Systems: Solve, Graph, Verify

Solve each system by substitution and by graphing, then check the shared solution.

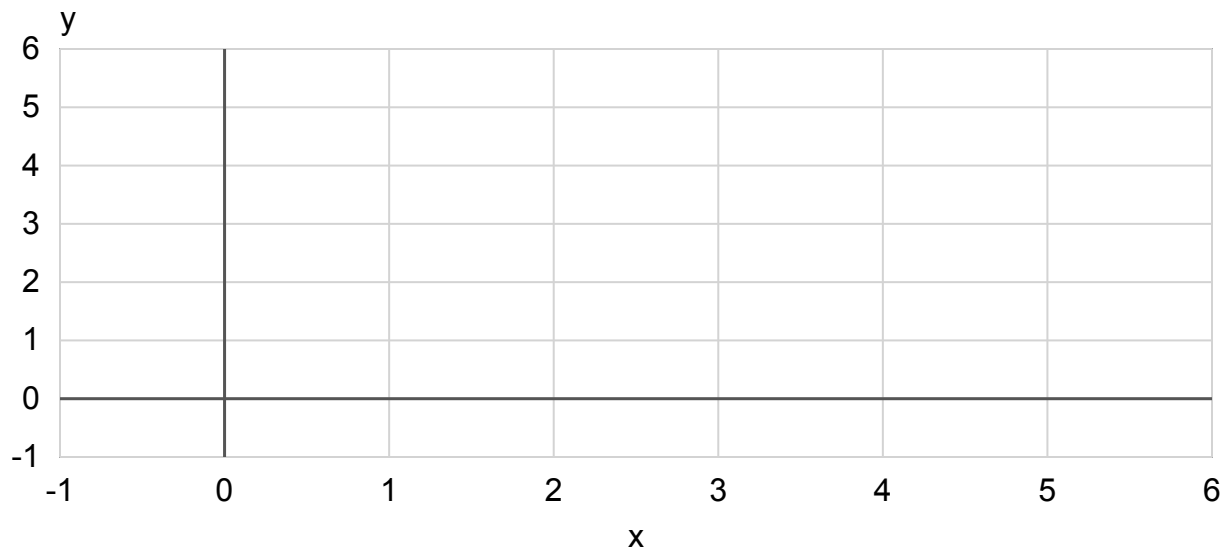
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System 1: Two Ways to Find One Point

Directions: Solve the system two ways. First use substitution. Then graph both equations on the coordinate plane. The point where the lines meet should match your algebra answer. Finally, substitute your ordered pair into *both* original equations.

1. y = x + 1
y = -x + 5

Algebra: Because both equations equal y, set the expressions equal. Show your substitution steps and solution.



Graph result: The lines intersect at (____, ____).

Check: Substitute that point into each equation. Show that each equation is true.

