

Solutions

4.1 Substitution and Elimination

4.1.1. Solve $y = 2x$ and $x + y = 12$.

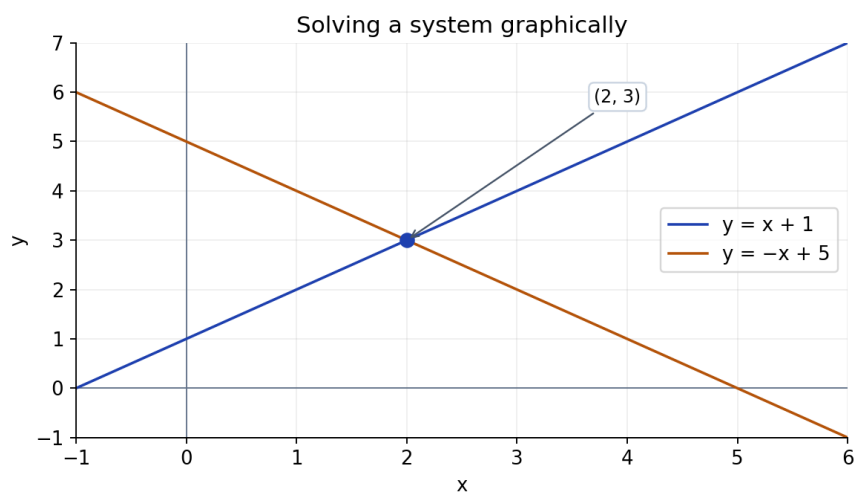
Solution. $x + 2x = 12$, so $x = 4$ and $y = 8$.

4.1.2. Solve $2x + y = 8$ and $2x - y = 4$.

Solution. Add: $4x = 12$, giving $x = 3$. Then $y = 2$.

4.1.3. Use the graph to solve the system $y = x + 1$, $y = -x + 5$.

Solution. The two lines meet at $(2, 3)$. Algebra confirms $x + 1 = -x + 5$, so $x = 2$ and $y = 3$.



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4.2 Number of Solutions

4.2.1. How many solutions do $y = -x + 2$ and $y = 3x - 2$ have?

Solution. The slopes differ, so there is one solution. Equating gives $4x = 4$, hence the point $(1, 1)$.

4.2.2. Classify $3x - y = 2$ and $6x - 2y = 9$.

Solution. Doubling the first gives $6x - 2y = 4$, incompatible with 9. There is no solution.

4.2.3. Classify $x - 2y = 5$ and $3x - 6y = 15$.

Solution. The equations are equivalent, so there are infinitely many solutions on the same line.

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4.3 Systems of Inequalities

4.3.1. Does $(1, 3)$ satisfy $y \leq 2x + 1$ and $y > 1$?

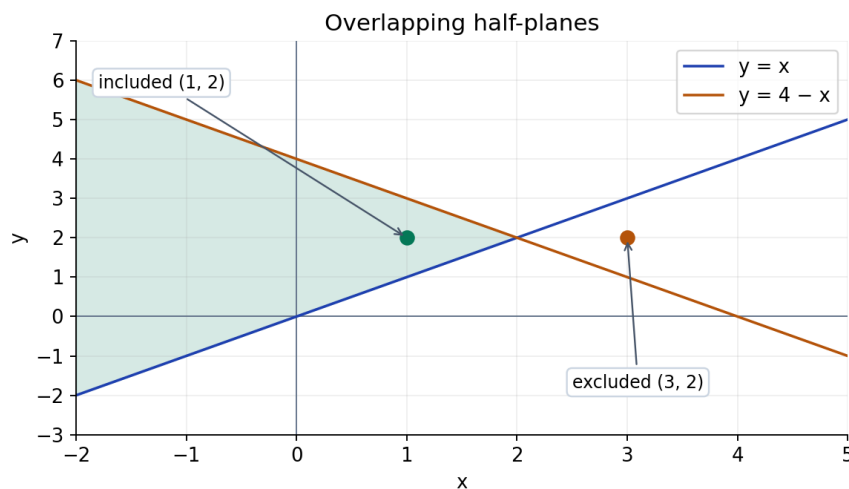
Solution. $3 \leq 3$ and $3 > 1$, so yes. The point is on an included boundary.

4.3.2. For $y < 4 - x$, is the boundary solid or dashed, and which side is shaded?

Solution. The boundary is dashed because equality is excluded. Shade below the line.

4.3.3. Use the graph to describe the solution of $y \geq x$ and $y \leq 4 - x$. Are $(1, 2)$ and $(3, 2)$ solutions?

Solution. The region lies on or above $y = x$ and on or below $y = 4 - x$, including boundaries. $(1, 2)$ satisfies both; $(3, 2)$ violates $y \geq x$.



$(1, 2)$ is inside the region; $(3, 2)$ is outside.