Class 11 Maths Chapter 5: Linear Inequalities - Notes, Important Questions and MCQs (2026-27)

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Class 11 Maths Chapter 5, Linear Inequalities, deals with statements that compare two expressions using <, >, ≤ or ≥, and with finding all values that satisfy them.

These notes cover types of inequalities, the rules for solving them, algebraic solutions of linear inequalities in one variable, representation on the number line and word problems, as per the rationalised 2026-27 syllabus.

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Chapter Overview

An inequality is formed when two real numbers or algebraic expressions are related by <, >, ≤ or ≥. For example, $3x - 4 < 5$ or $2x + 3 \geq 11$.

The set of all values of the variable that make the inequality true is its solution set. Inequalities model situations like budgets, marks and limits.

Important Topics and Concepts

Types of Inequalities

- Numerical: $3 < 5$, $7 > 2$.
- Literal: $x < 5$, $y \geq 3$.
- Strict: using < or >; slack: using ≤ or ≥.

- Linear inequality in one variable: $ax + b < 0$, $ax + b \geq 0$, etc., with $a \neq 0$.
- Linear inequality in two variables: $ax + by < c$; quadratic inequality: $ax^2 + bx + c \leq 0$.

Rules for Solving Inequalities

- Rule 1: The same number may be added to or subtracted from both sides without changing the sign.
- Rule 2: Both sides may be multiplied or divided by the same positive number without changing the sign.
- When both sides are multiplied or divided by a negative number, the inequality sign is reversed.
- Example: $-3x < 12 \Rightarrow x > -4$.

Algebraic Solution in One Variable

- Simplify both sides, collect variable terms on one side and constants on the other, then divide by the coefficient (reversing the sign if negative).
- Example: $4x + 3 < 6x + 7 \Rightarrow -2x < 4 \Rightarrow x > -2$; solution set $(-2, \infty)$.
- The domain matters: if $x \in N$, the solution set of $x < 4$ is $\{1, 2, 3\}$; if $x \in R$, it is $(-\infty, 4)$.

Graphical Representation on the Number Line

- Use an open circle for strict inequalities ($<$, $>$) – the endpoint is not included.
- Use a filled (dark) circle for $\leq$ or $\geq$ – the endpoint is included.
- Shade or draw an arrow in the direction of the solution set.
- Example: $x \geq -1$ is a filled circle at -1 with the line extending to the right.

Systems of Inequalities in One Variable

- Solve each inequality separately and take the intersection of solution sets.
- Example: $3x - 7 < 5 + x$ and $11 - 5x \leq 1$: first gives $x < 6$, second gives $x \geq 2$; solution $[2, 6)$.
- Double inequality: $-5 \leq (2 - 3x)/4 \leq 9 \Rightarrow -20 \leq 2 - 3x \leq 36 \Rightarrow -22 \leq -3x \leq 34 \Rightarrow -34/3 \leq x \leq 22/3$.

Word Problems

- Translate the condition into an inequality, solve, and interpret according to context (e.g. whole numbers for marks or items).
- Example: Ravi got 70 and 75 in two tests. For an average of at least 60 in three tests, x must satisfy $(70 + 75 + x)/3 \geq 60 \Rightarrow x \geq 35$.

Rules of Inequalities at a Glance

Operation on both sides	Effect on sign	Example
Add or subtract a number	No change	$x - 3 < 5 \Rightarrow x < 8$
Multiply/divide by positive	No change	$2x > 6 \Rightarrow x > 3$
Multiply/divide by negative	Reversed	$-2x > 6 \Rightarrow x < -3$
Take reciprocals (same sign values)	Reversed	$2 < 3 \Rightarrow 1/2 > 1/3$

Important Definitions and Terms

Term	Meaning
Inequality	A statement using <, >, ≤ or ≥.
Strict inequality	Uses < or >.
Slack inequality	Uses ≤ or ≥.
Linear inequality	Inequality with variables of degree one.
Solution set	All values satisfying an inequality.
Open circle	Endpoint not included on number line.
Closed circle	Endpoint included on number line.
Double inequality	Inequality of the form a ≤ expression ≤ b.

Short Answer Questions

Q1. Solve $24x < 100$ when x is a natural number.

$x < 100/24 \approx 4.17$, so $x \in \{1, 2, 3, 4\}$.

Q2. Solve $-12x > 30$ for real x.

Dividing by -12 reverses the sign: $x < -5/2$.

Q3. Solve $3(2 - x) \geq 2(1 - x)$.

$6 - 3x \geq 2 - 2x \Rightarrow 4 \geq x$, so $x \leq 4$, i.e. $(-\infty, 4]$.

Q4. Solve $x/3 > x/2 + 1$.

Multiply by 6: $2x > 3x + 6 \Rightarrow -x > 6 \Rightarrow x < -6$.

Q5. Represent $x < 2$ on the number line.

Open circle at 2, arrow pointing to the left.

Q6. Solve $5x - 3 \geq 3x - 5$.

$2x \geq -2 \Rightarrow x \geq -1$.

