LESSON MAKER PRO

# Intersection Detective

*Find where a line and a curve meet.*

**HIGH SCHOOL · HSA-REI.C.7**

**CCSS.Math.Content.HSA-REI.C.7** "Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = -3 x and the circle x 2 + y 2 = 3."

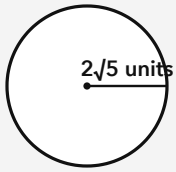
NAME _____ DATE _____

## ONE POINT, TWO RULES

An intersection point makes both equations true. Substitute the linear equation into the quadratic equation, solve for x, and use either equation to find y. A graph can show how many real intersection points to expect.

### WORKED EXAMPLE

The circle shown is centered at the origin. Write its equation, then solve the system formed by the circle and the line $y = 2x$.




1. The radius is $2\sqrt{5}$, so the circle equation is $x^2 + y^2 = 20$.
2. Substitute $y = 2x$: $x^2 + (2x)^2 = 20$.
3. Solve $5x^2 = 20$ to get $x = -2$ or $x = 2$.
4. Use $y = 2x$ to get $y = -4$ or $y = 4$.

**Answer: (-2, -4) and (2, 4)**

## PRACTICE 6 problems

**1** Solve the system algebraically. Give all ordered pairs. $y = x + 2$ and $y = x^2 + 2$

ANSWER _____

**2** Solve the system algebraically. Give all ordered pairs. $y = -x + 6$ and $y = x^2$

ANSWER _____

**3** Solve the system algebraically. Give all ordered pairs. $y = 2x - 1$ and $y = x^2 - 1$

ANSWER _____

**4** Solve the system algebraically. Give all ordered pairs. $y = x + 1$ and $y = x^2 - 3x + 1$

ANSWER _____

**5** Solve the system algebraically. State whether there are any real intersection points. $y = x + 1$ and $y = x^2 + 2$

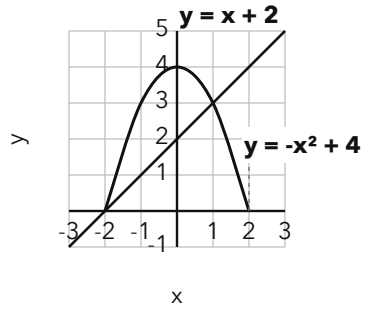
**ANSWER** _____

**6** Solve the system algebraically. Give the intersection point. $y = 2x + 3$ and $y = x^2 + 4$

**ANSWER** _____

## APPLY IT Show your work

**1** A video game designer models a character's curved jump path and a moving platform's path with the graph. The paths are $y = -x^2 + 4$ and $y = x + 2$, where each unit is a screen unit. First estimate both landing points from the graph. Then solve the system algebraically and compare your exact points with your estimates.




**ANSWER** _____

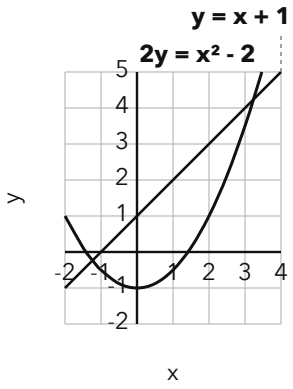
**2** For a robotics club display, a curved sensor boundary is modeled by $y = x^2 + 2$ and a straight robot route is modeled by $y = x + 4$. Find every point where the route crosses the sensor boundary.

WORK SPACE

**ANSWER** _____

## CHALLENGE One step up

The graph shows the line $y = x + 1$ and the curve $2y = x^2 - 2$. Find the exact intersection points algebraically. Then explain how the graph supports your answer.




WORK SPACE AND ANSWER

**ANSWER KEY** # Intersection Detective



## PART 1 · PRACTICE

| # | PROBLEM | ANSWER |
|---|---|---|
| 1 | Solve the system algebraically. Give all ordered pairs. $y = x + 2$ and $y = x^2 + 2$ | **(0, 2) and (1, 3)** |
| 2 | Solve the system algebraically. Give all ordered pairs. $y = -x + 6$ and $y = x^2$ | **(-3, 9) and (2, 4)** |
| 3 | Solve the system algebraically. Give all ordered pairs. $y = 2x - 1$ and $y = x^2 - 1$ | **(0, -1) and (2, 3)** |
| 4 | Solve the system algebraically. Give all ordered pairs. $y = x + 1$ and $y = x^2 - 3x + 1$ | **(0, 1) and (4, 5)** |
| 5 | Solve the system algebraically. State whether there are any real intersection points. $y = x + 1$ and $y = x^2 + 2$ | **No real intersection points.** |
| 6 | Solve the system algebraically. Give the intersection point. $y = 2x + 3$ and $y = x^2 + 4$ | **(1, 5)** |

## PART 2 · APPLY IT

1. **(-2, 0) and (1, 3)** Set $-x^2 + 4$ equal to $x + 2$. Solving $x^2 + x - 2 = 0$ gives $x = -2$ and $x = 1$, then use $y = x + 2$.
2. **(-1, 3) and (2, 6)** Set $x^2 + 2$ equal to $x + 4$, then solve $x^2 - x - 2 = 0$. Substitute $x = -1$ and $x = 2$ into $y = x + 4$.

## CHALLENGE

**$(1 - \sqrt{5}, 2 - \sqrt{5})$ and $(1 + \sqrt{5}, 2 + \sqrt{5})$. The graph shows two intersections, one near (-1.2, -0.2) and one near (3.2, 4.2), which agrees with the exact points.**

Accept ordered pairs in either order. For the challenge, accept equivalent exact radical forms and reasonable graph estimates that match the exact values.