



ChapterNotes

chapternotes.in · free NEET & JEE prep

CHAPTER NOTES

Linear Inequalities Class 11 Notes | CBSE Maths Chapter 5

- ✓ Chapter-wise notes & important questions
- ✓ Free gamified practice app — streaks, levels, revision
- ✓ Free mock & prediction papers with answer keys

Source: [https://chapternotes.in/cbse/class-11-maths/linear-inequalities-class-11-](https://chapternotes.in/cbse/class-11-maths/linear-inequalities-class-11-notes/)
notes/



Scan for free practice,
mocks & more notes

Linear Inequalities Class 11 Notes | CBSE Maths

Chapter 5

Linear Inequalities is Chapter 5 of CBSE Class 11 Maths — the chapter that teaches you to work with relationships like “less than” and “greater than” instead of plain equality. Whenever a problem says “at least”, “at most”, “minimum”, or “maximum”, you are really being asked to solve an inequality. Master this chapter and you build the foundation for Linear Programming, optimisation, and a steady block of easy board marks.

By the end of these notes you will be able to solve a linear inequality in one variable, plot its solution on the number line, draw the graph of a linear inequality in two variables, and find the common region of a system of inequalities. This is a scoring chapter carrying roughly 4–6 marks in boards, with questions that are mostly procedural — get the rules right and the marks are yours.

Table of Contents

- Key Concepts — Inequalities, rules, one variable, number line, two variables, systems
 - Weightage in Board & Entrance Exams
 - Important Definitions
 - Solved Examples
 - Important Questions for Board Exams
 - Quick Revision Points
-

Key Concepts

1. What is an Inequality?

If you say a movie ticket costs “at least ₹200”, you cannot write a single equals sign — the price could be 200, 250, or more. A statement that compares two quantities using a sign other than equality is called an **inequality**.

The four basic signs are: $<$ (less than), $>$ (greater than), $\leq$ (less than or equal to), and $\geq$ (greater than or equal to).

Strict vs Slack Inequalities

- **Strict inequality:** uses $<$ or $>$ (the boundary value is not included), e.g. $x > 3$.
- **Slack (non-strict) inequality:** uses $\leq$ or $\geq$ (the boundary value is included), e.g. $x \geq 3$.

An inequality like $3x - 7 < 5$ that contains a variable is an **algebraic inequality**; one like $5 < 7$ with only numbers is a **numerical inequality**.

2. Linear Inequality in One Variable

An inequality is **linear** if the highest power of the variable is 1. A **linear inequality in one variable** has the form $ax + b < 0$ (or $>$, $\leq$, $\geq$), where $a \neq 0$.

Examples: $3x - 7 < 5$, $2x + 1 \geq 9$, and $4 - x > 0$ are all linear inequalities in one variable.

An inequality such as $x^2 > 4$ is **not** linear because the power of x is 2.

3. Rules for Solving Inequalities

Solving an inequality means finding all values of the variable that make it true. The rules are almost the same as for equations, with one crucial twist.

- You may **add or subtract** the same number on both sides without changing the sign.
- You may **multiply or divide** both sides by the same **positive** number without changing the sign.
- **Key rule:** when you **multiply or divide by a negative number, the inequality sign reverses**. For example, $-x > 2$ becomes $x < -2$.

Common mistake: forgetting to flip the sign after dividing by a negative number is the single biggest error in this chapter — always check before you write the final answer.

4. Solution on the Number Line

The solution of a one-variable inequality is usually a range of values, best shown on a **number line**. The type of circle at the boundary tells you whether that point is included.

- **Open circle (O):** used for $<$ and $>$ — the boundary value is excluded.
- **Closed/filled circle (●):** used for $\leq$ and $\geq$ — the boundary value is included.

[DIAGRAM: A number line for $x > 3$ — open circle at 3 with the line shaded to the right towards $+\infty$.]

If the variable is a **natural number or integer**, the solution is a set of separate dots; if it is a **real number**, the solution is a continuous shaded ray.

5. Interval Notation

The shaded region on a number line can be written compactly using **intervals**. A square bracket includes the endpoint; a round bracket excludes it.

