1. i. linear, order 2; ii. nonlinear, order 1; iii. linear, order 3; iv. nonlinear, order 2.
2. (a); 3. (c); 4. (c); 5. (d).
6. (a) equilibrium solutions: \(y = -2, 0, 2\); (b) \(y = -2\) asymptotically stable; \(y = 0\) unstable; \(y = 2\) asymptotically stable; (c) \(y(t) = 2\).
7. (a) \(Q(t) = -6e^{-t/200} + 6\); (b) it will never happen (or, when \(t\) approaches infinity).
8. (b) \(x \ln{y} + x^2y + \sin 2x = C\).
9. (a) yes; (b) yes: \(W(y_1, y_2) = -4t\), which is not equal to zero when \(t\) is not zero; (c) since \(y_1\) and \(y_2\) are two linearly independent solutions, the general solution is therefore \(y(t) = C_1 t^3 + C_2 t^{-1}\).
10. (a) \(y(t) = C_1 e^{-4t} + C_2 e^t\); (b) \(y(t) = C_1 e^{-4t} + C_2 e^t - 3 \cos 2t - 4 \sin 2t\).
11. \(y(t) = 3e^{-3t} + 8te^{-3t}\).