Q7. Solve $2 \leq 3x - 4 \leq 5$.

$6 \leq 3x \leq 9 \Rightarrow 2 \leq x \leq 3$.

Q8. Why does the sign reverse on multiplying by a negative number?

Multiplying by a negative number reverses the order of numbers on the number line, e.g. $2 < 3$ but $-2 > -3$.

Long Answer Questions

Q1. Solve the system $2(x - 1) < x + 5$ and $3(x + 2) > 2 - x$, and show it on the number line.

First: $2x - 2 < x + 5 \Rightarrow x < 7$.

Second: $3x + 6 > 2 - x \Rightarrow 4x > -4 \Rightarrow x > -1$.

Solution: $-1 < x < 7$, i.e. $(-1, 7)$; open circles at -1 and 7 with the segment shaded.

Let the numbers be x and x + 2 with x odd and x > 10.

x + (x + 2) < 40 ⇒ 2x < 38 ⇒ x < 19.

So x ∈ {11, 13, 15, 17}: pairs (11,13), (13,15), (15,17), (17,19).

Q3. A solution of 8% boric acid is diluted by adding a 2% solution to 640 litres. How much 2% solution is needed so that the mixture is between 4% and 6%?

Let x litres of 2% solution be added. Total = 640 + x; acid = 0.08×640 + 0.02x.

4% < (51.2 + 0.02x)/(640 + x) × 100 < 6%.

Solving gives 320 < x < 1280, so between 320 and 1280 litres must be added.

MCQs with Answers

1. If −2x > 8, then:(a) x > −4 (b) x < −4 (c) x > 4 (d) x < 4Answer: (b) x < −4

2. Solution of x + 3 ≤ 5 (x ∈ R):(a) x ≤ 2 (b) x ≥ 2 (c) x < 2 (d) x > 2Answer: (a) x ≤ 2

3. Closed circle on number line means:(a) Endpoint excluded (b) Endpoint included (c) No solution (d) InfinityAnswer: (b) Endpoint included

4. Solution set of x < 3, x ∈ N:(a) {0,1,2} (b) {1,2} (c) {1,2,3} (d) {1,2,...}Answer: (b) {1,2}

5. Adding the same number to both sides:(a) Reverses sign (b) Keeps sign (c) Makes equality (d) Not allowedAnswer: (b) Keeps sign

6. 3x − 5 < 7 gives:(a) x < 4 (b) x > 4 (c) x < 2 (d) x ≤ 4Answer: (a) x < 4

7. −3 ≤ x < 2 in interval form:(a) (−3,2) (b) [−3,2) (c) [−3,2] (d) (−3,2]Answer: (b) [−3,2)

8. A strict inequality uses:(a) ≤ (b) ≥ (c) < (d) =Answer: (c) <

9. If x > 0 and y < 0, then xy:(a) > 0 (b) < 0 (c) = 0 (d) AnyAnswer: (b) < 0

10. Solution of 1 ≤ 2x − 1 ≤ 5:(a) 1 ≤ x ≤ 3 (b) 0 ≤ x ≤ 2 (c) 2 ≤ x ≤ 6 (d) 1 ≤ x ≤ 6Answer: (a) 1 ≤ x ≤ 3

Quick Revision Points

- Inequality symbols: <, >, ≤, ≥.
- Strict vs slack inequalities.
- Add/subtract – sign unchanged.
- Multiply/divide by positive – unchanged; by negative – reversed.
- Solution depends on domain (N, Z, R).
- Open circle: excluded; closed circle: included.
- System: intersection of solution sets.
- Double inequality: operate on all three parts.
- Word problems: translate, solve, interpret.
- Two-variable graphical solution is outside 2026-27 scope.

Chapter Summary

Linear inequalities compare expressions and have solution sets rather than single answers. They are solved like equations, except that multiplying or dividing by a negative number reverses the sign. The solution depends on whether the variable is natural, integer or real.

Solutions are shown on the number line with open or closed circles, and systems of inequalities are solved by taking intersections. Word problems require translating real conditions into inequalities.

Exam Tips and PYQ Pattern

- Always state the domain before writing the solution set.
- Reverse the sign every time you multiply or divide by a negative.
- Use interval notation for real solutions.
- Draw the number line neatly with open/closed circles.
- In word problems, interpret answers sensibly (no negative marks or fractional items).
- Focus on one-variable inequalities for 2026-27.

Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the NCERT Class 11 Mathematics textbook, prescribed in the CBSE 2026-27 syllabus.

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Yes. Use the free PDF link at the top of this page – no signup needed.

What happens when you multiply an inequality by a negative number?

The inequality sign is reversed.

Is graphing inequalities in two variables in the 2026-27 syllabus?

No. The rationalised syllabus covers algebraic solutions of linear inequalities in one variable and their number line representation.

How do you show ≤ on a number line?

With a filled circle at the endpoint, showing it is included.

Conclusion

Linear Inequalities is quick to master with the sign rules. Practise systems and word problems and download the free PDF for quick revision.

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