Use $V(x) = x_1^2 + x_2^2$ on

1.

$$\dot{x_1} = -x_2 - x_1 x_2$$
$$\dot{x_2} = x_1 + x_1^2$$

what is the conclusion? On what set does the flow lie?

2.

$$\dot{x_1} = -x_2 - x_1 x_2^2 - x_1^3$$
$$\dot{x_2} = x_1 - x_2 x_1^2 - x_2^3$$

What is the conclusion?

3.

$$\dot{x_1} = -x_2 + x_1 x_2^2 + x_1^3$$
$$\dot{x_2} = x_1 + x_2 x_1^2 + x_2^3$$

What is the conclusion?

4. What does the linearization say for all three cases?