ANSWERS:

1. A

2. E

3. \((-1, 1)\)

4. (a) \(y = -4, 0, 2\); (b) \(y = 0\) is (asymptotically) stable; (c) \(\lim_{t \to \infty} y(t) = 0\).

5. (a) \(\frac{\partial M}{\partial y} = 1 = \frac{\partial N}{\partial x}\); (b) \(x^4 + xy + \frac{5y^2}{2} = 10\).

6. (a) \(y(t) = C_1 e^{2t} + C_2 e^{-t} + 3te^{-t}\); (b) \(y(t) = -\frac{2}{3} e^{2t} + \frac{2}{3}e^{-t} + 3te^{-t}\).

7. (a) \(\sin y + \frac{y^2}{2} = e^t + t + \sin 3 + \frac{7}{2}\); (b) \(y = \frac{3 \ln t + 2}{t}\) or \(y = \frac{\ln t^3 + 2}{t}\).

8. \(y(t) = C_1 e^{-t} \cos \sqrt{2}t + C_2 e^{-t} \sin \sqrt{2}t\).

9. (a) Substitute \(y_1\) and \(y_2\) into the equation to see that they would each satisfy it. (b) Yes. Because \(W(y_1, y_2)(t) = te^t - e^t \neq 0\). (c) \(y(t) = C_1 t + C_2 e^t\).

10. \(W(y_1, y_2)(t) = 4t^2\)

11. (a) \(Q' = 10 - \frac{1}{50} Q\), or \(Q' + \frac{1}{50} Q = 10\), \(Q(0) = 0\).