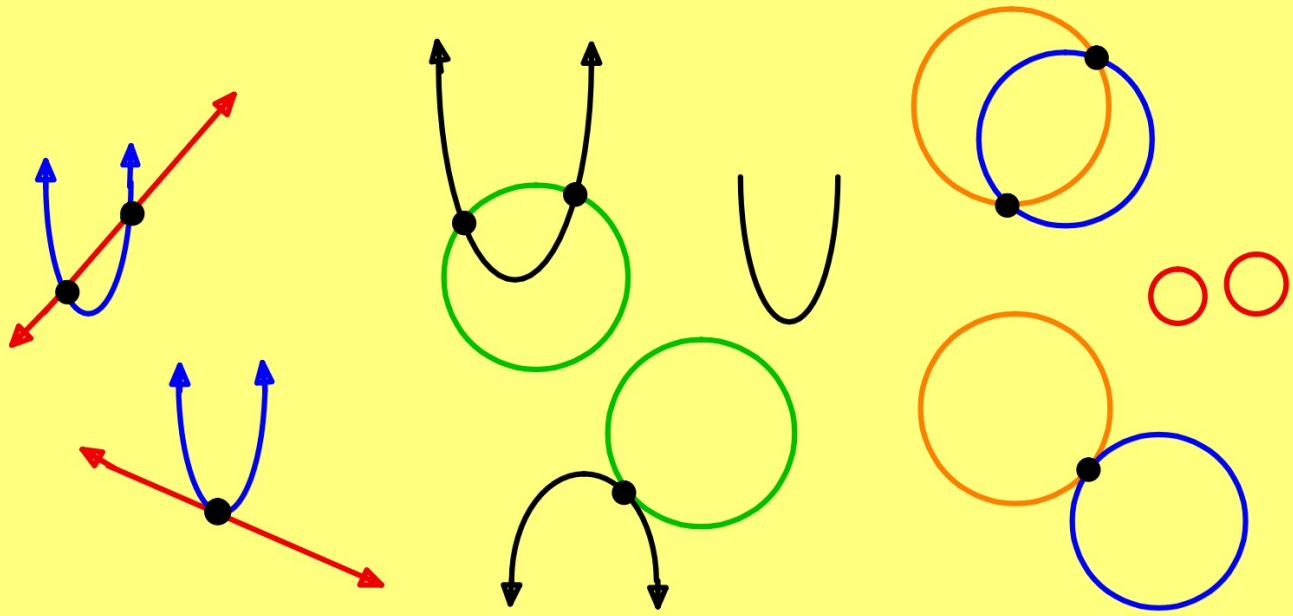
Sec 5.4

Solving Nonlinear Systems

...many more scenarios than with two linear equations



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

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

$y = x^2 + 1$

$x - x^2 - 1 = -1$

$0 = x^2 - x$

$0 = x(x-1)$

$x = 0 \text{ & } 1$

(0,1) and (1,2)

*substitution because ---> one variable is already isolated

$y = 1 \text{ & } 2$

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-

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

$x - 2y + 14 = 0$

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

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

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

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

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

$y = 6$ $\quad$ $y = 1$

$x = \frac{-12}{6} = -2$ $\quad$ $x = \frac{-12}{1} = -12$

$(-2, 6)$

$(-12, 1)$

1. Isolate a variable.
2. Substitute
3. Solve

*look ahead when deciding which variable to isolate...some options easier than others

Solve the system-

$$xy = 4 \rightarrow x = \frac{4}{y} = \frac{4}{2} = 2 \qquad (2,2)$$

$$= \frac{4}{-2} = -2 \qquad (-2,-2)$$

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

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

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

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

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

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

$$y = \pm 2$$

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

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

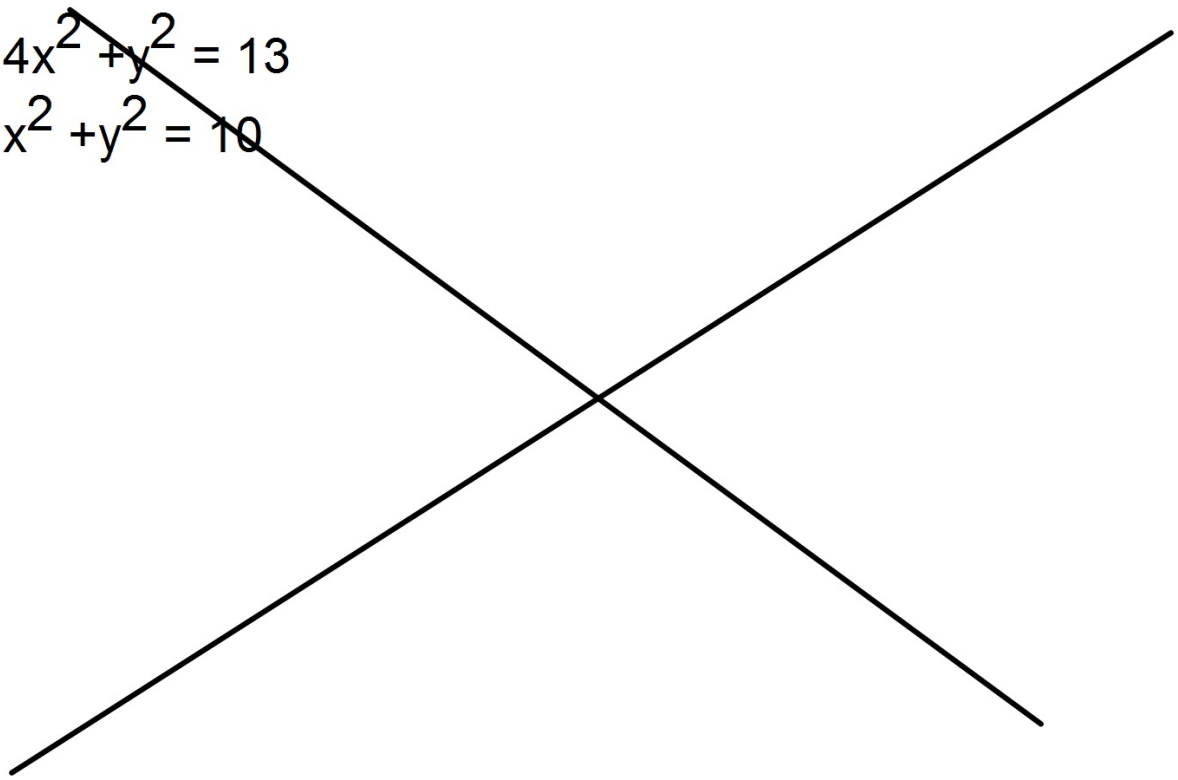
$(x-1)(5x-1)$

$x=1 \quad \& \quad 1/5$

$(1,2) \& (1/5, 18/5)$

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

$x^2 + y^2 = 10$



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)}