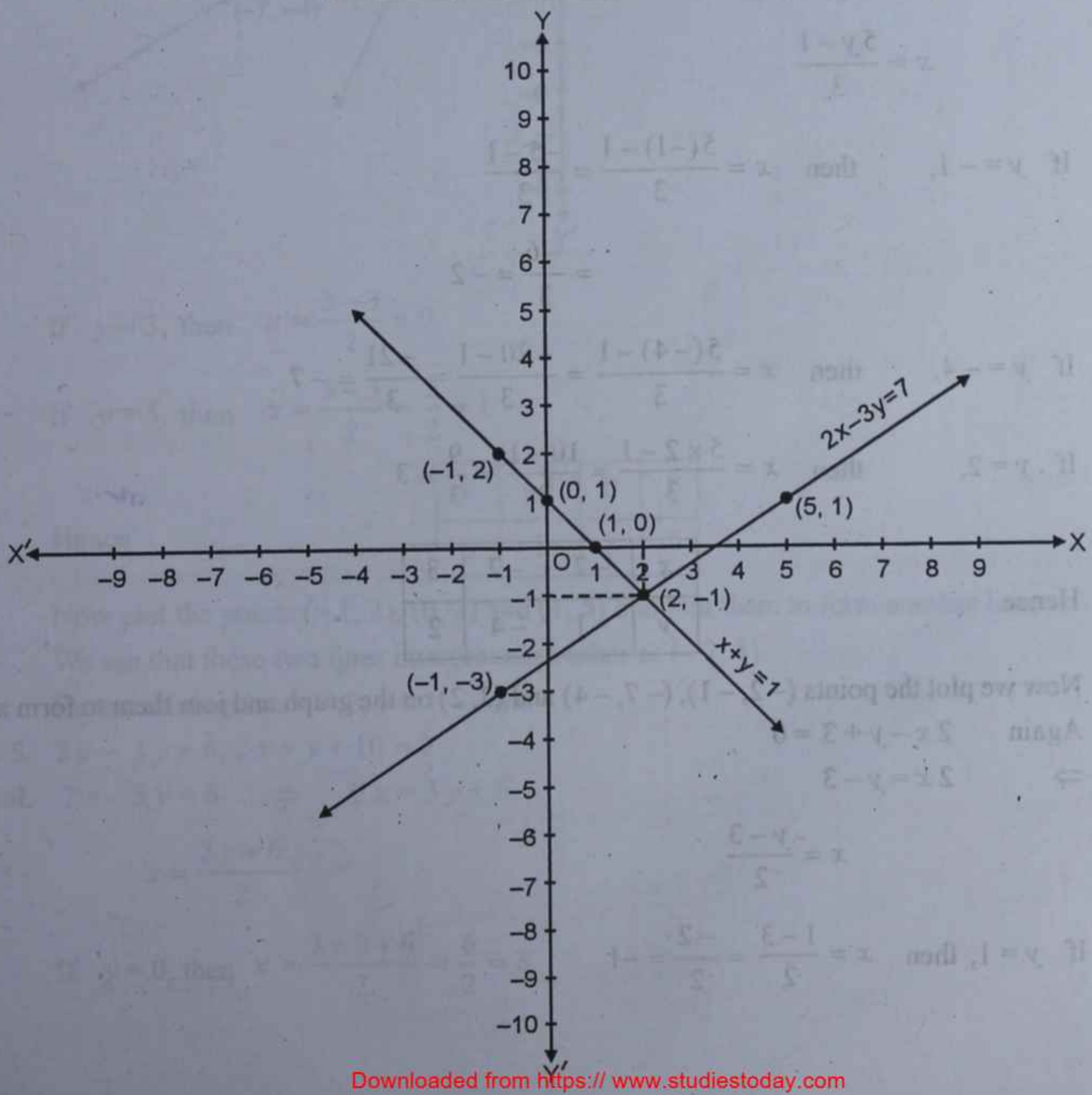
If $y = 1$, then $x = \frac{3 \times 1 + 7}{2} = \frac{3 + 7}{2} = \frac{10}{2} = 5$

If $y = -1$, then $x = \frac{3 \times (-1) + 7}{2} = \frac{-3 + 7}{2} = \frac{4}{2} = 2$

If $y = -3$, then $x = \frac{3 \times (-3) + 7}{2} = \frac{-9 + 7}{2} = \frac{-2}{2} = -$

Hence

x	5	2	–1
y	1	–1	–3



Now we plot the points (5, 1), (2, – 1) and (– 1, – 3) on the graph and join them to get the line.

Again $x + y = 1$

$\Rightarrow x = 1 - y$

If $y = 0$, then $x = 1 - 0 = 1$

If $y = 1$, then $x = 1 - 1 = 0$

If $y = 2$, then $x = 1 - 2 = -1$

Hence

x	1	0	-1
y	0	1	2

Now we plot the points (1, 0), (0, 1) and (– 1, 2) on the graph and join them to get another line. We see that these two lines intersect each other at (2, – 1).

Hence solution is $x = 2, y = -1$ **Ans.**

Q. 4. $3x - 5y + 1 = 0, 2x - y + 3 = 0$

Sol. $3x - 5y + 1 = 0$

$\Rightarrow \quad 3x = 5y - 1$

$$x = \frac{5y - 1}{3}$$

If $y = -1$, then $x = \frac{5(-1) - 1}{3} = \frac{-5 - 1}{3}$

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

If $y = -4$, then $x = \frac{5(-4) - 1}{3} = \frac{-20 - 1}{3} = \frac{-21}{3} = -7$

If $y = 2$, then $x = \frac{5 \times 2 - 1}{3} = \frac{10 - 1}{3} = \frac{9}{3} = 3$

Hence

x	-2	-7	3
y	-1	-4	2

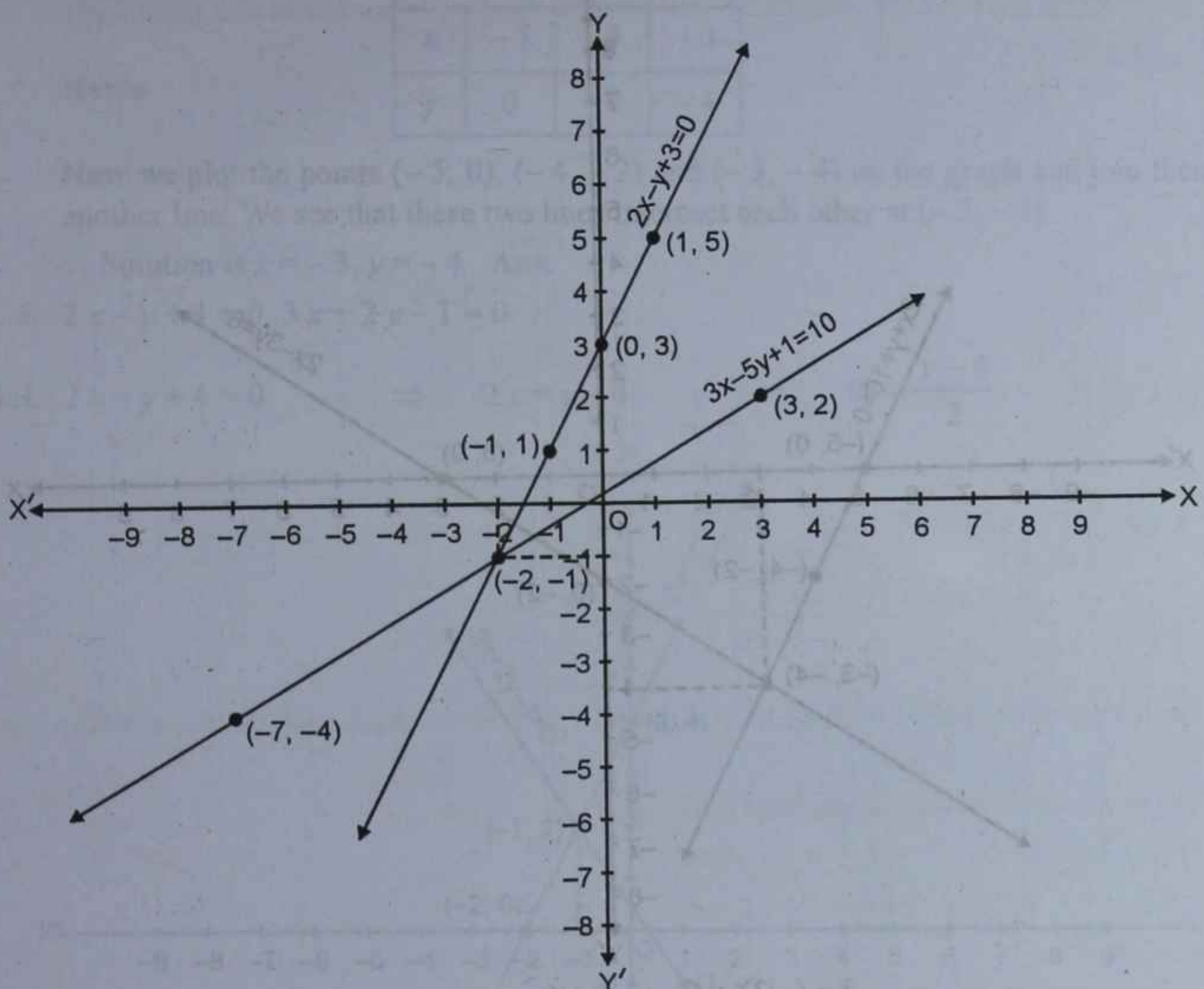
Now we plot the points (– 2, – 1), (– 7, – 4) and (3, 2) on the graph and join them to form a line.

Again $2x - y + 3 = 0$

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

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

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



If $y = 3$, then $x = \dfrac{3-3}{2} = 0$

If $y = 5$, then $x = \dfrac{5-3}{2} = \dfrac{2}{2} = 1$

Hence

x	-1	0	1
y	1	3	5

Now plot the points $(-1, 2)$, $(0, 3)$ and $(1, 5)$ and join them to form another line.

We see that these two lines intersect each other at $(-2, 1)$.

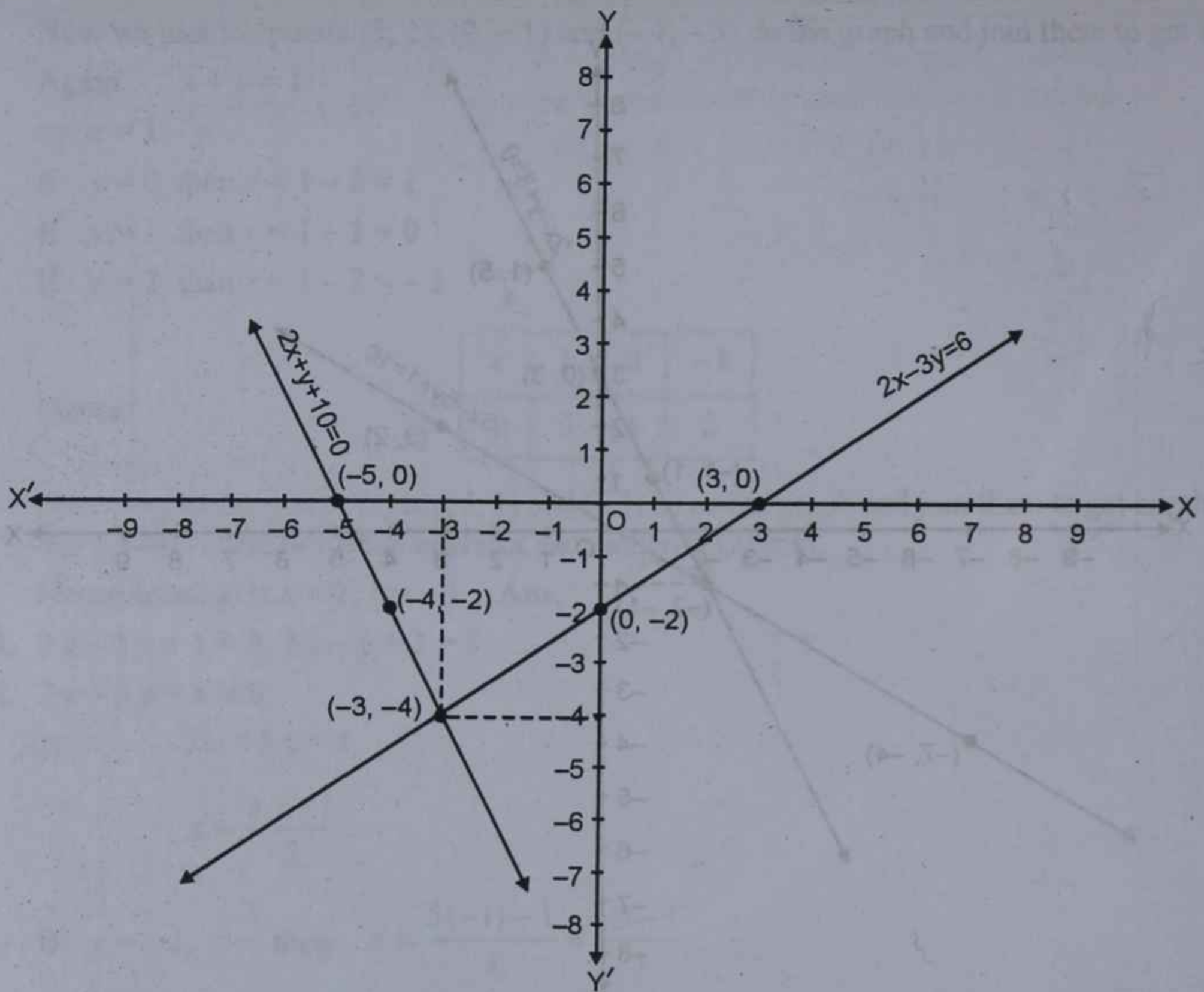
Hence solution is $x = -2, y = 1$. **Ans.**

Q. 5. $2x - 3y = 6, 2x + y + 10 = 0$

Sol. $2x - 3y = 6 \quad \Rightarrow \quad 2x = 3y + 6$

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

If $y = 0$, then $x = \dfrac{3 \times 0 + 6}{2} = \dfrac{6}{2} = 3$



If $y = -2$, then $x = \dfrac{3\times(-2)+6}{2} = \dfrac{-6+6}{2} = 0$

If $y = -4$, then $x = \dfrac{3(-4)+6}{2} = \dfrac{-12+6}{2} = \dfrac{-6}{2} = -3$

Hence

x	3	0	-3
y	0	-2	-4

Now we plot the points (3, 0), (0, – 2) and (– 3, – 4) on the graph and join them to form a line.

Again $2x + y + 10 = 0$

$2x = -(y + 10)$

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

If $y = 0$, then $x = \dfrac{-(0+10)}{2} = \dfrac{-10}{2} = -5$

If $y = -2$, then $x = \dfrac{-(-2+10)}{2} = \dfrac{-8}{2} = -4$

If $y = -4$, then $x = \dfrac{-(-4+10)}{2} = \dfrac{-6}{2} = -3$

Hence

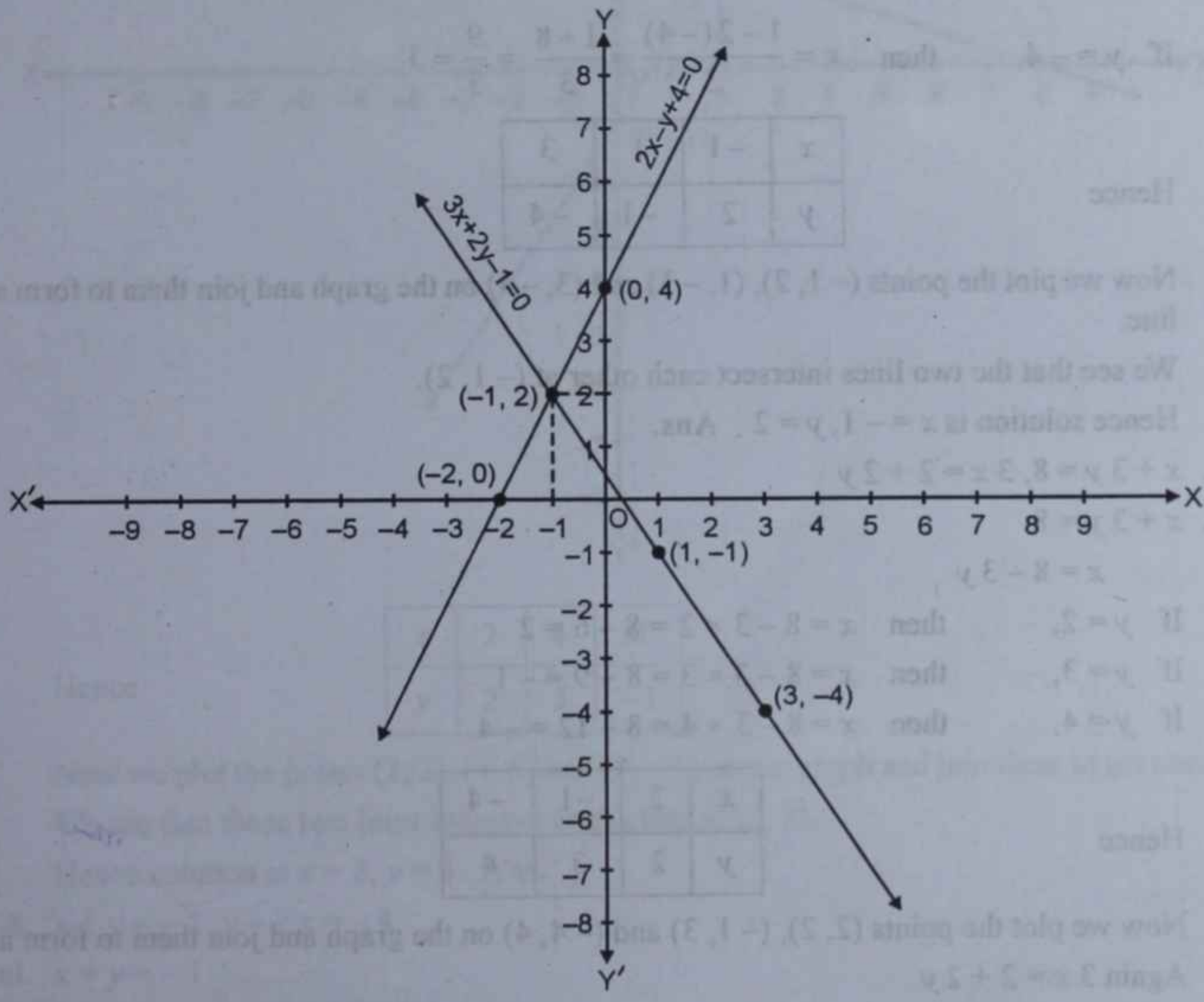
x	-5	-4	-3
y	0	-2	-4

Now we plot the points $(-5, 0)$, $(-4, -2)$ and $(-3, -4)$ on the graph and join them to form another line. We see that these two lines intersect each other at $(-3, -4)$.

