

Graphs as Solutions

Use curves, intersections, and shaded regions to solve.

HIGH SCHOOL • HSA-REI.D

CCSS.Math.Content.HSA-REI.D "Represent and solve equations and inequalities graphically"

NAME _____

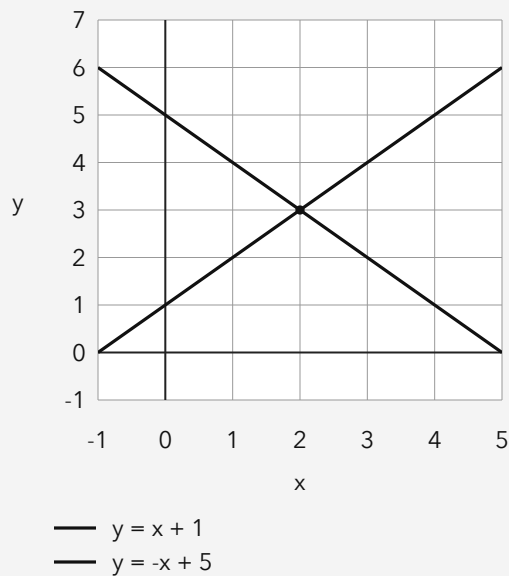
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WHAT COUNTS AS A SOLUTION?

Every point on an equation's graph satisfies the equation. A shared point solves both equations. To solve $f(x) = g(x)$, read the x-coordinates of intersections. An inequality includes a region: draw a solid boundary for $\leq$ or $\geq$ and a dashed boundary for $<$ or $>$. Test a point to choose the correct side.

WORKED EXAMPLE

Graph $y = x + 1$ and $y = -x + 5$. Use the intersection to solve $x + 1 = -x + 5$.

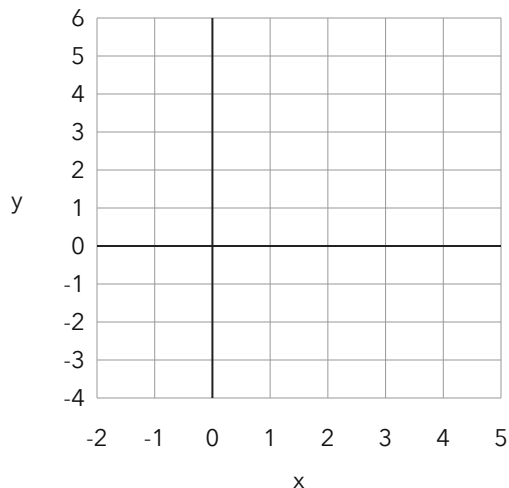


1. Draw each line using two points.
2. The lines meet at $(2, 3)$, so their y-values agree when $x = 2$.
3. Check: $2 + 1 = -2 + 5 = 3$.

Answer: The system has solution $(2, 3)$; the equation in x has solution $x = 2$.

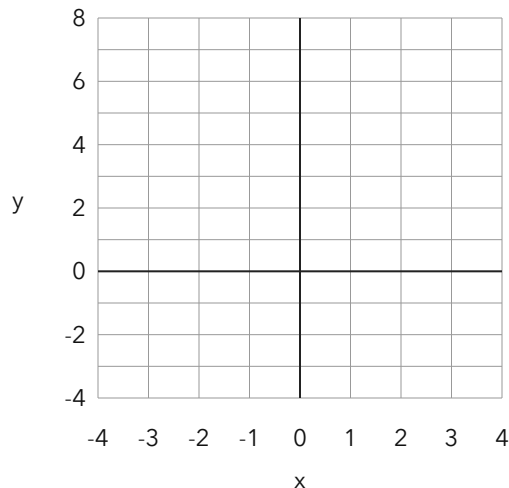
PRACTICE 4 problems

- 1** Graph $2x + y = 4$. Label intercepts and check $(1, 2)$ as a solution.



