

Solving Linear-Quadratic Systems

Name: _____ Date: _____ Score: _____ / 26

Quick Review

A **linear-quadratic system** has one linear equation and one quadratic equation. Solve by substitution: solve the linear equation for one variable, substitute into the quadratic, and solve the resulting quadratic (factor, quadratic formula, or completing the square). The system can have **2, 1, or 0** real solutions, corresponding to the line crossing the parabola in two places, being tangent (one place), or missing it entirely. Find each x from the quadratic, then substitute back into the linear equation to get the matching y . Check by substituting both into both original equations.

PRACTICE

Solve each linear-quadratic system.

- | | | | |
|------------------------------|-------|---------------------------------|-------|
| 1. $y = x^2, y = x + 2$ | _____ | 11. $y = x^2, y = 9$ | _____ |
| 2. $y = x^2 - 1, y = 3$ | _____ | 12. $y = x^2 + 2x, y = 8$ | _____ |
| 3. $y = x^2 + 1, y = 2x$ | _____ | 13. $y = x^2 - 6x + 9, y = 0$ | _____ |
| 4. $y = x^2, y = -1$ | _____ | 14. $y = 2x^2, y = 8$ | _____ |
| 5. $y = x^2 - 4, y = 0$ | _____ | 15. $y = x^2 + 3x, y = 10$ | _____ |
| 6. $y = x^2 + x, y = 2x + 2$ | _____ | 16. $y = x^2, y = -x + 6$ | _____ |
| 7. $y = x^2 - 2x, y = 3$ | _____ | 17. $y = x^2 - 9, y = 7$ | _____ |
| 8. $y = x^2 + 4, y = x$ | _____ | 18. $y = -(x - 1)^2 + 4, y = 0$ | _____ |
| 9. $y = x^2, y = 4x - 4$ | _____ | 19. $y = x^2, y = 2x - 1$ | _____ |
| 10. $y = -x^2 + 5, y = 1$ | _____ | 20. $y = x^2 + 1, y = x + 3$ | _____ |

VISUAL PRACTICE

Use the graph, table, chart, or diagram to answer the question.

21. Use the graph to find the solution points.



Answer: _____

22. Use the graph to find the solution points.



Answer: _____



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◆ Word Problems

23. A ball is thrown so its height is $h = -16t^2 + 48t + 4$. A bird flies at constant $h = 36$. When are they at the same height?

Model: _____

Answer: _____

24. A circular fountain is modeled by $x^2 + y^2 = 25$. A straight walkway follows $y = x + 1$. Does the walkway cross the fountain boundary, and at what points?

Model: _____

Answer: _____

25. A projectile's path is modeled by $y = -x^2 + 10x$. A drone flies level at $y = 21$. Do their paths meet, and if so, where?

Model: _____

Answer: _____

26. A company's profit is modeled by $P = -x^2 + 12x - 20$ thousand dollars, where x is hundreds of units sold. When is the profit exactly \$15 thousand?

Model: _____

Answer: _____



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Answer Keys

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. $(2, 4), (-1, 1)$ 2. $(\pm 2, 3)$ 3. $(1, 2)$ 4. no real solution 5. $(\pm 2, 0)$ 6. $(2, 6), (-1, 0)$ 7. $(3, 3), (-1, 3)$ 8. none 9. $(2, 4)$ 10. $(\pm 2, 1)$ 11. $(\pm 3, 9)$ 12. $(2, 8), (-4, 8)$ 13. $(3, 0)$ | <ol style="list-style-type: none"> 14. $(\pm 2, 8)$ 15. $(2, 10), (-5, 10)$ 16. $(2, 4), (-3, 9)$ 17. $(\pm 4, 7)$ 18. $(3, 0), (-1, 0)$ 19. $(1, 1)$ 20. $(2, 5), (-1, 2)$ 21. $(-1, 1)$ and $(2, 4)$ 22. $(-2, 2), (2, 2)$ 23. $t = 1$ and $t = 2$ 24. $(3, 4), (-4, -3)$ 25. $(3, 21), (7, 21)$ 26. $x = 5$ or $x = 7$ |
|--|--|