$\therefore$ Solution is $x = -3, y = -4$ **Ans.**

Q. 6. $2x - y + 4 = 0, 3x + 2y - 1 = 0$

Sol. $2x - y + 4 = 0 \quad \Rightarrow \quad 2x = y - 4 \quad \Rightarrow \quad x = \dfrac{y-4}{2}$



If $y = 0$, then $x = \dfrac{0-4}{2} = \dfrac{-4}{2} = -2$

If $y = 2$, then $x = \dfrac{2-4}{2} = \dfrac{-2}{2} = -1$

If $y = 4$, then $x = \dfrac{4-4}{2} = 0$

Hence

x	-2	-1	0
y	0	2	4

Now we plot the points $(-2, 0)$, $(-1, 2)$ and $(0, 4)$ on the graph and join them to form a line.

Again $3x + 2y - 1 = 0$

$$3x = 1 - 2y$$

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

If $y = 2$, then $x = \frac{1-2(2)}{3} = \frac{1-4}{3} = \frac{-3}{3} = -1$

If $y = -1$, then $x = \frac{1-2(-1)}{3} = \frac{1+2}{3} = \frac{3}{3} = 1$

If $y = -4$, then $x = \frac{1-2(-4)}{3} = \frac{1+8}{3} = \frac{9}{3} = 3$

Hence

x	-1	1	3
y	2	-1	-4

Now we plot the points $(-1, 2)$, $(1, -1)$ and $(3, -4)$ on the graph and join them to form another line.

We see that the two lines intersect each other at $(-1, 2)$.

Hence solution is $x = -1, y = 2$ **Ans.**

Q. 7. $x + 3y = 8, 3x = 2 + 2y$

Sol. $x + 3y = 8$

$$x = 8 - 3y$$

If $y = 2$, then $x = 8 - 3 \times 2 = 8 - 6 = 2$

If $y = 3$, then $x = 8 - 3 \times 3 = 8 - 9 = -1$

If $y = 4$, then $x = 8 - 3 \times 4 = 8 - 12 = -4$

Hence

x	2	-1	-4
y	2	3	4

Now we plot the points $(2, 2)$, $(-1, 3)$ and $(-4, 4)$ on the graph and join them to form a line.

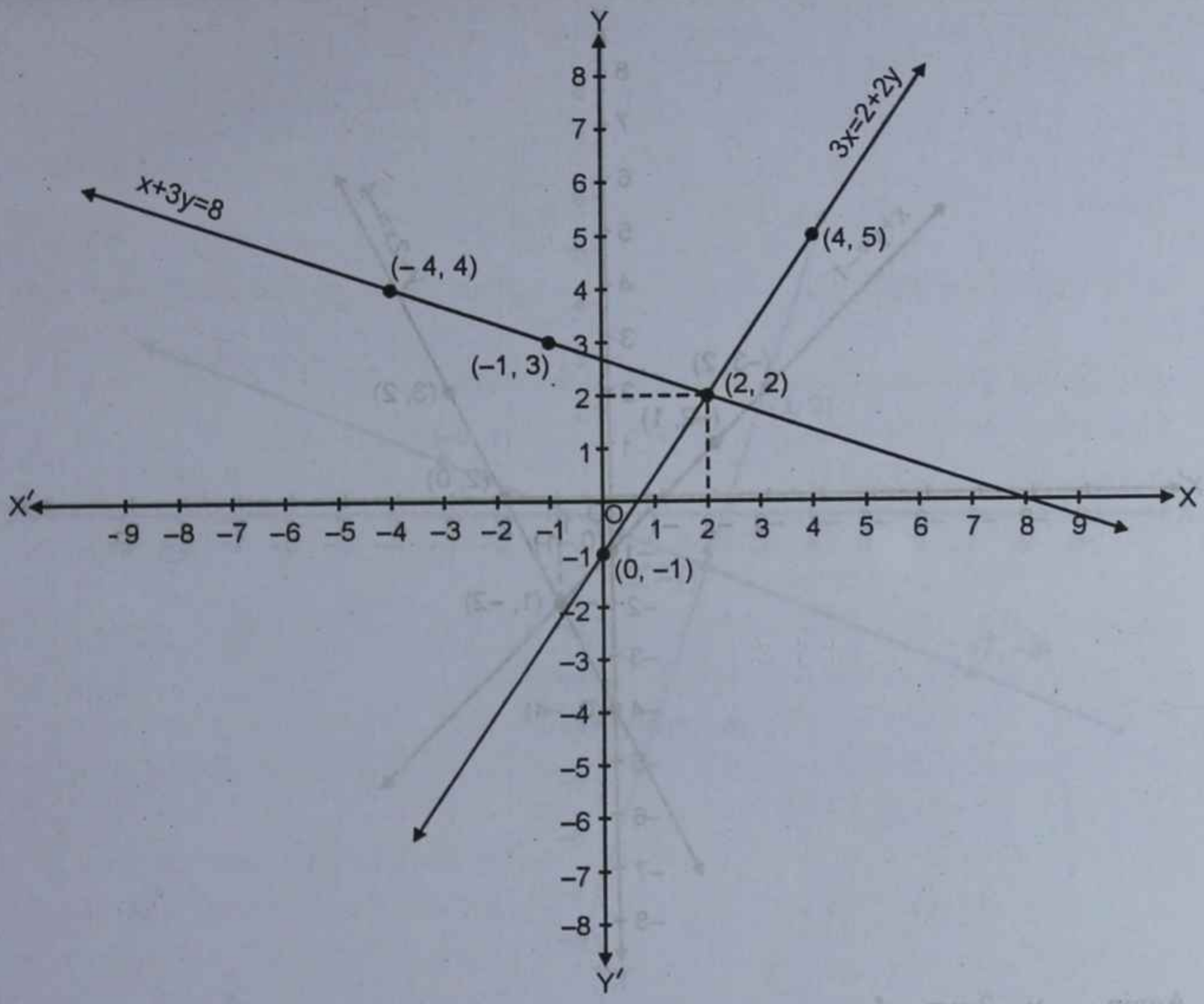
Again $3x = 2 + 2y$

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

If $y = 2$, then $x = \frac{2+2\times 2}{3} = \frac{2+4}{3} = \frac{6}{3} = 2$

If $y = 5$, then $x = \frac{2+2\times 5}{3} = \frac{2+10}{3} = \frac{12}{3} = 4$

If $y = -1$, then $x = \frac{2+2(-1)}{3} = \frac{2-2}{3} = 0$



Hence

x	2	4	0
y	2	5	–1

Now we plot the points (2, 2), (4, 5) and (0, – 1) on the graph and join them to get another line.

We see that these two lines intersect each other at (2, 2).

Hence solution is $x = 2, y = 2$ **Ans.**

Q. 8. $x + y = -1, y - 2x = -4$

Sol. $x + y = -1$

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

If $y = 1$, then $x = -(1 + 1) = -2$

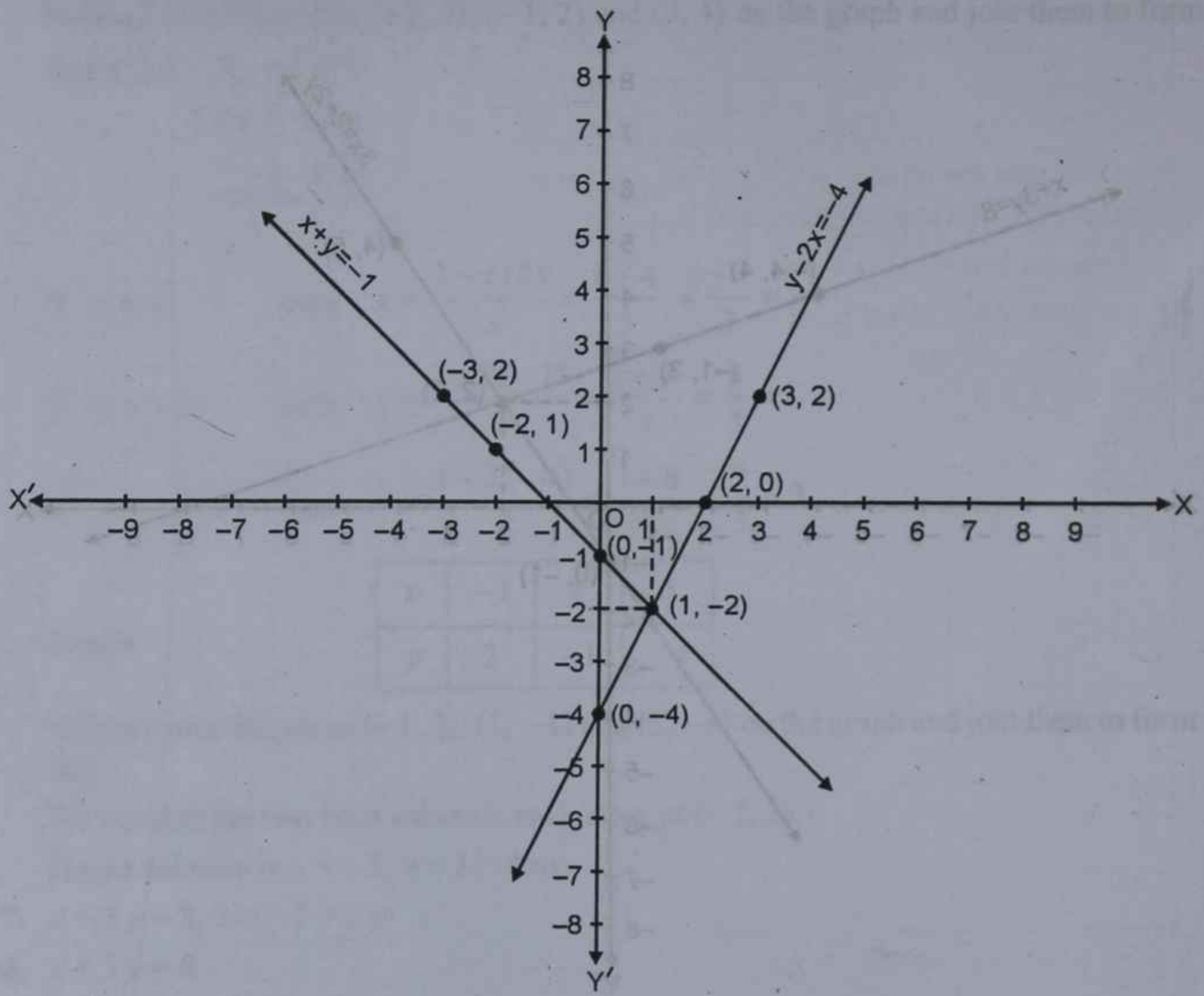
If $y = 2$, then $x = -(1 + 2) = -3$

If $y = -1$, then $x = -(1 - 1) = 0$

Hence

x	–2	–3	0
y	1	2	–1

Now we plot the points (– 2, 1), (– 3, 2) and (0, – 1) on the graph and join them to form a line.



Again $y - 2x = -4$

$y = 2x - 4$

If $x = 0$, then $y = 2 \times 0 - 4 = 0 - 4 = -4$

If $x = 2$, then $y = 2 \times 2 - 4 = 4 - 4 = 0$

If $x = 3$, then $y = 2 \times 3 - 4 = 6 - 4 = 2$

Hence

x	0	2	3
y	−4	0	2

Now we plot the points $(0, -4)$, $(2, 0)$ and $(3, 2)$ on the graph and join them to form another line. We see that these lines intersect each other at $(1, -2)$.

Hence solution is $x = 1, y = -2$ **Ans.**

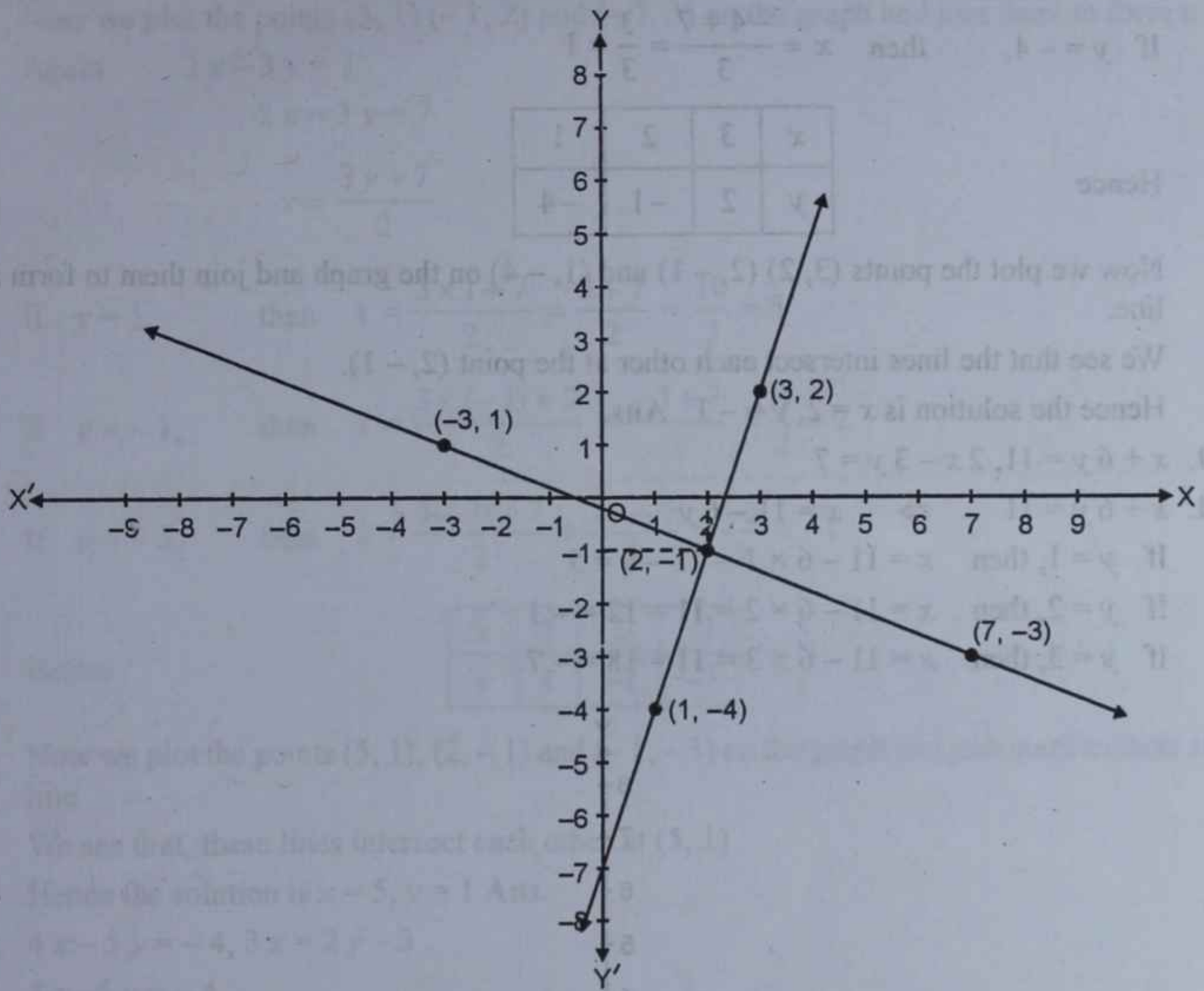
Q. 9. $2x + 5y = -1, 3x - y = 7$

Sol. $2x + 5y = -1$

$$2x = -1 - 5y = -(1 + 5y)$$

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

If $y = 1$, then $x = \frac{-(1+5\times 1)}{2} = \frac{-(1+5)}{2} = \frac{-6}{2} = -3$



If $y = -1$, then $x = \dfrac{-(1+5\times(-1))}{2} = \dfrac{-(1-5)}{2} = \dfrac{-(-4)}{2} = \dfrac{4}{2} = 2$

If $y = -3$, then $x = \dfrac{-[1+5\times(-3)]}{2} = \dfrac{-(1-15)}{2} = \dfrac{-(-14)}{2} = \dfrac{14}{2} = 7$

Hence

x	-3	2	7
y	1	-1	-3

Now we plot the points $(-3, 1)$, $(2, -1)$ and $(7, -3)$ on the graph and join them to form a line.

Again $3x - y = 7$

$3x = y + 7$

$x = \dfrac{y+7}{3}$

If $y = 2$, then $x = \dfrac{2+7}{3} = \dfrac{9}{3} = 3$

If $y = -1$, then $x = \dfrac{-1+7}{3} = \dfrac{6}{3} = 2$

If $y = -4$, then $x = \dfrac{-4+7}{3} = \dfrac{3}{3} = 1$

Hence

x	3	2	1
y	2	−1	−4

Now we plot the points (3, 2) (2, – 1) and (1, – 4) on the graph and join them to form another line.

We see that the lines intersect each other at the point (2, – 1).

