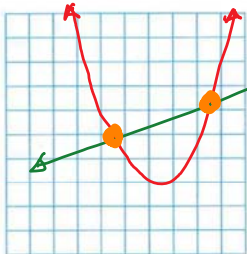


**EXPLORE & REASON**

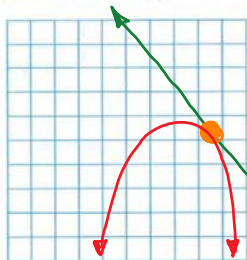
Draw a rough sketch of a parabola and a line on the coordinate plane.

A. Count the number of points of intersection between the two graphs.

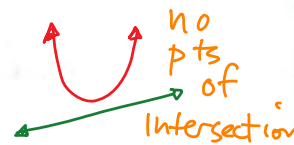


two pts. of intersection

B. Sketch another parabola on a coordinate plane. Use a straightedge to investigate the different ways that a line and a parabola intersect. What conjectures can you make?



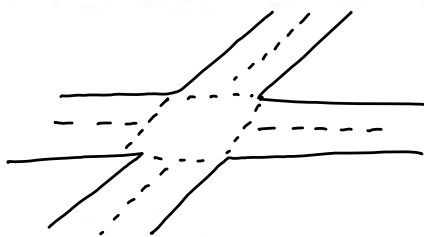
one pt. of intersection



no pts of intersection

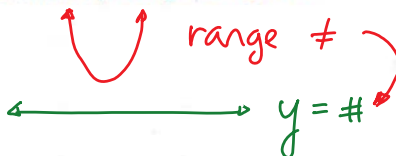
C. **Construct Arguments** How many different numbers of intersection points are possible between a quadratic function and a linear function? Justify that you have found all of the possibilities. © MP.3

3 ways: 2, 1, 0 intersections ...



**HABITS OF MIND**

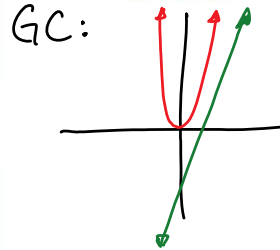
**Reason** What must be true about the equation for a horizontal line that has no points of intersection with the parabola with equation  $y = x^2$ ? © MP.2



**EXAMPLE 1** Try It! Determine the Number of Solutions

1. Determine the number of real solutions of the

$$\text{system } \begin{cases} y = 3x^2 \\ y = 3x - 2 \end{cases}$$



no real solutions

**EXAMPLE 2** Try It! Solve a Linear-Quadratic System Using Substitution

2. Solve each system by substitution.

GC? 1. Solve y...  
 $2x - 16 = y$

a.  $\begin{cases} y = 2x^2 - 6x - 8 \\ 2x - y = 16 \end{cases}$

$y = 2(2)^2 - 6(2) - 8$   
 $y = 8 - 12 - 8$   
 $y = -12$

$2x - (2x^2 - 6x - 8) = 16$   
 $2x - 2x^2 + 6x + 8 = 16$   
 $-2x^2 + 8x + 8 = 16$   
 $-2x^2 + 8x - 8 = 0$   
 $x^2 - 4x + 4 = 0$   
 $(x - 2)(x - 2) = 0$   
 $x = 2$  (double root)

b.  $\begin{cases} y = -3x^2 + x + 4 \\ 4x - y = 8 \end{cases}$

GC: 6 SLV → 1 SCT → ①

$4x - 2 = y$   
 $\rightarrow (-2, -10) \text{ \& } (1, 2)$

**EXAMPLE 3** Try It! Applying a Linear-Quadratic System

3. Revenue for the high school band concert is given by the function  $y = -30x^2 + 250x$ , where  $x$  is the ticket price, in dollars. The cost of the concert is given by the function  $y = 490 - 30x$ . At what ticket price will the band make enough revenue to cover their costs?

