6. [12 points] For the following, identify each as true or false by circling "True" or "False" as appropriate. Then, if it is true, provide a short (one sentence) explanation indicating why it is true; if false, explain why or provide a counter-example.

a. [3 points] Let **A** be a 3×3 matrix with characteristic polynomial $p(\lambda) = \lambda^3 + 4\lambda^2 + \lambda - 6$. Then the origin is an asymptotically stable critical point of the system $\mathbf{x}' = \mathbf{A}\mathbf{x}$.

True   False

b. [3 points] Consider the equation $y' = f(t, y)$, with f continuous for all values of t and y. We can solve this either by using an integrating factor or by separating variables (though in the latter case we may not be able to get an explicit solution for y).

True   False

c. [3 points] While we cannot solve the nonlinear system $x' = x - x^2 - xy + \sin(t)$, $y' = y + xy$, we can obtain a good qualitative understanding of solutions by linearizing around critical points and sketching a phase portrait.

True   False

d. [3 points] Long-term solutions to the system $y'' + 4y = 3\cos(4t)$ will be periodic.

True   False