Hence the solution is $x = 2, y = -1$ **Ans.**

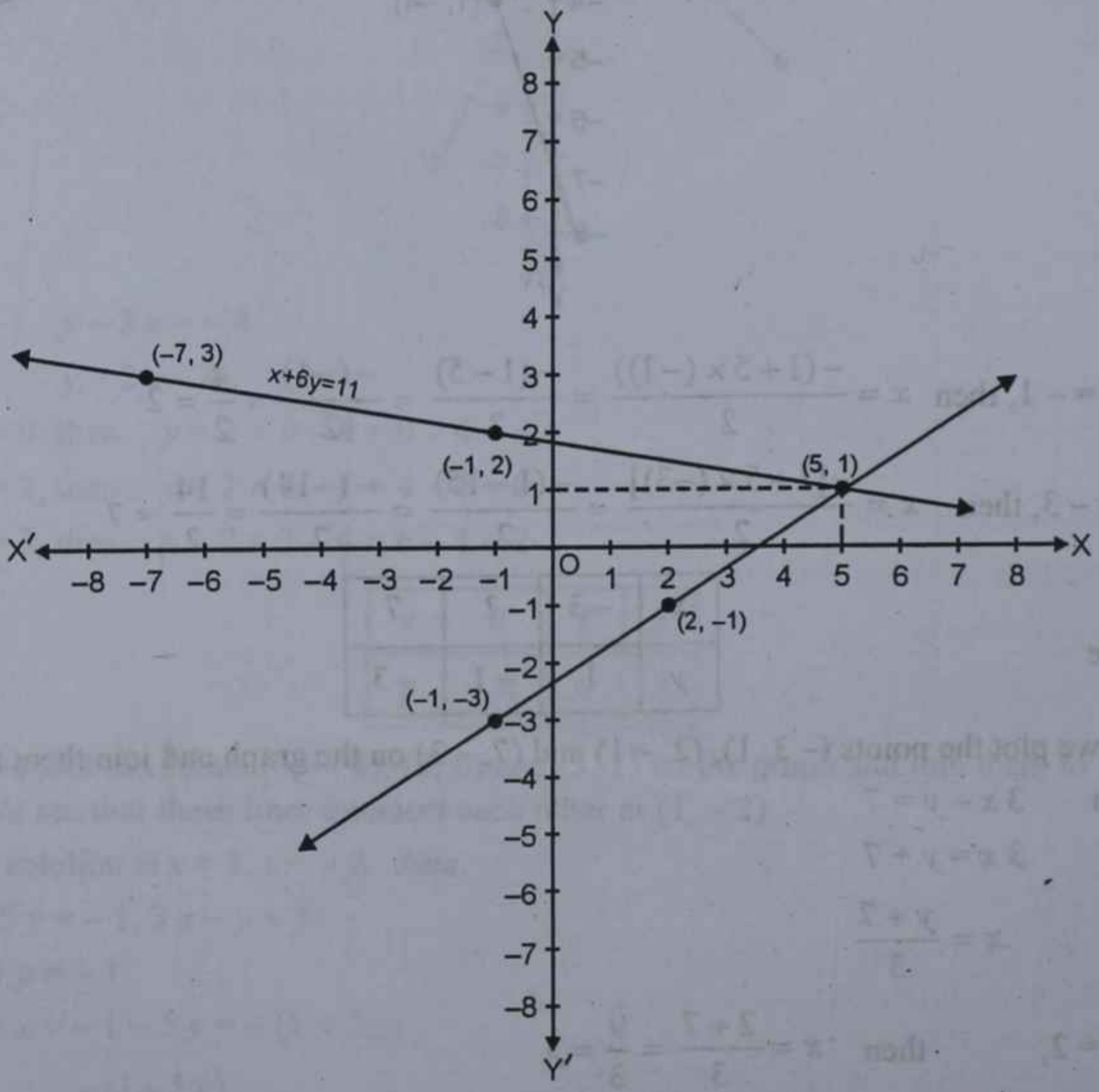
Q. 10. $x + 6y = 11, 2x - 3y = 7$

Sol. $x + 6y = 11 \quad \Rightarrow \quad x = 11 - 6y$

If $y = 1$, then $x = 11 - 6 \times 1 = 11 - 6 = 5$

If $y = 2$, then $x = 11 - 6 \times 2 = 11 - 12 = -1$

If $y = 3$, then $x = 11 - 6 \times 3 = 11 - 18 = -7$



x	5	−1	−7
y	1	2	3

Hence

Now we plot the points (5, 1) (– 1, 2) and (– 7, 3) on the graph and join them to form a line.

Again $2x - 3y = 7$

$$2x = 3y + 7$$

$$x = \frac{3y+7}{2}$$

If $y = 1$, then $x = \frac{3 \times 1 + 7}{2} = \frac{3+7}{2} = \frac{10}{2} = 5$

If $y = -1$, then $x = \frac{3 \times (-1) + 7}{2} = \frac{-3+7}{2} = \frac{4}{2} = 2$

If $y = -3$, then $x = \frac{3(-3)+7}{2} = \frac{-9+7}{2} = \frac{-2}{2} = -1$

Hence

x	5	2	–1
y	1	–1	–3

Now we plot the points (5, 1), (2, – 1) and (– 1, – 3) on the graph and join them to form another line.

We see that, these lines intersect each other at (5, 1)

Hence the solution is $x = 5, y = 1$ **Ans.**

Q. 11. $4x - 5y = -4, 3x = 2y - 3$

Sol. $4x - 5y = -4$

$$4x = 5y - 4$$

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

If $y = 0$, then $x = \frac{5 \times 0 - 4}{4} = \frac{-4}{4} = -1$

If $y = 4$, then $x = \frac{5 \times 4 - 4}{4} = \frac{20-4}{4} = \frac{16}{4} = 4$

If $y = -4$, then $x = \frac{5 \times (-4) - 4}{4} = \frac{-20-4}{4} = \frac{-24}{4} = -6$

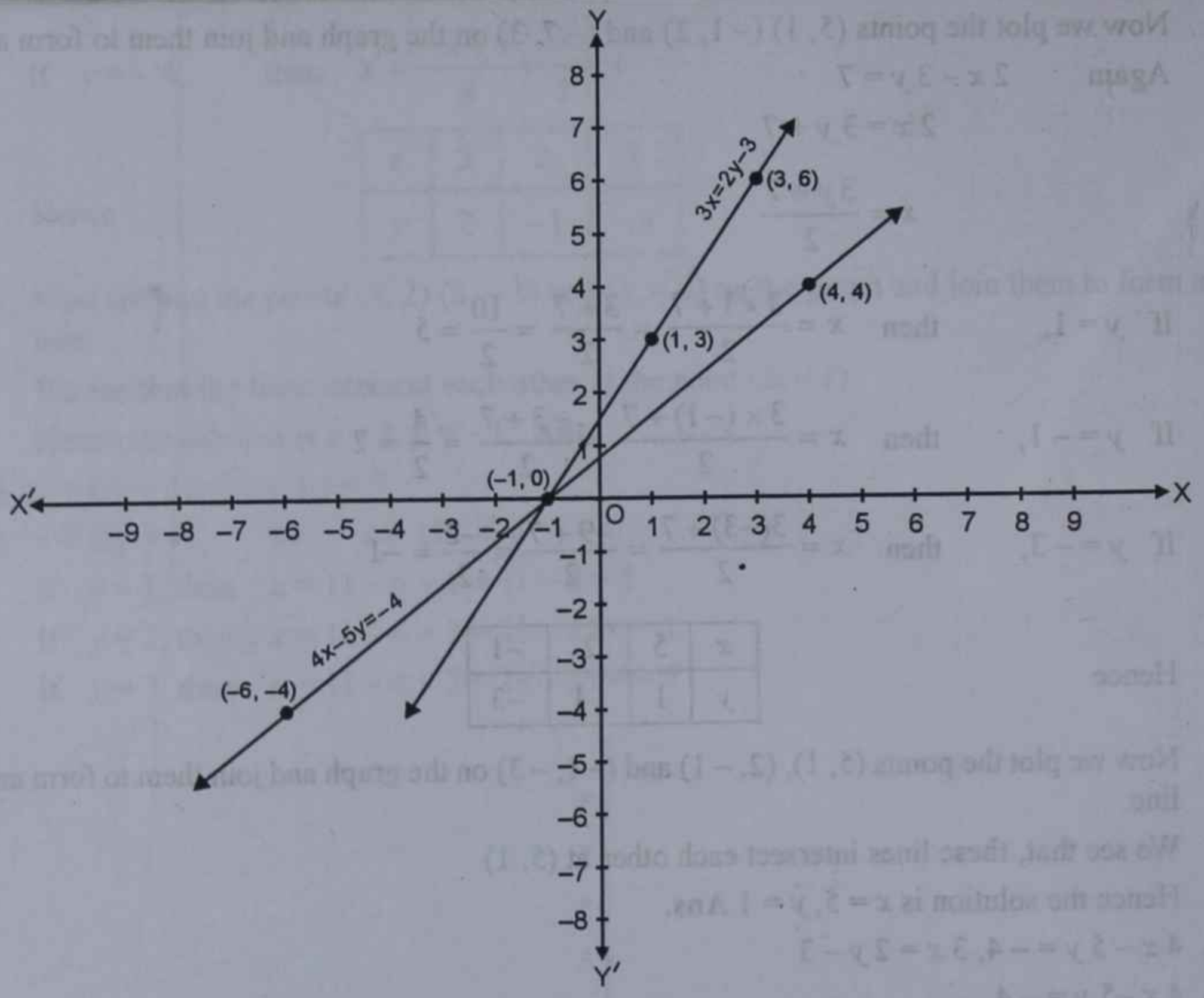
Hence

x	–1	4	–6
y	0	4	–4

Now we plot the points (– 1, 0), (4, 4) and (– 6, – 4) on the graph and join them to form a line.

Again $3x = 2y - 3$

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



If $y = 0$, then $x = \dfrac{2 \times 0 - 3}{3} = \dfrac{-3}{3} = -1$

If $y = 3$, then $x = \dfrac{2 \times 3 - 3}{3} = \dfrac{6 - 3}{3} = \dfrac{3}{3} = 1$

If $y = 6$, then $x = \dfrac{2 \times 6 - 3}{3} = \dfrac{12 - 3}{3} = \dfrac{9}{3} = 3$

Hence

x	-1	1	3
y	0	3	6

Now we plot the points $(-1, 0)$, $(1, 3)$ and $(3, 6)$ on the graph and join them to form another line.

We see that the lines intersect each other at the point $(-1, 0)$

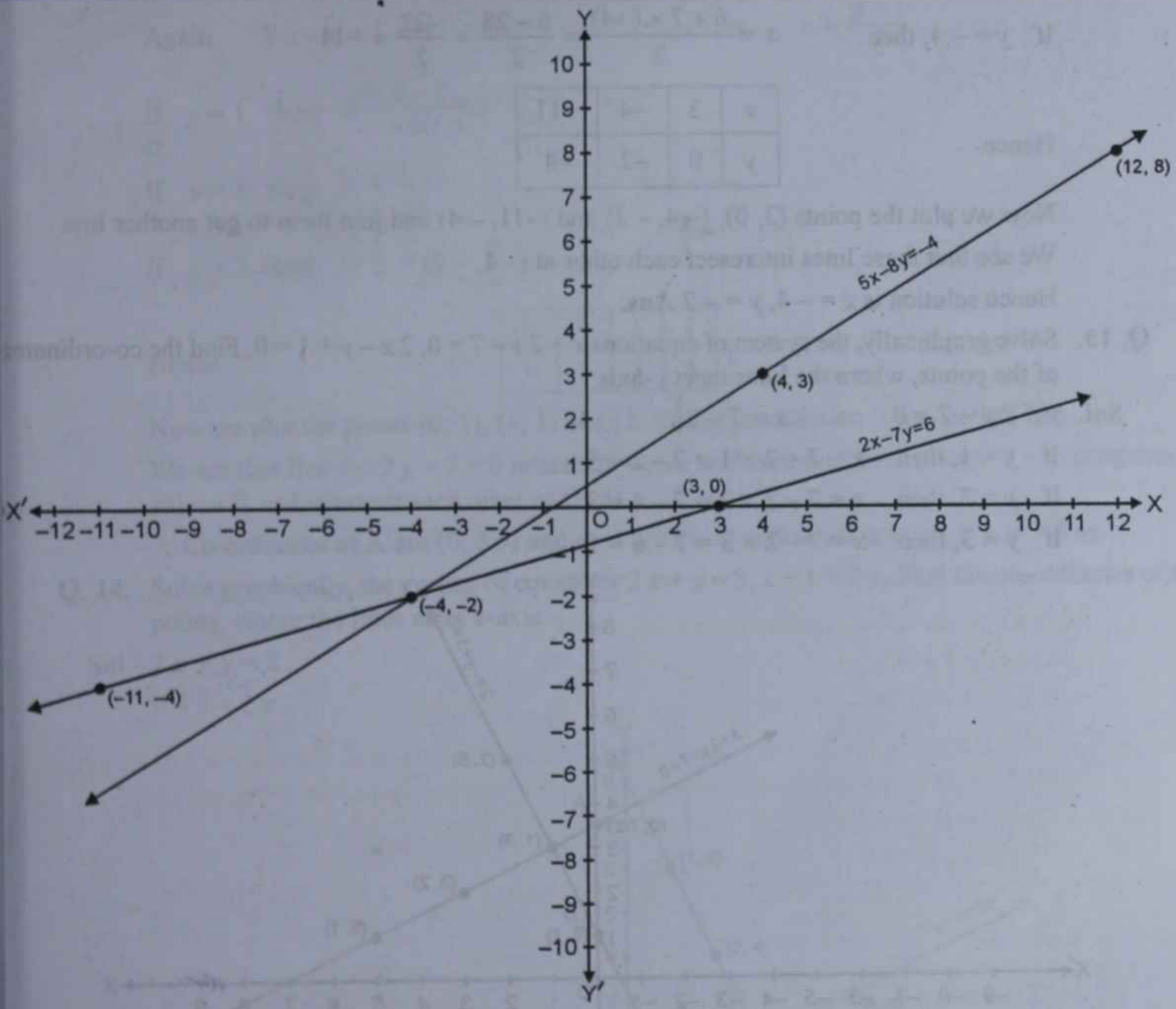
Hence solution is $x = -1,\ y = 0$ **Ans.**

Q. 12. $5x - 8y = -4, 2x - 7y = 6$

Sol. $5x - 8y = -4 \Rightarrow 5x = 8y - 4$

$$x = \frac{8y - 4}{5}$$

If $y = -2$, then $x = \dfrac{8 \times (-2) - 4}{5} = \dfrac{-16 - 4}{5} = \dfrac{-20}{5} = -4$



If $y = 3$, then $x = \dfrac{8 \times 3 - 4}{5} = \dfrac{24 - 4}{5} = \dfrac{20}{5} = 4$

If $y = 8$, then $x = \dfrac{8 \times 8 - 4}{5} = \dfrac{64 - 4}{5} = \dfrac{60}{5} = 12$

Hence

x	-4	4	12
y	-2	3	8

Now we plot the points $(-4, -2)$, $(5, 3)$ and $(12, 8)$ and join them to form a line.

Again $2x - 7y = 6 \Rightarrow 2x = 6 + 7y \Rightarrow x = \dfrac{6 + 7y}{2}$

If $y = 0$, then $x = \dfrac{6 + 7 \times 0}{2} = \dfrac{6}{2} = 3$

If $y = -2$, then $x = \dfrac{6 + 7 \times (-2)}{2} = \dfrac{6 - 14}{2} = \dfrac{-8}{2} = -4$

If $y = -4$, then $x = \dfrac{6 + 7 \times (-4)}{2} = \dfrac{6 - 28}{2} = \dfrac{-22}{2} = -11$

Hence

x	3	–4	–11
y	0	–2	–4

Now we plot the points (3, 0), (– 4, – 2) and (–11, – 4) and join them to get another line.

We see that these lines interesect each other at (– 4, – 2)

Hence solution is $x = -4, y = -2$ **Ans.**

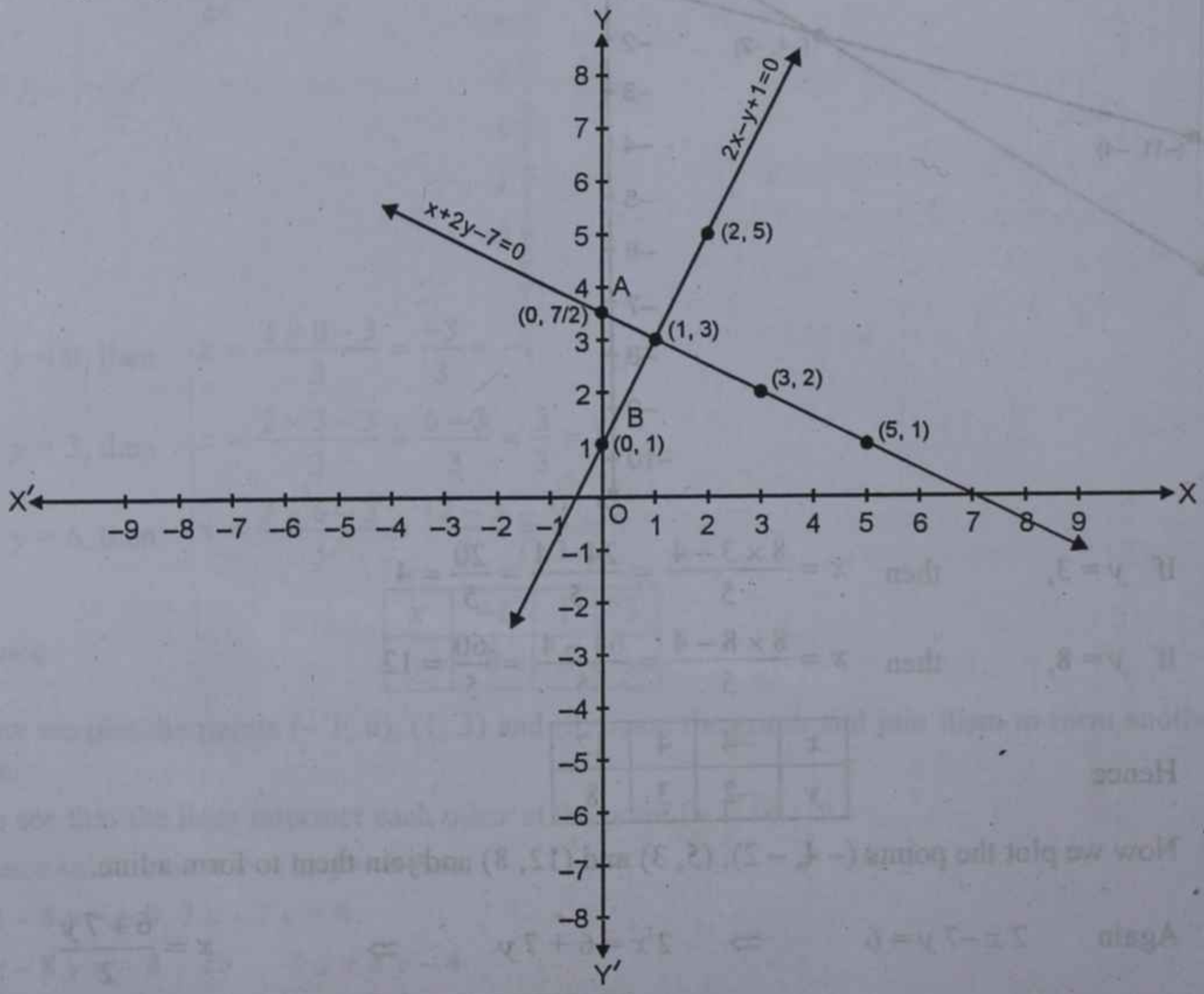
Q. 13. Solve graphically, the system of equations $x + 2y - 7 = 0$, $2x - y + 1 = 0$. Find the co-ordinates of the points, where the lines meet y-axis.

