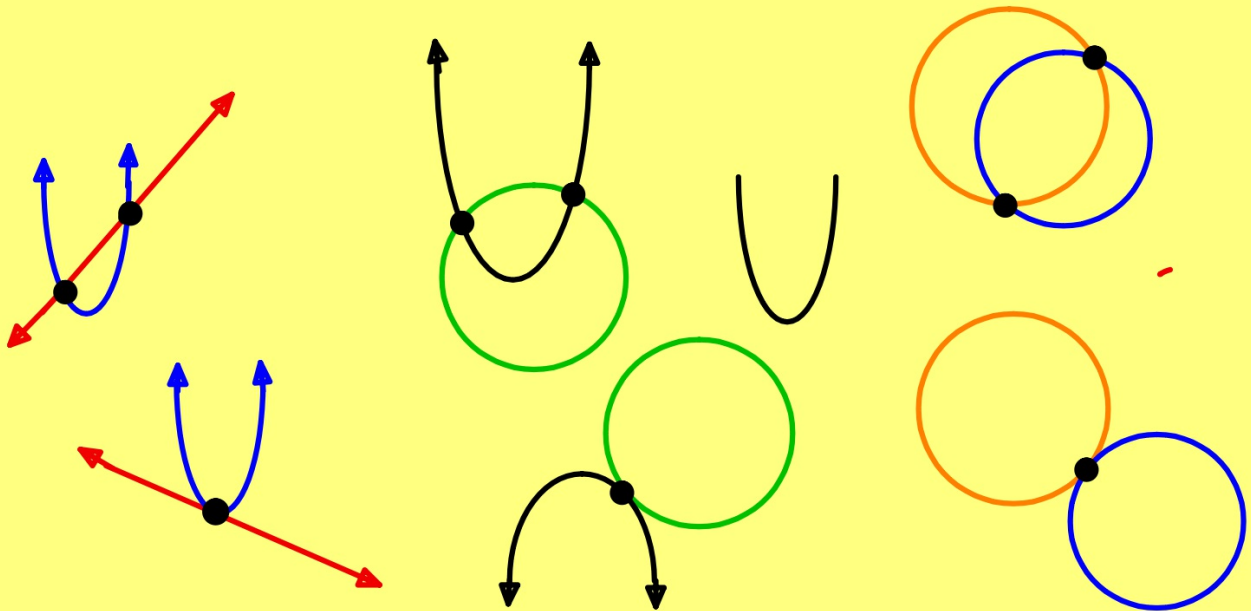


Sec 5.4.1

Solving Nonlinear Systems

...many more scenarios than with two linear equations



Solve the system (i.e., determine any points of intersection)

$$X - y = -1 \quad \rightarrow \quad X - (X^2 + 1) = -1$$

$$y = X^2 + 1 \quad X - X^2 - 1 = -1$$

$$0 = X^2 - X$$

$$0 = X(X - 1)$$

$$(0, 1)$$

$$X = 0 \text{ \& \ } 1$$

*substitution because \rightarrow one variable is already isolated

$$(1, 2)$$

$$y = 1 \text{ \& \ } 2$$

Solve the system-

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

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

$$x^2 + 4x + 5 = x^2 + 2x - 1$$

$$4x + 5 = 2x - 1$$

$$2x = -6$$

$$x = -3 \rightarrow 9 - 6 - 1$$

$$(-3, 2)$$

Solve the system-

$$xy = -12 \rightarrow x = \frac{-12}{y}$$

$$x - 2y + 14 = 0$$

$$y \left[\frac{-12}{y} - 2y + 14 = 0 \right] y$$

$$-12 - 2y^2 + 14y = 0$$

$$2y^2 - 14y + 12 = 0$$

$$2(y^2 - 7y + 6) = 0$$

$$2(y - 6)(y - 1) = 0$$

$$y = 6$$

$$y = 1$$

$$x = \frac{-12}{6} = -2$$

$(-2, 6)$

$$x = \frac{-12}{1} = -12$$

$(-12, 1)$

1. Isolate a variable.
 2. Substitute
 3. Solve
- *look ahead when deciding which variable to isolate...some options easier than others