Inequality	Interval	Endpoint included?
$a < x < b$	(a, b)	Neither — open interval
$a \leq x \leq b$	$[a, b]$	Both — closed interval
$a \leq x < b$	$[a, b)$	Only a
$x > a$	(a, ∞)	No — infinity is always open

Note: infinity (∞) is never a real number, so it always takes a round bracket.

6. Linear Inequality in Two Variables

An inequality of the form $ax + by < c$ (or $>$, $\leq$, $\geq$), where a and b are not both zero, is a **linear inequality in two variables**.

Examples: $2x + 3y \leq 6$ and $x - y > 0$ are linear inequalities in two variables.

Its solution is not a few numbers but a whole **region (half-plane)** of the coordinate plane.

7. Graphical Solution in Two Variables

To solve $ax + by \leq c$ graphically, first draw the boundary line $ax + by = c$, then decide which side of it to shade.

- **Draw the line:** use a **solid line** for $\leq$ or $\geq$ (boundary included) and a **dashed line** for $<$ or $>$ (boundary excluded).
- **Pick a test point:** the origin $(0, 0)$ is easiest, provided the line does not pass through it.
- **Shade:** if the test point *satisfies* the inequality, shade its side; otherwise shade the opposite side.

[DIAGRAM: The line $x + y = 4$ drawn on axes — for $x + y \leq 4$ the line is solid and the region containing the origin $(0,0)$ is shaded.]

The shaded half-plane is the **solution region**; every point in it satisfies the inequality.

8. System of Linear Inequalities

Real problems usually give several conditions at once — for example “ $x \geq 0$, $y \geq 0$, and $2x + y \leq 8$ ”. Solving them together is solving a **system of linear inequalities**.

Graph **each** inequality on the same axes and shade its half-plane. The **common region** — where all the shaded areas overlap — is the solution of the system.

- The constraints $x \geq 0$ and $y \geq 0$ restrict the solution to the **first quadrant**.
- If the shaded regions have no overlap, the system has **no solution**.

[DIAGRAM: First-quadrant region bounded by the axes and the line $2x + y = 8$ — the overlapping shaded triangle is the common solution region.]

Why it matters: this common region is exactly the “feasible region” you will use in **Linear Programming** in Class 12.

Weightage in Board & Entrance Exams

Exam	Typical Weightage	Most-Tested Areas
CBSE Board (Class 11)	4–6 marks	Solving one-variable inequalities, number-line graphs, two-variable graphs
JEE Main	1–2 questions (with other algebra)	Modulus inequalities, systems, range of solutions
Class 12 link	Foundation chapter	Feasible region in Linear Programming

[TABLE: Question-type split — VSA (1 mark): sign rules & interval notation; SA (2–3 marks): solve one-variable inequalities, plot on number line; LA (4–5 marks): graph two-variable inequalities and find the common region of a system.]

Important Definitions

Term	Definition
Inequality	A statement comparing two quantities using $<$, $>$, $\leq$, or $\geq$
Strict inequality	Uses $<$ or $>$; the boundary value is excluded
Slack inequality	Uses $\leq$ or $\geq$; the boundary value is included
Linear inequality (one variable)	$ax + b < 0$ form, with $a \neq 0$ and highest power of x equal to 1
Linear inequality (two variables)	$ax + by < c$ form, a and b not both zero
Sign-reversal rule	Multiplying or dividing an inequality by a negative number flips the sign
Interval	Compact notation for a range: $()$ excludes endpoints, $[]$ includes them
Half-plane	The region on one side of a boundary line; the solution of a two-variable inequality
Solution region	The set of all points satisfying a two-variable inequality
Common region	The overlap of all half-planes; the solution of a system of inequalities

Solved Examples

Example 1

Solve $3x - 7 < 5$ for real x and show the solution on the number line.

Answer: $3x < 12$, so $x < 4$. Solution set: $(-\infty, 4)$. On the number line, an **open circle** at 4 with shading to the left.

Example 2

Solve $-2x + 4 \geq 10$ for real x .

