

Chapter 6. Linear Inequalities

Question-1

Solve the inequation: $3x - 7 > x + 3$

Solution:

$$3x - 7 > x + 3$$

$$3x - 7 + 7 > x + 3 + 7$$

$$3x > x + 10$$

$$3x - x > x + 10 - x$$

$$2x > 10$$

$$x > 5$$

Question-2

Solve the inequation: $x + 12 < 4x - 2$

Solution:

$$x + 12 < 4x - 2$$

$$x + 12 - 12 < 4x - 2 - 12$$

$$x < 4x - 14$$

$$x - 4x < 4x - 14 - 4x$$

$$-3x < -14$$

$$-3x/-3 > -14/-3$$

$$x > 14/3$$

Question-3

Solve the inequation: $4x - 7 < 3 - x$

Solution:

$$4x - 7 < 3 - x$$

$$4x - 7 + 7 < 3 - x + 7$$

$$4x < 10 - x$$

$$4x + x < 10 - x + x$$

$$5x < 10$$

$$x < 2$$



Question-4

Solve the inequation: $3x + 17 \leq 2(1 - x)$

Solution:

$$3x + 17 \leq 2(1 - x)$$

$$3x \leq -2x - 15$$

$$3x + 2x \leq -2x - 15 + 2x$$

$$5x \leq -15$$

$$5x/5 \leq -15/5$$

$$x \leq -3$$

Question-5

Solve the inequation: $-2x + 6 \geq 5x - 4$

Solution:

$$-2x + 6 \geq 5x - 4$$

$$-2x \geq 5x - 10$$

$$-2x - 5x \geq 5x - 10 - 5x$$

$$-7x \geq -10$$

$$-7x/-7 \leq -10/-7$$

$$x \leq 10/7$$

Question-6

Solve the inequation: $-(x - 3) + 4 > -2x + 5$

Solution:

$$-(x - 3) + 4 > -2x + 5$$

$$-x + 7 > -2x + 5$$

$$-x + 7 - 7 > -2x + 5 - 7$$

$$-x > -2x - 2$$

$$x < 2x + 2$$

$$x - 2x < 2x + 2 - 2x$$

$$-x < 2$$

$$x > -2$$

Question-7

Solve the inequation: $2(2x + 3) - 10 < 6(x - 2)$

Solution:

$$2(2x + 3) - 10 < 6(x - 2)$$

$$4x + 6 - 10 < 6x - 12$$

$$4x - 4 < 6x - 12$$

$$4x - 4 + 4 < 6x - 12 + 4$$

$$4x < 6x - 8$$

$$4x - 6x < 6x - 8 - 6x$$

$$-2x < -8$$

$$-2x/-2 > -8/-2$$

$$x > 4$$

Question-8

Solve the inequation: $2 - 3x \geq 2(x + 6)$

Solution:

$$2 - 3x \geq 2x + 12$$

$$2 - 3x - 2 \geq 2x + 12 - 2$$

$$-3x \geq 2x + 10$$

$$-3x - 2x \geq 2x + 10 - 2x$$

$$-5x \geq 10$$

$$-5x/-5 \leq 10/-5$$

$$x \leq -2$$

Question-8

Solve the inequation: $2 - 3x \geq 2(x + 6)$

Solution:

$$2 - 3x \geq 2x + 12$$

$$2 - 3x - 2 \geq 2x + 12 - 2$$

$$-3x \geq 2x + 10$$

$$-3x - 2x \geq 2x + 10 - 2x$$

$$-5x \geq 10$$

$$-5x/-5 \leq 10/-5$$

$$x \leq -2$$

Question-9

Solve the inequation: $37 - (3x + 5) \geq 9x - 8(x - 3)$

Solution:

$$37 - 3x - 5 \geq 9x - 8x + 24$$

$$32 - 3x \geq x + 24$$

$$32 - 3x - 32 \geq x + 24 - 32$$

$$-3x \geq x - 8$$

$$-3x - x \geq x - 8 - x$$

$$-4x \geq -8$$

$$-4x/-4 \geq -8/-4$$

$$x \geq 2$$

Question-10

Solve the inequation: $\frac{5x}{2} + \frac{3x}{4} \geq \frac{39}{4}$

Solution:

$$\frac{5x}{2} + \frac{3x}{4} \geq \frac{39}{4}$$

$$10x + 3x \geq 39$$

$$13x \geq 39$$

$$13x/13 \geq 39/13$$

$$x \geq 3$$

Question-11

Solve the inequation: $\frac{4+2x}{3} \geq \frac{x}{2} - 3$

Solution:

$$\frac{4+2x}{3} \geq \frac{x}{2} - 3$$

$$2(4+2x) \geq 3x - 18 \text{ (Multiplying by 6 both sides)}$$

$$8 + 4x \geq 3x - 18$$

$$8 + 4x - 8 \geq 3x - 18 - 8$$

$$4x \geq 3x - 26$$

$$4x - 3x \geq 3x - 26 - 3x$$

$$x \geq -26$$

Question-12

Solve the inequation: $\frac{3(x-2)}{5} \geq \frac{5(2-x)}{3}$

Solution:

$$\frac{3(x-2)}{5} \geq \frac{5(2-x)}{3}$$

$9(x-2) \geq 25(2-x)$ (Multiplying by 15 both sides)

$$9x - 18 \geq 50 - 25x$$

$$9x - 18 + 18 \geq 50 - 25x + 18$$

$$9x \geq 68 - 25x$$

$$9x + 25x \geq 68 - 25x + 25x$$

$$34x \geq 68$$

$$34x/34 \geq 68/34$$

$$x \geq 2$$

Question-13

Solve the inequation: $\frac{x}{4} < \frac{5x-2}{3} - \frac{7x-3}{5}$

Solution:

$$\frac{x}{4} < \frac{5x-2}{3} - \frac{7x-3}{5}$$

$15x < 20(5x-2) - 12(7x-3)$ (Multiplying by 60 both sides)

$$15x < 100x - 40 - 84x + 36$$

$$15x < 16x - 4$$

$$15x - 16x < 16x - 4 - 16x$$

$$-x < -4$$

$$x > 4$$

Question-14

Solve the inequation: $\frac{5-2x}{3} \leq \frac{x}{6} - 5$

Solution:

$$\frac{5-2x}{3} \leq \frac{x}{6} - 5$$

$2(5-2x) \leq x - 30$ (Multiplying by 6 both sides)

$$10 - 4x \leq x - 30$$

$$10 - 4x - 10 \leq x - 30 - 10$$

$$-4x \leq x - 40$$

$$-4x - x \leq x - 40 - x$$

$$-5x \leq -40$$

$$-5x/-5 \leq -40/-5$$

$$x \geq 8$$



Question-15

Solve the inequation: $\frac{1}{2}\left(\frac{3}{5}x+4\right) \geq \frac{1}{3}(x-6)$

Solution:

$$\frac{1}{2}\left(\frac{3}{5}x+4\right) \geq \frac{1}{3}(x-6)$$

$$3\left(\frac{3}{5}x+4\right) \geq 2(x-6) \text{ (Multiplying by 6 both sides)}$$

$$3(3x+20) \geq 10(x-6) \text{ (Multiplying by 5 both sides)}$$

$$9x+60 \geq 10x-60$$

$$9x+60-60 \geq 10x-60-60$$

$$9x \geq 10x-120$$

$$9x-10x \geq 10x-120-10x$$

$$-x \geq -120$$

$$x \leq 120$$

Question-16

Solve the following system of inequations: $x-2 > 0$, $3x < 18$

Solution:

$$x-2 > 0$$

$$3x < 18$$

$$x-2 > 0$$

$$x > 2 \dots\dots\dots(1)$$

$$3x < 18$$

$$x < 6 \dots\dots\dots(2)$$

From (1) and (2), solutions of the given system are, therefore, given by $2 < x < 6$

Hence the solution of the system is $2 < x < 6$.



Question-17

Solve the following system of inequations: $5x + 1 > -24$, $5x - 1 < 24$

Solution:

$$5x + 1 > -24$$

$$5x - 1 < 24$$

$$5x + 1 > -24$$

$$5x > -25$$

$$x > -5 \dots\dots\dots(1)$$

$$5x - 1 < 24$$

$$5x < 25$$

$$x < 5 \dots\dots\dots(2)$$

From (1) and (2), solutions of the given system are, therefore, given by $-5 < x < 5$

$$x < 5$$

Hence the solution of the system of is $-5 < x < 5$.