Sol. $x + 2y - 7 = 0 \quad \Rightarrow \quad x = 7 - 2y$

If $y = 1$, then $x = 7 - 2 \times 1 = 7 - 2 = 5$

If $y = 2$, then $x = 7 - 2 \times 2 = 7 - 4 = 3$

If $y = 3$, then $x = 7 - 2 \times 3 = 7 - 6 = 1$



Hence

x	5	3	1
y	1	2	3

Now we plot the points (5, 1), (3, 2) and (1, 3) and join them to form a line.

Again $2x - y + 1 = 0 \quad \Rightarrow \quad 2x = y - 1 \quad \Rightarrow \quad x = \frac{y-1}{2}$

If $y = 1$, then $x = \frac{1-1}{2} = 0$

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

If $y = 5$, then $x = \frac{5-1}{2} = \frac{4}{2} = 2$

Hence

x	0	1	2
y	1	3	5

Now we plot the points (0, 1), (1, 3) and (2, 5) and join them to form another line.

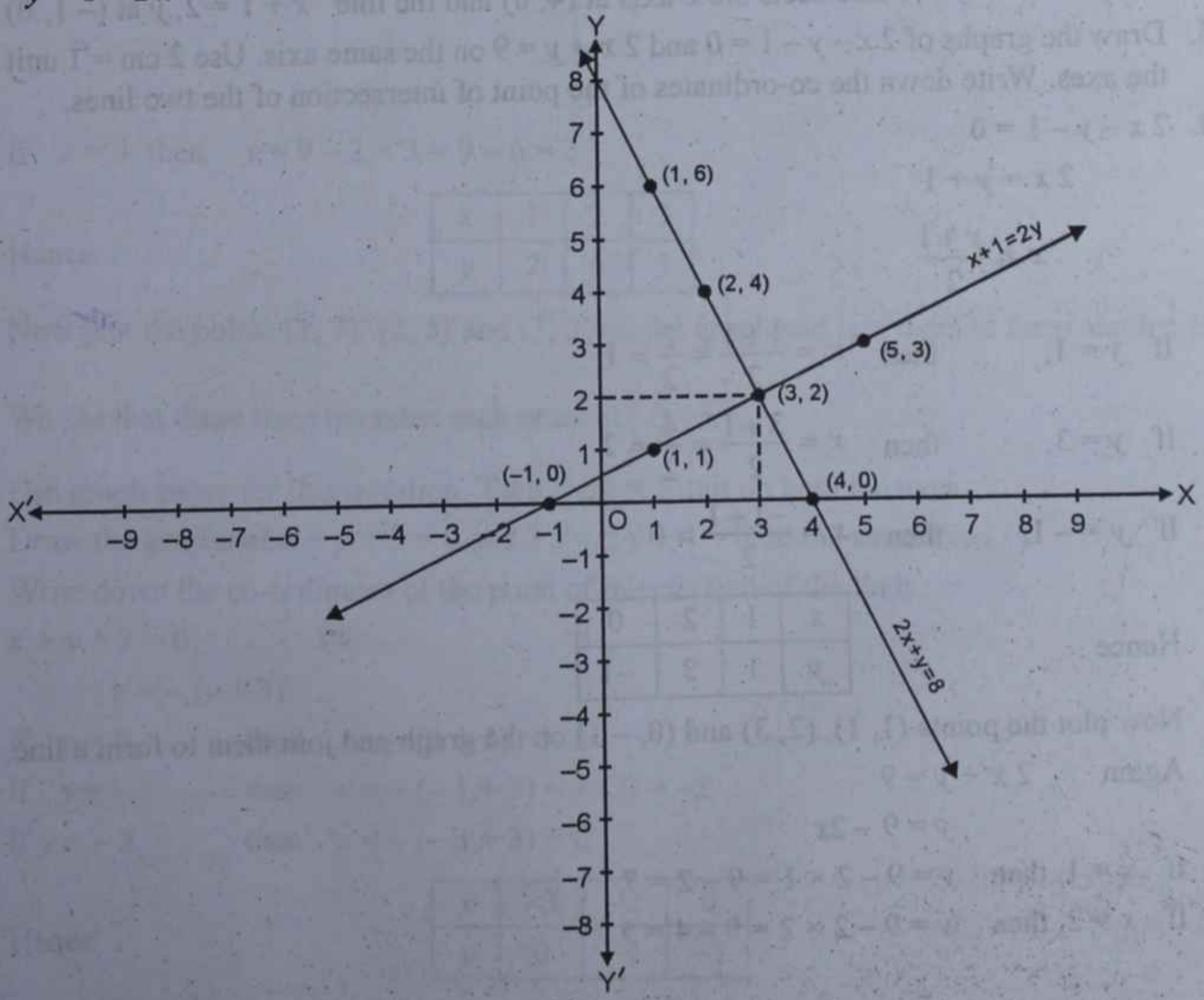
We see that line $x + 2y - 7 = 0$ intersects y-axis at A and the line $2x - y + 1 = 0$ intersects y-axis at B and intersect each other at (1, 3)

$\therefore$ Co-ordinates of A are (0, 3·5) and of B are (0, 1) and solution is $x = 1, y = 3$ **Ans.**

Q. 14. Solve graphically, the system of equations $2x + y = 8, x + 1 = 2y$. Find the co-ordinates of the points, where the lines meet x-axis.

Sol. $2x + y = 8$

$y = 8 - 2x$



If $x = 1$, then $y = 8 - 2 \times 1 = 8 - 2 = 6$

If $x = 2$, then $y = 8 - 2 \times 2 = 8 - 4 = 4$

If $x = 3$, then $y = 8 - 2 \times 3 = 8 - 6 = 2$

Hence

x	1	2	3
y	6	4	2

Now plot the points (1, 6), (2, 4) and (3, 2) on the graph. Join them to form a line.

Again $x + 1 = 2y$

$$x = 2y - 1$$

If $y = 1$, then $x = 2 \times 1 - 1 = 2 - 1 = 1$

If $y = 2$, then $x = 2 \times 2 - 1 = 4 - 1 = 3$

If $y = 3$, then $x = 3 \times 2 - 1 = 6 - 1 = 5$

Hence

x	1	3	5
y	1	2	3

Now plot the points (1, 1), (3, 2) and (5, 3) on the graph and join them to form another line.

We see that these lines intersect each other at (3, 2)

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

The line $2x + y = 8$ intersects the x-axis at (4, 0) and the line $x + 1 = 2, y$ at (– 1, 0) **Ans.**

Q. 15. Draw the graphs of $2x - y - 1 = 0$ and $2x + y = 9$ on the same axis. Use 2 cm = 1 unit on both the axes. Write down the co-ordinates of the point of intersection of the two lines.

Sol. $2x - y - 1 = 0$

$$2x = y + 1$$

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

If $y = 1$, then $x = \frac{1+1}{2} = \frac{2}{2} = 1$

If $y = 3$, then $x = \frac{3+1}{2} = \frac{4}{2} = 2$

If $y = -1$, then $x = \frac{-1+1}{2} = 0$

Hence

x	1	2	0
y	1	3	–1

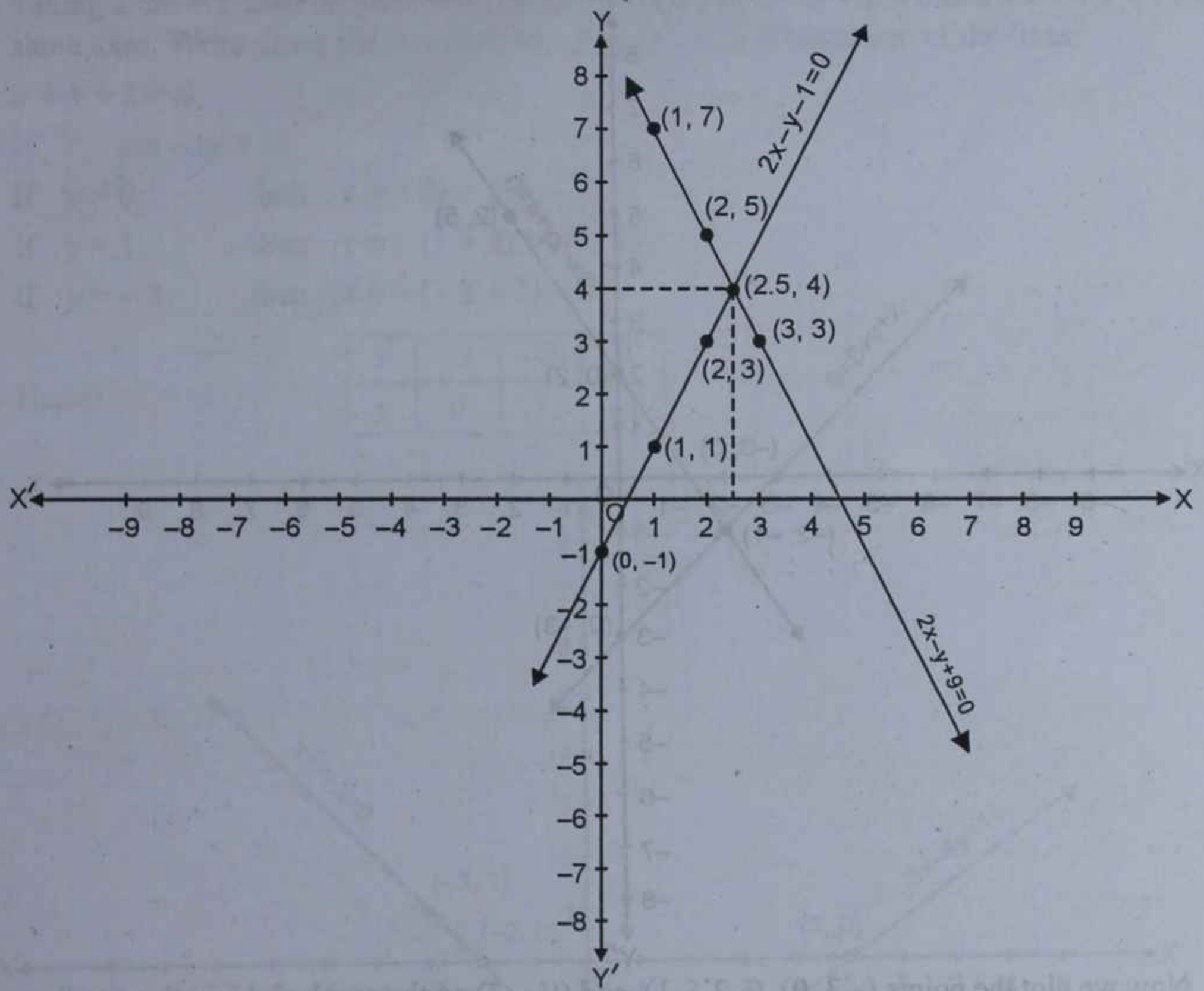
Now plot the points (1, 1), (2, 3) and (0, – 1) on the graph and join them to form a line.

Again $2x + y = 9$

$$y = 9 - 2x$$

If $x = 1$, then $y = 9 - 2 \times 1 = 9 - 2 = 7$

If $x = 2$, then $y = 9 - 2 \times 2 = 9 - 4 = 5$



If $x = 3$, then $y = 9 - 2 \times 3 = 9 - 6 = 3$

Hence

x	1	2	3
y	7	5	3

Now plot the points (1, 7), (2, 5) and (3, 3) on the graph and join them to form another line.

We see that these lines intersect each other at $\left(\frac{5}{2}, 4\right)$.

Q. 16. Use graph paper for this question. Take 2 cm = 1 unit on both the axes.

(*i*) Draw the graphs of $x + y + 3 = 0$ and $3x - 2y + 4 = 0$ on the same axes.

(*ii*) Write down the co-ordinates of the point of intersection of the lines.

Sol. $x + y + 3 = 0$

$x = -(y + 3)$

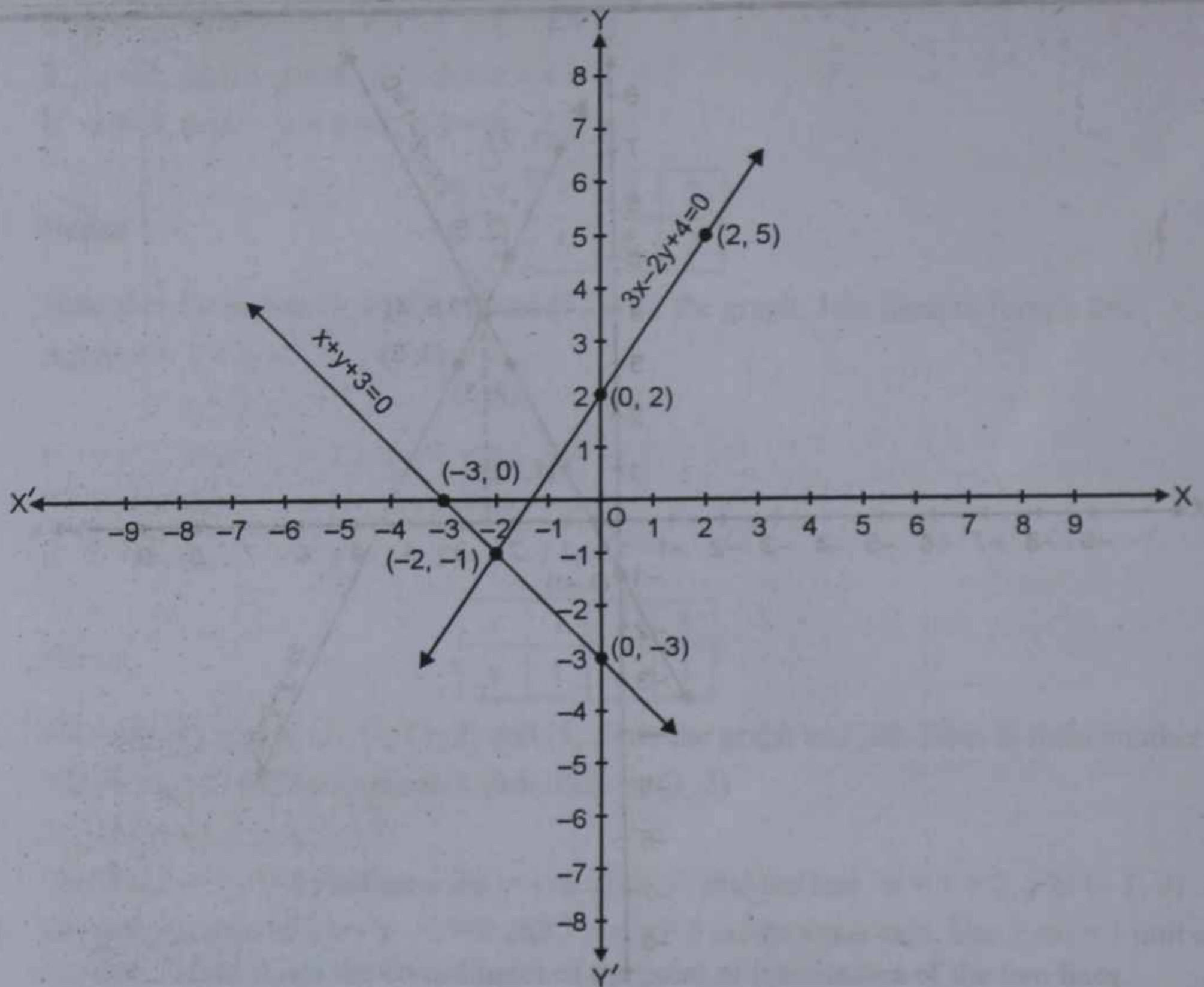
If $y = 0$, then $x = -(0 + 3) = -3$

If $y = -1$ then $x = -(-1 + 3) = -(2) = -2$

If $y = -3$, then $x = -(-3 + 3) = 0$

Hence

x	–3	–2	0
y	0	–1	–3



Now we plot the points $(-3, 0)$, $(-2, -1)$, and $(0, -3)$ on the graph and join them to form a line

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

$$3x = 2y - 4$$

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

If $y = -1$, then $x = \frac{2 \times (-1) - 4}{3} = \frac{-2 - 4}{3} = \frac{-6}{3} = -2$

If $y = 2$, then $x = \frac{2 \times 2 - 4}{3} = \frac{4 - 4}{3} = 0$

If $y = 5$, then $x = \frac{2 \times 5 - 4}{3} = \frac{10 - 4}{3} = \frac{6}{3} = 2$

Hence

x	–2	0	2
y	–1	2	5

Now we plot the points $(-2, -1)$, $(0, 2)$ and $(2, 5)$ on the graph and join them to form another line.

(*ii*) We see that these lines intersect each other at $(-2, -1)$

Hence solution is $x = -2, y = -1$ **Ans.**

Q. 17. Taking 2 cm = 1 units on both axes, draw the graphs of $x + y + 2 = 0$ and $3x - 4y = 15$ on the same axes. Write down the co-ordinates of the point of intersection of the lines.