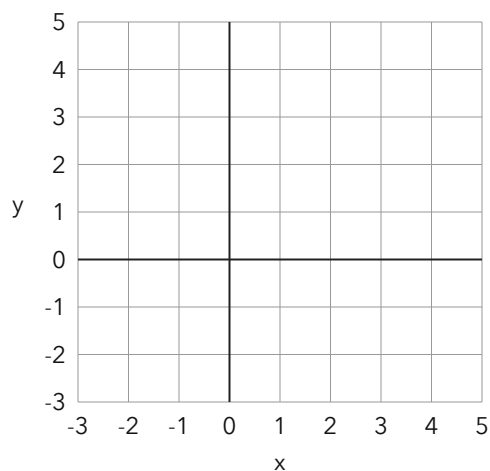
ANSWER _____

- 2** Graph $y = x^2 - 2$ and $y = x + 4$. Use intersections to solve $x^2 - 2 = x + 4$.



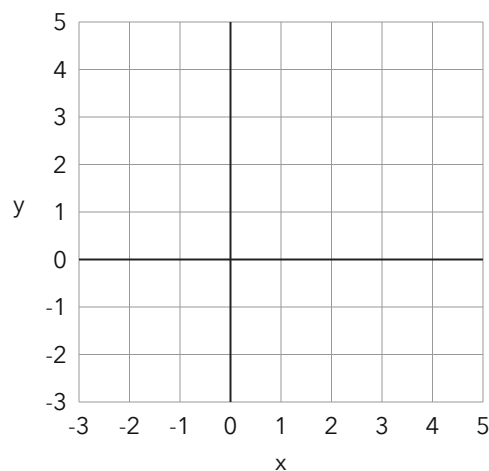
ANSWER _____

- 3** Graph and shade $y < -x + 2$. Explain the boundary and check $(0, 0)$.



ANSWER _____

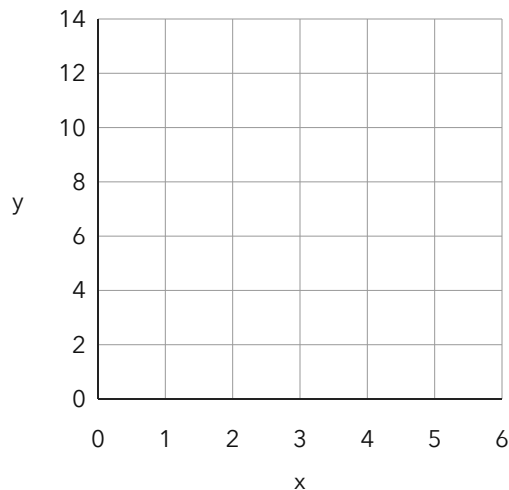
- 4** Graph $y \geq x - 1$ and $y \leq -x + 3$ together. Give a solution; test $(3, 2)$.



ANSWER _____

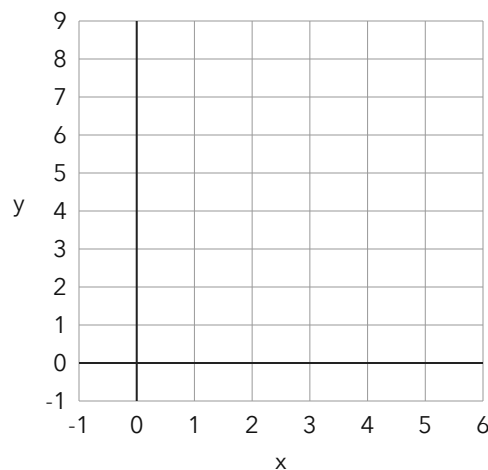
APPLY IT Show your work

- 1** A rental shop charges Plan A: \$1 plus \$2 per hour; Plan B: \$4 plus \$1 per hour. Let x be hours (0 to 6) and y be dollars. Graph both plans. When do they cost the same, and which is cheaper before that time?



