

Linear Inequalities And Shading

Quick revision notes [Open it online](#)

Name: _____

Date: _____

At a glance

Inequality symbols, number lines, solving inequalities, and regions on a graph.

1. Symbols and number lines
2. Solving inequalities
3. Regions on a graph

1. Symbols and number lines

☐ I revised this

- $<$ less than, $>$ greater than, $\leq$ less than or equal to, $\geq$ greater than or equal to.
- On a number line: open circle for $<$ or $>$; filled circle for $\leq$ or $\geq$.
- Double inequality $-2 < x \leq 3$ is drawn between the two values: open at -2 , filled at 3 .

Inequality	Circle	Arrow
$x > 2$	open at 2	right
$x \geq 2$	filled at 2	right
$x < -1$	open at -1	left
$-2 < x \leq 3$	open at -2 , filled at 3	between

Worked example

List the integers n with $-2 < n \leq 3$.

1. -2 is not included; 3 is.

$-1, 0, 1, 2, 3$

2. Solving inequalities

☐ I revised this

- Solve like an equation: add, subtract, multiply or divide both sides.
- **Multiplying or dividing by a negative number reverses the sign.**
- Double inequalities: do the same to all three parts.

Worked example

Solve $-3 \leq 2x + 1 < 7$ and list the integer solutions.

1. Subtract 1: $-4 \leq 2x < 6$.
2. Divide by 2: $-2 \leq x < 3$.

$x = -2, -1, 0, 1, 2$

Exam tip: To avoid flipping, move the x term to the side where it is positive: $4 - 2x \leq 10 \rightarrow -6 \leq 2x \rightarrow x \geq -3$.

3. Regions on a graph

☐ I revised this

- Draw each boundary line: **solid** for $\leq$ or $\geq$, **broken** for $<$ or $>$.
- Pick a test point not on the line (usually $(0, 0)$) to decide which side you want.
- Read the question: shade the region you want, or the region you **don't** want (unwanted region).
- $y \geq 1$ is above the line $y = 1$; $x \leq 3$ is to the left of $x = 3$.

How to do it

1. Draw the line (make a table or use $y = mx + c$).
2. Decide solid or broken.
3. Test a point: does it make the inequality true?
4. Shade the correct side.

Worked example

The region R satisfies $x \geq 1$, $y \geq 2$ and $x + y \leq 8$. Find the greatest value of $3x + 2y$ for integer points in R.

1. Corners of R: (1, 2), (6, 2), (1, 7).
2. $3x + 2y$: 7, 22 and 17.

22, at (6, 2)

Exam tip: Maximum and minimum values of an expression in a region are always at or near a corner.

Common mistakes

Don't write	Write instead
$\times$ $-2x \leq 6 \rightarrow x \leq -3$	$\checkmark$ Dividing by -2 flips the sign: $x \geq -3$
$\times$ Including -2 in $-2 < n$	$\checkmark$ $<$ means -2 is not included
$\times$ Drawing $y < x + 3$ with a solid line	$\checkmark$ Strict inequality $\rightarrow$ broken line
$\times$ Shading the wanted region when the question says shade the unwanted one	$\checkmark$ Read which region to shade

In the exam

- Label every boundary line with its equation.
- Use (0, 0) as a test point when it is not on the line — the arithmetic is easy.
- When listing integers, check the end values against the symbols.

My notes

<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
