

LESSON 19 | MEET THE IDEA

Systems of linear inequalities

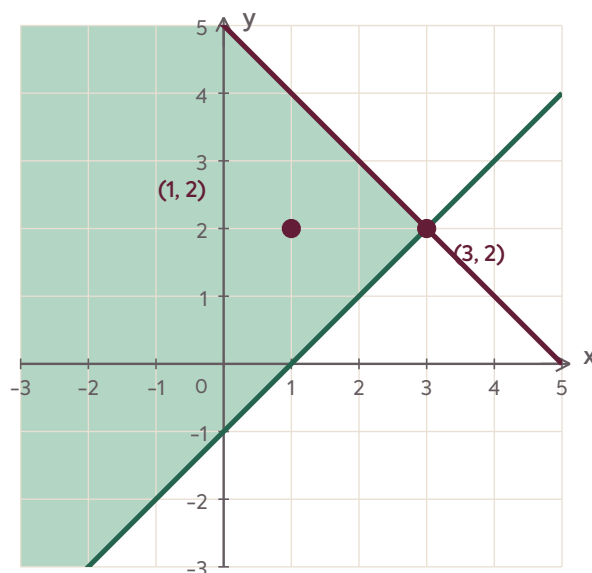
Tuesday, January 5, 2027 . 6:00–7:00 PM Central

By the end, I can...

Graph two linear inequalities on the same axes and find points that satisfy both conditions.

Welcome back. In Class 15, one inequality described one shaded side of a line. Now a **system of inequalities** asks for points that satisfy **both** inequalities. The shared region is the **overlap**.

Both: $y \geq x - 1$ and $y \leq -x + 5$

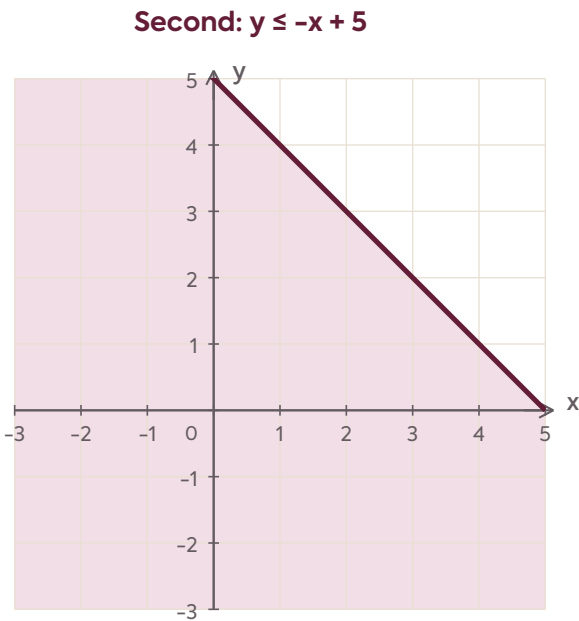
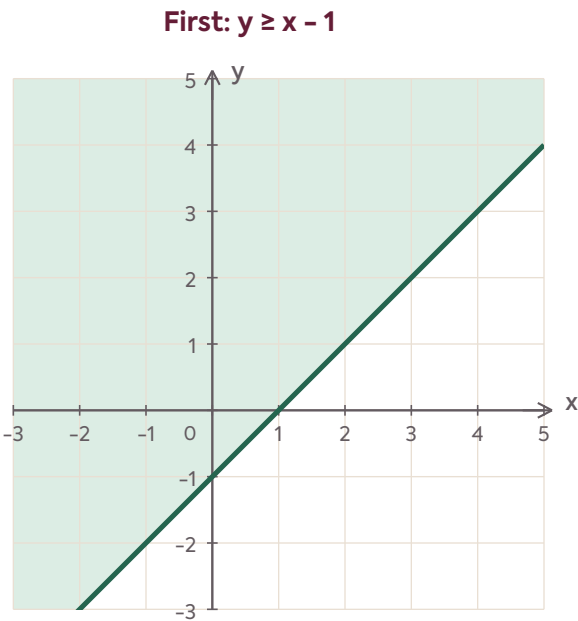


Read AND, not OR

Every point in the shaded overlap works for both rules. A point that works for just one rule is **not** a solution of the system. The displayed region continues to the left beyond this grid.

LESSON 19 | BUILD THE SHARED REGION

Shade each rule, then find the overlap



Use the same scales when combining the graphs. The overlap lies **above the first line and below the second**, including both boundaries wherever the other condition also holds.

