

Shade the Overlap

Graph linear inequalities and systems.

HIGH SCHOOL • HSA-REI.D.12

CCSS.Math.Content.HSA-REI.D.12 "Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality)..."

NAME _____

DATE _____

Materials and setup

Pencil and straightedge. On each blank grid, draw the boundary lines and shade only the solution region. Solid boundaries include equality; dashed boundaries exclude it. Graphs continue beyond the visible window.

THE BIG IDEA

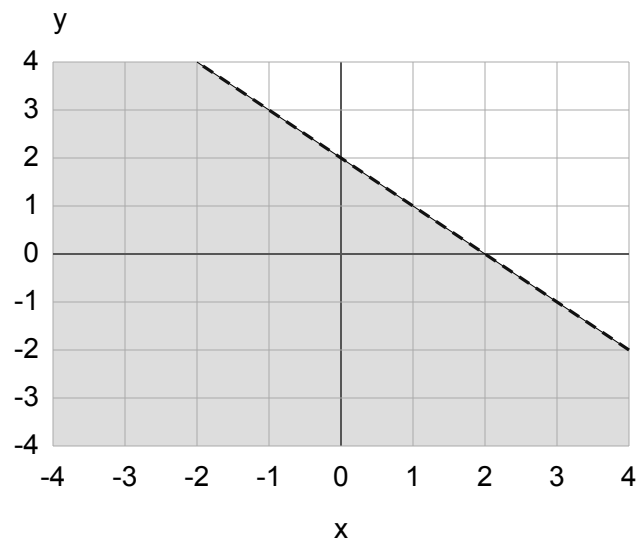
Replace the inequality sign with $=$ to draw a boundary. Test a point off the boundary to choose a half-plane. Use a solid line for $\leq$ or $\geq$ and a dashed line for $<$ or $>$. For a system, shade only points satisfying every inequality; overlapping boundaries are included only when every inequality allows them.

WORKED EXAMPLE

Graph $y < -x + 2$.

1. Draw $y = -x + 2$ through $(0, 2)$ and $(2, 0)$, using dashes.
2. Test $(0, 0)$: $0 < 2$ is true, so shade the side containing the origin.
3. Points on the dashed line are excluded.

Answer: The shaded lower half-plane is the solution.



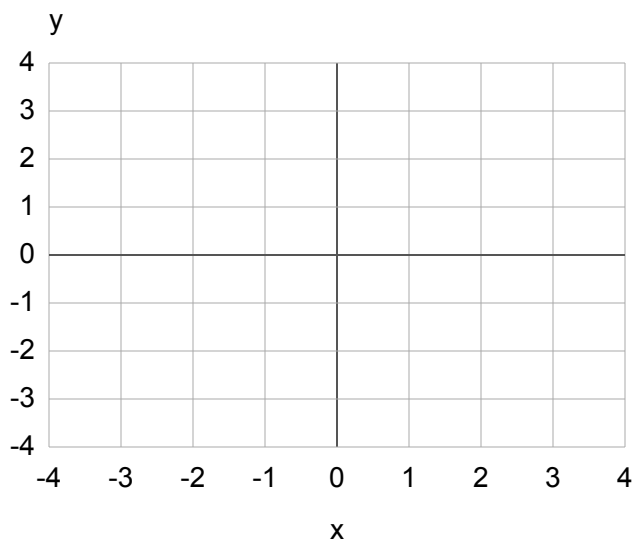
PRACTICE 4 problems

- 1** A student rewrites $2x - y \geq 4$ as $y \geq 2x - 4$. Correct the inequality and explain how the shaded side changes.

ANSWER _____

- 2** Graph $x + y \leq 4$. Give one included boundary point.

ANSWER _____

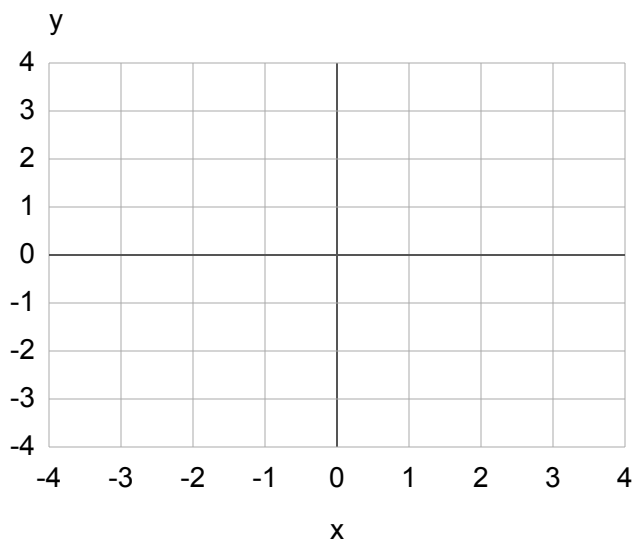


- 3** Graph both inequalities and shade their intersection.

