6.3 Graphical Solution of Inequalities in Two Variables

EXAMPLE - 1

Solve the inequality $x + y < 5$ graphically.

Solution: Given inequality is $x + y < 5$.

We consider the following equation:

$$x + y = 5$$

x	0	5
y	5	0

This line divides the xy-plane into two half planes.

We select a point (0, 0), which does not lie on the line.

Since, (0, 0) satisfies the given inequality. [... $x + y = 0 + 0 = 0 < 5$]

So, the half plane containing the point (0, 0) is the solution region of given inequality.

Also, points on the line do not satisfy the given inequality.

Hence, the required solution region is shown shaded in the graph.

EXAMPLE - 2

Solve the inequality $3x + 4y \leq 12$ graphically.

Solution: Given inequality is $3x + 4y \leq 12$.

We consider the following equation:

$$3x + 4y = 12$$

x	0	4
y	3	0

This line divides the xy-plane into two half planes.

We select a point (0, 0), which does not lie on the line.

Since, (0, 0) satisfies the given inequality. [...$3x + 4y = 3(0) + 4(0) = 0 \leq 12$]

So, the half plane containing the point (0, 0) is the solution region of given inequality.

Also, points on the line satisfy the given inequality.

Hence, the required solution region is shown shaded in the graph.

EXAMPLE - 3

Solve the inequality $2x - 3y > 6$ graphically.

Solution: Given inequality is $2x - 3y > 6$.

We consider the following equation:

$$2x - 3y = 6$$

x	0	3

y	-2	0

This line divides the xy-plane into two half planes.
We select a point (0, 0), which does not lie on the line.
Since, (0, 0) does not satisfy the given inequality. [...2x - 3y = 2(0) - 3(0) = 0 > 6]
So, the half plane not containing the point (0, 0) is the solution region of given inequality. Also, points on the line do not satisfy the given inequality.

Hence, the required solution region is shown shaded in the graph.

EXAMPLE - 4

Solve the inequality $-3x + 2y \geq -6$ graphically.

Solution: Given inequality is $-3x + 2y \geq -6$.

We consider the following equation:

$$-3x + 2y = -6$$

x	0	2
y	-3	0

This line divides the xy-plane into two half planes.
We select a point (0, 0), which does not lie on the line.
Since, (0, 0) satisfies the given inequality. [... $-3x + 2y = -3(0) + 2(0) = 0 \geq -6$]
So, the half plane containing the point (0, 0) is the solution region of given inequality.
Also, points on the line satisfy the given inequality.

Hence, the required solution region is shown shaded in the graph.

HOTS (Higher Order Thinking Skills)

EXAMPLE H -1

Solve the inequality $x + 2y \geq 0$ graphically.

Solution: Given inequality is $x + 2y \geq 0$.

We consider the following equation:

$$x + 2y = 0$$

x	0	2
y	0	-1

This line divides the xy-plane into two half planes.

We select a point (1, 1), which does not lie on the line.

Since, (1, 1) satisfies the given inequality. [...$x + 2y = 1 + 2(1) = 3 \geq 0$]

So, the half plane containing the point (1, 1) is the solution region of given inequality.

Also, points on the line satisfy the given inequality.

Hence, the required solution region is shown shaded in the graph.

EXAMPLE H - 2

Solve the inequality $3x - 6 \geq 0$ graphically in the two-dimensional plane.

Solution: Given inequality is $3x - 6 \geq 0$.

We consider the following equation:

$$3x - 6 = 0$$

$$x = 2$$

This line divides the xy-plane into two half planes.

We select a point (0, 0), which does not lie on the line.

Since, (0, 0) does not satisfy the given inequality. [... $3x - 6 = 3(0) - 6 = -6 \geq 0$]

So, the half plane not containing the point (0, 0) is the solution region of given inequality.

Also, points on the line satisfy the given inequality.

Hence, the required solution region is shown shaded in the graph.

EXAMPLE H - 3

Solve the inequality $y > -2$ graphically in the two-dimensional plane.

Solution: Given inequality is $y > -2$.

We consider the following equation:

$$y = -2$$

This line divides the xy-plane into two half planes.

We select a point (0, 0), which does not lie on the line.

Since, (0, 0) satisfies the given inequality. [... $y = 0 > -2$]

So, the half plane containing the point (0, 0) is the solution region of given inequality.

Also, points on the line do not satisfy the given inequality.

Hence, the required solution region is shown shaded in the graph.

Exercise 6.3

Solve the following linear inequalities graphically:

1. $x > -3$.
2. $y < 2$.
3. $3y - 5x < 30$.
4. $x - y \leq 2$.
5. $3x + 2y > 6$.
6. $2x + y \geq 6$.
7. $y + 8 \geq 2x$.