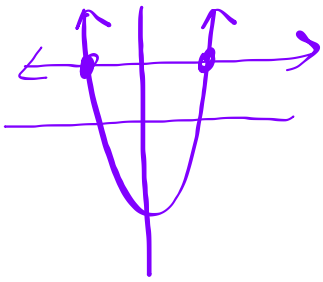
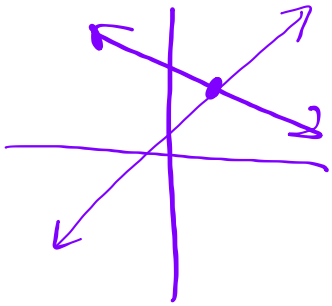
9.6: Solving Nonlinear Systems of Equations

Essential Question

How can you solve a system of two equations when one is linear and the other is quadratic?





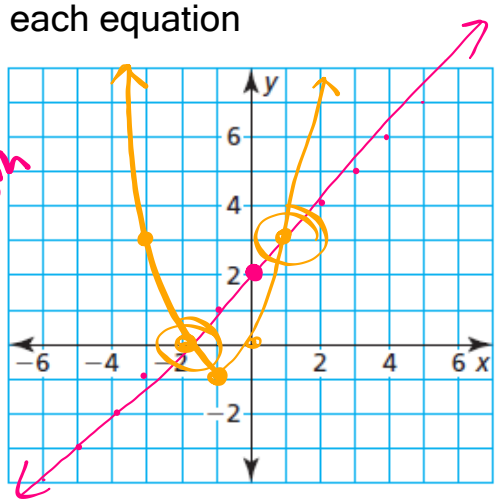
Essential Question

Solve the system of equations by graphing each equation and finding the points of intersection.

System of Equations

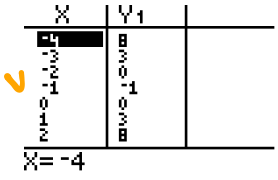
$y = \frac{1}{1}x + 2$ Linear $y = mx + b$ (move, begin)

$y = x^2 + 2x$ Quadratic



$(-2, 0) \& (1, 3)$

$V(\frac{3}{2}, y)$



Exploration 1

9.6 Solving Systems of Equations with work

Match each system of equations with its graph. Then solve the system of equations. Think about transformations from the parent function.

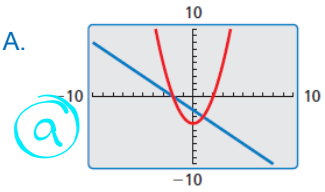
a. $y = x^2 - 4$ ↑↓4
$y = -x - 2$

b. $y = x^2 - 2x + 2$ y-int
$y = 2x - 2$

c. $y = x^2 + 1$ ↑1
$y = x - 1$

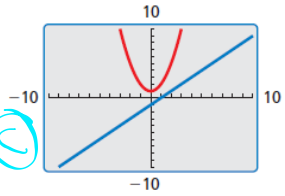
d. $y = x^2 - x - 6$ y-int
$y = 2x - 2$

A.



a

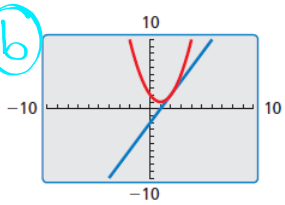
B.



c

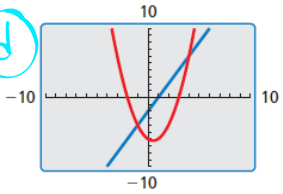
b

C.



d

D.



Exploration 2

Example:

Solve the system by graphing. Two equations on the same graph should always be labeled.

