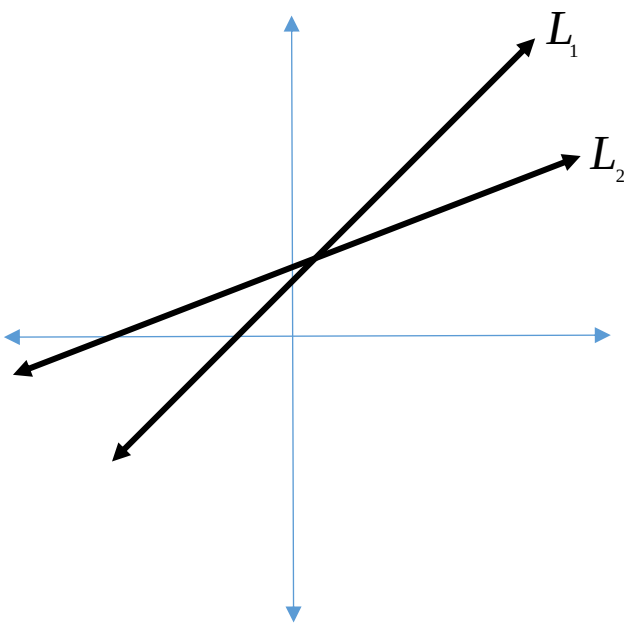
Non-linear Systems of Equations:

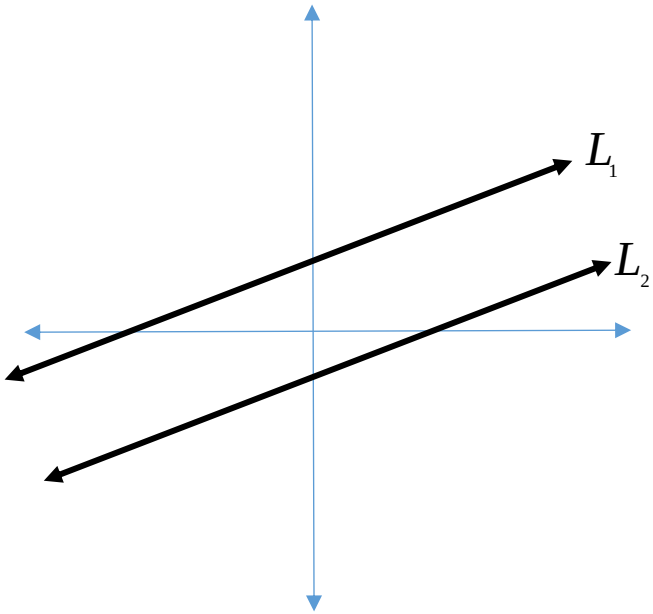
Let's start with a review of linear systems of equations:

$$E_1$$
$$E_2$$

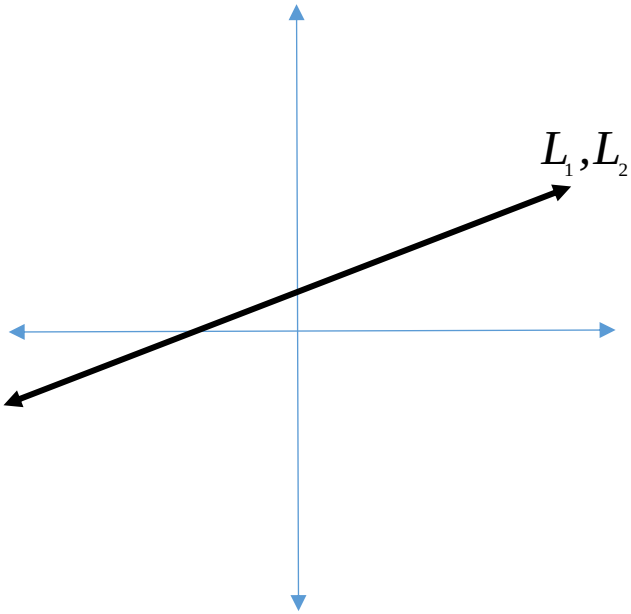
Possibilities:



1 solution



No solution

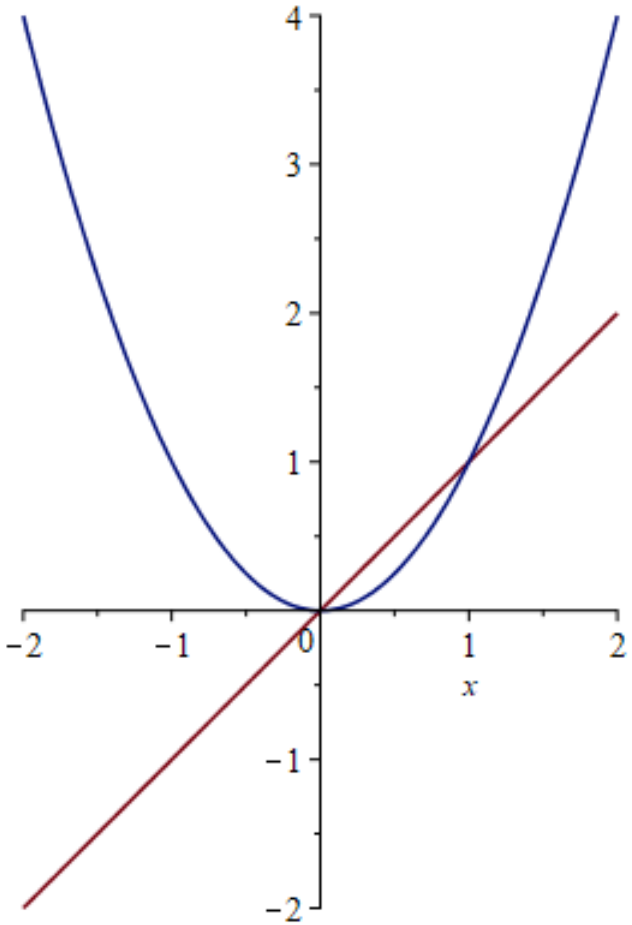


Infinitely many solutions

If at least one of the equations in the system is non-linear, then it's a non-linear system of equations. Unlike linear systems, anything can happen.

Examples:

1. $y = x$
$y = x^2$

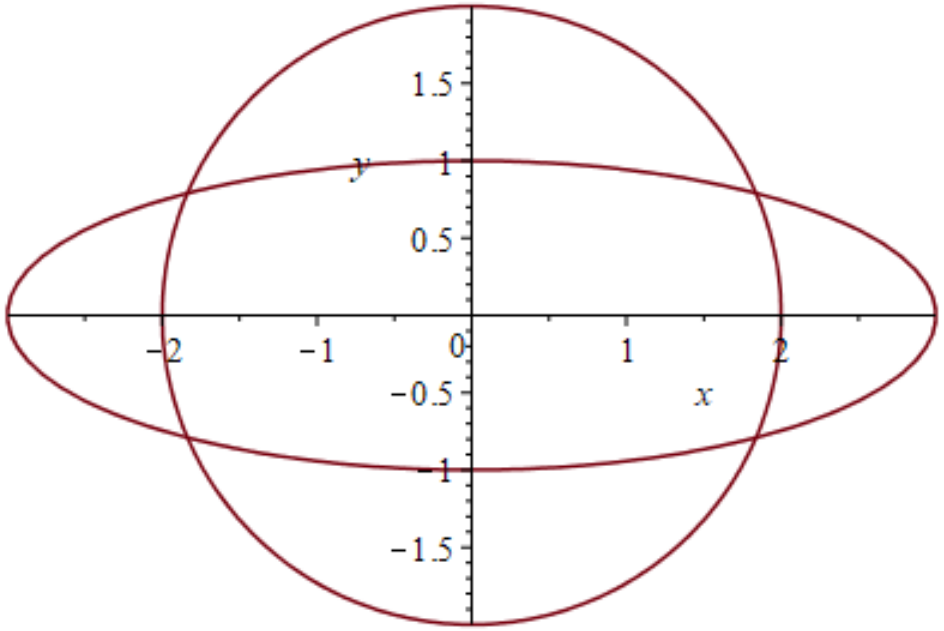


How many solutions?

Eyeball the solutions.