$$y \leq -x + 4$$

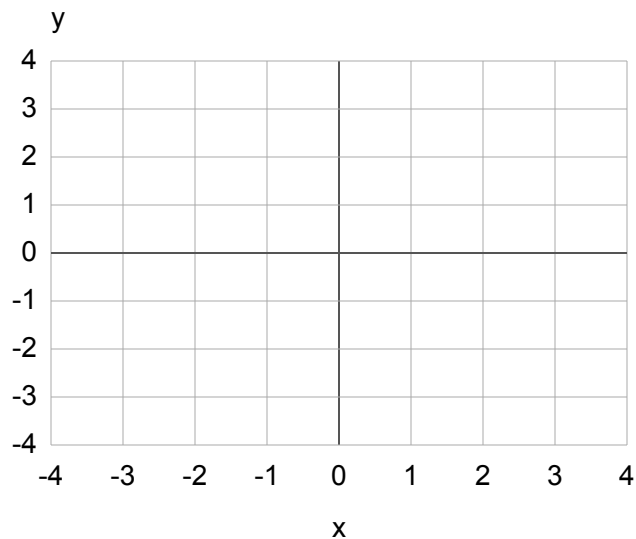
$$y > x - 2$$

ANSWER _____



- 4** Graph the system. State whether $(-1, 2)$ is a solution.
 $x \geq -1$
 $y < 2$

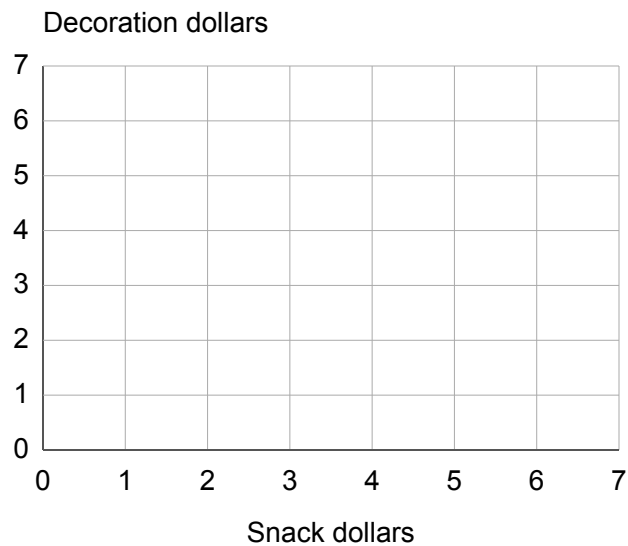
ANSWER _____



APPLY IT

Show your work

- 1** Let x be dollars for snacks and y dollars for decorations. Spend at most \$6 total and at least \$2 on decorations. Include nonnegative amounts. Write the system and graph all feasible amounts.



2

A lab models allowed settings by $y > x - 1$ and $y \leq -x + 5$. Check $A(1, 1)$, $B(3, 2)$ and $C(2, 3)$. Which are allowed? Explain each decision using both inequalities.

CHALLENGE One step up

Can $y > x + 2$ and $y \leq x - 1$ have any shared solutions? Explain using the relative positions of the two half-planes.

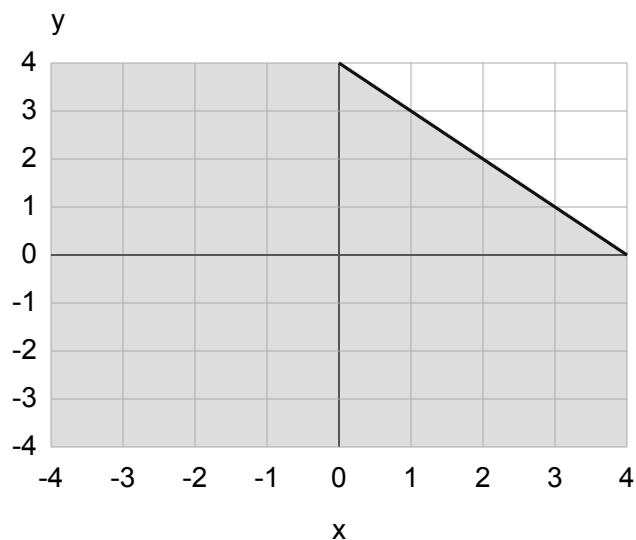
Accept equivalent systems and sensible shading. The rectangle framing a plotting window is not a solution boundary. For strict inequalities require dashed boundaries; for a system, a point on even one excluded boundary is excluded. Budget dollars are modeled as nonnegative real amounts.

