Unit 8 Systems of Equations

8.1 Solving Systems of Equations by Graphing

A system of equations is a group of two or more equations.

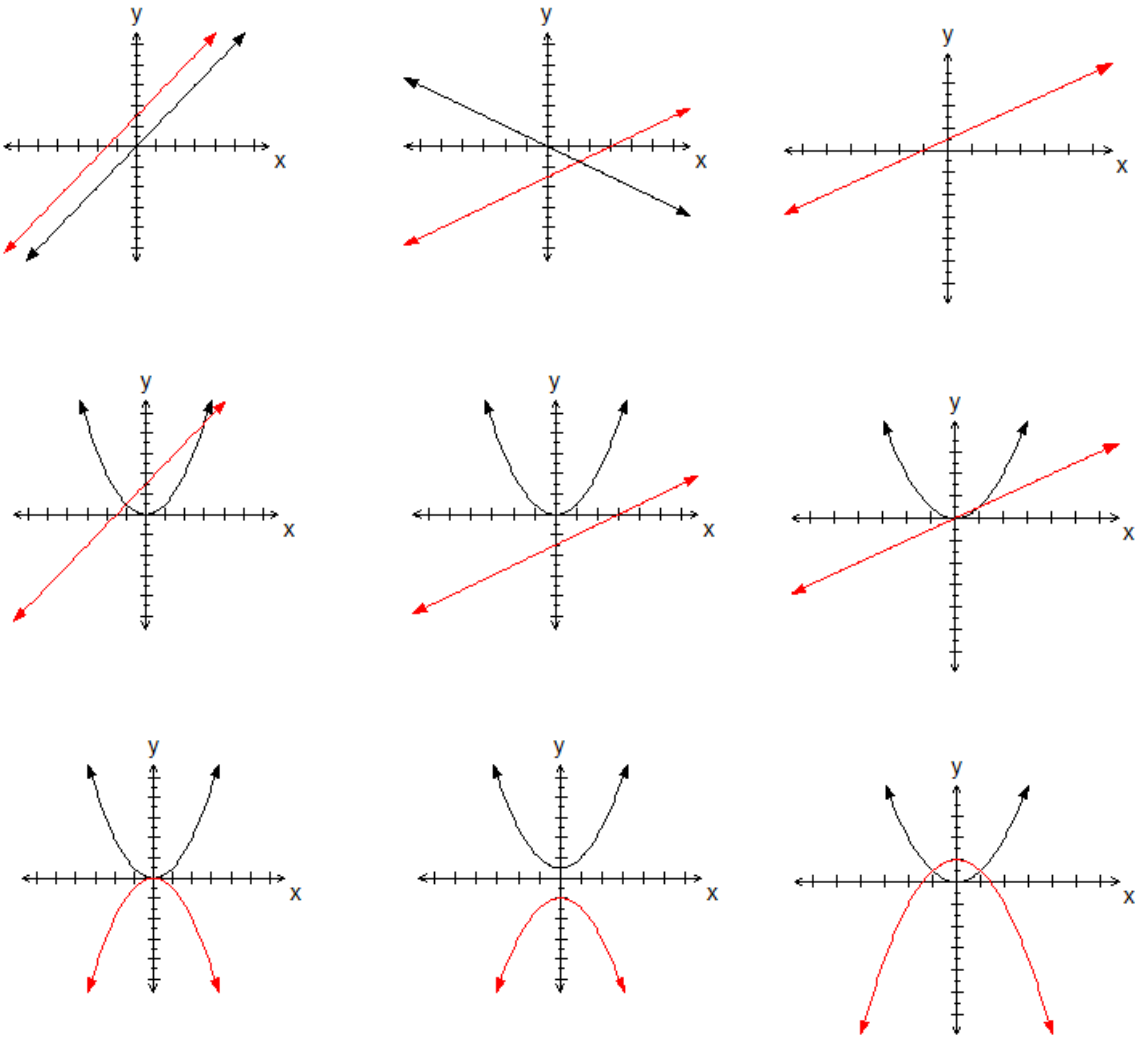
Solving a system is finding all the *x* and *y* values that satisfy all equations in the system. This is graphically interpreted as the **point(s) of intersection.**

In Grade 10,you studied systems of linear equations in which each equation in the system was a linear equation.