$x^2 + y^2 = 4$

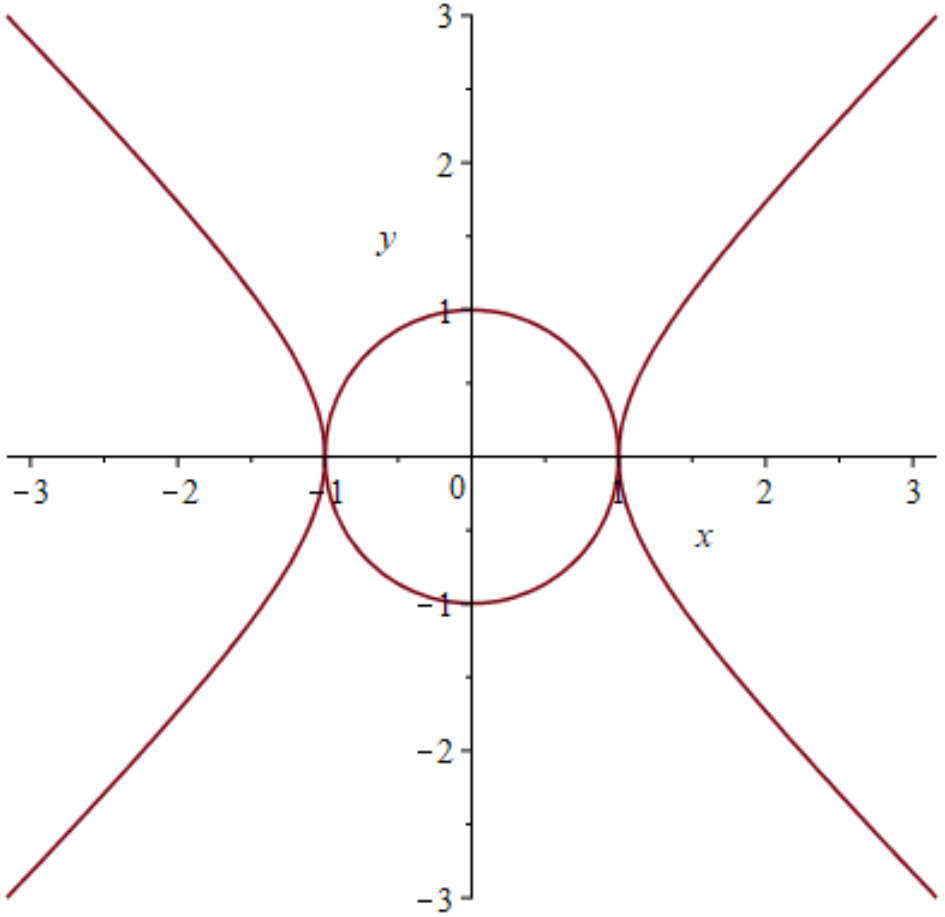
2. $\frac{x^2}{9} + y^2 = 1$



How many solutions?

Use elimination to find the solutions.

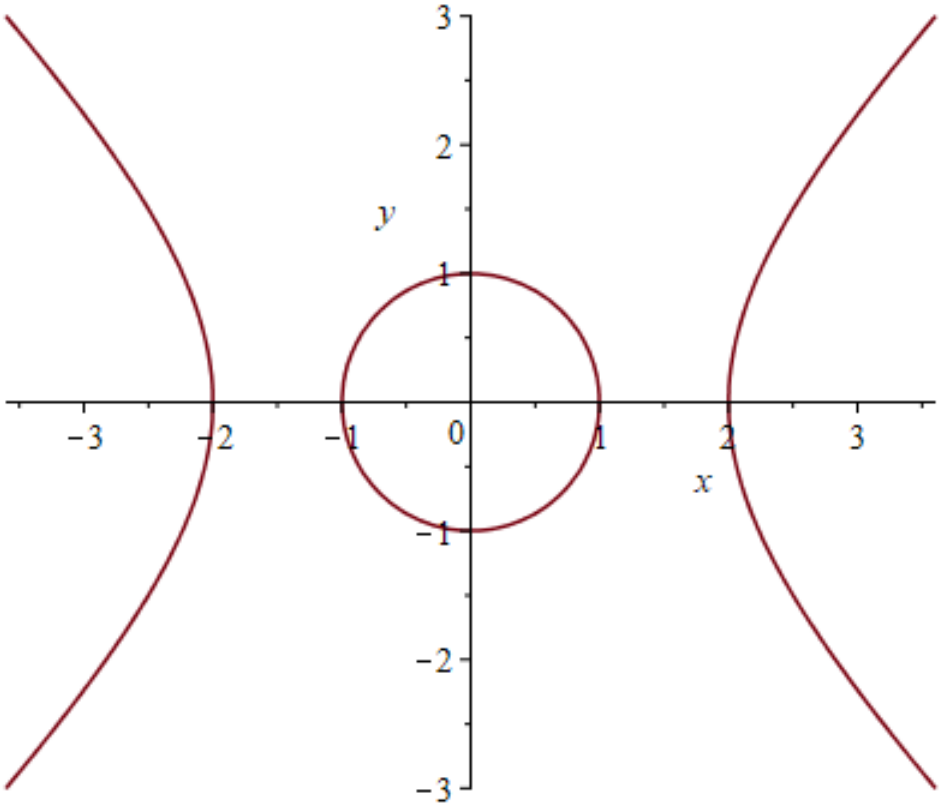
3. $x^2 - y^2 = 1$
$x^2 + y^2 = 1$



How many solutions?

Eyeball the solutions.

