13.5 Systems of Non-Linear Equations

A system of two non-linear equations in two variables, also called a nonlinear system, contains at least one equation that cannot be expressed as $Ax + By = C$. We solve systems by using either elimination or _____.

Ex. 1
$$\begin{cases} x^2 = 2y + 10 \\ 3x - y = 9 \end{cases}$$

Ex. 2
$$\begin{cases} (x-2)^2 + (y+3)^2 = 4 \\ x - y = 3 \end{cases}$$

Ex 3. How many possible solutions could there be for the intersection of a parabola and a circle?

Ex 4. How many possible solutions could there be for the intersection of a parabola and a line?

Ex 5. How many possible solutions could there be for the intersection of two parabolas?

Ex 6. Solve the following system of equations: $\begin{cases} y = -x^2 - 2x + 14 \\ y = x^2 - 4x - 10 \end{cases}$

Ex 7. Solve the following system of equations:
$$\begin{cases} x^2 + y^2 = 4 \\ y^2 - x = 4 \end{cases}$$

Ex 8. Solve the following system of equations:
$$\begin{cases} x^2 + y = 4 \\ 2x + y = 1 \end{cases}$$

Ex 9. Solve the following system of equations: $\begin{cases} x^2 + (y-2)^2 = 4 \\ x^2 - 2y = 0 \end{cases}$

Systems of Non-Linear Equations   Name _____

                                         Date _____

Recall SOME of the Equations we have covered:

a) Equations of Lines   b) Equations of Parabolas   c) Equations of Circles

There are many other non-linear equations, such as an ellipse, hyperbola, sine, cosine, logistic, limacons, to name a few. For those of you continuing on in Mathematics there is so much to look forward to!

To be a SOLUTION TO A SYSTEM OF LINEAR EQUATIONS $\Leftrightarrow$ must work in BOTH !

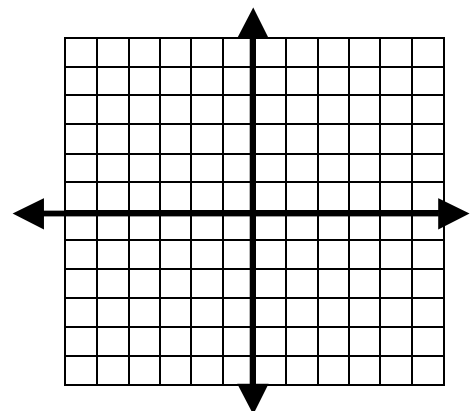**Ex 1.** Is $(-2, 3)$ a solution to the system ?   Yes   **Ex. 2.** Is $(-1, 7)$ a solution to the system? Yes
                                          or No ?   *or* No ?

$$\begin{cases} x + 2y = 4 \\ 2x + y = -1 \end{cases}$$

$$\begin{cases} 3x + 2y = 11 \\ x + 5y = 36 \end{cases}$$

PREREQUISITE KNOWLEDGE:

Revisiting: Ex 1.   Graph and find the solution to : $\begin{cases} x + 2y = 4 \\ 2x + y = -1 \end{cases}$

SOLVING A SYSTEM OF EQUATIONS

USING <u>ELIMINATION</u> AND <u>SUBSTITUTION</u>

SINCE GRAPHING A SYSTEM ONLY SHOWS LOCATION, CAN WE JUST SKIP THE GRAPHING AND USE ALGEBRA TO FIND THE POINT (if there is one) OF INTERSECTION?

☑ YES	THREE	1. You want EACH equation to be in **standard** form.
	EASY	2. You want to eliminate either the x **or** the y term or SUB
	STEPS	3. Solve and then find the point you need (substitute. . .AND CHECK)

Revisiting: Ex 1.
$$x + 2y = 4$$
$$2x + y = -1$$

A SOLUTION TO A SYSTEM OF NON-LINEAR EQUATIONS $\Leftrightarrow$ must work in BOTH !

Recall this problem from our last set of notes

⑦ Find the equation of the circle graphed below. Your answer should be in standard form.

⑧ Graph the parabola: $y = x^2$ on the graph in problem ⑦. At what two points do the graphs intersect?