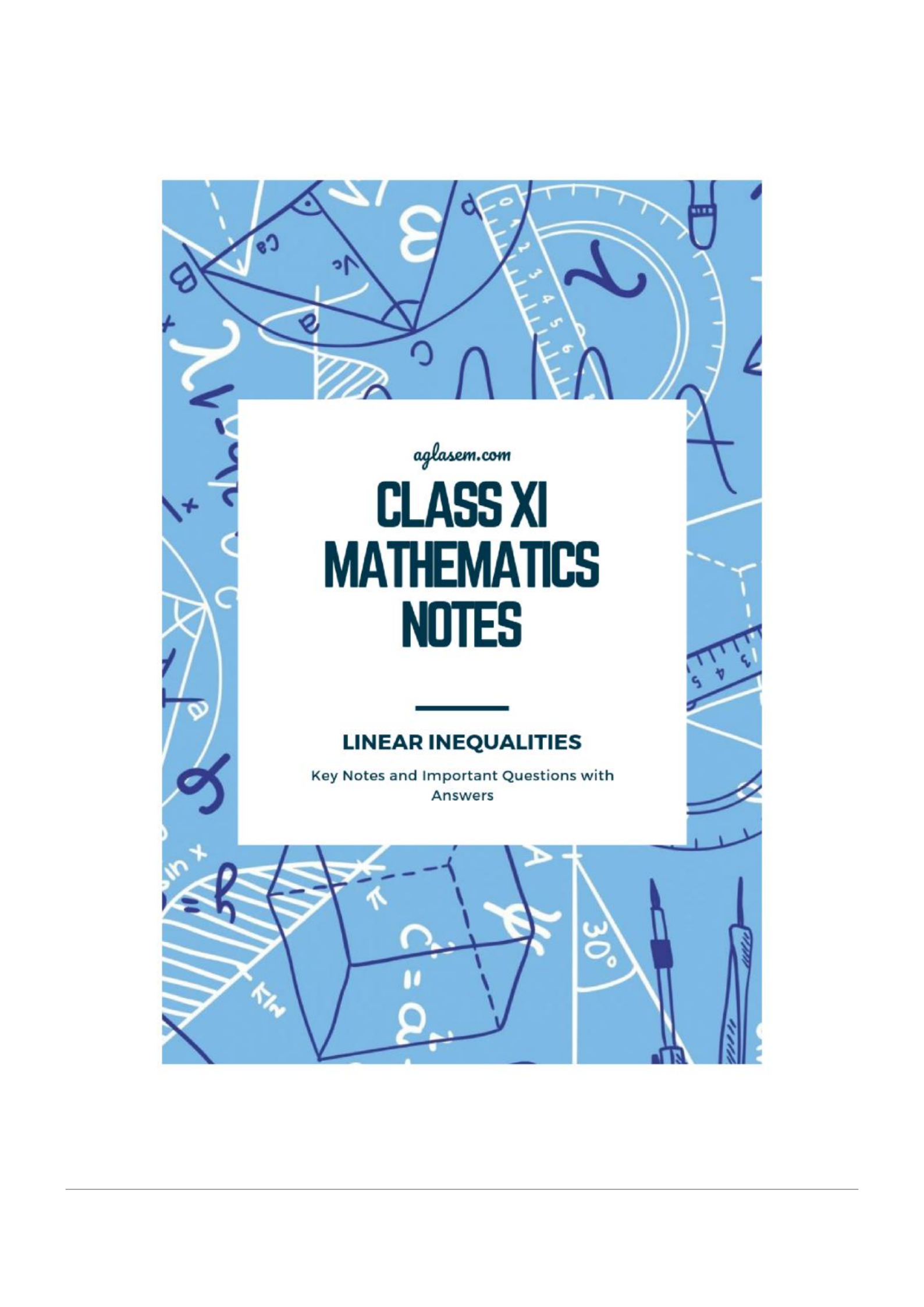


The background is a vibrant blue with various white mathematical sketches. These include a circle with inscribed angles labeled 'a', 'b', and 'c'; a ruler with markings from 1 to 6; a 30-degree angle; a 3D cube with dashed lines; and various mathematical symbols like λ , ϕ , ψ , α , β , γ , δ , ϵ , ζ , η , θ , ι , κ , λ , μ , ν , ξ , $\omicron$, π , ρ , σ , τ , υ , ϕ , χ , ψ , ω , α , β , γ , δ , ϵ , ζ , η , θ , ι , κ , λ , μ , ν , ξ , $\omicron$, π , ρ , σ , τ , υ , ϕ , χ , ψ , ω .