GC:  
 ZOOM  
 AUTO →  $(2.33, 420)$  \&  $(7, 280)$

**HABITS OF MIND**

**Make Sense and Persevere** Why does the substitution method work? How does it change the problem and make it possible for you to solve? © MP.1



**EXAMPLE 4** **Try It!** Solve a Linear-Quadratic System of Inequalities

4. Solve the system of inequalities using shading.

GC: isolate  $y$

$$\begin{cases} y > x^2 + 6x - 12 \\ 3x - y \geq -8 \end{cases}$$

Boundary:  
 $<, >$  dashed  
 $\leq, \geq$  solid

Shading:  
 $<, \leq$  below  
 $>, \geq$  above

$y \leq 3x + 8$

**EXAMPLE 5** **Try It!** Using a System to Solve an Equation

5. Solve the equation  $3x^2 - 7x + 4 = 9 - 2x$  by writing a linear-quadratic system and solving using the intersection feature of a graphing calculator.

GC: GSLV

$\rightarrow (-0.70, 10.41) \text{ \& } (2.37, 4.26)$

**HABITS OF MIND**

**Look for Relationships** How could you solve the inequality  $3x + 8 > x^2 + 6x - 2$  graphically? **MP.7**

greater than  
line parabola

$> ?$   
 $\rightarrow -5 < x < 2$

### Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How can you solve a system of two equations or inequalities in which one is linear and one is quadratic?

2. **Error Analysis** Dyani was asked to use substitution to solve this system:  

$$\begin{cases} y = 2x^2 - 6x + 4 \\ x - y = 7 \end{cases}$$
 She began as follows, to find the x-coordinate(s) to the solution(s) of the system:

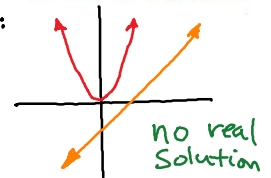
$x + 2x^2 - 6x + 4 = 7$	Substitute for y.
$2x^2 - 5x - 3 = 0$	Simplify.
$(2x + 1)(x - 3) = 0$	Factor.
$x = -\frac{1}{2}, x = 3$	Set each factor equal to 0, solve for x.

But Dyani has already made an error. What was her mistake? © MP.3

### Do You KNOW HOW?

Determine the number of solutions for the system of equations.

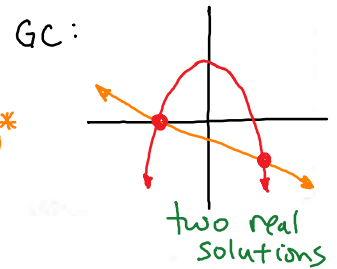
3. 
$$\begin{cases} y = \frac{2}{3}x^2 * \\ y = x - 2 * \end{cases}$$
 GC:



4. 
$$\begin{cases} y = -x - 1 * \\ 3x^2 + 2y = 4 \end{cases}$$
  

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

$$y = \frac{-3x^2 + 4}{2} *$$



Use substitution to solve the system of equations.

5. 
$$\begin{cases} y = 3x^2 + 7x - 10 \\ -19x = 22 \end{cases}$$

$$\begin{aligned} (3x^2 + 7x - 10) - 19x &= 22 \\ 3x^2 - 12x - 10 &= 22 \\ \underline{-22 \quad -22} & \\ 3x^2 - 12x - 32 &= 0 \end{aligned}$$

UGH...

GC:  
 $X = 5.8297$   
 $\& -1.8297$   
 Hmm....

6. 
$$\begin{cases} y = 3x^2 \\ -3x = -2 \end{cases}$$

$$\begin{aligned} (3x^2) - 3x &= -2 \\ 3x^2 - 3x + 2 &= 0 \\ (3x \dots) & \end{aligned}$$

Hmm....

$$\begin{aligned} X &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-3) \pm \sqrt{(-3)^2 - 4(3)(2)}}{2(3)} \\ &= \frac{3 \pm \sqrt{9 - 24}}{6} = \frac{3 \pm \sqrt{-15}}{6} \\ &= \frac{3 \pm i\sqrt{15}}{6} \end{aligned}$$

no real roots  
2 imag roots