$y = x^2 - 6x + 5$ Equation 1

$y = x - 1$ Equation 2

m = 1
b = −1

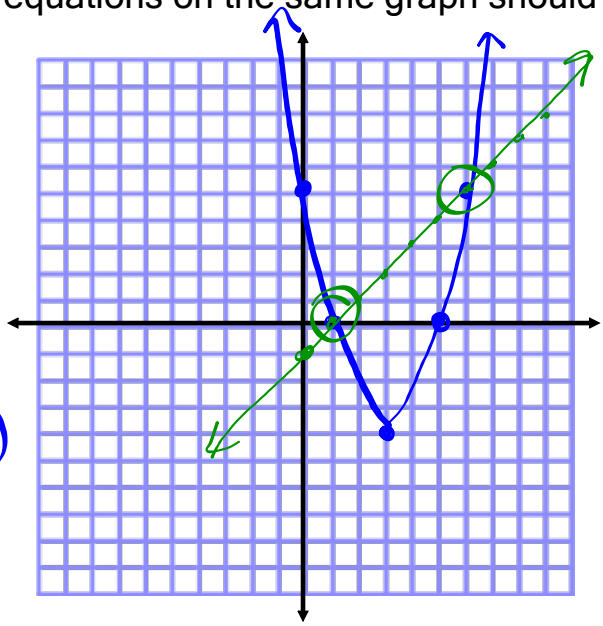
$(x-5)(x-1)$

$x = 1, 5$

$y = (3)^2 - 6(3) + 5$ (3, −4)

$= 9 - 18 + 5 = -4$

(1, 0) & (6, 5)



Example 1

Example:

Solve the system by substitution.

$y = x^2 + 4x$ Equation 1

$y = -4$ Equation 2

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

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

$\sqrt{0} = \sqrt{(x+2)^2}$

$\pm 0 = x + 2$

$-2 \quad -2$

$-2 = x$

$(-2, -4)$

$y = (-2)^2 + 4(-2)$

$= 4 - 8$

$= -4$

Example 2

Example:

Solve the system by elimination.

$y = x^2 + 2x - 5$ Equation 1

$(y = 2x - 1) \cdot -1$ Equation 2

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

$-y = 0x^2 - 2x + 1$

$0 = x^2 - 4$

$+4 \quad +4$

$\sqrt{4} = \sqrt{x^2}$

$x = \pm 2$

$(2, 3)$ & $(-2, -5)$

$y = 2(2) - 1$

$= 4 - 1$

$= 3$

$y = 2(-2) - 1$

$= -4 - 1$

$= -5$

Example 3

YOUR TURN:

Solve the system by substitution.

4. $y = x^2 + 9$

$y = 9$

$9 = x^2 + 9$

$0 = x^2$

$0 = x$

$(0, 9)$

5. $y = -5x$

$y = x^2 - 3x - 3$

$-5x = x^2 - 3x - 3$

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

$(x + 3)(x - 1)$

$x = -3, 1$

$-5(-3) = 15$

$-5(1) = -5$

$(-3, 15)$ & $(1, -5)$

6. $y = -3x^2 + 2x + 1$

$y = 5 - 3x$

$5 - 3x = -3x^2 + 2x + 1$

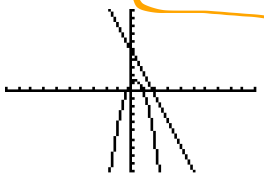
$0 = -3x^2 + 5x - 4$

$a = -3 \quad b = 5 \quad c = -4$

$x = \frac{-(5) \pm \sqrt{(5)^2 - 4(-3)(-4)}}{2(-3)}$

$= \frac{-5 \pm \sqrt{-23}}{2(-3)}$

no solution



Monitoring Progress 4-9

YOUR TURN:

Solve the system by elimination.