Question-18

Solve the following system of inequations: $x + 2 \leq 5$, $3x - 4 > -2 + x$

Solution:

$$x + 2 \leq 5$$

$$3x - 4 > -2 + x$$

$$x + 2 \leq 5$$

$$x \leq 3 \dots\dots\dots(1)$$

$$3x - 4 > -2 + x$$

$$3x > 2 + x$$

$$2x > 2$$

$$x > 1 \dots\dots\dots(2)$$

From (1) and (2), solutions of the given system are, therefore, given by $1 < x \leq 3$.

Hence the solution of the system of is $1 < x \leq 3$.



Question-19

Solve the following system of inequations: $4x + 5 > 3x$, $-(x + 3) + 4 \leq -2x + 5$

Solution:

$$4x + 5 > 3x$$

$$-(x + 3) + 4 \leq -2x + 5$$

$$4x + 5 > 3x$$

$$4x > 3x - 5$$

$$x > -5 \dots\dots\dots(1)$$

$$-(x + 3) + 4 \leq -2x + 5$$

$$-x - 3 + 4 \leq -2x + 5$$

$$-x + 1 \leq -2x + 5$$

$$-x \leq -2x + 4$$

$$x \leq 4 \dots\dots\dots(2)$$

From (1) and (2), solutions of the given system are, therefore, given by $-5 < x \leq 4$

Hence the solution of the system of is $-5 < x \leq 4$.

Question-20

Solve the following system of inequations: $\frac{4x}{3} - \frac{9}{4} < x + \frac{3}{4}$, $\frac{7x-1}{3} - \frac{7x+2}{6} > x$

Solution:

$$\frac{4x}{3} - \frac{9}{4} < x + \frac{3}{4}$$

$$16x - 27 < 12x + 9 \quad \text{(Multiplying by 12 both sides)}$$

$$16x < 12x + 36$$

$$4x < 36$$

$$x < 9 \dots\dots\dots(1)$$

$$\frac{7x-1}{3} - \frac{7x+2}{6} > x$$

$$2(7x - 1) - (7x + 2) > 6x \quad \text{(Multiplying by 6 both sides)}$$

$$14x - 2 - 7x - 2 > 6x$$

$$7x - 4 > 6x$$

$$7x > 6x + 4$$

$$x > 4 \dots\dots\dots(2)$$

From (3) and (4), solutions of the given system are, therefore, given by $4 < x < 9$

Hence the solution of the system of is $4 < x < 9$.

Question-21

Solve the following system of inequations: $2(x + 1) < x + 5$, $3(x + 2) > 2 - x$.

Solution:

$$2(x + 1) < x + 5$$

$$3(x + 2) > 2 - x$$

$$2(x + 1) < x + 5$$

$$2x + 2 < x + 5$$

$$2x < x + 3$$

$$x < 3 \dots\dots\dots (1)$$

$$3(x + 2) > 2 - x$$

$$3x + 6 > 2 - x$$

$$3x > -4 - x$$

$$4x > -4$$

$$x > -1 \dots\dots\dots (2)$$

From (1) and (2), solutions of the given system are, therefore, given by $-1 < x < 3$

Hence the solution of the system of is $-1 < x < 3$.

Question-22

Solve the following system of inequations: $3x - 1 \geq 5$, $x + 2 > -1$

Solution:

$$3x - 1 \geq 5$$

$$x + 2 > -1$$

$$3x - 1 \geq 5$$

$$3x \geq 5 + 1$$

$$3x \geq 6$$

$$x \geq 2 \dots\dots\dots (1)$$

$$x + 2 > -1$$

$$x > -1 - 2$$

$$x > -3 \dots\dots\dots (2)$$

From (1) and (2), solutions of the given system are, therefore, given by $x \geq 2$
Hence the solution of the system of is $x \geq 2$.

