Systems on a Graph

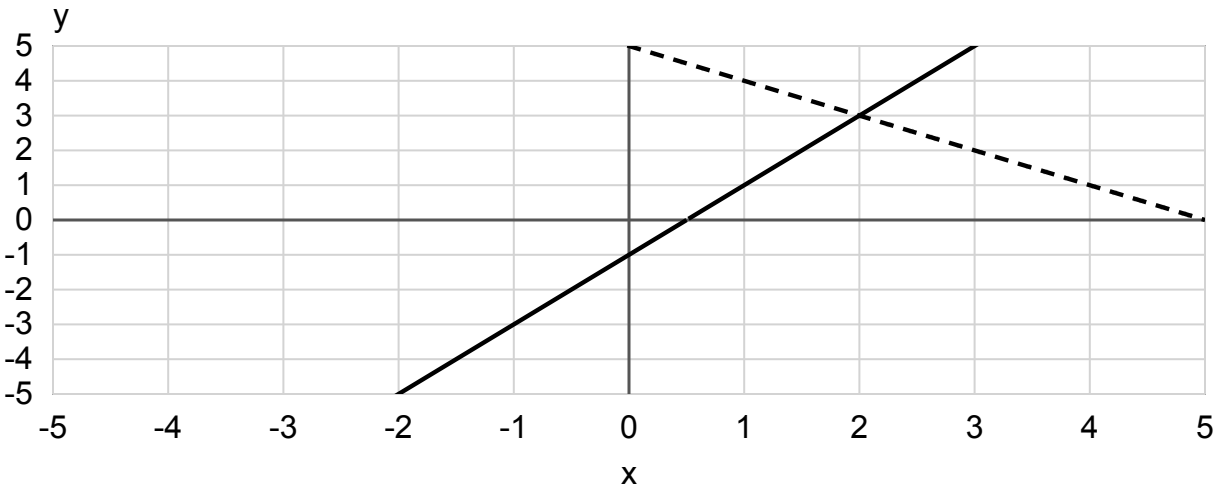
Use graphs and substitution to tell whether a system has one, none, or infinitely many solutions.

Name: _____ Date: _____

Part A - One shared point

For a system, a solution is an ordered pair that makes *both* equations true. Study the graph and equations.

Line A: y = 2x - 1
Line B: y = -x + 5



1. The lines cross where x = 2. Substitute x = 2 into each equation. What y-value does each equation give? Write the solution as an ordered pair. Why does this point solve the system?

Systems on a Graph

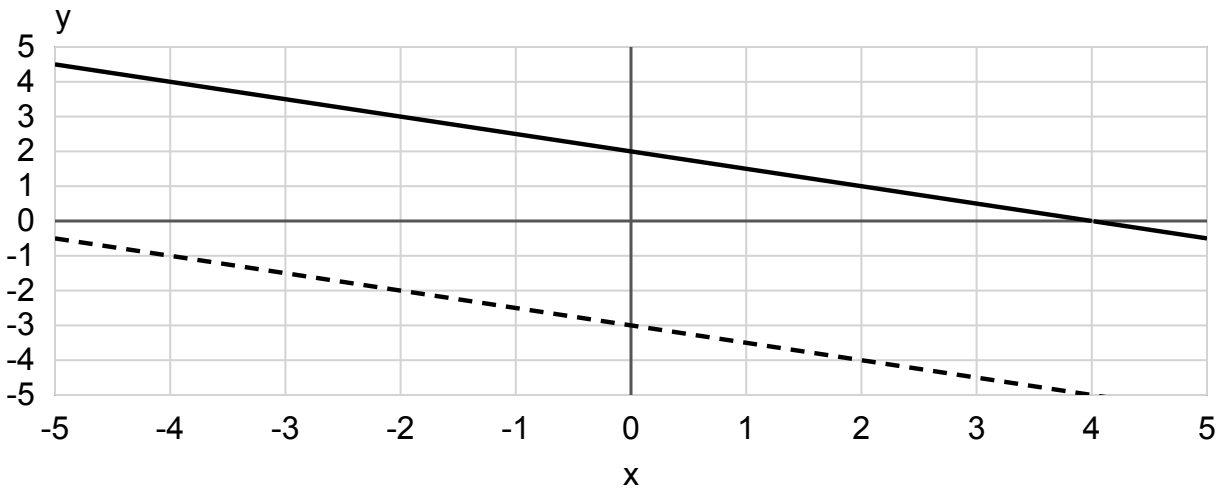
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Part B - No shared point

Study this system. A point must lie on both lines to be a solution.