Sol. $x + y + 2 = 0$

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

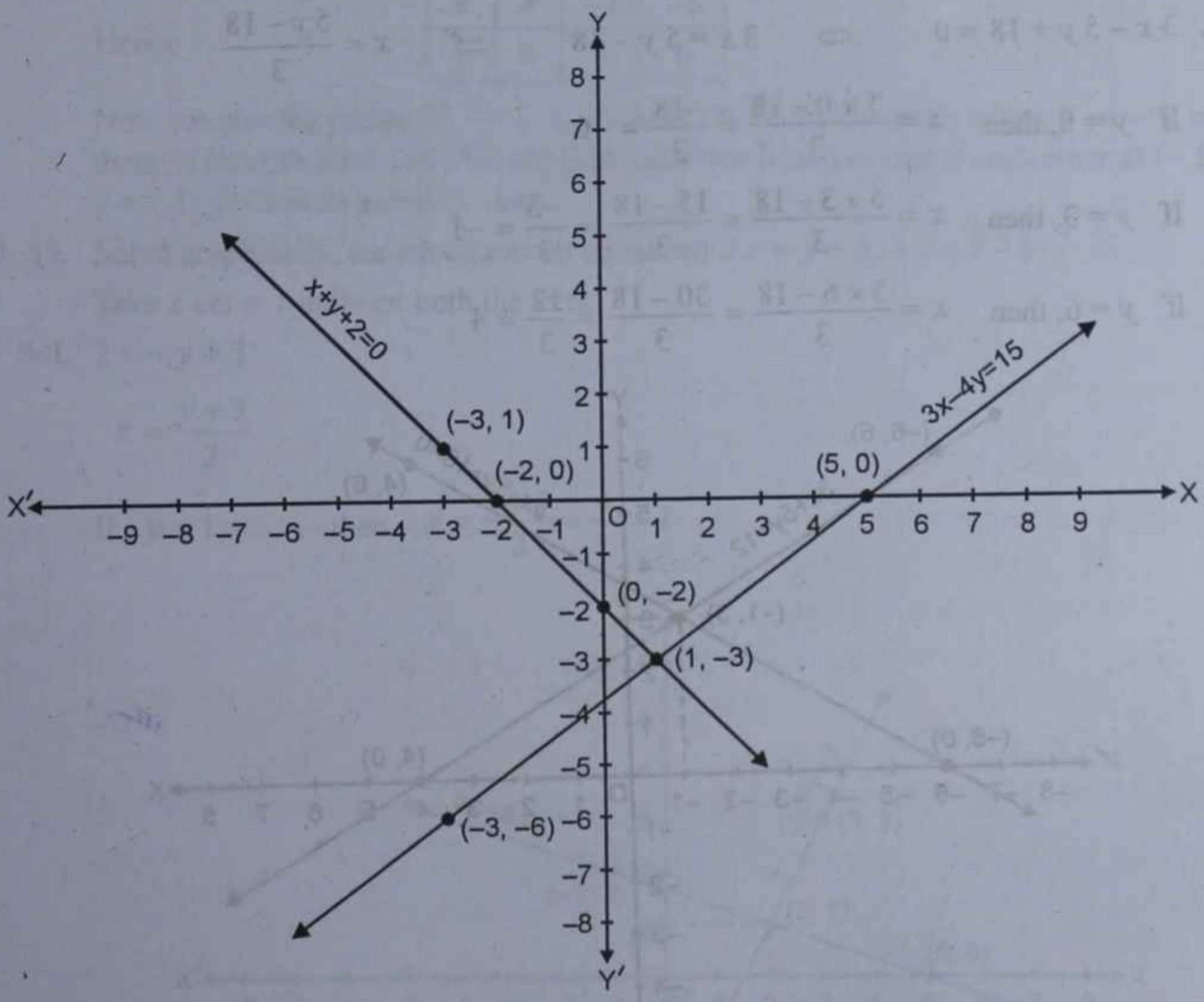
If $y = 0$, then $x = -(0 + 2) = -2$

If $y = 1$, then $x = -(1 + 2) = -3$

If $y = -2$, then $x = -(-2 + 2) = 0$

x	-2	-3	0
y	0	1	-2

Hence



Now we plot the points $(-2, 0)$, $(-3, 1)$ and $(0, -2)$ on the graph and join them to form a line.

Again $3x - 4y = 15$

$$3x = 4y + 15$$

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

If $y = 0$, then $x = \frac{4 \times 0 + 15}{3} = \frac{0 + 15}{3} = \frac{15}{3} = 5$

If $y = -3$, then $x = \dfrac{4 \times (-3) + 15}{3} = \dfrac{-12 + 15}{3} = \dfrac{3}{3} = 1$

If $y = -6$ then $x = \dfrac{4 \times (-6) + 15}{3} = \dfrac{-24 + 15}{3} = \dfrac{-9}{3} = -3$

Hence

x	5	1	–3
y	0	–3	–6

Now we plot these points (5, 0), (1, – 3) and (– 3, – 6) on the graph and join them to form another line. We see that these lines intersect each other at (1, – 3). **Ans.**

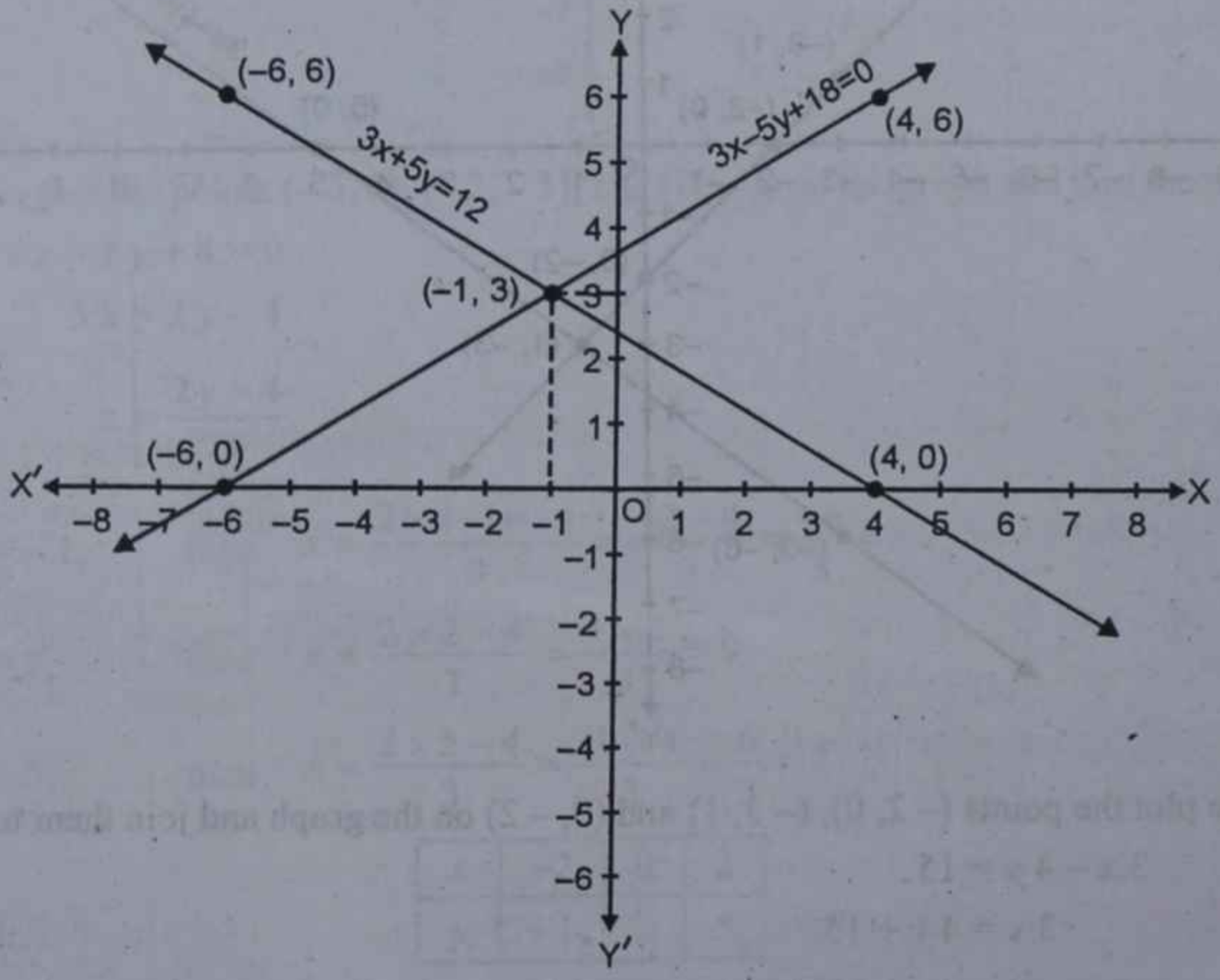
Q. 18. Solve graphically, the system of equations $3x - 5y + 18 = 0$, $3x + 5y = 12$. Take 2 cm = 2 units on x-axis and 2 cm = 1 unit on y-axis.

Sol. $3x - 5y + 18 = 0 \quad \Rightarrow \quad 3x = 5y - 18 \quad \Rightarrow \quad x = \dfrac{5y - 18}{3}$

If $y = 0$, then $x = \dfrac{5 \times 0 - 18}{3} = \dfrac{-18}{3} = -6$

If $y = 3$, then $x = \dfrac{5 \times 3 - 18}{3} = \dfrac{15 - 18}{3} = \dfrac{-3}{3} = -1$

If $y = 6$, then $x = \dfrac{5 \times 6 - 18}{3} = \dfrac{30 - 18}{3} = \dfrac{12}{3} = 4$



Hence

x	–6	–1	4
y	0	3	6

Now we plot the points (–6, 0), (– 1, 3) and (4, 6) on the graph taking 2 cm = 2 units and join them to form a line.

Again $3x + 5y = 12 \quad \Rightarrow \quad 3x = 12 - 5y \quad \Rightarrow \quad x = \dfrac{12 - 5y}{3}$

If $y = 0$, then $x = \dfrac{12 - 5 \times 0}{3} = \dfrac{12 - 0}{3} = \dfrac{12}{3} = 4$

If $y = 3$, then $x = \dfrac{12 - 5 \times 3}{3} = \dfrac{12 - 15}{3} = \dfrac{-3}{3} = -1$

If $y = 6$, then $x = \dfrac{12 - 5 \times 6}{3} = \dfrac{12 - 30}{3} = \dfrac{-18}{3} = -6$

Hence

x	4	–1	–6
y	0	3	6

Now we plot the points (4, 0), (– 1, 3) and (– 6, 6) on the graph taking 2 cm = 2 unit and join them to form another line. We see that these two lines interesect each other at (– 1, 3). Hence $x = -1, y = 3$ is its solution. **Ans.**

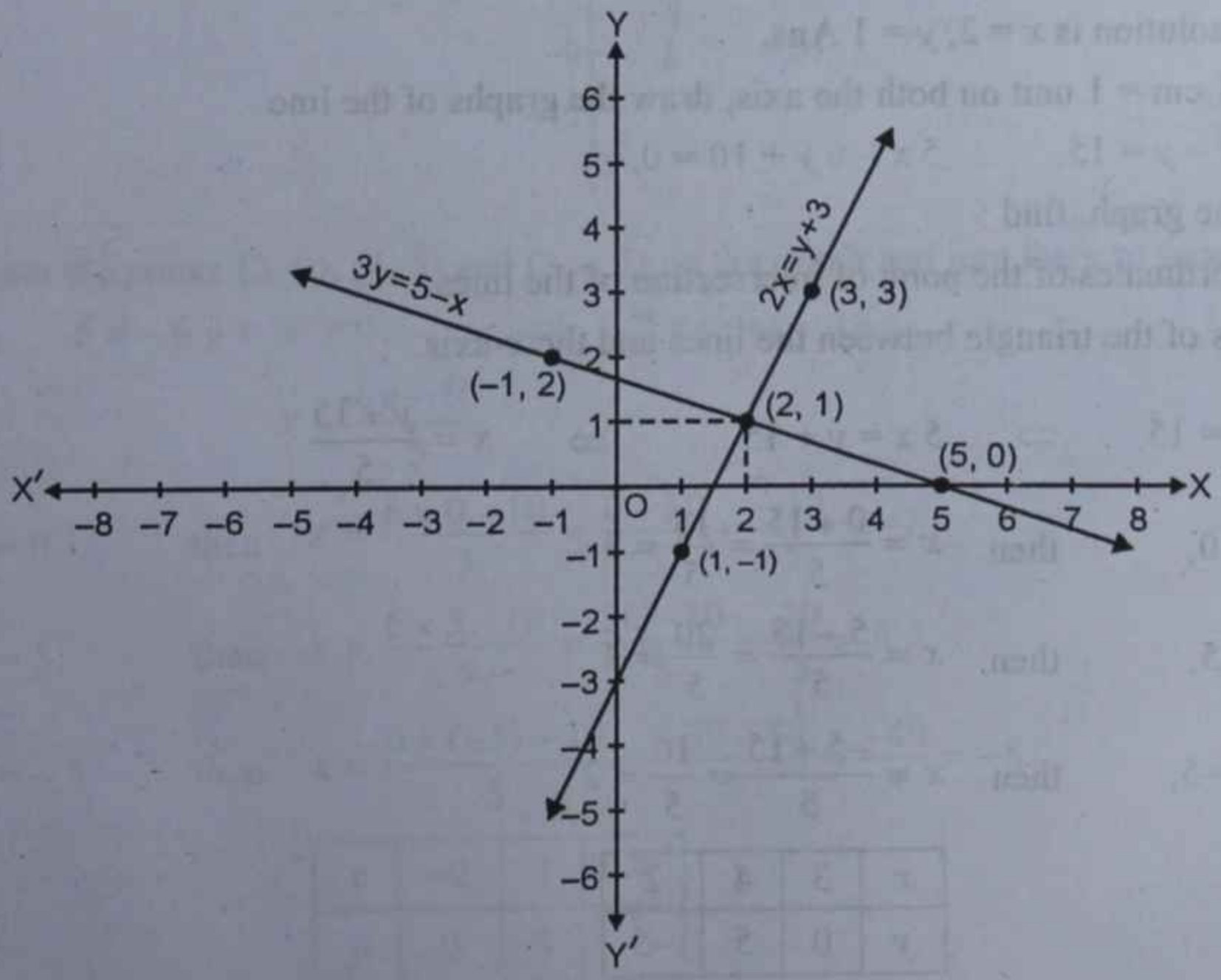
Q. 19. Solve graphically, the simultaneous equations $2x = y + 3$, $3y = 5 - x$.

Take 2 cm = 1 units on both the axes.

Sol. $2x = y + 3$

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

If $y = 1$, then $x = \dfrac{1 + 3}{2} = \dfrac{4}{2} = 2$



If $y = 3$, then $x = \frac{3+3}{2} = \frac{6}{2} = 3$

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

Hence

x	2	3	1
y	1	3	–1

Now we plot the points (2, 1), (3, 3) and (1, – 1) on the graph taking 2 cm = 1 unit and join them to form a line.

Again $3y = 5 - x$

$$y = \frac{5-x}{3}$$

If $x = 2$, then $y = \frac{5-2}{3} = \frac{3}{3} = 1$

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

If $x = 5$, then $y = \frac{5-5}{3} = \frac{0}{3} = 0$

Hence

x	2	–1	5
y	1	2	0

Now we plot these points (2, 1), (– 1, 2) and (5, 0) on the graph and join them to form another line. We see that these two lines intersect each other at (2, 1).

Hence solution is $x = 2, y = 1$ **Ans.**

Q. 20. Using 1 cm = 1 unit on both the axis, draw the graphs of the line

$5x - y = 15$, $5x - 6y + 10 = 0$.

From the graph, find :

(*i*) the co-ordinates of the point of intersection of the lines.

(*ii*) the axes of the triangle between the lines and the x-axis.

Sol. $5x - y = 15 \Rightarrow 5x = y + 15 \Rightarrow x = \frac{y+15}{5}$

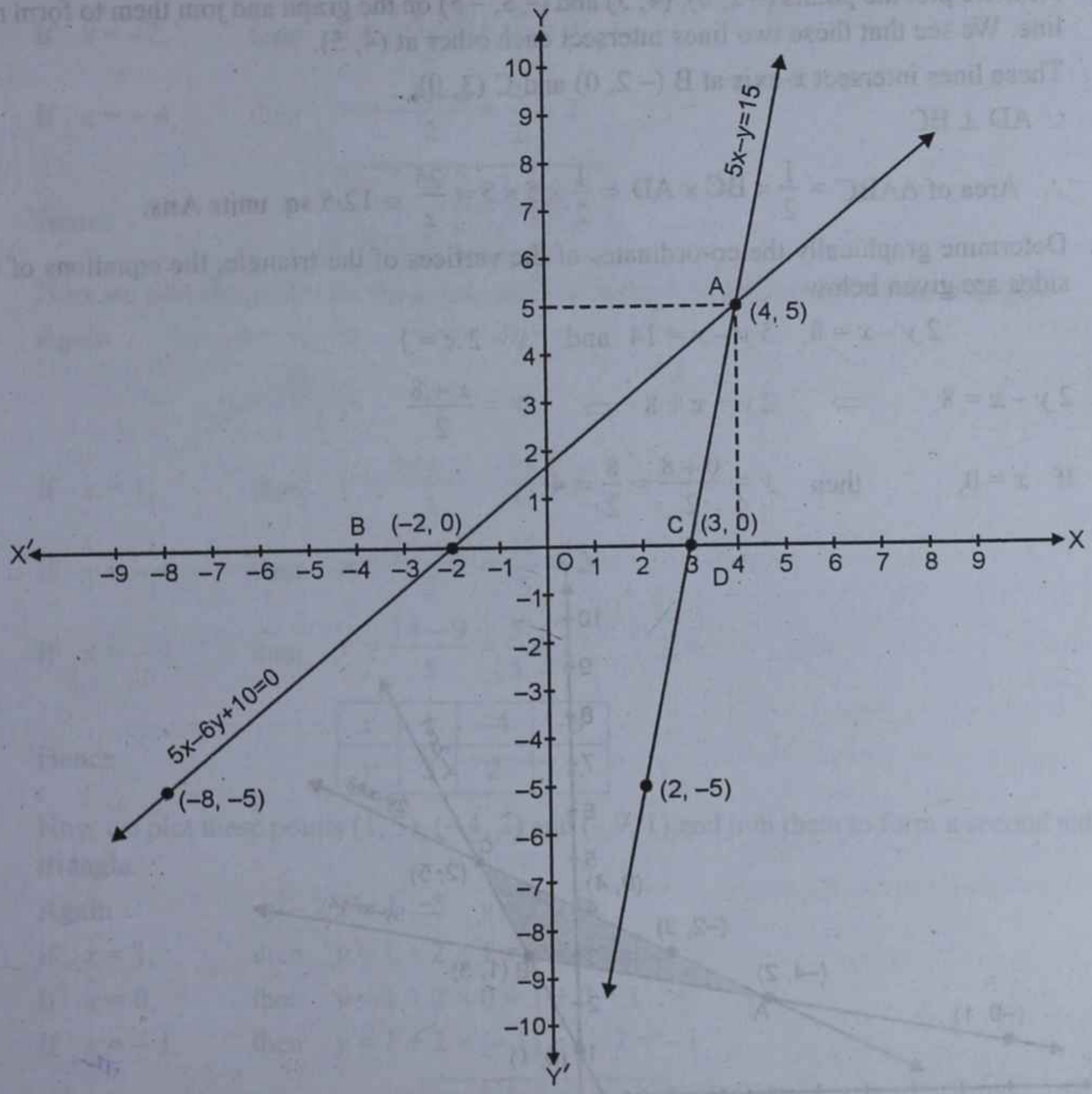
If $y = 0$, then $x = \frac{0+15}{5} = \frac{15}{5} = 3$

If $y = 5$, then $x = \frac{5+15}{5} = \frac{20}{5} = 4$

If $y = -5$, then $x = \frac{-5+15}{5} = \frac{10}{5} = 2$

Hence

x	3	4	2
y	0	5	–5



Now plot the points (3, 0), (4, 5) and (2, – 5) on the graph and join them to form a line.