Question-23

Solve the following system of inequations: $3x - 7 > 2(x - 6)$, $6 - x > 11 - 2x$

Solution:

$$3x - 7 > 2(x - 6)$$

$$6 - x > 11 - 2x$$

$$3x - 7 > 2x - 12$$

$$3x - 7 + 7 > 2x - 12 + 7$$

$$3x > 2x - 5$$

$$3x - 2x > 2x - 5 - 2x$$

$$x > -5 \dots\dots\dots(1)$$

$$6 - x > 11 - 2x$$

$$6 - x - 6 > 11 - 2x - 6$$

$$-x > 5 - 2x$$

$$-x + 2x > 5 - 2x + 2x$$

$$x > 5 \dots\dots\dots(2)$$

From (1) and (2), solutions of the given system are, therefore, given by $x > 5$

Hence the solution of the system is $x > 5$.

Question-24

Solve the following system of inequations: $-2 - \frac{x}{4} \leq \frac{1+x}{3}$, $3 - x < 4(x - 3)$

Solution:

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

$$3 - x < 4(x - 3)$$

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

$$-24 - 3x \leq 4(1 + x) \quad (\text{Multiplying by 12 both sides})$$

$$-24 - 3x \leq 4 + 4x$$

$$-3x \leq 4x + 28$$

$$-7x \leq 28$$

$$x \geq -4 \dots\dots\dots(1)$$

$$3 - x < 4x - 12$$

$$-x < 4x - 15$$

$$-5x < -15$$

$$x > 3 \dots\dots\dots(2)$$

From (1) and (2), solutions of the given system are, therefore, given by $x > 3$

Hence the solution of the system is $x > 3$.

Question-25

Solve the following system of inequations:

$$5(2x - 7) - 3(2x + 3) \leq 0, 2x + 19 \leq 6x + 47$$

Solution:

$$5(2x - 7) - 3(2x + 3) \leq 0$$

$$2x + 19 \leq 6x + 47$$

$$5(2x - 7) - 3(2x + 3) \leq 0$$

$$10x - 35 - 6x - 9 \leq 0$$

$$4x - 44 \leq 0$$

$$4x \leq 44$$

$$x \leq 11 \dots\dots\dots (3)$$

$$2x + 19 \leq 6x + 47$$

$$2x \leq 6x + 28$$

$$-4x \leq 28$$

$$x \geq -7 \dots\dots\dots (4)$$

From (1) and (2), solutions of the given system are, therefore, given by $-7 \leq$

$$x \leq 11$$

Hence the solution of the system is $-7 \leq x \leq 11$.

Question-26

Solve the following system of inequations: $2x - 7 < 11, 3x + 4 < -5$

Solution:

$$2x - 7 < 11$$

$$3x + 4 < -5$$

$$2x - 7 < 11$$

$$2x < 18$$

$$x < 9 \dots\dots\dots (1)$$

$$3x + 4 < -5$$

$$3x < -9$$

$$x < -3 \dots\dots\dots (2)$$

From (1) and (2), solutions of the given system are, therefore, given by $x < -$

$$3$$

Hence the solution of the system is $x < -3$.

Question-27

Solve the following system of inequations: $4 - 5x > -11$, $4x + 11 \leq -13$

Solution:

$$4 - 5x > -11$$

$$4x + 11 \leq -13$$

$$4 - 5x > -11$$

$$-5x > -15$$

$$x < 3 \dots\dots\dots (1)$$

$$4x + 11 \leq -13$$

$$4x \leq -24$$

$$x \leq -6 \dots\dots\dots (2)$$

From (1) and (2), solutions of the given system are, therefore, given by $x \leq -6$.

Hence the solution of the system is $x \leq -6$

Question-28

Solve the following system of inequations: $4x - 5 < 11$, $-3x - 4 \geq 8$.

Solution:

$$4x - 5 < 11$$

$$-3x - 4 \geq 8$$

$$4x - 5 < 11$$

$$4x < 16$$

$$x < 4 \dots\dots\dots (1)$$

$$-3x - 4 \geq 8$$

$$-3x \geq 12$$

$$x \leq -4 \dots\dots\dots (2)$$

From (1) and (2), solutions of the given system are, therefore, given by $x \leq -4$.

Hence the solution of the system is $x \leq -4$.