7. $y = x^2 + x$

$y = x + 5$

$y = x^2 + x$

$-y = -x - 5$

$0 = x^2 - 5$

$5 = x^2$

$\pm\sqrt{5} = x$

$(\pm\sqrt{5}, 5 \pm \sqrt{5})$

$y = 5\left(\frac{1}{3}\right) + 4$

$= \frac{5}{3} + \frac{12}{3}$

$y = 5\left(-\frac{3}{3}\right) + 4$

$= -\frac{10}{3} + 4$

$= -\frac{10}{3} + \frac{12}{3}$

8. $y = 9x^2 + 8x - 6$

$-y = -5x + 4$

$0 = 9x^2 + 3x - 2$

$a = 9 \quad b = 3 \quad c = -2$

$x = \frac{-3 \pm \sqrt{(3)^2 - 4(9)(-2)}}{2(9)}$

$x = \frac{-3 \pm \sqrt{81}}{18}$

$x = \frac{-3 \pm 9}{18}$ $\nearrow \frac{-3+9}{18} = \frac{1}{3}$ $\searrow \frac{-3-9}{18} = -\frac{2}{3}$

$\left(\frac{1}{3}, \frac{11}{3}\right)$ & $\left(-\frac{2}{3}, \frac{2}{3}\right)$

9. $y = 2x + 5$

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

$-y = -2x - 5$

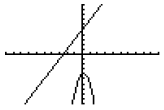
$0 = -3x^2 - x - 9$

$a = -3 \quad b = -1 \quad c = -9$

$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(-3)(-9)}}{2(-3)}$

$= \frac{1 \pm \sqrt{-107}}{-6}$

no sol.

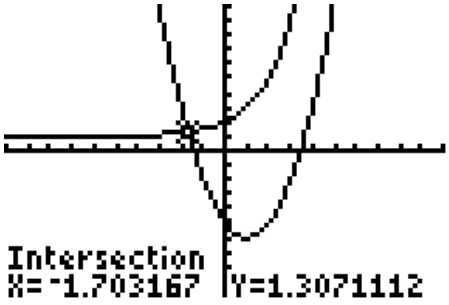


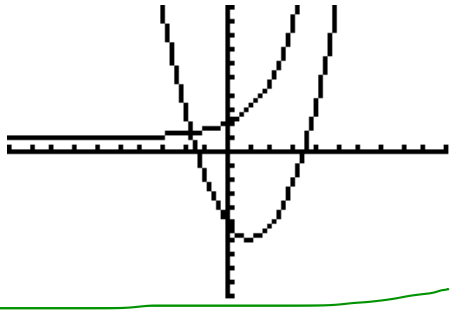
Example:

Approximate the solution(s) of the system to the nearest thousandth.

$y = x^2 - 2x - 5$ Equation 1

$y = 2^x + 1$ Equation 2





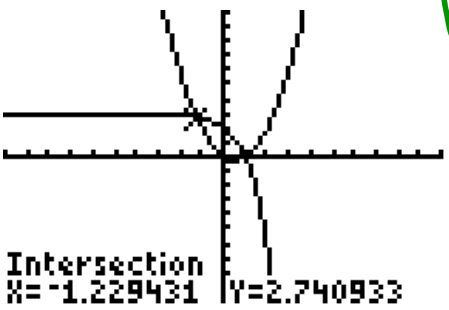
(-1.703, 1.307)

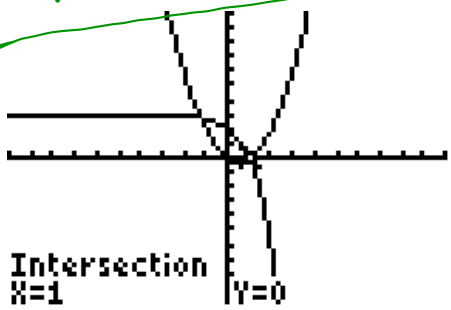
Example 4

Example:

Solve $-(3)^x + 3 = x^2 - x$.

y_1 y_2





(-1.229, 2.741)

and (1, 0)

Example 5

9.6 HW Assignment

DAY ONE: WS from the WB: Odds (9 problems)

DAY TWO: pg. 530 (13 problems)

6, 12, 18, 26, 28, 36, 38, 44, 46, 50, 54, 66, 70