

Linear Inequalities — Assignment 2

Class 11 Maths · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
 (2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
 (3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Linear Inequalities in One Variable

1. Solve $5x - 3 < 3x + 1$ and represent the solution on a number line.
2. Solve $3x + 8 > 2$ when x is a natural number.
3. Solve $3(2 - x) \geq 2(1 - x)$ and represent the solution on the number line.

Rules for Manipulating Inequalities

1. Solve $4x + 3 < 6x + 7$.
2. Explain the rules for manipulating inequalities with one example each.
3. Solve $2(2x + 3) - 3(x - 1) \leq 6x + 4$.

Solving Systems of Linear Inequalities in One Variable

1. Solve the system $3x - 7 < 5 + x$ and $11 - 5x \leq 1$.
2. Solve $5(2x - 7) - 3(2x + 3) \leq 0$ and $2x + 19 \leq 6x + 47$.
3. Solve the system $2x + 1 > 3$ and $3x - 2 \leq 5$ and represent the solution on the number line.

Absolute-Value Inequalities

1. Solve $|2x - 1| \leq 3$.
2. Solve $|x + 3| \geq 5$.
3. Solve $|3x - 4| \geq 2$ and write the solution set.

Linear Inequalities in Two Variables

1. Solve the inequality $2x + y \geq 6$ graphically.
2. Represent the solution of $x + y < 5$ in the first quadrant graphically.
3. Draw the graph of $x + y \leq 5$ and determine whether the solution region includes the boundary.

Graphical Solution of Systems of Linear Inequalities

1. Solve the system $x \geq 0, y \geq 0, x + y \leq 5$ graphically.
2. Solve the system $x + 2y \leq 8, x \geq 0, y \geq 0$ graphically.
3. Solve graphically: $x + y \leq 6, x + y \geq 4, x \geq 0, y \geq 0$.

Word Problems

1. A company makes ₹100 profit per item and wants at least ₹2000 profit. Write and solve an inequality for the number of items.
2. The length of a rectangle is 5 cm more than its breadth. If the perimeter is less than 50 cm, write an inequality for the breadth.
3. A manufacturer has 600 litres of a 12% acid solution. How many litres of a 30% acid solution must be added so that the acid content is more than 15% but less than 18%?

Part B — Integrated problems (multi-topic)

1. Solve $5x - 3 < 7$ when (i) x is an integer, (ii) x is a real number.
2. Solve the system $3x - 7 < 5 + x$ and $11 - 5x \leq 1$.
3. Solve $|2x - 3| \leq 5$.
4. Solve graphically: $x + y \leq 6$, $x + y \geq 4$, $x \geq 0$, $y \geq 0$.
5. A manufacturer has 600 litres of a 12% acid solution. How many litres of a 30% acid solution must be added so that the acid content is more than 15% but less than 18%?

Answer Key

Linear Inequalities in One Variable

$5x - 3 < 3x + 1 \Rightarrow x < 2$, $3x + 8 > 2 \Rightarrow x > -2$, natural numbers $\{1, 2, 3, \dots\}$. $3(2 - x) \geq 2(1 - x) \Rightarrow x \leq 4$.

Rules for Manipulating Inequalities

$4x + 3 < 6x + 7 \Rightarrow x > -2$. Adding keeps the sign; multiplying/dividing by a negative reverses it. $2(2x+3) - 3(x-1) \leq 6x+4 \Rightarrow x \geq 5/3$.

Solving Systems of Linear Inequalities in One Variable

$3x-7 < 5+x$ and $11-5x \leq 1 \Rightarrow x < 6$. $5(2x-7) - 3(2x+3) \leq 0$ and $2x+19 \leq 6x+47 \Rightarrow -7 \leq x \leq 11/2$. $2x+1 > 3$ and $3x-2 \leq 5 \Rightarrow 2/3 < x \leq 7/3$.

Absolute-Value Inequalities

$|2x-1| \leq 3 \Rightarrow -1 \leq x \leq 2$. $|x+3| \geq 5 \Rightarrow x \leq -8$ or $x \geq 2$. $|3x-4| \geq 2 \Rightarrow x \leq 2/3$ or $x \geq 2$.

Linear Inequalities in Two Variables

$2x+y \geq 6$: half-plane above the line $2x+y=6$. $x+y < 5$ in the first quadrant: region below the line within $x \geq 0$, $y \geq 0$. Boundary included for $\leq$.

Graphical Solution of Systems of Linear Inequalities

$x \geq 0$, $y \geq 0$, $x+y \leq 5$: triangle bounded by the axes and the line. $x+2y \leq 8$: feasible region in the first quadrant. $x+y \leq 6$, $x+y \geq 4$: strip between the two lines in the first quadrant (unbounded).

Word Problems

$100x \geq 2000 \Rightarrow x \geq 20$ items. Perimeter < 50 with b and $b+5$: $4b + 10 < 50 \Rightarrow b < 10$ cm. $15\% < 30x+72$ over $x+600 < 18\% \Rightarrow 20 < x < 200$ litres.

Integrated problems

1: integers $x \leq 3$, reals $x < 4$. 2: $2 \leq x < 6$. 3: $-1 \leq x \leq 4$. 4: strip $4 \leq x+y \leq 6$ in first quadrant. 5: $120 < x < 200$ litres.