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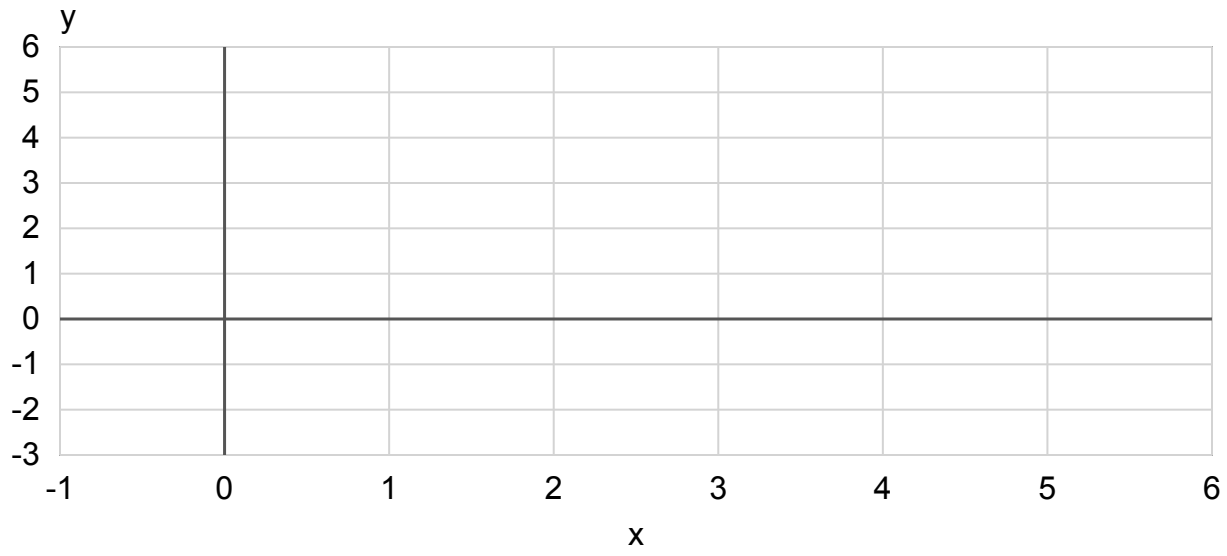
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System 2: Rewrite, Solve, Graph, Verify

Directions: Solve the system algebraically. You may first rewrite each equation in y = mx + b form. Then graph both lines. Check your solution by substituting the ordered pair into both *original* equations.

2. x + y = 4
2x - y = 2

Algebra: Show how you solve the system. Write the ordered-pair solution.



Graph result: The lines intersect at (____, ____).

Check: Substitute that point into x + y = 4 and 2x - y = 2.

Systems: Solve, Graph, Verify

Solve each system by substitution and by graphing, then check the shared solution.

Answer Key and Teaching Notes

Materials and setup: Supply each student with the two worksheet pages, pencil, ruler or straightedge, and optional colored pencils (color is not required). Students need no calculator. Have students work independently first; then pair-check graph intersections and equation checks. The blank coordinate planes and adjacent response areas are supplied on the student pages.

Teacher script: “A solution to a system is an ordered pair that makes both equations true. Algebra finds the pair using equation relationships. Graphing finds the same pair where the two lines intersect. Do not trust a point just because it looks correct - verify it in both original equations.”

Observation method: As students work, record whether each student (1) writes valid substitution or equivalent elimination steps, (2) draws two lines using plotted points, (3) identifies the common point, and (4) checks that point in both original equations. Ask: “What does the intersection mean?” Listen for: “It satisfies both equations.”

1. Answer and reasoning: Set x + 1 = -x + 5. Then 2x = 4, so x = 2. Substitute: y = 2 + 1 = 3. Solution: (2, 3). Graph y = x + 1, for example through (0, 1), (2, 3), and (4, 5). Graph y = -x + 5, for example through (0, 5), (2, 3), and (5, 0). The lines intersect at (2, 3). Check: 3 = 2 + 1 and 3 = -2 + 5.

2. Answer and reasoning: Rewrite as y = 4 - x and y = 2x - 2. Set 4 - x = 2x - 2. Then 6 = 3x, so x = 2; y = 4 - 2 = 2. Solution: (2, 2). Graph y = 4 - x, for example through (0, 4), (2, 2), and (4, 0). Graph y = 2x - 2, for example through (0, -2), (2, 2), and (3, 4). Check in originals: 2 + 2 = 4 and 2(2) - 2 = 2.

Scoring rubric: For each item, award 1 point for valid algebra, 1 point for correct ordered pair, 1 point for two correctly graphed lines with the matching intersection, and 1 point for checks in both original equations. Accept equivalent algebraic methods and reasonable graphing accuracy when the intended integer intersection is identified and verified.

Source credit: New York Next Generation Mathematics Standard AI-A.REI.6.a, “Solve systems of linear equations in two variables both algebraically and graphically.” https://www.nysed.gov/curriculum-instruction/mathematics