

## § 3.5 - Non-linear Systems

A system of equations in which at least one equation is not linear is called nonlinear system.

we solve it by substitution.

Example 1: solve

$$x^2 - 3 - y = 0 \quad (1)$$

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

Solution:

In (1), we isolate  $y$  to get  $y = x^2 - 3 \quad (3)$

we substitute it in (2) to get

$$2x + y = 5$$

$$2x + x^2 - 3 = 5$$

$$x^2 + 2x - 8 = 0$$

$$x = 2 \quad \underline{\text{or}} \quad x = -4 \quad \text{--- by the formula (Section 0.8)}$$

$$y = 1 \quad \underline{\text{or}} \quad y = 13$$

Solution set =  $\{(2, 1), (-4, 13)\}$ .

Exercise 1° Solve

$$y = x^3$$

$$x - 4y = 0$$

Example 2° Solve

$$y = 2\sqrt{x+1} \quad - (1)$$

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

Solution ° we substitute (2) in (1) to get

$$y = 2\sqrt{y+7+1}$$

$$y = 2\sqrt{y+8}$$

$$y^2 = 4(y+8)$$

$$y^2 - 4y - 32 = 0$$

$$y = 8 \quad \text{or} \quad y = -4$$

$$x = 2\sqrt{8+8} \quad \underline{\text{or}}$$

$$= 2\sqrt{16}$$

$$x = 2\sqrt{-4+8}$$

$$x = 2\sqrt{4} \quad \text{"rejected!"}$$

Exercise 2° Solve

$$(1) \quad y = \frac{y}{x}$$

$$2y = 3x + 1$$

$$(2) \quad y = \sqrt{x+2}$$

$$x = y^2 - 2$$

Solution set =  $\left\{ \begin{matrix} (2\sqrt{5}, 2) \\ (2, 2) \end{matrix} \right\}$