Again $5x - 6y + 10 = 0 \quad \Rightarrow \quad 5x = 6y - 10$

$$x = \frac{6y - 10}{5}$$

If $y = 0$, then $x = \frac{6 \times 0 - 10}{5} = \frac{0 - 10}{5} = \frac{-10}{5} = -2$

If $y = 5$, then $x = \frac{6 \times 5 - 10}{5} = \frac{30 - 10}{5} = \frac{20}{5} = 4$

If $y = -5$, then $x = \frac{6 \times (-5) - 10}{5} = \frac{-30 - 10}{5} = \frac{-40}{5} = -8.$

Hence

x	–2	4	–8
y	0	5	–5

Now we plot the points $(-2, 0)$, $(4, 5)$ and $(-8, -5)$ on the graph and join them to form another line. We see that these two lines intersect each other at $(4, 5)$.

These lines intersect x-axis at B $(-2, 0)$ and C $(3, 0)$,

$\because$ AD $\perp$ BC

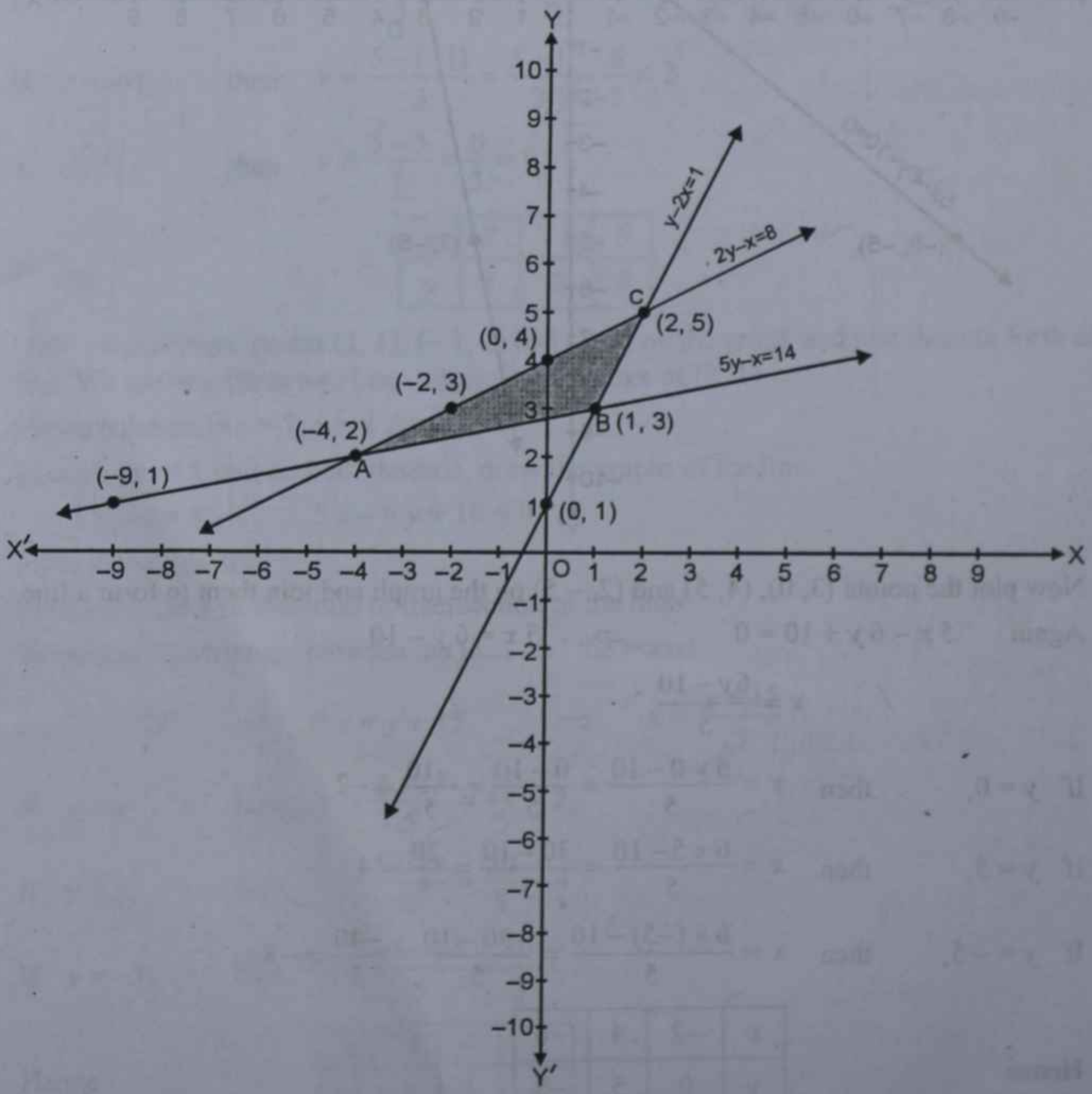
$$\therefore \quad \text{Area of } \Delta ABC = \frac{1}{2} \times BC \times AD = \frac{1}{2} \times 5 \times 5 = \frac{25}{2} = 12{\cdot}5 \text{ sq. units } \textbf{Ans.}$$

Q. 21. Determine graphically the co-ordinates of the vertices of the triangle, the equations of whose sides are given below :

$$2y - x = 8, \quad 5y - x = 14 \text{ and } \quad y - 2x = 1$$

Sol. $2y - x = 8 \quad \Rightarrow \quad 2y = x + 8 \quad \Rightarrow \quad y = \dfrac{x+8}{2}$

If $x = 0$, then $y = \dfrac{0+8}{2} = \dfrac{8}{2} = 4$



If $x = -2$, then $y = \frac{-2+8}{2} = \frac{6}{2} = 3$

If $x = -4$, then $y = \frac{-4+8}{2} = \frac{4}{2} = 2$

Hence

x	0	−2	−4
y	4	3	2

Now we plot the points on the graph and join them to form one side of the triangle.

Again $5y - x = 14 \Rightarrow 5y = 14 + x$

$$y = \frac{14+x}{5}$$

If $x = 1$, then $y = \frac{14+1}{5} = \frac{15}{5} = 3$

If $x = -4$, then $y = \frac{14-4}{5} = \frac{10}{5} = 2$

If $x = -9$, then $y = \frac{14-9}{5} = \frac{5}{5} = 1$

Hence

x	1	−4	−9
y	3	2	1

Now we plot these points (1, 3), (– 4, 2) and (– 9, 1) and join them to form a second side of the triangle.

Again $y - 2x = 1 \Rightarrow y = 1 + 2x$

If $x = 1$, then $y = 1 + 2 \times 1 = 1 + 2 = 3$

If $x = 0$, then $y = 1 + 2 \times 0 = 1 + 0 = 1$

If $x = -1$, then $y = 1 + 2 \times (-1) = 1 - 2 = -1$

Hence

x	1	0	−1
y	3	1	−1

Now we plot these points (1, 3), (0, 1) and (– 1, – 1) and join them to form the third side of the triangle.

We see that these three lines intersect each other at three points A (– 4, 2), B (1, 3) and C (2, 5) **Ans.**

Q. 22. Determine graphically the co-ordinates of the vertices of the triangle, whose equations are given below :

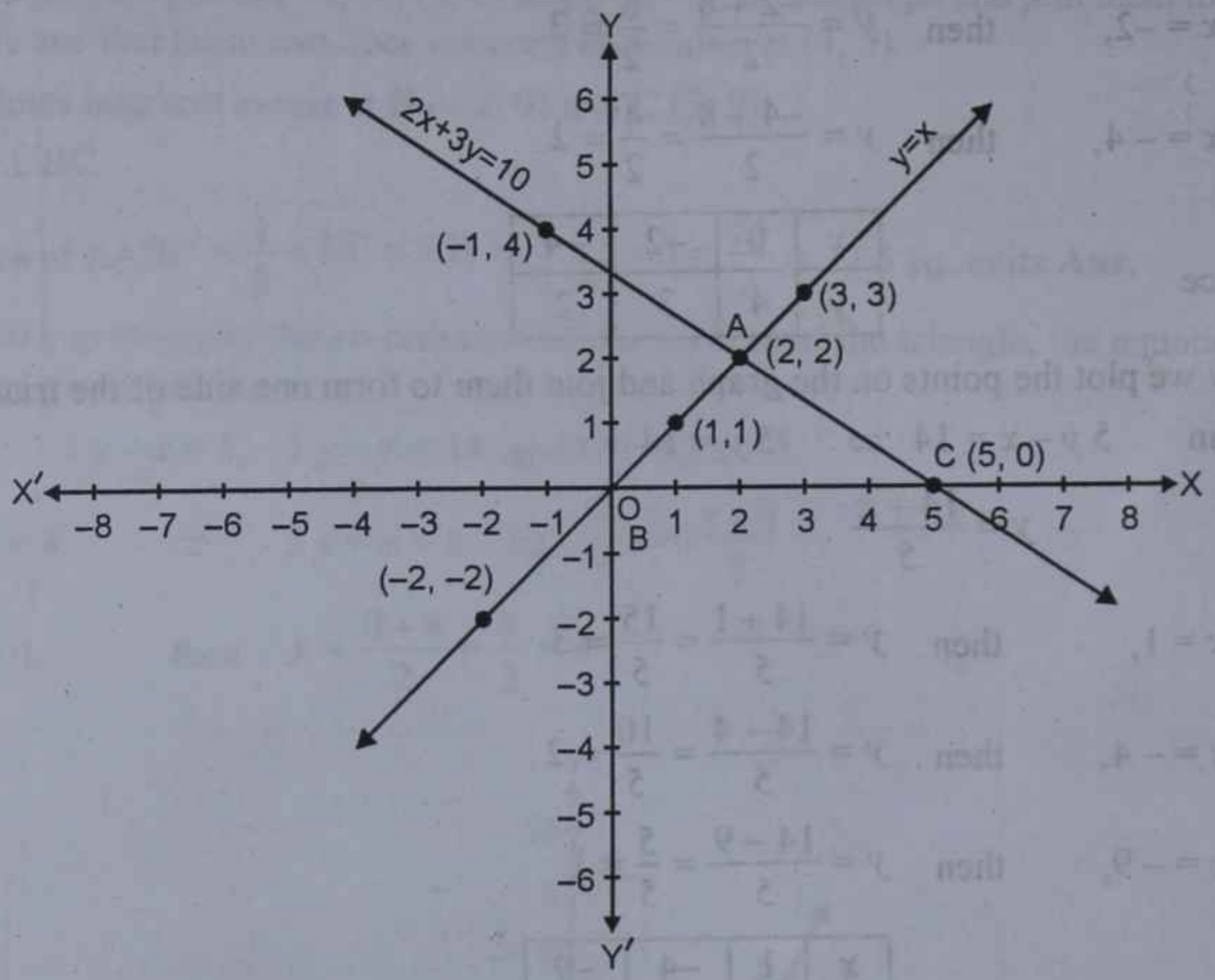
$$y = 0, \quad y = x$$

and $2x + 3y = 10.$

Sol. (*i*) $y = 0$, It x-axis

(*ii*) $y = x$

Here values of x and y are equal.



Hence

x	1	–2	3
y	1	–2	3

Now we plot these points (1, 1), (2, 2) and (3, 3) and join them to form the second line.

Again $2x + 3y = 10$

$$2x = 10 - 3y$$

$$x = \frac{10 - 3y}{2}$$

If $y = 0$, then $x = \frac{10 - 3 \times 0}{2} = \frac{10 - 0}{2} = \frac{10}{2} = 5$

If $y = 2$, then $x = \frac{10 - 3 \times 2}{2} = \frac{10 - 6}{2} = \frac{4}{2} = 2$

If $y = 4$, then $x = \frac{10 - 3 \times 4}{2} = \frac{10 - 12}{2} = \frac{-2}{2} = -1$

Hence

x	5	2	–1
y	0	2	4

Now we plot these points (5, 0), (2, 2) and (– 1, 4) and join them to form the third line.

We see that these three lines intersect each other at A (2, 2), B (0, 0) and C (5, 0) **Ans.**

EXERCISE 7 (F)

Q. 1. The sum of two numbers is 53 and their difference is 25. Find the numbers.

Sol. Let first number $= x$

and second number $= y$

Now according to the condition,

$$x + y = 53 \quad ...(i)$$

and $$x - y = 25 \quad ...(ii)$$

Adding, we get, $2x = 78$

$$\Rightarrow \quad x = \frac{78}{2} = 39$$

and subtracting, we get

$$2y = 28 \quad \Rightarrow \quad y = \frac{28}{2} = 14$$

$\therefore$ First number $= 39$ and

and second number $= 14$ **Ans.**

Q. 2. The sum of two numbers exceeds thrice the smaller by 2. If the difference between them is 19, find the numbers.

Sol. Let first number $= x$

and second number $= y$

According to the conditions,

$$x + y = 3y + 2 \Rightarrow x + y - 3y = 2$$

$$x - 2y = 2 \quad ...(i)$$

and $$x - y = 19 \quad ...(ii)$$

from (ii) $$x = 19 + y \quad ...(iii)$$

Substituting the value of x in (i)

$$19 + y - 7y = 2 \quad \Rightarrow 19 - y = 2$$

$$\Rightarrow -y = 2 - 19 \quad \Rightarrow -y = -17$$

$$\therefore \quad y = 17$$

Substituting the value of y in (iii)

$$x = 19 + 17 = 36$$

Hence numbers are 36, 17 **Ans.**

Q. 3. The sum of two numbers is 51. If the larger is doubled and the smaller is tripled, the difference is 12. Find the numbers.

Sol. Let larger number $= x$

and smaller number $= y$

According to the conditions,

$$x + y = 51 \quad ...(i)$$

$$2x - 3y = 12 \quad ...(ii)$$

Multiplying (i) by 3 and (ii) by 1, we get

$$3x + 3y = 153$$

$$2x - 3y = 12$$

Adding, $5x = 165$

$$x = \frac{165}{5} = 33$$

Substituting the value of x in (i)

$$33 + y = 51$$

$$\Rightarrow \quad y = 51 - 33 = 18$$

Hence larger number $= 33$

and smaller number $= 18$ **Ans.**

Q. 4. Find two numbers such that the sum of twice the first and thrice the second is 103 and four times the first exceeds seven times the second by 11.

Sol. Let first number $= x$

and second number $= y$

According to the conditions,

$$2x + 3y = 103 \quad ...(i)$$

$$4x - 7y = 11 \quad ...(ii)$$

Multiply (i) by 7 and (ii) by 3, we get,

$$14x + 21y = 721$$

$$12x - 21y = 33$$

Adding, $26x = 754$

$$x = \frac{754}{26} = 29$$

Substituting the value of x in (i)

$$2 \times 29 + 3y = 103$$

$$\Rightarrow \quad 58 + 3y = 103$$

$$\Rightarrow 3y = 103 - 58 = 45$$

$$\therefore \quad y = \frac{45}{3} = 15$$

Hence first number $= 29$

and second number $= 15$ **Ans.**

Q. 5. Find two numbers such that the sum of thrice of the first and the second is 142

and four times the first exceeds the second by 138.

Sol. Let the first number = x

and second number = y

Now according to the conditions,

$$3x + y = 142 \quad ...(i)$$

$$4x - y = 138 \quad ...(ii)$$

Adding, we get

$$7x = 280$$

$$x = \frac{280}{7} = 40$$

Substituting the value of x in (i)

$$3 \times 40 + y = 142$$

$$\Rightarrow \quad 120 + y = 142$$

$$\Rightarrow \quad y = 142 - 120 = 22$$

$\therefore$ First number = 40

and second number = 22 **Ans.**

Q. 6. Of the two numbers, 4 times the smaller one is less than 3 times the larger one by 6. Also, the sum of the numbers is larger than 6 times their difference by 5. Find the numbers.

Sol. Let the larger number = x

and the smaller number = y

Now according to the conditions,

$$3x - 4y = 6 \quad ...(i)$$

$$x + y - 6(x - y) = 5$$

$$\Rightarrow x + y - 6x + 6y = 5$$

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

Multiply (i) by 7 and (ii) by 4,

$$21x - 28y = 42$$

$$-20x + 28y = 20$$

Adding, we get,

$$x = 62$$

Substituting the value of x in (i)

$$3 \times 62 - 4y = 6$$

$$\Rightarrow \quad 186 - 4y = 6$$

$$\Rightarrow \quad -4y = 6 - 186 = -180$$

$$y = \frac{-180}{-4} = 45$$

$\therefore$ Larger number = 62

and smaller number = 45 **Ans.**

Q. 7. If from twice the greater of the two numbers, 45 is subtracted, the result is the other number. If from twice the smaller number, 21 is subtracted, the result is the greater number. Find the numbers.

