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Systems of Linear and Quadratic Equations

Unit 9 Lesson 8

SYSTEMS OF LINEAR AND QUADRATIC SYSTEMS

Students will be able to:

Understand how to solve the systems of linear and quadratic systems.

Key Vocabulary:

- System of Equations
- Solution by Graphing
- Solution by Substitution Method

SYSTEMS OF LINEAR AND QUADRATIC SYSTEMS

A **system of linear and quadratic equations** has two equations of the form:

$$f(x) = ax + b$$

$$f(x) = ax^2 + bx + c$$

i.e. it has:

- One linear equation
- One quadratic equation

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Solution by Graphing of Linear and Quadratic Equations

If we have a system of linear and quadratic equations, we can graph both the linear and quadratic equation and see the points where the two graphs intersect each other. The points where these graphs intersect each other are the solutions of the equations.

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Problem 1: What are the solutions of the system $y = x^2 - x - 2$ and $y = x + 1$?

Solve by graphing.

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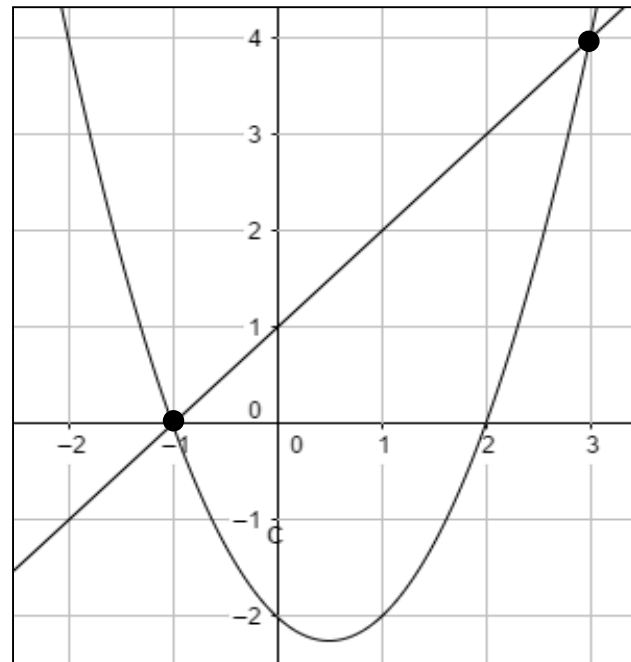
Problem 1: What are the solutions of the system $y = x^2 - x - 2$ and $y = x + 1$?

Solve by graphing.

By graphing both the linear and quadratic equations, we see that both graphs intersect each other at two points i.e. $(-1, 0)$ and $(3, 4)$. So the solutions are:

$(-1, 0)$

$(3, 4)$



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Solution by Algebraic Method

If we have a system of linear and quadratic equations, we can solve them using algebraic method i.e. by substituting the value of one variable from the linear equation into the quadratic equation and then solving the quadratic equation using the quadratic formula (or factorization). And finally solve the linear equation to get the full solutions.

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Problem 2: What are the solutions of the system $y = -x^2 + 4x - 1$ and $y = -x + 2$?

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Problem 2: What are the solutions of the system $y = -x^2 + 4x - 1$ and $y = -x + 3$?

First put the value of y from the linear equation into the quadratic equation:

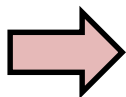
$$-x + 3 = -x^2 + 4x - 1$$

$$-x^2 + 4x - 1 + x - 3 = 0$$

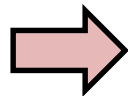
$$-x^2 + 5x - 4 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

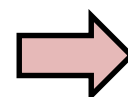
$$x = \frac{-5 \pm \sqrt{5^2 - 4(-1)(-4)}}{2(-1)}$$



$$x = \frac{-5 \pm 3}{-2}$$



$$x = \frac{-5 + 3}{-2} = 1$$

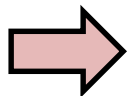


$$x = \frac{-5 - 3}{-2} = 4$$

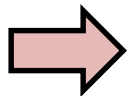
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Problem 2: What are the solutions of the system $y = -x^2 + 4x - 1$ and $y = -x + 3$?

Now put each value of x in the linear equation:

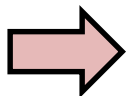


$$y = -1 + 3 = 2$$

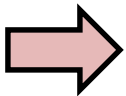


$$y = -4 + 3 = -1$$

So the solutions are:



$$(1, 2)$$



$$(4, -1)$$

