

Shade the Plane

Graph inequalities and find where their regions overlap.

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 _____

BOUNDARY AND SHADE

Graph the boundary line first. Use a solid line for $\leq$ or $\geq$ because points on the line are included, and use a dashed line for $<$ or $>$ because points on the line are not included. For an inequality written with y , shade above the line for greater than and below the line for less than.

WORKED EXAMPLE

Graph $y > -11x + 17$.

1. Graph the boundary line $y = -11x + 17$.
2. Draw the boundary as a dashed line because the inequality is strict.
3. Shade the region above the line because y is greater than $-11x + 17$.

Answer: A dashed boundary line $y = -11x + 17$, with the region above the line shaded.

PRACTICE 6 problems

1 Graph $y \leq 3x + 5$.

ANSWER _____

2 Graph $y > -x + 4$.

ANSWER _____

3 Graph $4x + y < 8$.

ANSWER _____

4 Graph the system: $x + y \geq 3$ and $y < x + 5$.

ANSWER _____

5 Graph the system: $y \geq -3x - 1$ and $x \leq 5$.

ANSWER _____

6 Graph $x > -6$.

ANSWER _____

APPLY IT Show your work

1

A music club earns \$3 for each sticker pack, x , and \$5 for each button pack, y . The club needs to earn at least \$45 and can display no more than 14 packs. Graph all possible combinations, including only nonnegative numbers of packs.

WORK SPACE

ANSWER _____

2

For a game design competition, Jordan plans x hours of coding and y hours of art. Jordan needs at least 6 total hours of work. Coding uses 2 focus points per hour, art uses 1 focus point per hour, and Jordan has at most 10 focus points. Graph the possible time plans, including only nonnegative hours.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Without graphing, decide whether the system $y > 3x + 1$ and $y \leq 3x - 4$ has a solution. In exactly 2 sentences, explain how the parallel boundary lines and inequality directions determine your answer.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Graph $y \leq 3x + 5$.	A solid boundary line $y = 3x + 5$, with the region on or below the line shaded.
2	Graph $y > -x + 4$.	A dashed boundary line $y = -x + 4$, with the region above the line shaded.
3	Graph $4x + y < 8$.	Rewrite as $y < -4x + 8$. Draw a dashed boundary line $y = -4x + 8$ and shade below it.
4	Graph the system: $x + y \geq 3$ and $y < x + 5$.	Graph a solid line $y = 3 - x$ and shade above it. Graph a dashed line $y = x + 5$ and shade below it. Shade only the overlap, which lies to the right of the boundary intersection $(-1, 4)$; the dashed boundary is excluded.
5	Graph the system: $y \geq -3x - 1$ and $x \leq 5$.	Graph a solid line $y = -3x - 1$ and shade above it. Graph a solid vertical line $x = 5$ and shade to its left. Shade the overlap, including both boundaries.
6	Graph $x > -6$.	Draw a dashed vertical line $x = -6$ and shade to the right.

PART 2 • APPLY IT

1. Graph $x \geq 0$, $y \geq 0$, $3x + 5y \geq 45$, and $x + y \leq 14$. Shade the overlap, including all boundaries. The region has vertices $(0, 9)$, $(0, 14)$, and $(25/2, 3/2)$. Use revenue for $3x + 5y \geq 45$ and the display limit for $x + y \leq 14$. The feasible region is in the first quadrant, above the revenue line, and below the total-packs line.
2. Graph $x \geq 0$, $y \geq 0$, $x + y \geq 6$, and $2x + y \leq 10$. Shade the overlap, including all boundaries. The region has vertices $(0, 6)$, $(0, 10)$, and $(4, 2)$. The total-work requirement is $x + y \geq 6$, and the focus limit is $2x + y \leq 10$. Restrict the graph to the first quadrant and shade the shared region.

CHALLENGE

The lines $y = 3x + 1$ and $y = 3x - 4$ are parallel, and the first line is always 5 units above the second. The system has no solution because a y -value cannot be above the higher line and at or below the lower line.

Accept equivalent boundary equations and correct shading descriptions. For graphing items, boundaries must be solid or dashed correctly, and system answers must show only the overlapping shaded region.