# Solving Linear-Quadratic Systems

| Name: _____ | Date: _____ | Score: _____ / 26 |
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## 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.** $y = -(x - 1)^2 + 4, y = 0$ _____

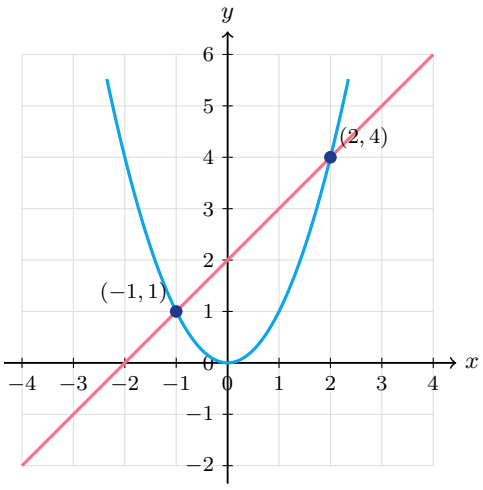
**19.** $y = x^2, y = 2x - 1$ _____

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

## VISUAL PRACTICE

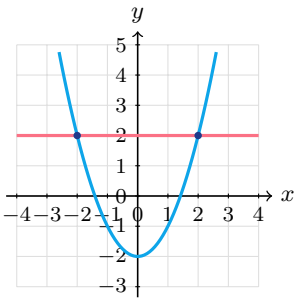
*Use the graph, table, chart, or diagram to answer the question.*

**21.** Use the graph to find the solution points.




**Answer:** _____

**22.** Use the graph to find the solution points.




**Answer:** _____

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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:** _____

# 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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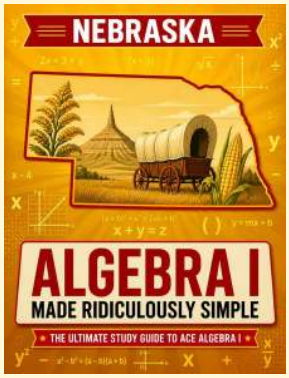


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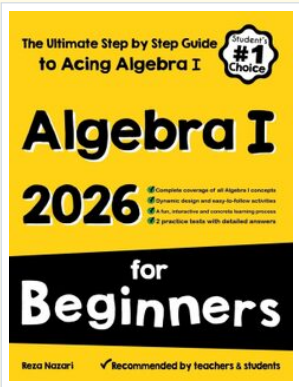


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