aglasem.com

CLASS XI MATHEMATICS NOTES

LINEAR INEQUALITIES

Key Notes and Important Questions with
Answers

CHAPTER - 6

LINEAR INEQUALITIES

KEY POINTS

- Two real numbers or two algebraic expressions related by the symbol ' $<$ ', ' $>$ ', ' $\leq$ ' or ' $\geq$ ' form an inequality.
- The inequality containing $<$ or $>$ is called strict inequality.
- The inequality containing $\leq$ or $\geq$ is called slack inequality.
- $6 < 8$ statements $7.2 > -1$ are examples of numerical inequalities and $3x + 7 > 8$, $x + 3 \leq 7$, $\frac{y-3}{2} > 2y + 2$ are examples of literal inequalities.
- The inequalities of the form $ax + b > 0$, $ax + b < 0$, $ax + b \geq 0$, $ax + b \leq 0$; $a \neq 0$ are called linear inequalities in one variable x .
- The inequalities of the form $ax + by + c > 0$, $ax + by + c < 0$, $ax + by + c \geq 0$, $ax + by + c \leq 0$, $a \neq 0$, $b \neq 0$ are called linear inequalities in two variables x and y .
- Rules for solving inequalities :
 - (i) $a \geq b$ then $a \pm k \geq b \pm k$ where k is any real number.
 - (ii) but if $a \geq b$ then ka is not always $\geq kb$

If $k > 0$ (i.e. positive) then $a \geq b \Rightarrow ka \geq kb$

If $k < 0$ (i.e. negative) then $a \geq b \Rightarrow ka \leq kb$

Thus always reverse the sign of inequality while multiplying or dividing both sides of an inequality by a negative number.

- Procedure to solve a linear inequality in one variables.
 - (i) Simplify both sides by removing group symbols and collecting like terms.
 - (ii) Remove fractions (or decimals) by multiplying both sides by appropriate factor (L.C.M of denominator or a power of 10 in case of decimals.)
 - (iii) Isolate the variable on one side and all constants on the other side. Collect like terms whenever possible.
 - (iv) Make the coefficient of the variable.
 - (v) Choose the solution set from the replacement set.
- **Replacement Set:** The set from which values of the variable (involved in the inequality) are chosen is called replacement set.
- **Solution Set:** A solution to an inequality is a number which when substituted for the variable, makes the inequality true. The set of all solutions of an inequality is called the solution set. It is obviously a subset of replacement set.
- The graph of the inequality $ax + by > c$ is one of the half planes and is called the solution region.
- When the inequality involves the sign $\leq$ or $\geq$ then the points on the line are included in the solution region but if it has the sign $<$

or $>$ then the points on the line are not included in the solution region and it has to be drawn as a dotted line.

- The common values of the variable form the required solution of the given system of linear inequalities in one variable.
- The common part of coordinate plane is the required solution of the system of linear inequations in two variables when solved by graphical method.

Important Questions with Solutions

VERY SHORT ANSWER TYPE QUESTIONS (1 MARK)

1. Solve $5x < 24$ when $x \in \mathbb{N}$
2. Solve $3 - 2x < 9$ when $x \in \mathbb{R}$. Express the solution in the form of interval.
3. Show the graph of the solution of $2x - 3 > x - 5$ on number line.
4. Solve $\frac{1}{x-2} \leq 0$, $x \in \mathbb{R}$.
5. Solve $0 < \frac{-x}{3} < 1$, $x \in \mathbb{R}$
6. Solve $-3 \leq -3x + 2 < 4$, $x \in \mathbb{R}$.
7. Draw the graph of the solution set of $x + y \geq 4$.
8. Draw the graph of the solution set of $x < y$.

SHORT ANSWER TYPE QUESTIONS (2 MARKS)

9. Solve $\frac{(x-1)(x-2)}{(x-3)(x-4)} \geq 0$, $x \in \mathbb{R}$.
10. Solve $\frac{x+3}{x-1} > 0$, $x \in \mathbb{R}$.

Solve the inequalities for real x

11. $\frac{2x-3}{4} + 9 \geq 3 + \frac{4x}{3}, \quad x \in \mathbb{R}.$

12. $\frac{2x+3}{4} - 3 < \frac{x-4}{3} - 2, \quad x \in \mathbb{R}.$

13. $-5 \leq \frac{2-3x}{4} \leq 9, \quad x \in \mathbb{R}.$

14. $\frac{x+3}{x-2} > 0, \quad x \in \mathbb{R}$

Show the solution set on the number line.