Line A: y = -0.5x + 2
Line B: y = -0.5x - 3



2. Test the point (0, 2). Substitute x = 0 into both equations. Does the point satisfy Line A? Does it satisfy Line B? Then state how many solutions this system has and explain how the graph supports your answer.

Systems on a Graph

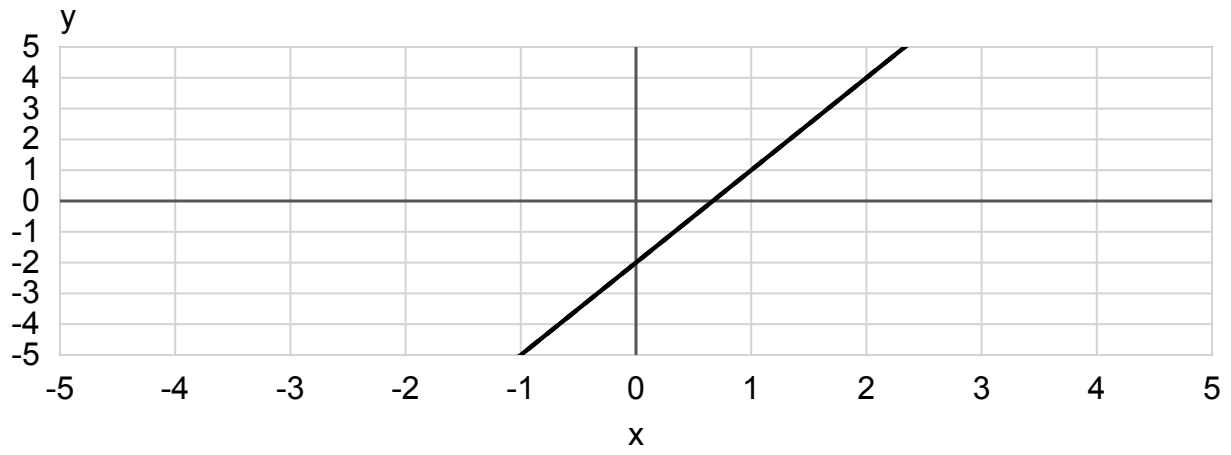
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Part C - The same line twice

Study this system. The dashed and solid drawings overlap because they are the same line.

Line A: y = 3x - 2
Line B: 2y = 6x - 4



3. Multiply every part of Line A by 2. Write the resulting equation. Then use x = 1 to find y in both equations. How many solutions are there? Explain why every point on the graph satisfies both equations.

4. Complete the comparison.

Graph relationship	Number of solutions	What is true about the point(s)?
Lines cross once		
Parallel, different lines		
Same line		

Systems on a Graph

Use graphs and substitution to tell whether a system has one, none, or infinitely many solutions.

Answer key and teaching notes

Materials and setup: Print and supply all student pages, keeping teacher-key pages separate. Each student needs a pencil; a straightedge is optional. Display or distribute the task in Part A first. Students work independently on each part, then compare with a partner after Part C.

Teaching script: “A solution to a system is one ordered pair that makes both equations true. On a graph, look for points that belong to both lines. In each part, use substitution to check what the graph is telling you. A crossing gives one shared point. Lines that never meet have no shared point. If two equations describe the same line, every point on that line is shared.” Ask: “What must be true when a point satisfies both equations?”

Observation method: As students work, record whether each student (1) identifies the graph relationship, (2) substitutes correctly, and (3) connects the calculation to simultaneous satisfaction. Prompt only: “Check the same x-value in both equations.” Do not supply a classification. Collect Part C to assess the written explanation.

1. At x = 2: Line A gives y = 2(2) - 1 = 3; Line B gives y = -2 + 5 = 3. Solution: (2, 3). It satisfies both equations, so it is the one intersection and the system has one solution.

2. For (0, 2), Line A gives y = -0.5(0) + 2 = 2, so yes. Line B gives y = -0.5(0) - 3 = -3, so no. There are no solutions: the distinct parallel lines have equal slopes and never intersect. Accept equivalent reasoning that no ordered pair lies on both lines.

3. 2(y = 3x - 2) gives 2y = 6x - 4, exactly Line B. At x = 1, Line A gives y = 1; Line B gives 2y = 2, so y = 1. There are infinitely many solutions because the equations are equivalent and graph as the same line. Full-credit explanation states that every point on that line makes both equations true.

4. Cross once: one solution; the one intersection point satisfies both equations. Parallel, different lines: no solution; no point satisfies both. Same line: infinitely many solutions; every point on the line satisfies both.

Source credit: New York Next Generation Mathematics Learning Standards, NY-8.EE.8.a, https://lessonmakerpro.com/standards/ny-nextgen-math/ny-8-ee-8-a. Student systems and graphs are original instructional content.