Point	$y \geq x - 1$	$y \leq -x + 5$	Both?
(1, 2)	$2 \geq 0$: true	$2 \leq 4$: true	Yes
(3, 0)	$0 \geq 2$: false	$0 \leq 2$: true	No
(3, 3)	$3 \geq 2$: true	$3 \leq 2$: false	No

Boundary points still need both checks

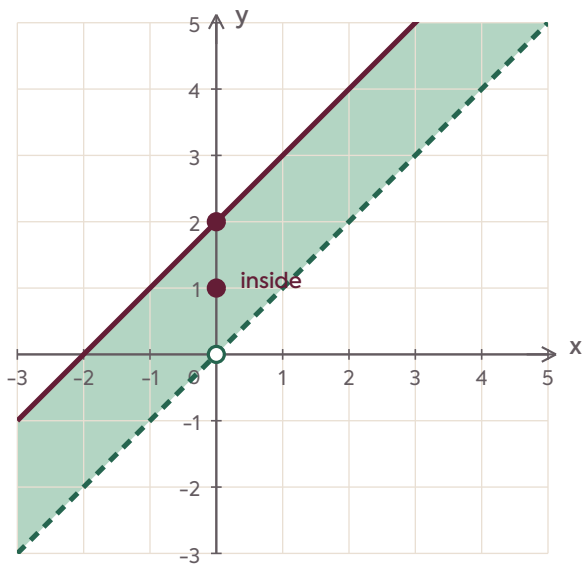
At (3, 2), both equations give $y = 2$, and both inequalities allow equality. This intersection is included. A solid line does not make its entire length a solution of the system.

LESSON 19 | TWO USEFUL CONTRASTS

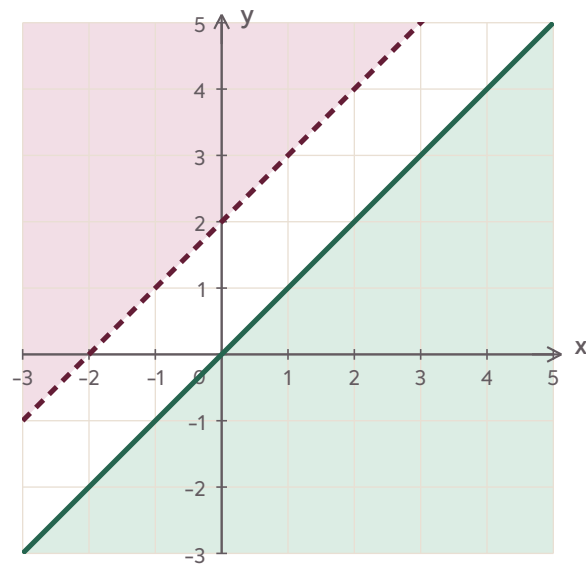
Excluded edges and empty overlap

A strict inequality excludes its boundary. Some pairs of inequalities have no common region at all.

A strip: $y > x$ and $y \leq x + 2$



No overlap: $y > x + 2$; $y \leq x$



Graph	What the region means
Left: a strip	Above $y = x$, excluding that dashed line; at or below $y = x + 2$, including that solid line. $(0, 1)$ and $(0, 2)$ work; $(0, 0)$ does not.
Right: no solution	Pink is above $y = x + 2$; green is at or below $y = x$. These regions never meet: y cannot be greater than $x + 2$ and also no greater than x .

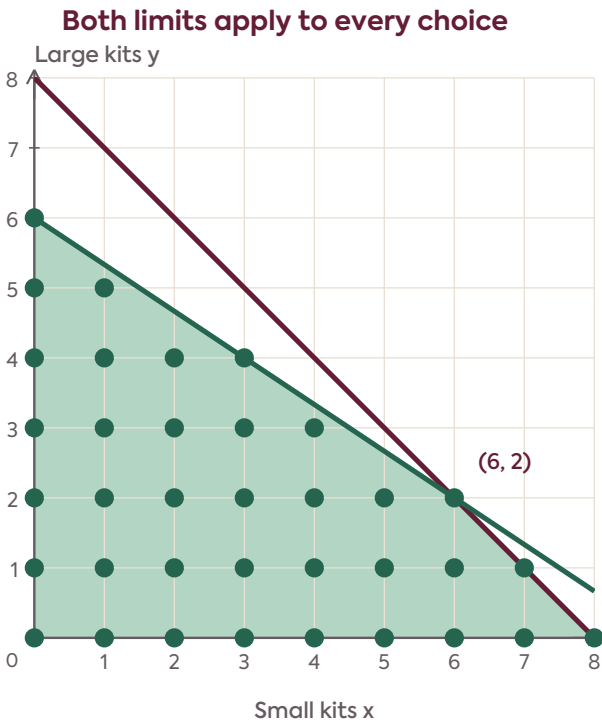
Use the symbols as well as the picture

$\leq$ or $\geq$ includes the boundary. $<$ or $>$ excludes it. A point where a dashed boundary meets another boundary is still excluded if it fails the strict inequality.

