Day 08 Solving Non-Linear Systems Algebraically CW/HW Name Master 8

Solving a System Algebraically: For each problem, do the following.

1) Solve each equation for y.
2) Set the two equations equal to each other and solve for x.
3) Plug your x values into either one of the original equations to solve for the y values.
4) State your solutions as coordinate points.

1) $y = -2(x-2)^2 + 8$
$y = (x-2)^2 + 5$

$(3,6)$ $(1,6)$

$-2(x-2)^2+8 = (x-2)^2+5$
$-2(x^2-4x+4)+8 = (x^2-4x+4)+5$
$-2x^2+8x-8+8 = x^2-4x+9$
$-2x^2+8x = x^2-4x+9$
$+2x^2 \quad -8x \quad +2x^2 \quad -8x$
$0 = 3x^2-12x+9$
$0 = 3(x^2-4x+3)$
$0 = 3(x-3)(x-1)$
$x = 3, \; x = 1$

$x=3$: $y = (3-2)^2+5 = (1)^2+5 = 1+5 = 6$
$x=1$: $y = (1-2)^2+5 = (-1)^2+5 = 1+5 = 6$

2) $y = \frac{1}{2}x^2 + 4$
$y = 3x^2 - 6$

$\frac{1}{2}x^2+4 = 3x^2-6$
$-\frac{1}{2}x^2 \quad -\frac{1}{2}x^2$
$4 = \frac{5}{2}x^2 - 6$
$+6 \quad +6$
$\frac{2}{5}(10) = \left(\frac{5}{2}x^2\right)\frac{2}{5}$
$4 = x^2$
$x = \pm 2$

$3 = \frac{6}{2}$
$-\frac{1}{2}$

$x=2$: $y = 3(2)^2-6 = 3(4)-6 = 12-6 = 6$
$x=-2$: $y = 3(-2)^2-6 = 3(4)-6 = 6$

$(2,6)$ $(-2,6)$

3) $x + y = 6$ $\quad y = -x+6$
$y = -(x-4)^2 + 4$

$-x+6 = -(x-4)^2+4$
$-x+6 = -(x^2-8x+16)+4$
$-x+6 = -x^2+8x-16+4$
$-x+6 = -x^2+8x-12$
$+x^2-8x+12 = +x^2-8x+12$
$x^2-9x+18 = 0$
$(x-6)(x-3) = 0$
$x = 6, \; 3$

$x=6$: $6+y=6$ $\quad y=0$
$x=3$ $\quad 3+y=6$ $\quad y=3$

$(6,0)$ $(3,3)$

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

$x^2 = x+2$
$x^2-x-2=0$
$(x-2)(x+1)=0$
$x = 2, \; -1$

$x=2$: $y = 2+2 = 4$
$x=-1$ $\quad y = -1+2 = 1$

$(2,4)$ $(-1,1)$

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

$-x+1=-(x+1)^2+4$
$-x+1=-(x^2+2x+1)+4$
$-x+1=-x^2-2x-1+4$
$-x+1=-x^2-2x+3$
$+x^2+2x-3 \quad +x^2+2x-3$
$x^2+x-2=0$
$(x+2)(x-1)=0$
$x=-2, 1$

$x=-2 \quad -2+y=1 \quad y=3$
$x=1 \quad 1+y=1 \quad y=0$

$\boxed{(-2,3) \quad (1,0)}$

6) $y=-x^2-3$
$y=x^2-5$

$-x^2-3=x^2-5$
$+x^2 \quad +x^2$
$-3=2x^2-5$
$+5 \quad +5$
$2=2x^2$
$1=x^2$
$x=\pm 1$

$x=1 \quad y=(1)^2-5=1-5=-4$
$x=-1 \quad y=(-1)^2-5=1-5=-4$

$\boxed{(1,-4) \quad (-1,-4)}$

7) $y=x^2-4$
$y=3x$

$x^2-4=3x$
$x^2-3x-4=0$
$(x-4)(x+1)=0$
$x=4, -1$

$x=4 \quad y=3(4)=12$
$x=-1 \quad y=3(-1)=-3$

$\boxed{(4,12) \quad (-1,-3)}$

8) $y=(x-1)^2+3$
$2x+y=5$ $y=-2x+5$

$(x-1)^2+3=-2x+5$
$x^2-2x+1+3=-2x+5$
$x^2-2x+4=-2x+5$
$+2x-5 \quad +2x-5$
$x^2-1=0$
$x^2=1$
$x=\pm 1$

$x=1 \quad 2(1)+y=5$
$2+y=5 \quad y=3$

$x=-1 \quad 2(-1)+y=5$
$-2+y=5 \quad y=7$

$\boxed{(1,3) \quad (-1,7)}$