Question 1

The nonlinear system of differential equations given below has an equilibrium point at $(0,0)$. Identify the system which represents a linear approximation of the nonlinear system around this point.

$$\frac{dx}{dt} = y + x^2$$

$$\frac{dy}{dt} = -2y + \sin x$$

A.
$$\frac{dx}{dt} = y + 2x$$
$$\frac{dy}{dt} = -2y$$

B.
$$\frac{dx}{dt} = y$$
$$\frac{dy}{dt} = -2y$$

C.
$$\frac{dx}{dt} = y + 2x$$
$$\frac{dy}{dt} = -2y + x$$

D.
$$\frac{dx}{dt} = y$$
$$\frac{dy}{dt} = -2y + x$$

Question 2

The nonlinear system given below has an equilibrium point at $(0,0)$. Classify this point.

(a) Sink (d) Spiral Sink

(b) Source (e) Spiral Source

(c) Saddle (f) Center

$$\frac{dx}{dt} = y + x^2$$

$$\frac{dy}{dt} = -2y + \sin x$$

Question 3

The nonlinear system given below has an equilibrium point at $(0,0)$. Classify this point.

(a) Sink

(d) Spiral Sink

(b) Source

(e) Spiral Source

(c) Saddle

(f) Center

$$\frac{dx}{dt} = x + 2xy$$

$$\frac{dy}{dt} = 2y + x^2$$

Question 4

The following nonlinear system is a Hamiltonian system.

A. TRUE
B. FALSE

$$\frac{dx}{dt} = x + 2xy$$

$$\frac{dy}{dt} = -2y + x^2$$

Question 5

The following nonlinear system is a gradient system.

A. TRUE   B. FALSE

$$\frac{dx}{dt} = x + 2xy$$

$$\frac{dy}{dt} = -2y + x^2$$