PRACTICE 1

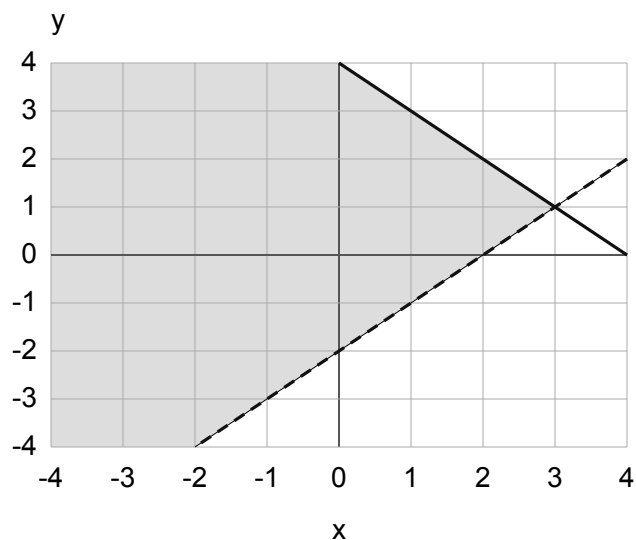
$y \leq 2x - 4$. Dividing $-y \geq 4 - 2x$ by -1 reverses the sign; shade below the solid boundary, not above it.

PRACTICE 2

Solid $x + y = 4$; shade below it. For example, $(0, 4)$ is included.

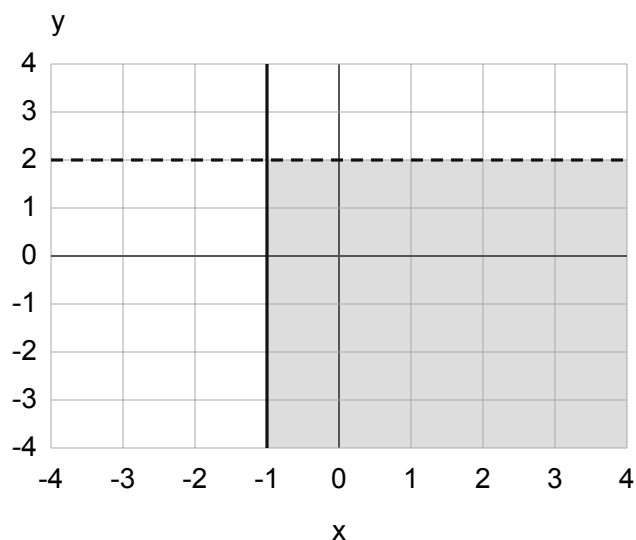
**PRACTICE 3**

Solid upper boundary $y = -x + 4$; dashed lower boundary $y = x - 2$. Shade $x - 2 < y \leq -x + 4$, left of $(3, 1)$; the intersection point itself is excluded.



PRACTICE 4

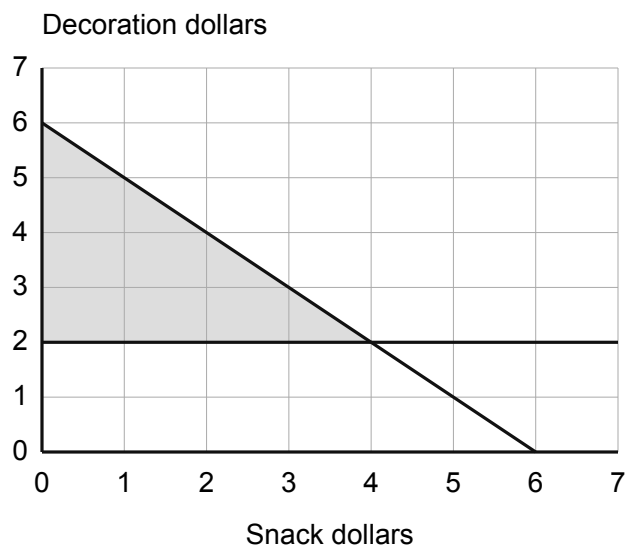
Solid $x = -1$; dashed $y = 2$. Shade right of or on $x = -1$ and below $y = 2$. $(-1, 2)$ is excluded because $y < 2$ is strict.



APPLY IT 1

$$x + y \leq 6, y \geq 2, x \geq 0, y \geq 0.$$

The closed triangular region has vertices $(0, 2)$, $(0, 6)$, $(4, 2)$; include its edges.



APPLY IT 2

A and C are allowed; B is not.

A: $1 > 0$ and $1 \leq 4$. B: $2 > 2$ is false, though $2 \leq 2$ is true. C: $3 > 1$ and $3 \leq 3$. A strict boundary is excluded even if the other inequality allows the point.

CHALLENGE

No. The first region is above $y = x + 2$; the second is on or below the lower parallel line $y = x - 1$. Since $x + 2 > x - 1$ for every x , the regions never overlap.