Answer: $-2x \geq 6$. Dividing by -2 **reverses the sign**: $x \leq -3$. Solution set: $(-\infty, -3]$.

Example 3

Solve $5x - 3 < 3x + 1$ when x is an integer, and list the solutions.

Answer: $5x - 3x < 1 + 3 \Rightarrow 2x < 4 \Rightarrow x < 2$. Integer solutions: ..., -1 , 0 , 1 (all integers less than 2).

Example 4

Solve the double inequality $-5 \leq (3 - 2x)/2 < 3$ for real x .

Answer: Multiply throughout by 2: $-10 \leq 3 - 2x < 6$. Subtract 3: $-13 \leq -2x < 3$. Divide by -2 (flip both signs): $13/2 \geq x > -3/2$, i.e. $-3/2 < x \leq 13/2$. Solution set: $(-3/2, 13/2]$.

Example 5

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

Answer: Draw the **solid** line $2x + 3y = 6$ (through $(3, 0)$ and $(0, 2)$). Test $(0, 0)$: $2(0) + 3(0) = 0 \leq 6$ — true. So shade the side **containing the origin**. That half-plane is the solution.

Example 6

Find the common solution region of the system: $x + y \leq 4$, $x \geq 0$, $y \geq 0$.

Answer: $x \geq 0$ and $y \geq 0$ restrict to the **first quadrant**. The line $x + y = 4$ passes through $(4, 0)$ and $(0, 4)$; the origin satisfies $x + y \leq 4$, so shade towards it. The common region is the **triangle with vertices $(0, 0)$, $(4, 0)$ and $(0, 4)$** , boundaries included.

Important Questions for Board Exams

1-Mark Questions (VSA)

1. What happens to the inequality sign when both sides are divided by a negative number?
2. Write the interval notation for the solution $x \geq -2$.
3. When do you use a dashed line while graphing a two-variable inequality?
4. Is $x^2 < 9$ a linear inequality? Justify.
5. What does an open circle on a number line indicate?

2–3-Mark Questions (SA)

1. Solve $4x + 3 < 6x + 7$ for real x and represent the solution on the number line.
2. Solve $3(x - 2) \leq 5x + 4$ and write the solution set in interval form.
3. Solve $-8 \leq 5 - 3x < 13$ for real x and write the solution set.
4. Solve the inequality $x + y \geq 5$ graphically.

4–5-Mark Questions (LA)

1. Solve the system $2x + y \geq 6$, $3x + 4y \leq 12$ graphically and shade the common region.

2. Solve graphically: $x \geq 0$, $y \geq 0$, $x + 2y \leq 8$, $2x + y \leq 8$, and identify the feasible region.
3. A solution is to be kept between 30°C and 35°C . Using $C = 5(F - 32)/9$, find the range of temperature in degrees Fahrenheit.
-

Quick Revision Points

- Inequality signs: $<$ (less than), $>$ (greater than), $\leq$ (less than or equal to), $\geq$ (greater than or equal to)
 - Add/subtract any number — sign unchanged; multiply/divide by a positive number — sign unchanged
 - Multiply or divide by a **negative** number — the sign **reverses**
 - Number line: open circle ($\circ$) for $<$, $>$; closed circle ($\bullet$) for $\leq$, $\geq$
 - Intervals: $()$ excludes endpoints, $[]$ includes them; ∞ is always open
 - Two-variable inequality solution = a half-plane (region), not a single value
 - Boundary line: solid for $\leq$, $\geq$; dashed for $<$, $>$
 - Use the test point $(0, 0)$ to decide which side to shade
 - System of inequalities: solution = common (overlapping) region
 - $x \geq 0$ and $y \geq 0$ confine the solution to the first quadrant
 - This common region becomes the feasible region in Class 12 Linear Programming
-

Next Chapter: Chapter 6 — Permutations and Combinations



Got this PDF from a friend?

Everything here is free at **chapternotes.in** — 134 chapters of notes, a gamified practice app, and full NEET mock & prediction papers.



Scan for free practice, mocks & more notes