

Solving Special Systems

Name: _____ Date: _____ Score: _____ / 32

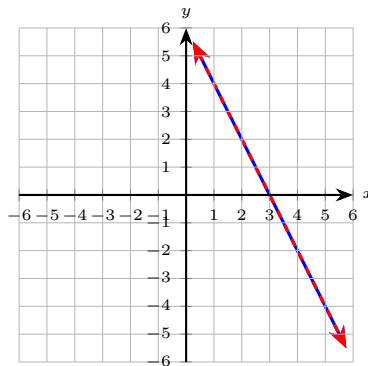
Q Quick Review

Special systems are linear systems with either **no solution** or **infinitely many solutions**. Two parallel lines share the same slope but have different y -intercepts — they never meet, so the system has *no solution*. Algebraically you'll see a false statement like $0 = 5$ pop out. Two coincident lines (the same line written two ways) have the same slope and the same y -intercept — every point on the line is a solution, so the system has *infinitely many solutions*. Algebraically: a true statement like $0 = 0$. The fast check: put both equations in slope-intercept form $y = mx + b$. Same slope and same intercept \Rightarrow infinitely many. Same slope and different intercepts \Rightarrow none. Different slopes \Rightarrow exactly one. Watch out: an equation like $2x + 4y = 8$ looks different from $x + 2y = 4$ at a glance, but dividing the first by 2 gives the second — they're the same line in disguise.

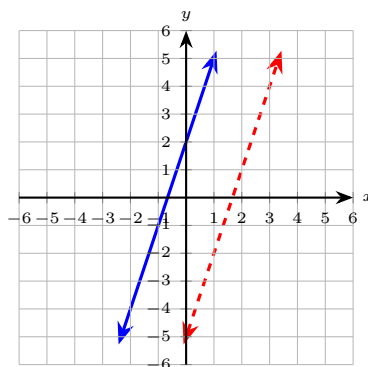
PRACTICE

Determine the number of solutions. If finite, solve.

1. How many solutions does the system $\begin{cases} 2x + y = 6 \\ 4x + 2y = 12 \end{cases}$ have? The two equations are graphed below _____
(the second is dashed).



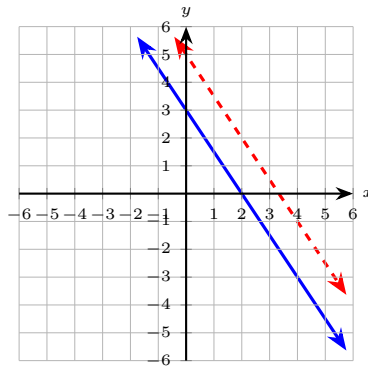
2. How many solutions does the system $\begin{cases} y = 3x + 2 \\ y = 3x - 5 \end{cases}$ have? Both lines are graphed below. _____



3. $\begin{cases} x - y = 4 \\ 2x - 2y = 8 \end{cases}$ _____



4. How many solutions does the system $\begin{cases} 3x + 2y = 6 \\ 3x + 2y = 10 \end{cases}$ have? The two lines are graphed below. _____



5. $\begin{cases} x + y = 5 \\ x + y = 5 \end{cases}$ _____

6. $\begin{cases} y = 2x + 7 \\ -4x + 2y = 14 \end{cases}$ _____

7. $\begin{cases} y = -\frac{1}{2}x + 3 \\ y = -\frac{1}{2}x + 1 \end{cases}$ _____

8. $\begin{cases} 3x - y = 7 \\ 6x - 2y = 14 \end{cases}$ _____

9. $\begin{cases} 5x + 4y = 20 \\ 5x + 4y = 0 \end{cases}$ _____

10. $\begin{cases} 2x + 3y = 6 \\ 4x + 6y = 18 \end{cases}$ _____

11. $\begin{cases} y = 4x - 1 \\ 8x - 2y = 2 \end{cases}$ _____

12. $\begin{cases} x + 2y = 3 \\ x + 2y = -1 \end{cases}$ _____

13. $\begin{cases} x - 3y = 6 \\ 2x - 6y = 12 \end{cases}$ _____

14. $\begin{cases} y = 5x \\ y = 5x + 0.0001 \end{cases}$ _____

15. $\begin{cases} 3x - 4y = 8 \\ 9x - 12y = 24 \end{cases}$ _____

16. $\begin{cases} 2x + 5y = 10 \\ 4x + 10y = 25 \end{cases}$ _____

17. Slope-intercept of $2x - 6y = 12$ _____

18. Slope-intercept of $4x + 6y = 18$ _____



19.
$$\begin{cases} y = 7x - 2 \\ y = 7x - 2 \end{cases}$$

20.
$$\begin{cases} x + y = 0 \\ x + y = 1 \end{cases}$$

◆ Word Problems

21. Two phone plans charge a flat fee plus a per-minute rate. Plan A is modeled by $C = 0.05m + 20$ and Plan B by $C = 0.05m + 15$. For how many minutes do the two plans charge the same? _____

22. A printer's daily output is described two different ways by the same supervisor: $p = 120t + 50$ and $240t - 2p = -100$. How many solutions does this system have? _____

23. A grocery store's pricing chart says a banana costs \$0.50. A clerk's receipt says 4 bananas cost \$2.10. Are these two pieces of pricing consistent (same line)? _____

