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. $y = x^2, y = x + 2$ _____

2. $y = x^2 - 1, y = 3$ _____

3. $y = x^2 + 1, y = 2x$ _____

4. $y = x^2, y = -1$ _____

5. $y = x^2 - 4, y = 0$ _____

6. $y = x^2 + x, y = 2x + 2$ _____

7. $y = x^2 - 2x, y = 3$ _____

8. $y = x^2 + 4, y = x$ _____

9. $y = x^2, y = 4x - 4$ _____

10. $y = -x^2 + 5, y = 1$ _____

11. $y = x^2, y = 9$ _____

12. $y = x^2 + 2x, y = 8$ _____

13. $y = x^2 - 6x + 9, y = 0$ _____

14. $y = 2x^2, y = 8$ _____

15. $y = x^2 + 3x, y = 10$ _____

16. $y = x^2, y = -x + 6$ _____

17. $y = x^2 - 9, y = 7$ _____

18. $y = -(x - 1)^2 + 4, y = 0$ _____

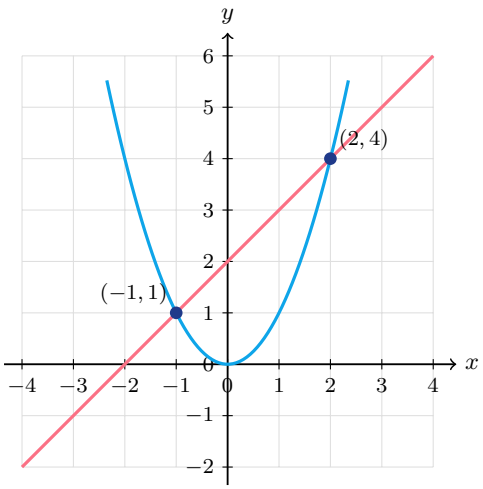
19. $y = x^2, y = 2x - 1$ _____

20. $y = x^2 + 1, y = x + 3$ _____

VISUAL PRACTICE

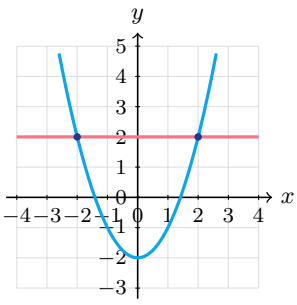
Use the graph, table, chart, or diagram to answer the question.

21. Use the graph to find the solution points.



Answer: _____

22. Use the graph to find the solution points.



Answer: _____

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:** _____

Answer Keys

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. $(3,0)$
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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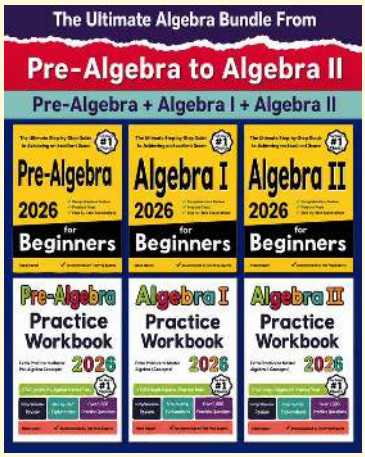

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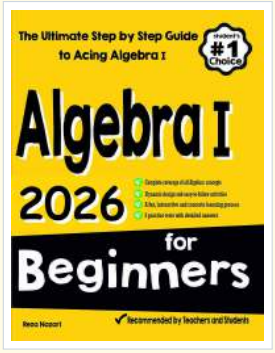

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