$\mu = 0$

2.3

a)

$$\dot{x} = -4y - x^3$$
$$\dot{y} = 4x + 2y^3 \quad (1) \Rightarrow \omega = 4$$

$$\dot{x} = y - x^2$$
$$\dot{y} = -x + 2x^2 \quad (2) \Rightarrow \omega = -1$$

$$\dot{x} = -\omega y + f(x,y)$$
$$\dot{y} = \omega x + g(x,y)$$

b)

$\Rightarrow$ $f_{(1)} = -x^3$ $\quad$ $f_{(2)} = -x^2$

$g_{(1)} = 2y^3$ $\quad$ $g_{(2)} = 2x^2$

2.3c

System 1.

$f_{xxx} = \frac{\partial^3}{\partial x^3} - x^3 = -6$ $\quad g_{yyy} = 12$

$f_{xyy} = 0$ $\quad f_{xy} = 0$

$g_{xxy} = 0$ $\quad g_{xy} = 0$ $f_{yy} = 0$

$f_{xx} = -6x$ $\quad g_{xx} = 0$

$f_{yy} = 0$ $\quad g_{yy} = 12y$

$$\Rightarrow \quad a = \frac{-6 + 12}{16} = \frac{-6}{16} = \frac{3}{8}$$

System 2.

$f_{xxx} = 0$ $\quad g_{yyy} = 0$ $\quad f_{xyy} = 0$ $\quad g_{xxy} = 0$

$f_{xy} = 0$ $\quad f_{xx} = -2$ $\quad f_{yy} = 0$ $\quad g_{xy} = 0$ $\quad g_{xx} = 4$

$g_{yy} = 0$

$$\Rightarrow 16a = -1 - (-2 \cdot 4)$$

$$\Rightarrow \quad a = \frac{-8}{16} = \frac{-1}{2}$$