This year, we will study linear-quadratic and quadratic-quadratic systems.

$$\begin{cases} x+y=5 \\ y=3x-2 \end{cases} \qquad \begin{cases} y=x^2+5x+6 \\ y=2x-3 \end{cases} \qquad \begin{cases} y=(x-2)^2+1 \\ y=2(x-2)(x+5) \end{cases}$$

How systems look graphically:



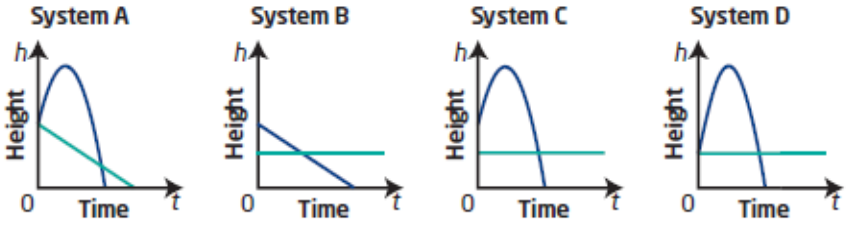
Example 1

Relate a System of Equations to a Context

Blythe Hartley, of Edmonton, Alberta, is one of Canada's best springboard divers. She is doing training dives from a 3-m springboard. Her coach uses video analysis to plot her height above the water.

a) Which system could represent the scenario? Explain your choice and why the other graphs do not model this situation.

b) Interpret the point(s) of intersection in the system you chose.



b) The points of intersection in System D represent the two times when Blythe's height above the water is equal to the height of the diving board.

Example 1: Your Turn

Two divers start their dives at the same time. One diver jumps from a 1-m springboard and the other jumps from a 3-m springboard. Their heights above the water are plotted over time.

a) Which system could model this scenario? Explain your choice. Tell why the other graphs could not model this situation. Pg 427

b) Explain why there is no point of intersection in the graph you chose.

Example 2

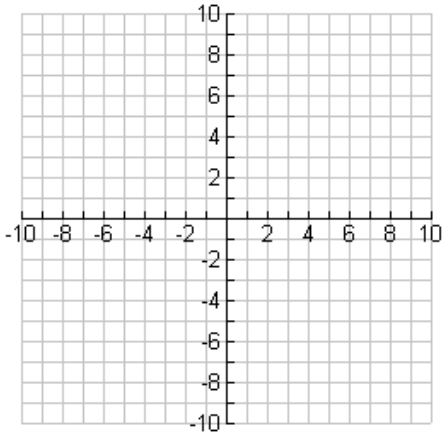
Solve a System of Linear-Quadratic Equations Graphically

a) Solve the following system of equations graphically:

$4x - y + 3 = 0$

$2x^2 + 8x - y + 3 = 0$

b) Verify your solution.

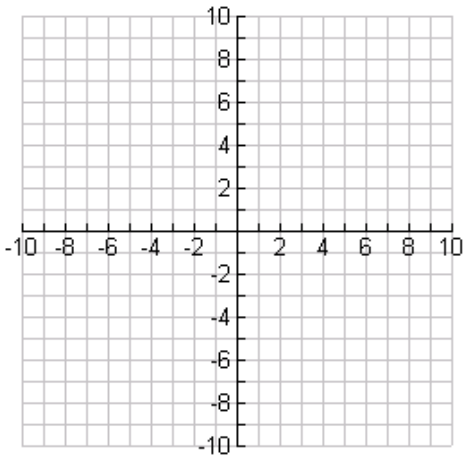


Example 3

Solve the system graphically and verify your solution.