LESSON 19 | A FEASIBLE REGION

Find choices that fit two limits

You will make at most 8 craft kits. A small kit needs \$2 of supplies; a large kit needs \$3. Your supplies budget is at most \$18. Let x be small kits and y be large kits.
 $x + y \leq 8$ and $2x + 3y \leq 18$; x and y are nonnegative whole numbers.



The dots are **feasible choices**: choices that obey every restriction. The whole shaded shape models the numerical limits; only its nonnegative whole-number points are allowed kit counts.

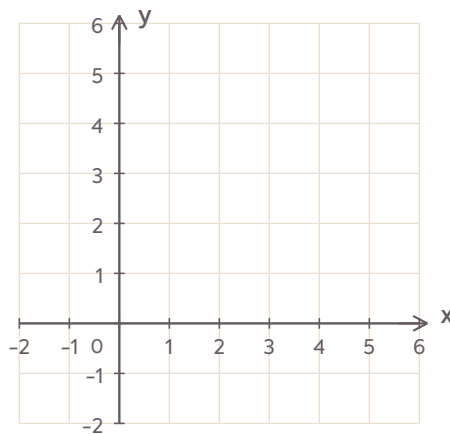
Choice	Number of kits	Supplies cost	Feasible?
(2, 4)	$6 \leq 8$	$\$16 \leq \18	Yes
(4, 4)	$8 \leq 8$	$\$20 > \18	No
(6, 2)	$8 \leq 8$	$\$18 \leq \18	Yes

LESSON 19 | SHORT CHECKS

Your turn

1. Graph $y \geq 0$ and $y < -x + 4$ together. Shade only the overlap and show included/excluded boundaries.

Your shared solution region



2. For $y \geq x - 1$ and $y \leq -x + 5$, test $(2, 2)$, $(4, 2)$ and $(0, -2)$ in both inequalities.

3. Does $y > x + 3$ together with $y \leq x + 1$ have any solution? Explain.

4. In the craft-kit example, is $(5, 3)$ feasible? Check the count and cost limits.

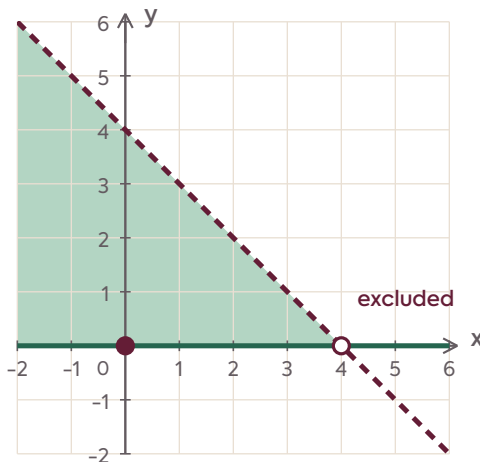
5. For $x \geq 1$ and $y > 2$, a student shades the entire plane to the right of $x = 1$. What is missing? Describe the correct overlap.

LESSON 19 | WORKED ANSWERS

Check every condition

1. Use $y = 0$ **solid** and $y = -x + 4$ **dashed**. Shade at or above the x-axis and strictly below the sloping line. The meeting point (4, 0) is excluded because $0 < 0$ is false.

Answer 1: $y \geq 0$ AND $y < -x + 4$



2. **(2, 2): yes** ($2 \geq 1$ and $2 \leq 3$). **(4, 2): no** ($2 \geq 3$ is false and $2 \leq 1$ is false). **(0, -2): no** ($-2 \geq -1$ is false, even though $-2 \leq 5$ is true).

3. **No solution.** A number greater than $x + 3$ cannot also be at most the smaller number $x + 1$. There is no overlap.

4. **No.** There are $5 + 3 = 8$ kits, but supplies cost $2(5) + 3(3) = \$19$, which exceeds \$18.

5. The second condition is missing. Shade **right of or on $x = 1$ AND above $y = 2$** . The vertical boundary is solid; the horizontal boundary is dashed.

I can...

- ☐ Find overlap and check both inequalities.
- ☐ Respect strict boundaries and contextual restrictions.

Next class: review and the Chapter 3 checkpoint. Curriculum focus: A.3H.