Name: ___________________________________ Date: __________________

Solving Linear – Quadratic Systems Algebraically
Algebra 1

In this lesson we will begin to work with solving linear-quadratic systems of equations. Recall that to solve a system we must find the set of *all* points (x, y) that satisfy all equations in the system. We will review this concept with an example from linear systems.

***Exercise* #1:** Consider the linear system shown to the right.

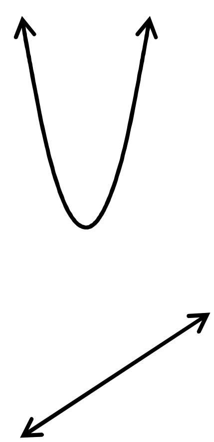
$$y = 2x + 5$$
$$x + 2y = 15$$

(a) Solve this system algebraically using the substitution method.

(b) Explain, in graphical terms, what the ordered pair from (a) represents.

The substitution method was used above because it is the only method that we can use to solve linear – quadratic systems algebraically. Solving such systems requires solving a quadratic equation. Since we are working with quadratics, it is natural to expect more than one answer. This has a graphical connection as *Exercise* #2 will illustrate.

***Exercise* #2:** Consider the sketch of a line and a parabola shown at the right.



(a) What is the maximum number of intersection points that a line and a parabola could have? Illustrate with a picture.

(b) What is the minimum number of intersection points that a line and a parabola could have? Illustrate with a picture.

(c) Is it possible for a line and a parabola to intersect in only one point? If so, illustrate with a picture.

Exercise #3: Solve each of the following systems of equations ***algebraically*** and check using **STORE** on your calculator. In each case the substitution method should be used to begin the process.

(a) $y = x^2 + 4x - 1$
$y = 7x + 9$

(b) $y = x^2 + 2x + 7$
$y = 6x + 3$

(c) $y = x^2 + 2x - 6$
$3x + y = -12$

(d) $y - 10x = 5$
$y = x^2 + 7x + 5$

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Solving Linear – Quadratic Systems Algebraically
Algebra 1 Homework

Skills

1. Which of the following is a solution to the system of equations shown to the right? $y = x^2 - 9$
$y = x + 3$

(1) $(4, 7)$ (3) $(3, 0)$

(2) $(-4, -1)$ (4) $(2, 5)$

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2. Mateo produced the following table on his calculator to find the solutions to a linear-quadratic system of equations. Based on this table, which of the following sets gives the *x*-values that solve this system?

(1) $\{-4, 2\}$ (3) $\{3, 6\}$

(2) $\{-4, 3\}$ (4) $\{-2, 1\}$

X	Y1	Y2
-4	1	11
-3	2	6
-2	3	3
-1	4	2
0	5	3
1	6	6
2	7	11

X= -4

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3. Which of the following is *not* a possible number of solutions to a linear-quadratic system?

(1) 1 (3) 3

(2) 2 (4) 0

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Solve each of the following linear – quadratic systems of equations ***algebraically*** and check using **STORE** on your calculator.

4. $y = x^2 + 5x - 2$
$y = x - 2$

5. $y = x^2 - 3x + 3$
$y - 3x = -6$

6. $y = x^2 + 2x - 8$
$4x - y = 5$

7. $2x - y = -10$
$y = x^2 - 2x - 2$

Applications

8. The price *C*, in dollars per share, of a high-tech stock has fluctuated over a twelve-year period according to the equation $C = 14 + 12x - x^2$, where *x* is in years. The price *C*, in dollars per share, of a second high-tech stock has shown a steady increase during the same time period according to the relationship $C = 2x + 30$.

(a) For what values are the two stock prices the same? (Only an ***algebraic*** solution will be accepted.)

(b) Determine the values of *x* for which the quadratic stock price is greater than the linear stock price. State your answer as an inequality. (Hint: You should be able to answer this almost immediately based upon your analysis in part (a) above.)

Reasoning

9. Which value below for *b* would result in the linear-quadratic system $y = x^2 + 3x + 1$ and $y = -x - b$ having only one intersection point? Justify your answer algebraically, graphically or with a table.

(1) 1 (2) 2 (3) 3 (4) 4

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Solving Linear – Quadratic Systems II
Algebra 1 Class work / Homework

Skills

1. Which of the following is a solution to the system of equations shown to the right? $y = x^2 + x$, $y = 5x + 5$

   (1) $(1, 0)$ (3) $(-1, 0)$

   (2) $(5, 1)$ (4) $(0, 5)$

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2. If the equations $y = x^2$ and $y = x$ were drawn on the same coordinate grid, how many times would they intersect?

   (1) 1 (3) 3

   (2) 2 (4) 0

   ____

3. Nadia created the following table on her graphing calculator to solve a linear-quadratic system. Which of the following points is a solution to this system?

   (1) $(21, 3)$ (3) $(0, -9)$

   (2) $(-19, 21)$ (4) $(-2, -19)$

X	Y1	Y2
-3	-21	-27
-2	-19	-19
-1	-15	-11
0	-9	-3
1	-1	5
2	9	13
3	21	21

X=1

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For problems 4 through 7, solve each linear-quadratic system algebraically. Check your answers using **STORE** on your calculator.

4. $y = x^2 + 7x + 6$
   $y = -x - 10$

5. $y = 5 - x^2$
   $y = x - 15$

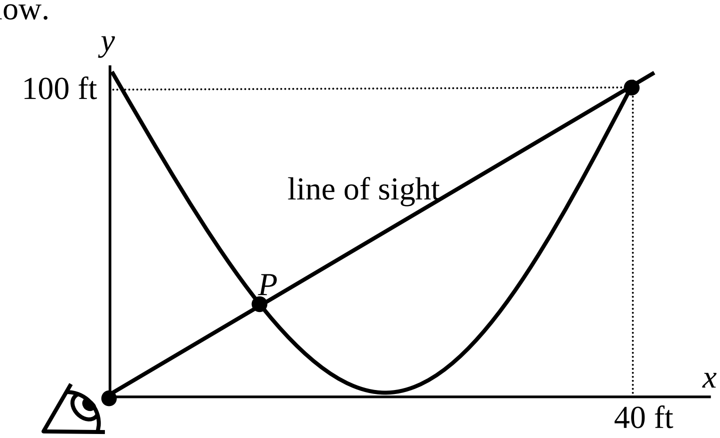
6. $y = 2x^2 + 6x$
$4x + y = -12$

7. $y = x^2 + 3x$
$x - y = -3$

Applications

8. A main support cable of a suspension bridge hangs in the shape of a parabola modeled by the equation $y = .25x^2 - 10x + 100$, where x represents the number of feet from its left-most support and where y represents the number of feet the cable is above the road deck for any given x value. A surveyor's line of sight is shown in the diagram below.

(a) Write an equation for the line of sight in $y = mx + b$ form. (Hint – The line of sight goes through the origin and $(40, 100)$.)



(b) Find the coordinates of the point where the line of sight first intersects the cable, point P, by solving the system of equations consisting of $y = .25x^2 - 10x + 100$ and your linear equation from part (a). (Hint - After you substitute, divide both sides of your resulting equation by 0.25 before you continue.)