$x - y + 1 = 0$

$x^2 - 6x + y + 3 = 0$



Example 4

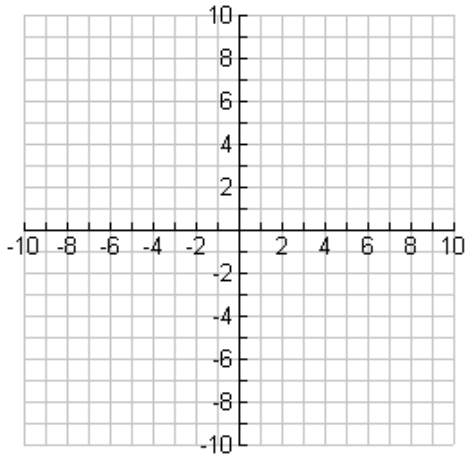
Solve a System of Quadratic-Quadratic Equations Graphically

a) Solve:

$2x^2 - 16x - y = -35$

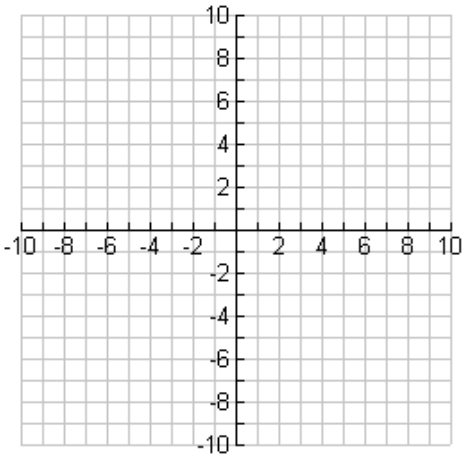
$2x^2 - 8x - y = -11$

b) Verify your solution.

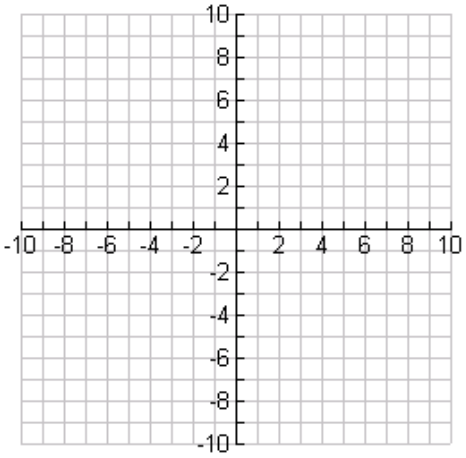


Example 5

Solve the system graphically and verify your solution.
$2x^2 + 16x + y = -26$
$x^2 + 8x - y = -19$



Example 6 Solve by graphing. Verify your solution. $\begin{cases} x^2 - 4 = y \\ x^2 + y = 9 \end{cases}$



Example 7

Engineers us vertical curves to improve the comfort and safety of roadways. Vertical curves are parabolic in shape and are used for transitions from one straight grade to another. Each grade line is tangent to the curve.

There are several vertical curves on the Trans Canada Highway through the Rocky Mountains. To construct a vertical curve, surveyors lay out a grid system and mark the location for the beginning of the curve and the end of the curve.

Suppose surveyors model the first grade line for a section of road with the linear equation $y = -0.06x + 2.6$, the second grade line with the linear equation $y = 0.09x + 2.35$ and the parabolic curve with the quadratic equation $y = 0.0045x^2 + 2.8$.

a) Write the two equations that would be used to determine the coordinates of the point of tangency.

b) Using graphing technology, show the surveyor's layout of the vertical curve.

c) Determine the coordinates of the points of tangency graphically, to the nearest hundredth.

d) interpret each point of tangency.

Key Ideas p. 434

Assign p. 435-439 #1, 2, 3, 4(ad), 5(b), 6, 7, 8