Question-29

Solve the following system of inequations: $5x - 7 < 3(x + 3)$, $1 - \frac{3x}{2} \geq x - 4$

Solution:

$$5x - 7 < 3(x + 3)$$

$$1 - \frac{3x}{2} \geq x - 4$$

$$5x - 7 < 3(x + 3)$$

$$5x - 7 < 3x + 9$$

$$5x < 3x + 16$$

$$2x < 16$$

$$x < 8 \dots\dots\dots(1)$$

$$1 - \frac{3x}{2} \geq x - 4 \quad \text{(Multiplying both sides by 2)}$$

$$2 - 3x \geq 2x - 8$$

$$-3x \geq 2x - 10$$

$$-5x \geq -10$$

$$x \leq 2 \dots\dots\dots(2)$$

From (1) and (2), solutions of the given system are, therefore, given by $x \leq 2$.

Hence the solution of the system is $x \leq 2$.

Question-30

Solve the following system of inequations: $2(2x + 3) - 10 < 6(x - 2)$,

$$\frac{2x-3}{4} + 6 \geq 2 + \frac{4x}{3}$$

Solution:

$$2(2x + 3) - 10 < 6(x - 2)$$

$$\frac{2x-3}{4} + 6 \geq 2 + \frac{4x}{3}$$

$$2(2x + 3) - 10 < 6(x - 2)$$

$$4x + 6 - 10 < 6x - 12$$

$$4x - 4 < 6x - 12$$

$$4x < 6x - 8$$

$$-2x < -8$$

$$x > 4 \dots\dots\dots(1)$$

$$\frac{2x-3}{4} + 6 \geq 2 + \frac{4x}{3}$$

$$3(2x - 3) + 72 \geq 24 + 16x \quad \text{(Multiplying both sides by 12)}$$

$$6x - 9 + 72 \geq 24 + 16x$$

$$6x + 63 \geq 24 + 16x$$

$$6x \geq 16x - 39$$

$$-10x \geq -39$$

$$x \leq 39/10 \dots\dots\dots(2)$$

From (1) and (2), the system has no solution.

Question-31

Represent the following inequation graphically in two dimensional plane and hence solve them: $x - 2y + 4 \leq 0$

Solution:

We draw the graph of the equation $x - 2y + 4 = 0$

x	0	-4
y	2	0

Put $x = 0$

$$\text{Then } 0 - 2y + 4 \leq 0$$

$$\text{or } -2y \leq -4$$

$$\text{or } y \geq 2$$

Put $x = 0, y = 0$

$$\text{Then } 0 - 2(0) + 4 \leq 0$$

or $4 \leq 0$, which is false.

Hence, half plane II is not the solution of the given inequation.

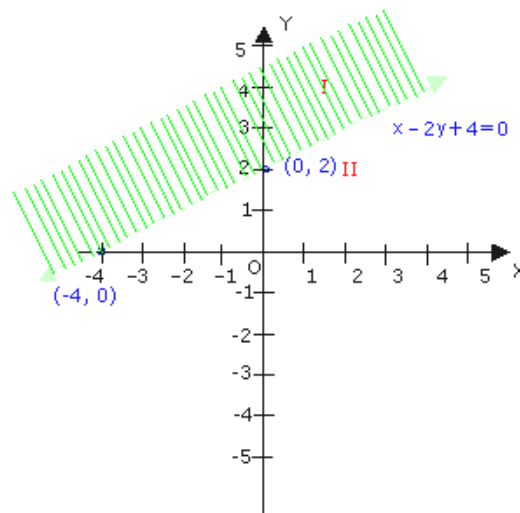
Therefore, the shaded half plane I is the solution region of the inequation including points on the line

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

Scale

1 cm = 1 unit along x-axis

1 cm = 1 unit along y-axis



Question-32

Represent the following inequation graphically in two dimensional plane and hence solve them: $2x + y > 3$

Solution:

We draw the graph of the equation $2x + y = 3$

X	0	$\frac{3}{2}$
Y	3	0

Put $x = 0$

Then $2(0) + y > 3$

or $y > 3$

Put $x = 0, y = 0$

Then $2(0) + 0 > 3$

or $0 > 3$, which is false.

Hence, half plane I is not the solution of the given inequation.