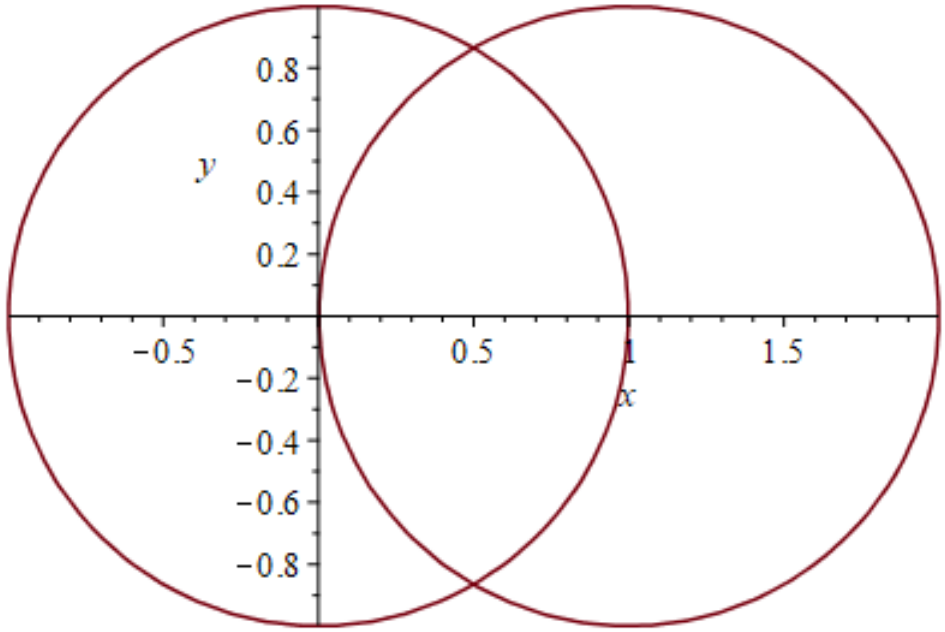
4.
$$x^2 - y^2 = 4$$
$$x^2 + y^2 = 1$$



How many solutions?

5.

$$x^2 + y^2 = 1$$
$$(x-1)^2 + y^2 = 1$$

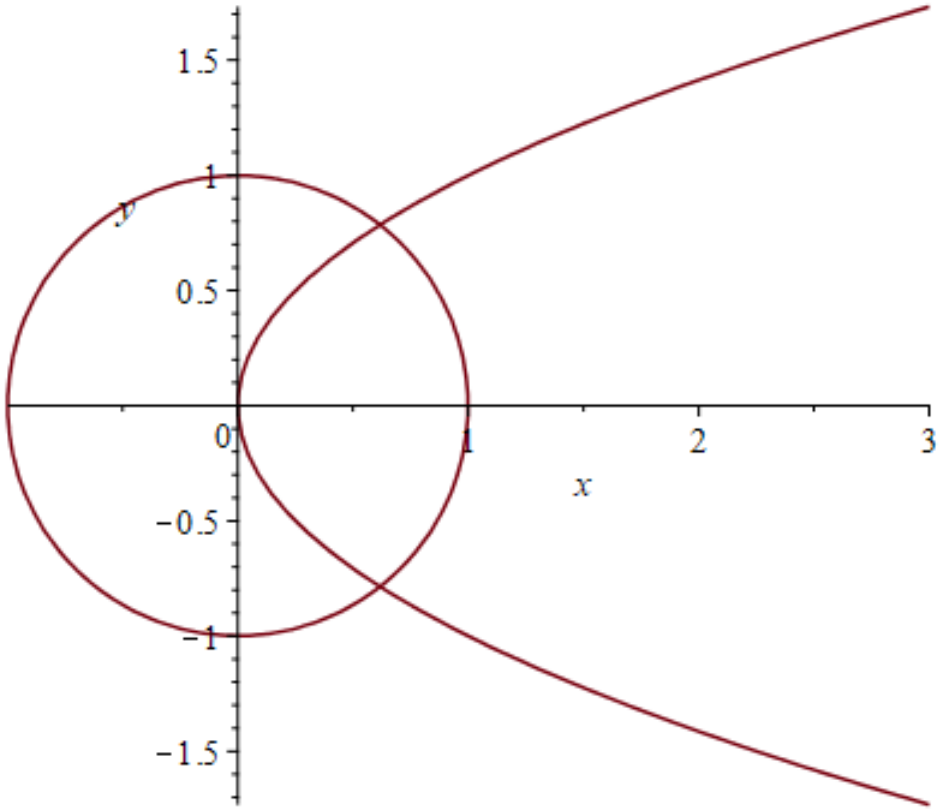


How many solutions?

Use elimination to find the solutions.

6. $y^2 = x$

$x^2 + y^2 = 1$



How many solutions?

Use substitution to find the solutions.