24. Two equations describe the cost of a job: $C = 15h + 40$ and $30h - 2C = -80$. Identify how many solutions the system has and explain in plain English. _____

Additional Practice

25. Solve: $2x + y = 7$ and $x - y = 2$. _____

26. Solve: $x + y = 10$ and $x - y = 4$. _____

27. Solve: $3x - 2y = 4$ and $x + y = 6$. _____

28. Classify: $2x + 4y = 8$ and $x + 2y = 4$. _____

29. Classify: $y = 3x + 1$ and $y = 3x - 5$. _____

30. Solve: $4x + y = 1$ and $2x - y = 5$. _____

31. Eliminate y : $x + y = 8$ and $2x - y = 7$. _____

32. Eliminate x : $3x + 2y = 12$ and $3x - y = 3$. _____



Answer Keys

1. infinitely many
2. no solution
3. infinitely many
4. no solution
5. infinitely many
6. infinitely many
7. no solution
8. infinitely many
9. no solution
10. no solution
11. infinitely many
12. no solution

Additional Practice Answers

25. (3, 1)
26. (7, 3)
27. $(\frac{16}{5}, \frac{14}{5})$
28. infinitely many

13. infinitely many
14. no solution
15. infinitely many
16. no solution
17. $y = \frac{1}{3}x - 2$
18. $y = -\frac{2}{3}x + 3$
19. infinitely many
20. no solution
21. never (no solution)
22. infinitely many
23. no (inconsistent — parallel/contradiction)
24. infinitely many

29. no solution
30. (1, -3)
31. $x = 5$
32. $y = 3$

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

1. Multiply the first by 2: $4x + 2y = 12$ — the second equation. Both reduce to $y = -2x + 6$, so the dashed line lands exactly on top of the solid one. Every point on the line solves both: infinitely many solutions.
2. Same slope (3), different intercepts \Rightarrow the lines run parallel and never cross. No solution.
3. Multiply the first equation by 2: $2x - 2y = 8$, which is exactly the second. They're the same line in disguise, so every point on it solves both — infinitely many solutions.
4. Same left side, different right sides. In slope-intercept form both have slope $-\frac{3}{2}$ but intercepts 3 and 5 — parallel lines that never meet. No solution.
5. A careful way to see it: Identical equations \Rightarrow same line \Rightarrow every point on the line solves it. That gives a quick check on the answer.
6. Keep the rule visible: From the second: $2y = 4x + 14 \Rightarrow y = 2x + 7$. Same line. This is the part to check before moving on, because it keeps the answer tied to the original question.
7. Both are already in $y = mx + b$ form with the same slope $-\frac{1}{2}$ but different intercepts (3 vs. 1). Same steepness, different heights \Rightarrow parallel lines that never cross, so no solution.
8. Multiply the first by 2: $6x - 2y = 14$, matching the second exactly. One line written two ways — infinitely many solutions.
9. The left sides are identical but the right sides differ (20 vs. 0). The same combination $5x + 4y$ can't equal two different numbers at once, so the lines are parallel and the system has no solution.
10. Keep the rule visible: Doubling the first gives $4x + 6y = 12$, not 18 — parallel. That gives a quick check on the answer.
11. One steady path is: From the second: $-2y = 2 - 8x \Rightarrow y = 4x - 1$. Same line. This is the part to check before moving on, because it keeps the answer tied to the original question.

12. Same left side $x + 2y$, but it can't be both 3 and -1 . The lines are parallel (same slope, different intercepts), so there is no solution.
13. Multiply the first by 2 and you get $2x - 6y = 12$ — the second equation exactly. Same line, infinitely many solutions.
14. Same slope, ever-so-slightly different intercepts. Still parallel; never meet.
15. One steady path is: Multiplying the first by 3 gives the second. This is the part to check before moving on, because it keeps the answer tied to the original question.
16. Start with the key idea: Doubling the first gives $4x + 10y = 20$, not 25 — parallel. That gives a quick check on the answer.
17. A careful way to see it: $-6y = -2x + 12 \Rightarrow y = \frac{1}{3}x - 2$. This is the part to check before moving on, because it keeps the answer tied to the original question.
18. Keep the rule visible: $6y = -4x + 18 \Rightarrow y = -\frac{2}{3}x + 3$. This is the part to check before moving on, because it keeps the answer tied to the original question.
19. One steady path is: Identical equation twice \Rightarrow same line. Every point on the line is a solution. That gives a quick check on the answer.
20. The sum $x + y$ can't equal both 0 and 1. Same left side, different right sides \Rightarrow parallel lines, no point in common.
21. Same slope, different intercepts — the two lines are parallel. Plan A is always \$5 more expensive, no matter how many minutes.
22. From the second: $-2p = -240t - 100 \Rightarrow p = 120t + 50$ — the same as the first. They describe the same line; infinitely many solutions.
23. Chart: $C = 0.50b$, so 4 bananas should cost \$2.00. Receipt says \$2.10. Same per-unit slope, different fixed component — inconsistent (no solution as a strict system).
24. Rewrite the second: $-2C = -30h - 80 \Rightarrow C = 15h + 40$ — the same as the first. The two equations are the same job in two algebraic disguises.



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