REASONING AND ANSWER

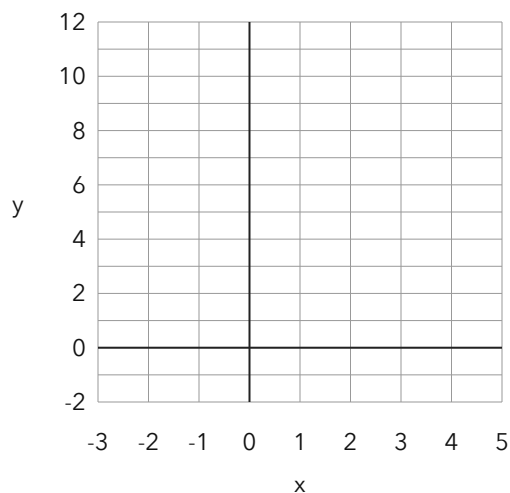
- 2** A club has \$8 for \$2 notebooks and \$1 pens. Let x be notebooks and y be pens. Graph $2x + y \leq 8$ with $x \geq 0$ and $y \geq 0$. Give two affordable combinations. Explain which points in the shaded region represent possible purchases.



REASONING AND ANSWER

CHALLENGE One step up

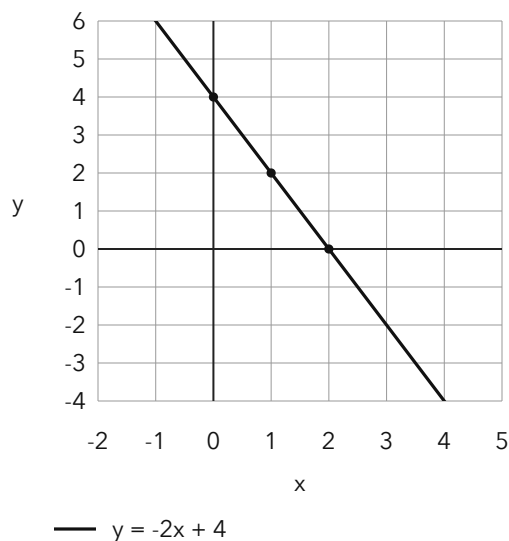
Graph $y = x^2$ and $y = 2x + 3$. Mark their intersections. Use where the parabola is on or below the line to solve $x^2 \leq 2x + 3$. Explain why both endpoints are included.



WORK SPACE AND ANSWER

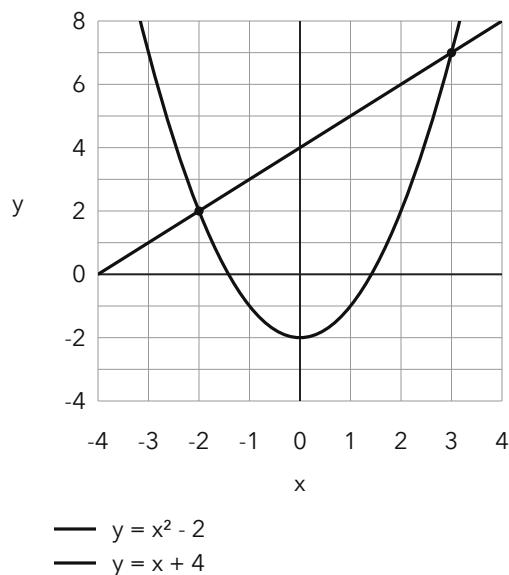
PRACTICE 1

Line through $(0, 4)$ and $(2, 0)$. Yes: $(1, 2)$ lies on it and $2(1) + 2 = 4$.



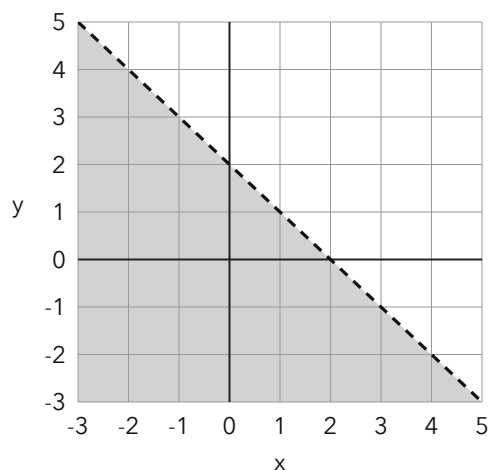
PRACTICE 2

Intersections $(-2, 2)$ and $(3, 7)$; $x = -2$ or $x = 3$.