Solve the system-

$$xy = 4$$

$$\rightarrow x = \frac{4}{y}$$

$$y = \pm 2$$

$$x^2 + y^2 = 8$$

$$\left(\frac{4}{y}\right)^2 + y^2 = 8$$

$$y = 2 \rightarrow x = \frac{4}{2} = 2$$

$$(2, 2)$$

$$\left[\frac{16}{y^2} + y^2 = 8\right] y^2$$

$$16 + y^4 = 8y^2$$

$$y^4 - 8y^2 + 16 = 0$$

$$y = -2$$
$$x = \frac{4}{-2} = -2$$

$$(-2, -2)$$

$$(y^2 - 4)(y^2 - 4) = 0$$

$$(y - 2)(y + 2)(y + 2)(y - 2) = 0$$

$$y = \pm 2$$

Solve the system-

$$2x + y = 4$$

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

$$(x+1)^2 + (-2x+4-2)^2 = 4$$

$$x^2 + 2x + 1 + 4x^2 - 8x + 4 = 4$$

$$5x^2 - 6x + 1 = 0$$

$$x^2 - 6x + 5$$

$$(x - \frac{5}{5})(x - \frac{1}{5}) = 0$$

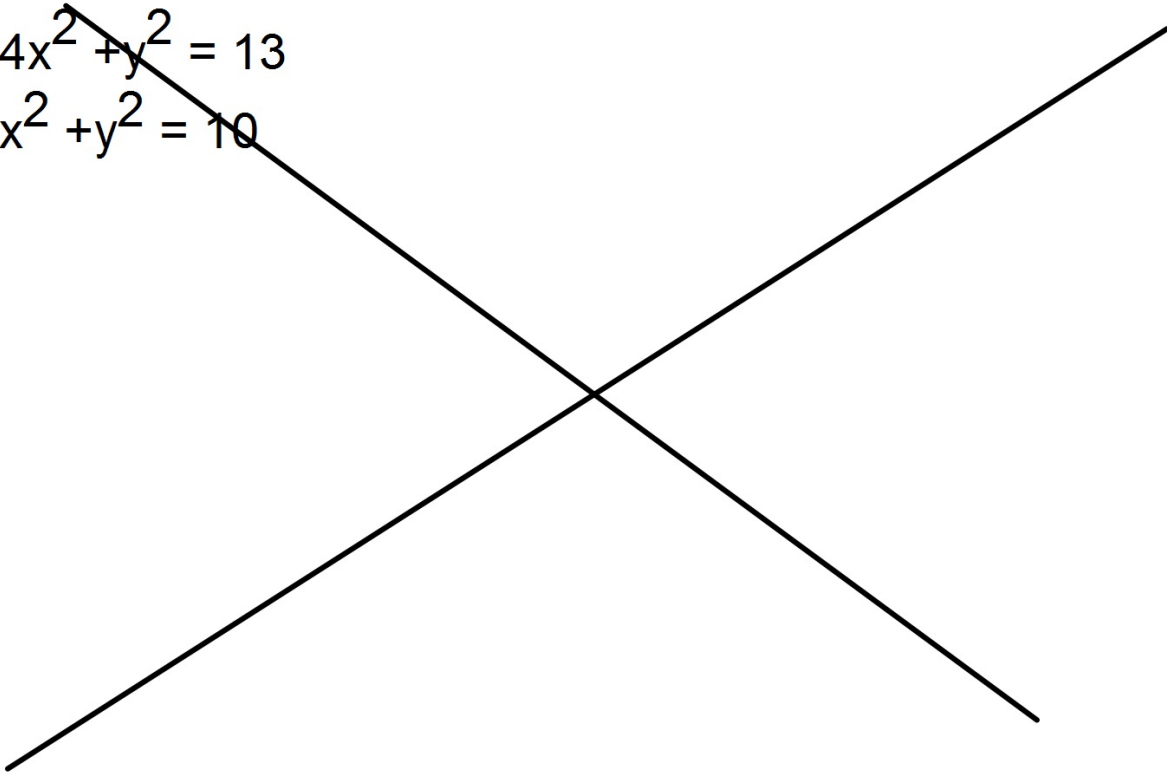
$$(x - 1)(5x - 1)$$

$$x = 1 \quad \& \quad \frac{1}{5}$$

$$(1, 2) \quad \& \quad (\frac{1}{5}, \frac{18}{5})$$

$$4x^2 + y^2 = 13$$

$$x^2 + y^2 = 10$$



Highly Suggested
Practice
Sec 5.4
page 559
1, 5, 9, 13, 17, 19

1. $\{(-3,5), (2,0)\}$

5. $\{(4,-10), (-3,11)\}$

9. $\{(-1.5,-4), (2,3)\}$

13. $\{(3,1), (-3,-1), (1,3), (-1,-3)\}$

17. $\{(0,1), (4,-3)\}$

19. $\{(3,2), (3,-2), (-3,2), (-3,-2)\}$