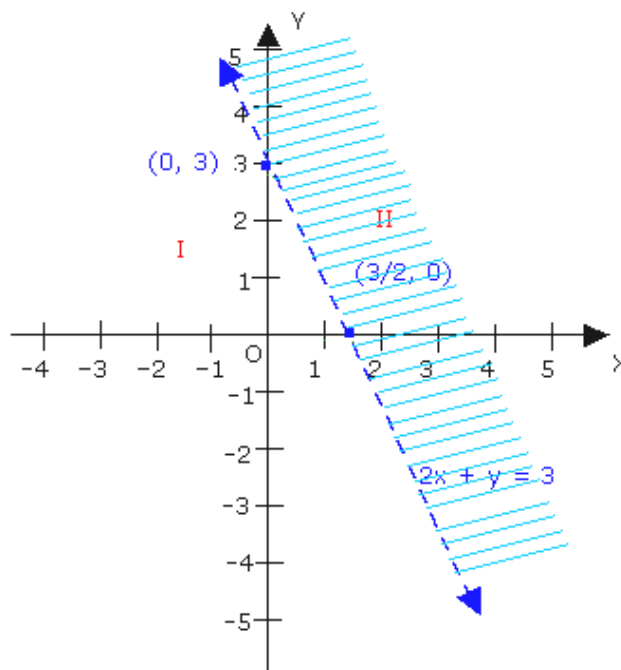
Therefore, the shaded half plane II is the solution region of the inequation excluding points on the line

$2x + y = 3$.

Scale

1 cm = 1 unit along x-axis

1 cm = 1 unit along y-axis



Question-33

Represent the following inequation graphically in two dimensional plane and hence solve them: $3x - 4y < 12$

Solution:

We draw the graph of the equation $3x - 4y = 12$

x	0	4
y	-3	0

Put $x = 0$

$$\text{Then } 3(0) - 4y < 12$$

$$\text{or } -y < 3$$

$$\text{or } y > -3$$

Put $x = 0, y = 0$

$$\text{Then } 3(0) - 4(0) < 12$$

or $0 < 12$, which is true.

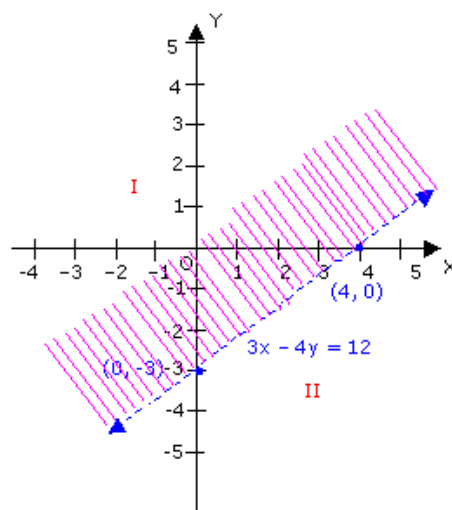
Hence, half plane II is not the solution of the given inequation.

Therefore, the shaded half plane I is the solution region of the inequation excluding points on the line $3x - 4y = 12$.

Scale

1 cm = 1 unit along x-axis

1 cm = 1 unit along y-axis



Question-34

Represent the following inequation graphically in two dimensional plane and hence solve them: $y + 8 \geq 2x$

Solution:

We draw the graph of the equation $y + 8 = 2x$

x	2	4
y	-4	0

Put $x = 0$

Then $y + 8 \geq 2x$

or $y + 8 \geq 0$

Put $x = 0, y = 0$

Then $0 + 8 \geq 2(0)$

or $8 \geq 0$, which is true.

Hence, half plane I is not the solution of the given inequation.

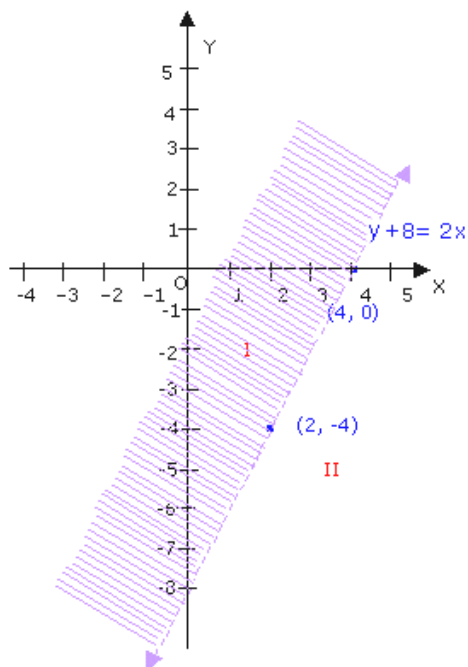
Therefore, the shaded half plane II is the solution region of the inequation including points on the line

$$y + 8 = 2x.$$

Scale

1 cm = 1 unit along x-axis

1 cm = 1 unit along y-axis



Question-35

Represent the following inequation graphically in two dimensional plane and hence solve them: $2x \leq 6 - 3y$