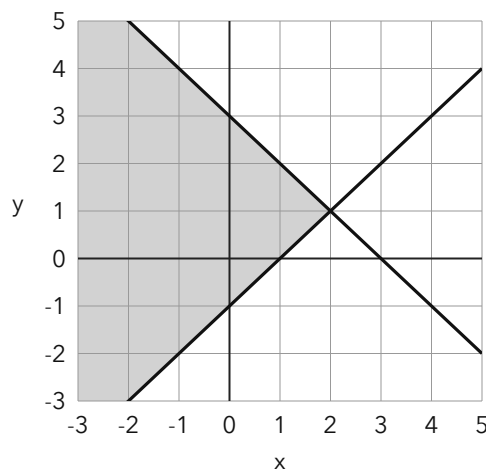
PRACTICE 3

Dashed $y = -x + 2$; shade below. The boundary is excluded. $(0, 0)$ is included because $0 < 2$.



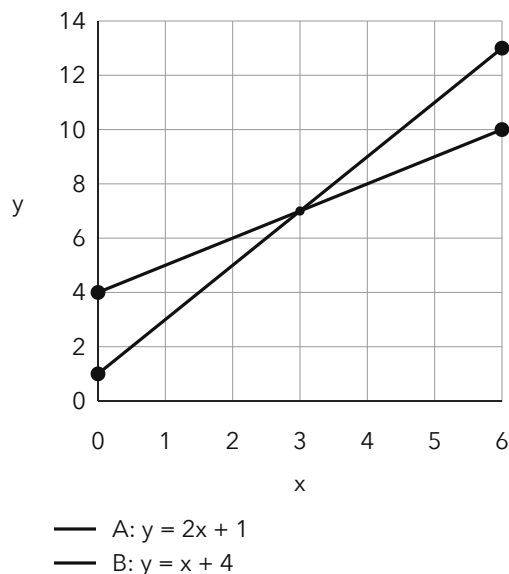
PRACTICE 4

Solid boundaries; shade above $y = x - 1$ and below $y = -x + 3$, to the left of $(2, 1)$. Sample $(0, 0)$. $(3, 2)$ fails $2 \leq 0$.



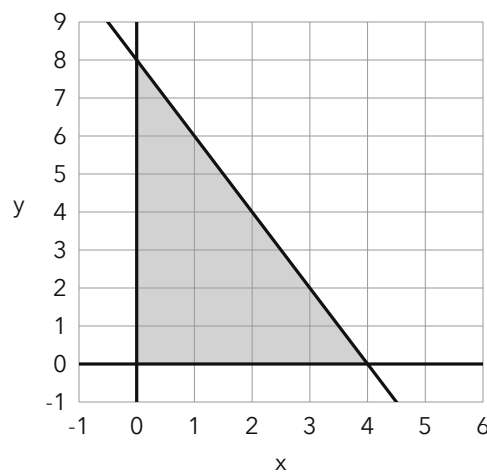
APPLY IT 1

At 3 hours both cost \$7. Plan A is cheaper for $0 \leq x < 3$. The graphs $y = 2x + 1$ and $y = x + 4$ intersect at (3, 7). Before $x = 3$, Plan A has the lower y -value.



APPLY IT 2

Shade the triangle including vertices (0, 0), (4, 0), (0, 8). Examples: (1, 5) and (3, 2). Only whole-number coordinate pairs are possible purchases. The budget boundary is $y = -2x + 8$. The two axis boundaries enforce nonnegative quantities; fractional notebooks or pens are not purchases.



CHALLENGE

Intersections (-1, 1) and (3, 9). The parabola is on or below the line for $-1 \leq x \leq 3$. Equality holds at each endpoint, so both are included.

Graph windows show part of each unrestricted curve; extend lines and parabolas beyond the window. Accept equivalent equations and correctly placed/sketched graphs. Inequality fills show mathematical regions, including fractional coordinates; the purchase problem restricts feasible purchases to lattice points. Any valid sample points with checks are acceptable.