Sol. Let larger number = x

and smaller number = y

$$2x - 45 = y$$

$$\Rightarrow \quad 2x - y = 45 \quad ...(i)$$

$$2y - 21 = x$$

$$\Rightarrow \quad x - 2y = -21 \quad ...(ii)$$

Adding, we get,

$$3x - 3y = 24$$

$$\Rightarrow \quad x - y = 8 \quad ...(iii)$$

(Dividing by 3)

Subtracting, we get,

$$x + y = 66 \quad ...(iv)$$

Again adding (iii) and (iv), we get

$$2x = 74 \quad \Rightarrow \quad x = \frac{74}{2} = 37$$

Subtracting (iii) from (iv),

$$2y = 58 \quad \Rightarrow \quad y = \frac{58}{2} = 29$$

Hence larger number = 37

and smaller number = 29 **Ans.**

Q. 8. If three times the larger of the two numbers is divided by the smaller, then the quotient is 4 and remainder is 5. If 6 times the smaller is divided by the larger, the quotient is 4 and the remainder is 2. Find the numbers.

Sol. Let the larger number = x

and the smaller number = y

We know that, number =

Divisor × quotient + remainder

Now, according to the conditions,

$$3x = 4y + 5$$

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

and $\quad 6y = 4x + 2$

$\Rightarrow \quad 4x - 6y = -2$

$\Rightarrow \quad 2x - 3y = -1 \qquad ...(ii)$

(Dividing by 2)

Multiplying (i) by 3 and (ii) by 4, we get

$$9x - 12y = 15$$

$$8x - 12y = -4$$

Subtracting we get,

$$x = 19$$

Substituting the value of x in (i)

$3 \times 19 - 4y = 5 \quad \Rightarrow 57 - 4y = 5$

$\Rightarrow -4y = 5 - 57 \quad \Rightarrow \quad -4y = -52$

$$\therefore \quad y = \frac{-52}{-4} = 13$$

Hence larger number = 19

and smaller number = 13 **Ans.**

Q. 9. If 2 is added to each of the two given numbers, then their ratio becomes 1 : 2. However, if 4 is subtracted from each of the given numbers, the ratio becomes 5 : 11. Find the numbers.

Sol. Let the first number $= x$

and the second number $= y$

Now according to the conditions,

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

$\Rightarrow 2x - y = 2 - 4$

$\Rightarrow 2x - y = -2 \qquad ...(i)$

and $\quad \frac{x-4}{y-4} = \frac{5}{11}$

$\Rightarrow \quad 11x - 44 = 5y - 20$

$\Rightarrow \quad 11x - 5y = 44 - 20$

$\Rightarrow \quad 11x - 5y = 24 \qquad ...(ii)$

Multiplying (i) by 5 and (ii) by 1, we get

$$10x - 5y = -10$$

$$11x - 5y = 24$$

Subtracting we get,

$$-x = -34 \quad \Rightarrow \quad x = 34$$

Substituting the value of x in (i)

$2 \times (34) - y = -2 \quad \Rightarrow 68 - y = -2$

$\Rightarrow \quad -y = -68 - 2 = -70$

$$\therefore \quad y = 70$$

Hence numbers are 34, 70 **Ans.**

Q. 10. The difference between two numbers is 12 and the difference between their squares is 456. Find the numbers.

Sol. Let the first number $= x$

and second number $= y$

Now according to the conditions,

$$x - y = 12 \qquad ...(i)$$

and $\quad x^2 - y^2 = 456 \qquad ...(ii)$

Dividing (ii) by (i)

$$\frac{x^2 - y^2}{x - y} = \frac{456}{12}$$

$$\Rightarrow \quad \frac{(x+y)(x-y)}{x-y} = \frac{456}{12}$$

$$\Rightarrow \quad x + y = 38 \qquad ...(iii)$$

Adding (i) and (iii), we get

$$2x = 50 \quad \Rightarrow \quad x = \frac{50}{2} = 25$$

and subtracting (i) from (iii),we get

$$2y = 26 \quad \Rightarrow \quad y = \frac{26}{2} = 13.$$

Hence numbers are 25 and 13 **Ans.**

Q. 11. Find the fraction which becomes $\frac{1}{2}$ when its numerator is increased by 6 and is equal to $\frac{1}{3}$ when its denominator is increased by 7.

Sol. Let numerator of the fraction $= x$

and denominator $= y$

then fraction $= \frac{x}{y}$

Now according to the conditions,

$$\frac{x+6}{y} = \frac{1}{2} \Rightarrow 2x + 12 = y \quad ...(i)$$

$$\frac{x}{y+7} = \frac{1}{3} \Rightarrow 3x = y + 7$$

$$\Rightarrow \quad 3x - y = 7 \quad ...(ii)$$

Substituting the value of y from (i) in (ii)

$3x - 2x - 12 = 7 \Rightarrow x - 12 = 7$

$x = 7 + 12 = 19$

Substituting the value of x in (i)

$2 \times 19 + 12 = y \Rightarrow y = 38 + 12 = 50$

$\therefore$ Fraction $= \frac{x}{y} = \frac{19}{50}$ **Ans.**

Q. 12. A fraction becomes $\frac{1}{2}$ when 1 is subtracted from its numerator and 1 is added to its denominator. Also, it becomes $\frac{1}{3}$ when 6 is subtracted from its numerator and 1 from the denominator. Find the original fraction.

Sol. Let numerator of the fraction $= x$

and denominator $= y$

then fraction $= \frac{x}{y}$

Now, according to the conditions,

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

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

$$\Rightarrow \quad 2x - y = 3 \quad ...(i)$$

and $\frac{x-6}{y-1} = \frac{1}{3} \Rightarrow 3x - 18 = y - 1$

$$\Rightarrow 3x - y = 18 - 1 = 17 \quad ...(ii)$$

Subtracting (i) from (ii)

$x = 17 - 3 = 14$

Substituting the value of x in (i)

$2 \times 14 - y = 3 \Rightarrow 28 - y = 3$

$\Rightarrow -y = 3 - 28 = -25$

$\therefore \quad y = 25$

Hence original fraction $= \frac{x}{y} = \frac{14}{25}$ **Ans.**

Q. 13. The denominator of a fraction is greater than its numerator by 9. If 7 is subtracted from both, its numerator and denominator, the fraction becomes $\frac{2}{3}$. Find the original fraction.

Sol. Let numerator of fraction $= x$

and denominator $= y$

then fraction $= \frac{x}{y}$

Now according to the conditions,

$$y = x + 9$$

$$\Rightarrow \quad x - y = -9 \quad ...(i)$$

and $\frac{x-7}{y-7} = \frac{2}{5}$

$\Rightarrow 5x - 35 = 2y - 14$

$\Rightarrow 5x - 2y = -14 + 35 = 21 \quad ...(ii)$

from (i), $x = y - 9 \quad ...(iii)$

Substituting the value of x in (ii)

$5(y - 9) - 2y = 21$

$\Rightarrow \quad 5y - 45 - 2y = 21$

$\Rightarrow \quad 3y = 21 + 45 = 66$

$\Rightarrow \quad y = \frac{66}{3} = 22$

Substituting the value of y in (iii)

$x = 22 - 9 = 13$

$\therefore$ Original fraction $= \frac{x}{y} = \frac{13}{22}$ **Ans.**

Q. 14. A number consists of two digits, the difference of whose digits is 3. If 4 times the number is equal to 7 times the number obtained by reversing the digits, find the number.

Sol. Let unit's digit $= x$

and ten's digit $= y$

then number $= x + 10y$

By reversing the digits,
the unit's digit of new number $= y$
and ten's digit $= x$
then number $= y + 10x$
Now according to the conditions,

$$y - x = 3 \qquad ...(i)$$

and $4(x + 10y) = 7(y + 10x)$

$$\Rightarrow \quad 4x + 40y = 7y + 70x$$

$$\Rightarrow \quad 40y - 7y = 70x - 4x$$

$$\Rightarrow \quad 33y = 66x$$

$$x = \frac{33y}{66} = \frac{1}{2}y \qquad ...(ii)$$

Substituting the value of x in (i)

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

$$\Rightarrow \quad y = 6$$

Substituting the value of y in (ii)

$$x = \frac{1}{2} \times 6 = 3$$

$\therefore$ Number $= x + 10y = 3 + 10 \times 6$

$= 3 + 60 = 63$ **Ans.**

Q. 15. A number consists of two digits, the difference of whose digits is 5. If 8 times the number is equal to 3 times the number obtained by reversing the digits, find the number.

Sol. Let unit's digit of the number $= x$
and ten's digits $= y$
then number $= x + 10y$
By reversing the digits
the unit's digit of new number $= y$
and ten's digit $= x$
$\therefore$ number $= y + 10x$
Now according to the conditions,

$$x - y = 5 \qquad ...(i)$$

and $8(x + 10y) = 3(y + 10x)$

$$\Rightarrow \quad 8x + 80y = 3y + 30x$$

$$\Rightarrow \quad 80y - 3y = 30x - 8x$$

$$\Rightarrow \quad 22x = 77y$$

$$\Rightarrow \quad 2x = 7y \qquad ...(ii)$$

from (i), $x = 5 + y \qquad ...(iii)$

Substituting the value of x in (ii)

$$2(5 + y) = 7y \Rightarrow 10 + 2y = 7y$$

$$\Rightarrow 7y - 2y = 10 \Rightarrow 5y = 10$$

$$y = \frac{10}{5} = 2$$

Substituting the value of y in (iii)

$$2x = 7 \times 2 \quad \Rightarrow \quad 2x = 14$$

$$\Rightarrow \quad x = \frac{14}{2} = 7$$

$\therefore$ Number $= x + 10y = 7 + 10 \times 2$

$= 7 + 20 = 27$ **Ans.**

Q. 16. The result of dividing a number of two digits by a number with digits reversed is $1\frac{3}{4}$. If the sum of the digits is 12, find the number.

Sol. Let the unit's digit of the number $= x$
and ten's digit $= y$
then the number $= x + 10y$
By reversing the digits,
the unit's digit of the new number $= y$
and ten's digit $= x$
then number $= y + 10x$
Now according to the conditions,

$$x + y = 12 \qquad ...(i)$$

and $$\frac{x + 10y}{y + 10x} = 1\frac{3}{4} = \frac{7}{4}$$

$$\Rightarrow \quad 4x + 40y = 7y + 70x$$

$$\Rightarrow \quad 40y - 7y = 70x - 4x$$

$$\Rightarrow \quad 33y = 66x$$

$$\Rightarrow \quad x = \frac{33}{66}y = \frac{y}{2} \qquad ...(ii)$$

Substituting the value of x in (i)

$$\frac{y}{2} + y = 12 \quad \Rightarrow \quad \frac{3}{2}y = 12$$

$\Rightarrow \quad y = 12 \times \frac{2}{3} = 8$

$\therefore \quad x = \frac{y}{2} = \frac{8}{2} = 4$

Hence given number $= x + 10\,y$

$= 4 + 10 \times 8 = 4 + 80 = 84$ **Ans.**

Q. 17. When a two-digit number is divided by the sum of its digits, the quotient is 8. On diminishing the ten's digit by three times the unit's digit the remainder obtained is 1. Find the number.

Sol. Let unit's digit of the number $= x$

and ten's digit $= y$

then number $= x + 10\,y$

Now according to the conditions,

$$\frac{x + 10\,y}{x + y} = 8$$

$\Rightarrow \quad x + 10\,y = 8\,x + 8\,y$

$\Rightarrow \quad 10\,y - 8\,y = 8\,x - x$

$\Rightarrow \quad 2\,y = 7\,x$

$\Rightarrow \quad 7\,x - 2\,y = 0 \qquad ...(i)$

from (ii), $y = 3\,x + 1$

Substituting the value of y in (i)

$7\,x - 2\,(3\,x + 1) = 0$

$\Rightarrow \quad 7\,x - 6\,x - 2 = 0$

$x = 2$

$\therefore \quad y = 3\,x + 1 = 3 \times 2 + 1 = 6 + 1 = 7$

Hence number $= x + 10\,y = 2 + 10 \times 7$

$= 2 + 70 = 72$ **Ans.**

Q. 18. A number of two digits exceeds four times the sum of its digits by 6 and the number is increased by 9 on reversing the digits. Find the number.

Sol. Let units digit of the number $= x$

and ten's digit $= y$

then number $= x + 10\,y$

On reversing the digit of the given number,

the unit's digit of new number $= y$

and ten's digit $= x$

$\therefore \quad$ Number $= y + 10\,x$

Now according to the conditions,

$x + 10\,y - 4\,(x + y) = 6$

$\therefore \quad x + 10\,y - 4\,x - 4\,y = 6$

$\Rightarrow \quad -3\,x + 6\,y = 6$

$\Rightarrow \quad x - 2\,y = -2 \qquad ...(i)$

(Dividng by 3)

and $x + 10\,y + 9 = (y + 10\,x)$

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

$\Rightarrow \quad x - 10\,x + 10\,y - y = -9$

$\Rightarrow \quad -9\,x + 9\,y = -9$

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

Subtracting (ii) from (i)

$-y = -3 \quad \Rightarrow \quad y = 3$

$\therefore \quad x - 3 = 1 \quad \therefore \quad x = 1 + 3 = 4$

Hence number $= x + 10\,y = 4 + 10 \times 3$

$= 4 + 30 = 34$ **Ans.**

Q. 19. The sum of the digits of a two-digit number is 12. If the digits are reversed, the new number is 12 less than twice the original number. Find the original number.

Sol. Let unit's digit of the number $= x$

and ten's digit $= y$

then the number $= x + 10\,y$

On reversing the digits,

the unit's digit $= y$

and ten's digit $= x$

then number $= y + 10\,x$

Now according to the conditions,

$x + y = 12 \qquad ...(i)$

and $y + 10\,x = 2\,(x + 10\,y) - 12$

$\Rightarrow \quad y + 10\,x = 2\,x + 20\,y - 12$

$\Rightarrow 10\,x - 2\,x + y - 20\,y = -12$

$\Rightarrow \quad 8\,x - 19\,y = -12 \qquad ...(ii)$

from (i), $\quad x = 12 - y$

Substituting the value of x in (ii)

$$8(12-y)-19y=-12$$

$$\Rightarrow \quad 96-8y-19y=-12$$

$$\Rightarrow \quad 96-27y=-12$$

$$\Rightarrow \quad -27y=-12-96=-108$$

$$\therefore \quad y=\frac{-108}{-27}=4$$

$$\therefore \quad x=12-y=12-4=8$$

Hence number $= x+10y=8+10\times 4$

$= 8+40=48$ **Ans.**

Q. 20. If 11 pens and 19 pencils together cost Rs. 502 ; while 19 pens and 11 pencils together cost Rs. 758, how much 3 pens and 6 pencils cost together ?

Sol. Let price of one pen = Rs. x

and price of one pencil = Rs. y

According to the conditions,

$$11x+19y=502 \qquad ...(i)$$

$$19x+11y=758 \qquad ...(ii)$$

Adding we get,

$$30x+30y=1260$$

$$\Rightarrow \quad x+y=42 \qquad ...(iii)$$

(Dividing by 30)

Subtracting (ii) from (i), we get

$$-8x+8y=-256$$

$$x-y=32 \qquad ...(iv)$$

(Dividing by -8)

Again, adding (iii) and (iv),

$$2x=74 \quad \Rightarrow \quad x=\frac{74}{2}=37$$

and subtracting

$$2y=10 \quad \Rightarrow \quad y=\frac{10}{2}=5$$

$\therefore$ Price of one pen = Rs. 37

and price of one pencil = Rs. 5

Now cost of 3 pens and 6 pencils

$=$ Rs. $(3\times 37+6\times 5)$

$=$ Rs. $111+$ Rs. $30=$ Rs. 141 **Ans.**

Q. 21. 5 kg sugar and 7 kg rice together cost Rs. 258 while 7 kg sugar and 5 kg rice together cost Rs. 246. Find the total cost of 8 kg sugar and 10 kg rice.

Sol. Let price of 1 kg sugar = Rs. x

and price of 1 kg rice = Rs. y

Now according to the conditions,

$$5x+7y=258 \qquad ...(i)$$

$$7x+5y=246 \qquad ...(ii)$$

Adding (i) and (ii), we get

$$12x+12y=504$$

$$x+y=42 \qquad ...(iii)$$

(Dividing by 12)

and subtracting (ii) from (i)

$$2x-2y=-12$$

$$x-y=-6 \qquad ...(iv)$$

(Dividing by 2)

Again adding (iii) and (iv)

$$2x=36 \quad \Rightarrow \quad x=\frac{36}{2}=18$$

Subtracting (iv) from (iii)

$$2y=48 \quad \Rightarrow \quad y=\frac{48}{2}=24$$

$\therefore$ Price of 1 kg sugar = Rs. 18

and price of 1 kg rice = Rs. 24

Now cost of 8 kg sugar and 10 kg of rice

$=$ Rs. $(8\times 18+10\times 24)$

$=$ Rs. $144+$ Rs. 240

$=$ Rs. 384 **Ans.**

Q. 22. One year ago, a man was four times as old as his son. After 6 years, his age exceeds twice his son's age by 9 years. Find their present ages.

Sol. Let present age of son = x years

and age of his father = y years

According to the conditions,

One year ago. Age of son = $(x+1)$ and age of father = $(y+1)$ years

$\therefore \; y-1=4(x-1) \Rightarrow y-1=4x-4$

$\Rightarrow \quad 4x - y = 4 - 1$

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

6 years after, age of son = $(x + 6)$ years

and age of father = $(y + 6)$ years

$\therefore \quad y + 6 = 2(x + 6) + 9$

$\Rightarrow \quad y + 6 = 2x + 12 + 9 = 2x + 21$

$\Rightarrow 2x - y = -21 + 6$

$\Rightarrow 2x - y = -15 \qquad ...(ii)$

Subtracting (ii) from (i)

$$2x = 18 \quad \Rightarrow \quad x = \frac{18}{2} = 9$$

Substituting the value of x in (i)

$4 \times 9 - y = 3 \quad \Rightarrow \quad 36 - y = 3$

$\Rightarrow \quad -y = 3 - 36$

$\Rightarrow \quad -y = -33 \quad \Rightarrow \quad y = 33$

Hence present age of father = 33 years

and age of son = 9 years **Ans.**

Q. 23. 5 years ago, A was thrice as old as B and 10 years later, A shall be twice as old as B. What are the present ages of A and B ?