Solution:

We draw the graph of the equation $2x = 6 - 3y$

x	0	3
y	2	0

Put $x = 0$

Then $2(0) \leq 6 - 3y$

or $y \leq 2$

Put $x = 0, y = 0$

Then $2(0) \leq 6 - 3(0)$

or $0 \leq 6$, which is true.

Hence, half plane I is not the solution of the given inequation.

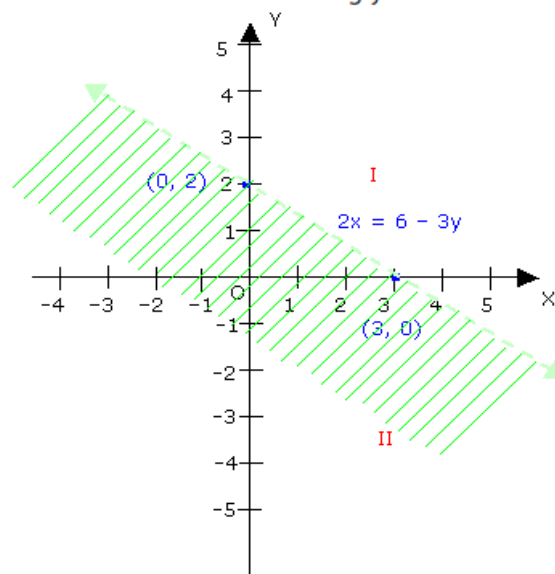
Therefore, the shaded half plane II is the solution region of the inequation

including points on the line $2x = 6 - 3y$

Scale

1 cm = 1 unit along x-axis

1 cm = 1 unit along y-axis



Question-36

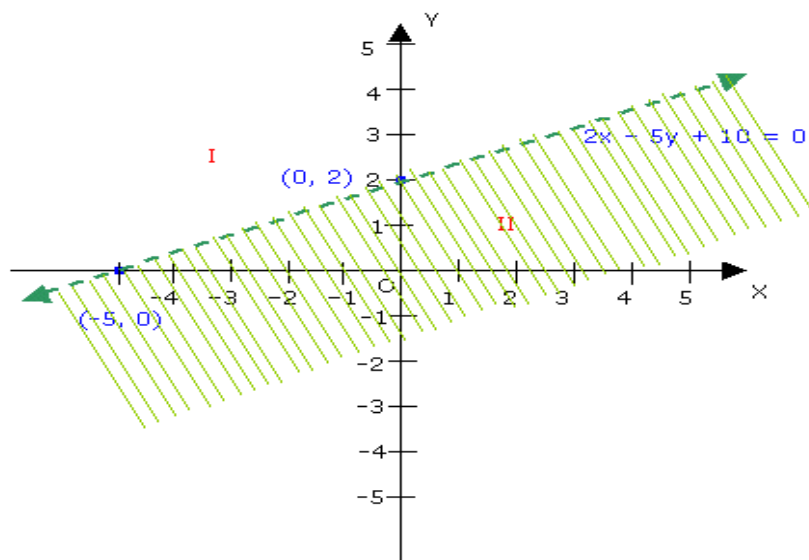
Represent the following inequation graphically in two dimensional plane and hence solve them: $0 \leq 2x - 5y + 10$

Solution:

Scale

1 cm = 1 unit along x-axis

1 cm = 1 unit along y-axis



We draw the graph of the equation $2x - 5y + 10 = 0$

x	0	-5
y	2	0

Put $x = 0$

Then $0 \leq 2(0) - 5y + 10$

or $-10 \leq -5y$

Put $x = 0, y = 0$

Then $0 \leq 2(0) - 5(0) + 10$

or $0 \leq 10$, which is false.