Step-by-Step Tutor Notes

1. For a table question, slow down and locate the exact row, column, or cell before calculating. $x^2 = x + 2 \Rightarrow x^2 - x - 2 = 0 \Rightarrow (x - 2)(x + 1) = 0$. This gives $(2, 4), (-1, 1)$.
2. For a table question, slow down and locate the exact row, column, or cell before calculating. $x^2 - 1 = 3 \Rightarrow x^2 = 4 \Rightarrow x = \pm 2$. This gives $(\pm 2, 3)$.
3. $x^2 + 1 = 2x \Rightarrow x^2 - 2x + 1 = 0 \Rightarrow (x - 1)^2 = 0$. One solution (tangent): $x = 1$.
4. This is a good place to slow down, check the notation, and simplify cleanly. $x^2 = -1$ has no real x . So the answer is no real solution.
5. Read the table by matching the correct row and column first, then use the count or total that fits the question. $x^2 = 4 \Rightarrow x = \pm 2$. This gives $(\pm 2, 0)$.
6. For a table question, slow down and locate the exact row, column, or cell before calculating. $x^2 + x = 2x + 2 \Rightarrow x^2 - x - 2 = 0 \Rightarrow (x - 2)(x + 1)$. This gives $(2, 6), (-1, 0)$.
7. For a table question, slow down and locate the exact row, column, or cell before calculating. $x^2 - 2x - 3 = 0 \Rightarrow (x - 3)(x + 1) = 0$. This gives $(3, 3), (-1, 3)$.
8. This is a good place to slow down, check the notation, and simplify cleanly. $x^2 - x + 4 = 0$. Discriminant $1 - 16 < 0$. No real solution. So the answer is none.
9. Use the labels on the display first; they tell you which count or total belongs in the answer. $x^2 = 4x - 4 \Rightarrow x^2 - 4x + 4 = 0 \Rightarrow (x - 2)^2 = 0$. Tangent. This gives $(2, 4)$.
10. Use the labels on the display first; they tell you which count or total belongs in the answer. $-x^2 + 5 = 1 \Rightarrow x^2 = 4 \Rightarrow x = \pm 2$. This gives $(\pm 2, 1)$.
11. Focus on the main idea of the problem, then simplify carefully. $x^2 = 9$. So the answer is $(\pm 3, 9)$.
12. Read the table by matching the correct row and column first, then use the count or total that fits the question. $x^2 + 2x - 8 = 0 \Rightarrow (x + 4)(x - 2) = 0$. This gives $(2, 8), (-4, 8)$.
13. Read the table by matching the correct row and column first, then use the count or total that fits the question. $(x - 3)^2 = 0 \Rightarrow x = 3$ (double root). This gives $(3, 0)$.
14. Read the table by matching the correct row and column first, then use the count or total that fits the question. $2x^2 = 8 \Rightarrow x^2 = 4$. This gives $(\pm 2, 8)$.
15. Read the table by matching the correct row and column first, then use the count or total that fits the question. $x^2 + 3x - 10 = 0 \Rightarrow (x + 5)(x - 2) = 0$. This gives $(2, 10), (-5, 10)$.
16. Read the table by matching the correct row and column first, then use the count or total that fits the question. $x^2 = -x + 6 \Rightarrow x^2 + x - 6 = 0 \Rightarrow (x + 3)(x - 2)$. This gives $(2, 4), (-3, 9)$.
17. Focus on the main idea of the problem, then simplify carefully. $x^2 = 16$. So the answer is $(\pm 4, 7)$.
18. Read the table by matching the correct row and column first, then use the count or total that fits the question. $(x - 1)^2 = 4 \Rightarrow x - 1 = \pm 2 \Rightarrow x = 3$ or -1 . This gives $(3, 0), (-1, 0)$.
19. Use the labels on the display first; they tell you which count or total belongs in the answer. $x^2 - 2x + 1 = 0 \Rightarrow (x - 1)^2 = 0$. Tangent. This gives $(1, 1)$.
20. Use the labels on the display first; they tell you which count or total belongs in the answer. $x^2 + 1 = x + 3 \Rightarrow x^2 - x - 2 = 0 \Rightarrow (x - 2)(x + 1)$. This gives $(2, 5), (-1, 2)$.
21. Focus on the main idea of the problem, then simplify carefully. The solutions are the intersection points of the line and parabola. So the answer is $(-1, 1)$ and $(2, 4)$.
22. Focus on the main idea of the problem, then simplify carefully. The line and parabola meet at $(-2, 2)$ and $(2, 2)$. So the answer is $(-2, 2), (2, 2)$.
23. $-16t^2 + 48t + 4 = 36 \Rightarrow -16t^2 + 48t - 32 = 0 \Rightarrow t^2 - 3t + 2 = 0 \Rightarrow (t - 1)(t - 2) = 0$.
24. Substitute: $x^2 + (x + 1)^2 = 25 \Rightarrow 2x^2 + 2x + 1 = 25 \Rightarrow 2x^2 + 2x - 24 = 0 \Rightarrow x^2 + x - 12 = 0 \Rightarrow (x + 4)(x - 3) = 0$. So $x = 3, y = 4$ and $x = -4, y = -3$.
25. Use the labels on the display first; they tell you which count or total belongs in the answer. $-x^2 + 10x = 21 \Rightarrow x^2 - 10x + 21 = 0 \Rightarrow (x - 3)(x - 7) = 0$. This gives $(3, 21), (7, 21)$.
26. Read the table by matching the correct row and column first, then use the count or total that fits the question. $-x^2 + 12x - 20 = 15 \Rightarrow x^2 - 12x + 35 = 0 \Rightarrow (x - 5)(x - 7) = 0$. This gives $x = 5$ or $x = 7$.



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