Sol. Let present age of A = x years

and age of B = y years

5 years ago,

Age of A = $(x - 5)$ years

and Age of B = $(y - 6)$ years

10 years later,

Age of A = $(x + 10)$ years

and Age of B = $(y + 10)$ years

According to the conditions,

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

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

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

$\Rightarrow \quad x - 3y = -10 \qquad ...(i)$

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

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

$\Rightarrow \quad x - 2y = 20 - 10 = 10 \qquad ...(ii)$

Subtracting (ii) from (i)

$-y = -20 \quad \Rightarrow \quad y = 20$

Substituting the value of y in (i)

$x - 3(20) = -10 \quad \Rightarrow \quad x - 60 = -10$

$x = -10 + 60 = 50$

Hence present age of A = 50 years

and age of B = 20 years **Ans.**

Q. 24. The monthly incomes of A and B are in the ratio of 7 : 5 and their expenditures are in the ratio of 3 : 2. If each saves Rs. 1500 per month, find their monthly incomes.

Sol. Let income of A = Rs. x p.m.

and income of B = Rs. y p.m.

and saving of each one = Rs. 1500 p.m.

$\therefore$ Expenditure of A = Rs. $(x - 1500)$

and expenditure of B = Rs. $(y - 1500)$

Now according to the conditions,

$$\frac{x}{y} = \frac{7}{5} \Rightarrow 5x = 7y \qquad ...(i)$$

and $\dfrac{x - 1500}{y - 1500} = \dfrac{3}{2}$

$\Rightarrow \quad 2x - 3000 = 3y - 4500$

$\Rightarrow 2x - 3y = -4500 + 3000$

$\Rightarrow 2x - 3y = -1500 \qquad ...(ii)$

from (i), $x = \dfrac{7}{5}y$

Substituting the value of x in (ii)

$$2\left(\frac{7}{5}\right)y - 3y = -1500$$

$$\Rightarrow \quad \frac{14}{5}y - 3y = -1500$$

$$\Rightarrow \quad = \frac{14y - 15y}{5} = -1500$$

$$\frac{-y}{5} = -1500 \Rightarrow y = 7500.$$

Substituting the value of y in (i),

$5x = 7 \times 7500$

$$\Rightarrow \quad x = 7 \times \frac{7500}{5} = 10500$$

Hence income of A = Rs. 10500

and income of B = Rs. 7500 **Ans.**

Q. 25. A 90% acid solution is mixed with 97% acid solution to obtain 21 litres of a 95% solution. Find the quantity of each of the solutions to get the resultant mixture.

Sol. Let 90% solution = x litres

and 97% solution = y litres

According to the conditions,

$$x + y = 21 \quad ...(i)$$

90% of x + 97% of y = 95% of 21

$$\Rightarrow \quad \frac{90}{100}x + \frac{97}{100}y = \frac{95}{100} \times 21$$

$$\Rightarrow \quad 90x + 97y = 1995 \quad ...(ii)$$

from (i), $x = 21 - y$

Substituting the value of x in (ii)

$$90(21 - y) + 97y = 1995$$

$$\Rightarrow 1890 - 90y + 97y = 1995$$

$$\Rightarrow 7y = 1995 - 1890 = 105$$

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

Substituting the value of y in (i),

$x + 15 = 21 \quad \Rightarrow \quad x = 21 - 15 = 6$

Hence 90% solution = 6 litres

and 97% solution = 15 litres **Ans.**

Q. 26. There are two examination halls A and B. If 12 pupils are sent from A to B, the number of pupils in each halls becomes the same. If 11 pupils are sent from B to A, then the number of pupils in A is double their number in B. Find the number of pupils in each room.

Sol. Let number of pupils in A hall = x

and number of pupils in B = y

Now according to the conditions,

$$x - 12 = y + 12$$

$$\Rightarrow \quad x - y = 12 + 12 = 24 \quad ...(i)$$

$$x + 11 = 2(y - 11)$$

$$\Rightarrow \quad x + 11 = 2y - 22$$

$$\Rightarrow x - 2y = -22 - 11 = -33 \quad ...(ii)$$

Subtracting (ii) from (i)

$$y = 57$$

$$\therefore \quad x - 57 = 24 \qquad \text{(from } (i)\text{)}$$

$$x = 24 + 57 = 81$$

Hence no. of pupils in A room = 81

and no. of pupils in B room = 57 **Ans.**

Q. 27. A and B each have a certain number of marbles A says to B. "If you give 30 to me, I will have twice as many as left with you." B replies, "If you give me 10, I will have thrice as many as left with you." How many marbles does each have ?

Sol. Let no. of marbles A have = x

and no. of marbles B have = y

According to the conditions,

$$x + 30 = 2(y - 30)$$

$$\Rightarrow \quad x + 30 = 2y - 60$$

$$\Rightarrow \quad x - 2y = -60 - 30$$

$$\Rightarrow \quad x - 2y = -90 \quad ...(i)$$

and $3(x - 10) = (y + 10)$

$$\Rightarrow \quad 3x - 30 = y + 10$$

$$3x - y = 10 + 30 = 40 \quad ...(ii)$$

Multiplying (i) by 1 and (ii) by 2

$$x - 2y = -90$$

$$6x - 2y = 80$$

$$- \quad + \quad -$$

Subtracting we get

$$-5x = -170 \quad \Rightarrow \quad x = \frac{-170}{-5} = 34$$

Substituting the value of x in (i)

$$34 - 2y = -90$$

$$\Rightarrow \quad -2y = -90 - 34 = -124$$

$$y = \frac{-124}{-2} = 62$$

Hence A has marbles = 34

and B has marbles = 62 **Ans.**

Q. 28. The present age of a man is 3 years more than three times the age of his son. Three

years hence, the man's age will be 10 years more than twice the age of his son. Determine their present ages.

Sol. Let man's present age = x years

and his son's age = y years

3 years hence,

age of man = $(x + 3)$ years

and age of his son = $(y + 3)$ years

According to the conditions,

$$x = 3y + 3 \quad ...(i)$$

$$x + 3 = 2(y + 3) + 10$$

$$\Rightarrow \quad x + 3 = 2y + 6 + 10$$

$$\Rightarrow x - 2y = 16 - 3 = 13 \quad ...(ii)$$

Substituting the value of x from (i) in (ii)

$3y + 3 - 2y = 13 \Rightarrow y = 13 - 3 = 10$

Substituting the value of y in (i)

$x = 3 \times 10 + 3 = 30 + 3 = 33$

Hence age of man = 33 years

and age of his son = 10 years **Ans.**

Q. 29. The length of a room exceeds its breadth by 3 metres. If the length is increased by 3 m and breadth is decreased by 2 metres, the area remains the same. Find the length and breadth of the room.

Sol. Let length of room = x metres

and breadth of room = y metres

$\therefore$ Area = length $\times$ breadth = xy m^2

In second case,

length = $(x + 3)$ m

and breadth = $(y - 2)$ m

$\therefore$ Area = $(x + 3)(y - 2)$ m^2

According to the conditions,

$$x = y + 3 \quad ...(i)$$

$$(x + 3)(y - 2) = xy$$

$$xy - 2x + 3y - 6 = xy$$

$$-2x + 3y = 6$$

$$2x - 3y = -6 \quad ...(ii)$$

Substituting the value of x from (i) in (ii)

$$2(y + 3) - 3y = -6$$

$$\Rightarrow \quad 2y + 6 - 3y = -6$$

$$-y = -6 - 6 = -12$$

$$\therefore \quad y = 12$$

and $x = y + 3 = 12 + 3 = 15$

Hence length of the room = 15 m

and breadth of the room = 12 m **Ans.**

Q. 30. The area of a rectangle gets reduced by 8 m^2, if its length is reduced by 5 m and breadth increased by 3 m. If we increase the length by 3 m and breadth by 2 m, the area is increased by 74 m^2. Find the length and breadth of the rectangle.

Sol. Let length of rectangle = x m

and breadth = y m

and area = xy m^2

In first case,

$$(x - 5)(y + 3) = xy - 8$$

$$\Rightarrow xy + 3x - 5y + 5 = xy - 8$$

$$\Rightarrow 3x - 5y = -8 + 15 = 7$$

$$\Rightarrow 3x - 5y = 7 \quad ...(i)$$

and in second case,

$$(x + 3)(y + 2) = xy + 74$$

$$\Rightarrow xy + 2x + 3y + 6 = xy + 74$$

$$\Rightarrow 2x + 3y = 74 - 6 = 68 \quad ...(ii)$$

Multiplying (i) by 3 and (ii) by 5,

$$9x - 15y = 21$$

$$10x + 15y = 340$$

Adding, we get

$$19x = 361 \Rightarrow x = \frac{361}{19} = 19$$

Substituting the value of x in (i)

$3 \times 19 - 5y = 7 \Rightarrow 57 - 5y = 7$

$\Rightarrow \quad -5y = 7 - 57 = -56$

$$y = \frac{-50}{-5} = 10$$

$\therefore$ Length of rectangle = 19 m

and breadth of rectangle = 10 m **Ans.**

Q. 31. A motorboat takes 6 hours to cover 100 km downstream and 30 km upstream. If

the motorboat goes 75 km downstream and returns back to its starting point in 8 hours, find the speed of the motor boat in still water and the rate of the stream.

Sol. Let the speed of motorboat in still water $= x$ km/h

and speed of stream $= y$ km/h

$\therefore$ Speed of upstream $= (x - y)$ km/h

and speed of downstream

$= (x + y)$ km/h

Now according to the conditions,

$$\frac{100}{x+y} + \frac{30}{x-y} = 6$$

and $$\frac{75}{x+y} + \frac{75}{x-y} = 8$$

Let $x + y = a$ and $x - y = b$.

$$\therefore \quad \frac{100}{a} + \frac{30}{b} = 6 \qquad \ldots(i)$$

$$\frac{75}{a} + \frac{75}{b} = 8 \qquad \ldots(ii)$$

Multiplying (i) by 5 and (ii) by 2

$$\frac{500}{a} + \frac{150}{b} = 30$$

$$\frac{150}{a} + \frac{150}{b} = 16$$

$$- \quad - \quad -$$

Subtracting, $\frac{350}{a} = \frac{14}{1} \Rightarrow 14\,a = 350$

$$a = \frac{350}{14} = 25$$

Substituting the value of a in (i)

$$\frac{100}{25} + \frac{30}{b} = 6 \Rightarrow 4 + \frac{30}{b} = 6$$

$$\Rightarrow \frac{30}{b} = 6 - 4 = \frac{2}{1} \Rightarrow 2\,b = 30$$

$$b = \frac{30}{2} = 15$$

$\therefore \quad x + y = 25 \qquad \ldots(iii)$

$x - y = 15 \qquad \ldots(iv)$

Adding, we get,

$$2\,x = 40, \quad \Rightarrow \quad x = \frac{40}{2} = 20$$

and subtracting,

$$2\,y = 10 \quad \Rightarrow \quad y = \frac{10}{2} = 5$$

Hence speed of motorboat in still water $= 20$ km/h

and speed of stream $= 5$ km/h **Ans.**

Q. 32. A man sold a chair and a table for Rs. 2178, thereby making a profit of 12% on the chair and 16% on the table. By selling them for Rs. 2154, he gains 16% on the chair and 12% on the table. Find the cost price of each.

Sol. Let C.P. of chair = Rs. x

and C.P. of table = Rs. y

In first case, gain on chair = 12%

and gain on table = 16%

$\therefore$ S.P. of chair $= \frac{x(100+12)}{100} = \frac{112}{100}x$

and S.P. of table

$$= \frac{y(100+16)}{100} = \frac{116}{100}y$$

In second case, gain on chair = 16%

and gain on table = 12%

$\therefore$ S.P. of chair $= \frac{x(100+16)}{100} = \frac{116}{100}x$

and S.P. of table

$$= \frac{y(100+12)}{100} = \frac{112}{100}y$$

According to the conditions,

$$\frac{112}{100}x + \frac{116}{100}y = 2178$$

$$\Rightarrow \quad 112\,x + 116\,y = 217800 \qquad \ldots(i)$$

and $$\frac{116}{100}x + \frac{112}{100}y = 2154$$

$\Rightarrow$ $116x + 112y = 215400$ ...(*ii*)

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

$228x + 228y = 433200$

$x + y = 1900$ ...(*iii*)

and subtracting (*i*) and (*ii*), we get,

$-4x + 4y = 2400$

$\Rightarrow$ $x - y = -600$ ...(*iv*)

Again adding (*iii*) and (*iv*),

$$2x = 1300 \Rightarrow x = \frac{1300}{2} = 650$$

and subtracting,

$$2y = 2500 \Rightarrow y = \frac{2500}{2} = 1250$$

Hence C.P. of chair = Rs. 650 and C.P. of table = Rs. 1250 **Ans.**

Q. 33. A man travels 600 km partly by train and partly by car. If he covers 120 km by train and the rest by car, it takes him 8 hours. But, if he travels 200 km by train and the rest by car, he takes 20 minutes longer. Find the speed of the car and that of the train.

Sol. Let the speed of car = x km/h

and speed of train = y km/h

Total journey = 600 km.

In first case,

Distance covered by train = 120 km

and distance covered by car = 600 – 120

= 480 km

Time taken = 8 hours

In second case,

Distance covered by train = 200 km

and distance covered by car = 600 – 200

= 400 km

Total time taken = 8 hours 20 minutes

$$= 8\frac{20}{60} = 8\frac{1}{3} = \frac{25}{3} \text{ hours.}$$

Now according to the conditions

$$\frac{120}{y} + \frac{480}{x} = 8$$

$\Rightarrow$ $\frac{15}{y} + \frac{60}{x} = 1$ (Dividing by 8) ...(*i*)

and $\frac{200}{y} + \frac{400}{x} = \frac{25}{3}$

$\Rightarrow$ $\frac{8}{y} + \frac{16}{x} = \frac{1}{3}$ (Dividing by 25) ...(*ii*)

Multiplying (*i*) by 8 and (*ii*) by 15,

$$\frac{120}{y} + \frac{480}{x} = 8$$

$$\frac{120}{y} + \frac{240}{x} = 5$$

$- \quad - \quad -$

Subtracting, $\frac{240}{x} = 3 \Rightarrow 3x = 240$

$\Rightarrow$ $x = \frac{240}{3} = 80$

Substituting the value of x in (*i*)

$$\frac{15}{y} + \frac{60}{80} = 1$$

$\Rightarrow$ $\frac{15}{y} = 1 - \frac{60}{80} = 1 - \frac{3}{4} = \frac{1}{4}$

$\Rightarrow$ $y = 60$

$\therefore$ Speed of car = 80 km/h

and speed of train = 60 km/h **Ans.**

Q. 34. 6 men and 8 boys can finish a piece of work in 14 days while 8 men and 12 boys can do it in 10 days. Find the time taken by one man alone and that by one boy alone to finish the work.

Sol. Let a man can do the work in = x days

and a boy can do the same work in

= y days

$\therefore$ Man's 1 day's work = $\frac{1}{x}$

and boy's 1 day's work = $\frac{1}{y}$

According to the conditions,

$$\frac{6}{x}+\frac{8}{y}=\frac{1}{14} \qquad ...(i)$$

and $$\frac{8}{x}+\frac{12}{y}=\frac{1}{10} \qquad ...(ii)$$

Multiplying (i) by 3 and (ii) by 2,

$$\frac{18}{x}+\frac{24}{y}=\frac{3}{14}$$

$$\frac{16}{x}+\frac{24}{y}=\frac{2}{10}$$

$$- \quad - \quad -$$

Subtracting,

$$\frac{2}{x}=\frac{3}{14}-\frac{2}{10}=\frac{30-28}{140}=\frac{2}{140}=\frac{1}{70}$$

$\therefore x = 140$

Substituting the value of x in (i)

$$\frac{6}{140}+\frac{8}{y}=\frac{1}{14}$$

$$\Rightarrow \frac{8}{y}=\frac{1}{14}-\frac{6}{140}=\frac{10-6}{140}$$

$$\Rightarrow \frac{8}{y}=\frac{4}{140} \quad \Rightarrow \quad \frac{8}{y}=\frac{1}{35}$$

$\therefore \quad y = 8 \times 35 = 280$

Hence a man can do the work in

$= 140$ days

and a boy can do the same work in

$= 280$ days **Ans.**

Q. 35. A lady has 25-P and 50-P coins in her purse. If in all she has 80 coins totalling Rs. 25, how many coins of each kind does she have ?

Sol. Let no. of 25 – P coins $= x$

and no. of 50 – P coins $= y$

According to the condition,

$$x + y = 80 \qquad ...(i)$$

and $$\frac{x \times 25}{100}+\frac{y \times 50}{100}=25$$

$$\Rightarrow \frac{x}{4}+\frac{y}{2}=25$$

$$\Rightarrow x + 2y = 100 \qquad ...(ii)$$

Subtracting (i) from (ii)

$$y = 20$$

Substituting the value of y in (i)

$$x + 20 = 80 \Rightarrow x = 80 - 20 = 60$$

Hence no. of 25 – P coins = 60

and no. of 50-P coins = 20 **Ans.**

Q. 36. A and B together can do a piece of work in 6 days. If A's one day's work be $1\frac{1}{2}$ times the one day's work of B, find in how many days, each alone can finish the work.

Sol. (A + B)'s one days work $= \frac{1}{6}$

Let A can do the work in $= x$ days

and B can do the work in $= y$ days

$\therefore$ A's 1 days' work $= \frac{1}{x}$

and B's 1 day's work $= \frac{1}{y}$

According to the conditions,

$$\frac{1}{x}=\frac{3}{2}\times\frac{1}{y}=\frac{3}{2y} \qquad ...(i)$$

$$\frac{1}{x}+\frac{1}{y}=\frac{1}{6} \qquad ...(ii)$$

Substituting the value of $\frac{1}{x}$ in (ii)

$$\frac{3}{2y}+\frac{1}{y}=\frac{1}{6} \Rightarrow \frac{5}{2y}=\frac{1}{6}$$

$$\Rightarrow 2y = 30 \quad \Rightarrow \quad y=\frac{30}{2}=15$$

Substituting the value of y in (i)

$$\frac{1}{x}=\frac{3}{2\times 15}=\frac{1}{10}$$

$$\Rightarrow x = 10$$

Hence A can do the work in = 10 days

and B can do the work in = 15 days **Ans.**