Hence, half plane I is not the solution of the given inequation.

Therefore, the shaded half plane II is the solution region of the inequation including points on the line $2x - 5y + 10 = 0$.

Question-37

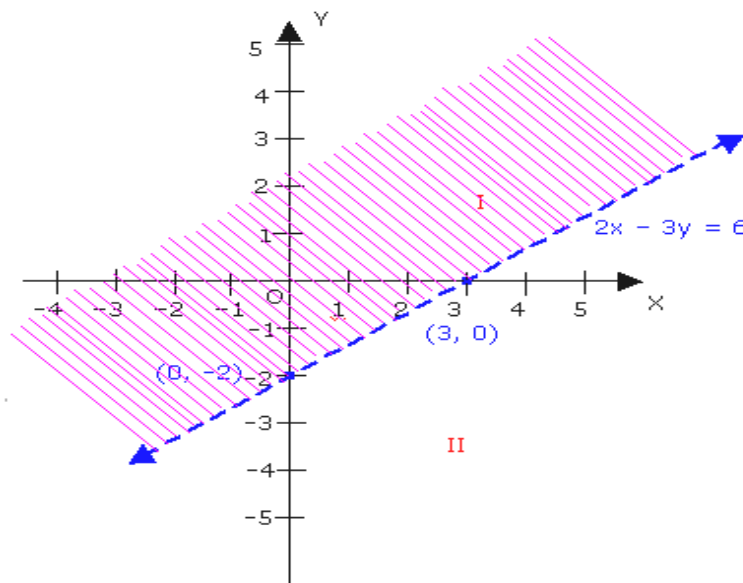
Represent the following inequation graphically in two dimensional plane and hence solve them: $2x - 3y < 6$

Solution:

Scale

1 cm = 1 unit along x-axis

1 cm = 1 unit along y-axis



We draw the graph of the equation $2x - 3y = 6$

x	0	3
y	-2	0

Put $x = 0$

Then $2(0) - 3y < 6$

or $y < -2$

Put $x = 0, y = 0$

Then $2(0) - 3(0) < 6$

or $0 < 6$, which is true.

Hence, half plane II is not the solution of the given inequation.

Therefore, the shaded half plane I is the solution region of the inequation excluding points on the line

$2x - 3y = 6$

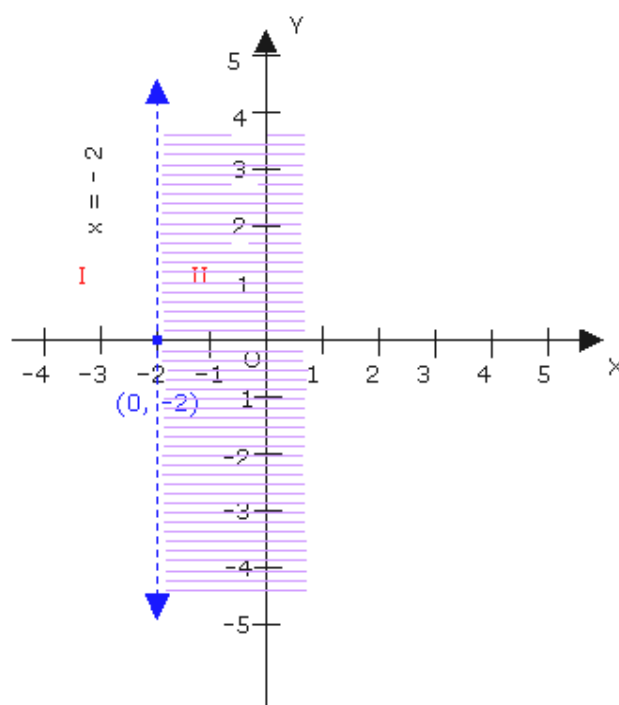
Question-38

Represent the following inequation graphically in two dimensional plane and hence solve them: $x > -2$

Solution:

1 cm = 1 unit along x-axis

1 cm = 1 unit along y-axis



The graph of the equation $x = -2$ is vertical line parallel to y – axis.

Put $x = 0$

Then $0 > -2$, which is true.

Hence, the solution region is the shaded region on the right hand side of the line $x = -2$ containing the origin.

Hence every point on the shaded region is the solution of the given inequation.