LESSON MAKER PRO

Shade the Plane

Graph linear inequality solution sets with clear boundaries.

HIGH SCHOOL · MA.912.AR.2.8

MA.912.AR.2.8 "Given a mathematical or real-world context, graph the solution set to a two-variable linear inequality."

NAME _____ DATE _____

BOUNDARY AND SHADING

First graph the boundary line by changing the inequality sign to =. Use a dashed line for < or >, and use a solid line for <= or >=. Test a point not on the line to choose which side to shade.

WORKED EXAMPLE

Graph $7x + 5y < 35$.

1. Graph the boundary line $7x + 5y = 35$.
2. Plot (5,0) and (0,7), then draw a dashed line because < does not include the boundary.
3. Test (0,0): $7(0) + 5(0) < 35$ is true, so shade the side containing (0,0).

Answer: Draw a dashed line through (5,0) and (0,7). Shade the side containing (0,0).

PRACTICE 6 problems

1 Graph $y > 2x - 3$.

ANSWER _____

2 Graph $y <= -x + 4$.

ANSWER _____

3 Graph $3x + 2y >= 12$.

ANSWER _____

4 Graph $x - 4y < 16$.

ANSWER _____

5 Graph $6x + y <= 18$.

ANSWER _____

6 Graph $x + 3y < 18$.

ANSWER _____

APPLY IT Show your work

1 At a school festival, x is the number of $3 snack tickets and y is the number of $4 game tickets a student buys. The student can spend no more than $12. Both x and y must be whole numbers, including 0. Graph all feasible choices as lattice points in the first quadrant.

WORK SPACE

ANSWER _____

2 A student film club plans a short film. Let x be hours spent filming and y be hours spent editing. Each hour of filming uses 2 crew-hours, and each hour of editing uses 3 crew-hours. The club has at most 18 crew-hours, and fractional hours are allowed. Graph all possible plans in the first quadrant.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Graph -3x + 2y <= 6. Then explain in one sentence why the boundary line is solid.

_____

_____

ANSWER KEY

Shade the Plane

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Graph y > 2x - 3.	**Draw a dashed boundary line y = 2x - 3. Shade above the line.**
2	Graph y <= -x + 4.	**Draw a solid boundary line y = -x + 4. Shade below the line.**
3	Graph 3x + 2y >= 12.	**Draw a solid boundary line through (4,0) and (0,6). Shade above the line.**
4	Graph x - 4y < 16.	**Rewrite as y > x/4 - 4. Draw a dashed boundary line through (16,0) and (0,-4), then shade above the line.**
5	Graph 6x + y <= 18.	**Draw a solid boundary line through (3,0) and (0,18). Shade below the line.**
6	Graph x + 3y < 18.	**Rewrite as y < -x/3 + 6. Draw a dashed boundary line through (18,0) and (0,6), then shade below the line.**

PART 2 · APPLY IT

1. **3x + 4y <= 12, where x and y are nonnegative whole numbers. Plot only these feasible points: (0,0), (1,0), (2,0), (3,0), (4,0), (0,1), (1,1), (2,1), (0,2), (1,2), (0,3).** Write 3x + 4y <= 12. Because tickets are counted in whole numbers, plot feasible lattice points only, not a continuously shaded region.
2. **2x + 3y <= 18, with x >= 0 and y >= 0. Draw a solid line through (9,0) and (0,6), then shade the region below the line in the first quadrant.** Use 2x + 3y <= 18 because the total crew-hours cannot exceed 18. Since time is continuous, shade the entire feasible region in the first quadrant.

CHALLENGE

Rewrite as y <= 3/2x + 3. Draw a solid boundary line through (-2,0) and (0,3), then shade below the line. The line is solid because points on the line make -3x + 2y = 6, which satisfies <= 6.

Accept equivalent boundary equations, correct intercepts or slope-intercept forms, and any correct test-point reasoning. For the first word problem, accept only the listed feasible lattice points, not continuous shading.