SHORT ANSWER TYPE QUESTIONS (4 MARKS)

15. A company manufactures cassettes and its cost and revenue functions are $C(x) = 26000 + 30x$ and $R(x) = 43x$ respectively, where x is number of cassettes produced and sold in a week. How many cassettes must be sold per week to realise some profit.
16. Find all pairs of consecutive even positive integers, both of which are larger than 5 such that their sum is less than 23.
17. To receive Grade 'A' in a course, one must obtain an average of 90 marks or more in five examinations (each of 100 marks). If Sunita's marks in first four examinations are 87, 92, 94 and 95, find minimum marks that Sunita must obtain in fifth examination to get grade 'A' in the course. What life skills should she acquire in order to get grade 'A' in the course?
18. While drilling a hole in the earth, it was found that the temperature ($T^{\circ}\text{C}$) at x km below the surface of the earth was given by $T = 30 + 25(x - 3)$, when $3 \leq x \leq 15$.

Between which depths will the temperature be between 200°C and 300°C ?

19. The water acidity in a pool is considered normal when the average PH reading of their daily measurements is between 7.2 and 7.8. If the first two PH reading are 7.48 and 7.85. Find the range of PH value for the 3rd reading that will result in acidity level being normal.

Solve the following systems of inequalities for all $x \in \mathbb{R}$

20. $2(2x+3)-10 < 6(x-2), \quad \frac{2x-3}{4}+6 \geq 4+\frac{4x}{3}$

21. $|2x-3| \leq 11, \quad |x-2| \geq 3$

22. $\frac{4x}{3}-\frac{9}{4} < x+\frac{3}{4}, \quad \frac{7x-1}{3}-\frac{7x+2}{6} > x$

23. Solve: $\frac{|x|-1}{|x|-2} \geq 0 \quad x \in \mathbb{R}, \quad x \neq \pm 2$

24. Solve for real x , $|x+1|+|x| > 3$

LONG ANSWER TYPE QUESTIONS (6 MARKS)

Solve the following system of inequalities graphically:

25. $2x+y \leq 24, \quad x+y < 11, \quad 2x+5y \leq 40, \quad x \geq 0, \quad y \geq 0$

26. $3x+2y \geq 24, \quad 3x+y \leq 15, \quad x \geq 4$

27. $x-2y \leq 3$

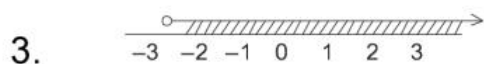
$$3x+4y > 12$$

$$x \geq 0, \quad y \geq 1$$

ANSWERS

1. $\{1,2,3,4\}$

2. $(-3, \infty)$



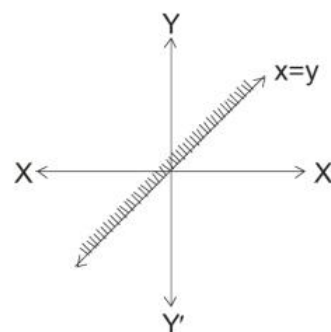
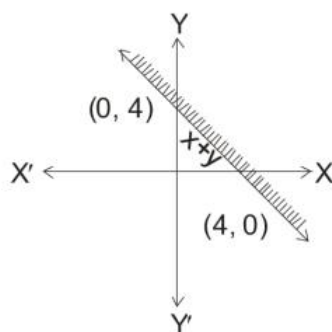
4. $(-\infty, 2)$ or $x < 2$

5. $-3 < x < 0$

6. $\left(\frac{-2}{3}, \frac{5}{3}\right]$

7.

8.



9. $X > 4$

10. $(-\infty, -3) \cup (2, \infty)$

11. $\left(-\infty, \frac{63}{10}\right]$

12. $\left(-\infty, \frac{-13}{2}\right)$

13. $\left[\frac{-34}{3}, \frac{22}{3}\right]$

14. $(-\infty, -3) \cup (2, \infty)$

15. More than 2000 cassettes

16. $(6,8), (8,10), (10,12)$

17. Minimum of 82 marks. Hard working, self-confidence, diligent and dedicated to her work.
18. Between 9.8 m and 13.8 m
19. Between 6.27 and 8.07
20. Solution set = ϕ
21. $[-4, -1] \cup [5, 7]$
22. (4,9)
23. $[-1, 1] \cup (-\infty, -2) \cup (2, \infty)$
24. $(-\infty, -2) \cup (1, \infty)$