

4-9

Quadratic Systems

Objectives To solve and graph systems of linear and quadratic equations
To solve and graph systems of quadratic inequalities



Problem 3 Solving a Quadratic System of Equations

What is the solution of the system? $\begin{cases} y = -x^2 - x + 12 \\ y = x^2 + 7x + 12 \end{cases}$

Method 1 Use substitution.

Substitute $y = -x^2 - x + 12$ for y in the second equation. Solve for x .

$$-x^2 - x + 12 = x^2 + 7x + 12 \quad \text{Substitute for } y.$$

$$-2x^2 - 8x = 0 \quad \text{Write in standard form.}$$

$$-2x(x + 4) = 0 \quad \text{Factor.}$$

$$x = 0 \text{ or } x = -4 \quad \text{Solve for } x.$$

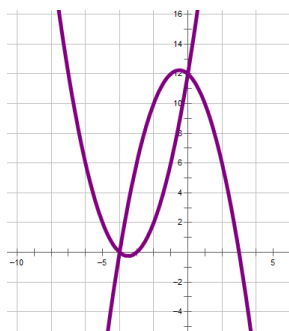
Substitute each value of x into either equation. Solve for y .

$$y = x^2 + 7x + 12 \quad y = x^2 + 7x + 12$$

$$y = (0)^2 + 7(0) + 12 \quad y = (-4)^2 + 7(-4) + 12$$

$$y = 0 + 0 + 12 = 12 \quad y = 16 - 28 + 12 = 0$$

The solutions are $(0, 12)$ and $(-4, 0)$.



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Ex) SOLVE

$$y = -x^2 - 2x - 2$$

$$y = x - 4$$

$$y = -x^2 - 2x - 2$$

$$x - 4 = -x^2 - 2x - 2$$

$$x^2 + 3x - 2 = 0$$

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(-2)}}{2(1)}$$

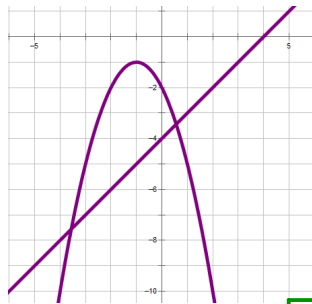
$$= \frac{-3 \pm \sqrt{17}}{2}$$

WHEN $x = \frac{-3 + \sqrt{17}}{2}$

$$y = x - 4$$

$$y = \frac{-3 + \sqrt{17}}{2} - 4$$

$$y = \frac{-11 + \sqrt{17}}{2}$$



$$\left(\frac{-3 + \sqrt{17}}{2}, \frac{-11 + \sqrt{17}}{2} \right)$$

WHEN

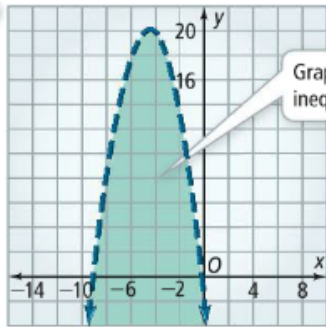
$$x = \frac{-3 - \sqrt{17}}{2}$$

$$y = \frac{-3 - \sqrt{17}}{2} - 4 = \frac{-11 - \sqrt{17}}{2}$$

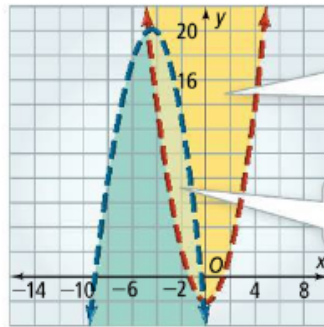
$$\left(\frac{-3 - \sqrt{17}}{2}, \frac{-11 - \sqrt{17}}{2} \right)$$

Problem 4 Solving a Quadratic System of Inequalities

What is the solution of the system of inequalities? $\begin{cases} y < -x^2 - 9x - 2 \\ y > x^2 - 2 \end{cases}$



Graph the first inequality.



Graph the second inequality.

Identify where the graphs overlap.

The solution of this system is the region where the graphs overlap. The region contains no boundary points.

$$\begin{aligned} y &= -x^2 - 9x - 2 \\ &= -\left(x^2 + 9x + \frac{81}{4}\right) - 2 + \frac{81}{4} \\ &= -\left(x + \frac{9}{2}\right)^2 + \frac{73}{4} \quad V: \left(-\frac{9}{2}, \frac{73}{4}\right) \end{aligned}$$

NOTE: THE GRAPH IN BOOK IS INCORRECT ON Y-COORD OF VERTEX.

