MA 103 Solving Systems of Non-linear Equations
Section 10.4

Earlier in the semester, we studied how to solve systems of linear equations. We solved these systems

- **Graphically**, by graphing each equation and finding any point or points of intersection
- **Algebraically**, by using either the **Substitution Method** or the **Elimination Method**

Systems of non-linear equations can often be solved using the same methods.

1. Given the system of equations

$$x^2 + y = 5 + 9x$$
$$y = -2x + 23$$

(a) Solve this system **graphically**, using your calculator. Write the answer as an ordered pair.

(b) Solve this system **algebraically**.

2. Find all real solutions of each of the following systems of equations **algebraically**. Write answers as ordered pairs. Check each real solution by substituting it into each equation in the system or by solving the system graphically. If there are no real solutions, state this and confirm why this is the case by graphing the functions on your calculator.

(a)
$$y = 2x^2 - x - 5$$
$$y = x^2 + 7$$

(b)
$$4x = y - 9$$
$$y = 3x^2 + x + 3$$

(c)
$$y = 5 + 9x - x^2$$
$$y = x^2 + x + 15$$

(d)
$$y = \sqrt{3x + 1}$$
$$y = 3 - x$$

(e)

$$y = \frac{x}{x+6}$$

$$y = \frac{3}{x}$$

(f)

$$xy = -8$$

$$y = x - 6$$