Investigate the stability of zero solution using the Lyapunov's theorem:

1. $\begin{cases} \dot{x} = 2xy - x + y \\ \dot{y} = 5x^4 + y^3 + 2x - 3y \end{cases}$

2. $\begin{cases} \dot{x} = x^2 + y^2 - 2x \\ \dot{y} = 3x^2 - x + 3y \end{cases}$

3. $\begin{cases} \dot{x} = e^{x+2y} - \cos(3x) \\ \dot{y} = \sqrt{4 + 8x} - 2e^y \end{cases}$

4. $\begin{cases} \dot{x} = \ln(4y + e^{-3x}) \\ \dot{y} = 2y - 1 + \sqrt[3]{1 - 6x} \end{cases}$

5. $\begin{cases} \dot{x} = \ln(3e^y - 2\cos x) \\ \dot{y} = 2e^x - \sqrt[3]{8 + 12y} \end{cases}$

6. $\begin{cases} \dot{x} = \operatorname{tg}(y - x) \\ \dot{y} = 2^y - 2\cos\left(\frac{\pi}{3} - x\right) \end{cases}$

7. $\begin{cases} \dot{x} = \operatorname{tg}(z - y) - 2x \\ \dot{y} = \sqrt{9 + 12x} - 3e^y \\ \dot{z} = -3y \end{cases}$

8. $\begin{cases} \dot{x} = e^x - e^{-3z} \\ \dot{y} = 4z - 3\sin(x + y) \\ \dot{z} = \ln(1 + z - 3z) \end{cases}$

Investigate, at which values of parameters (a, b) the zero solution is stable:

9. $\begin{cases} \dot{x} = ax - 2y + x^2 \\ \dot{y} = x + y + xy \end{cases}$

10. $\begin{cases} \dot{x} = ax + y + x^2 \\ \dot{y} = x + ay + y^2 \end{cases}$

11. $\begin{cases} \dot{x} = x + ay + y^2 \\ \dot{y} = bx - 3y - x^2 \end{cases}$

12. $\begin{cases} \dot{x} = y + \sin x \\ \dot{y} = ax + by \end{cases}$

13. $\begin{cases} \dot{x} = 2e^{-x} - \sqrt{4 + ay} \\ \dot{y} = \ln(1 + x + ay) \end{cases}$

14. $\begin{cases} \dot{x} = \ln(e + ax) - e^y \\ \dot{y} = bx + \operatorname{tg} y \end{cases}$

Investigate the stability of the solution:

15. $x_0 = -t^2, \quad y_0 = t$
$\begin{cases} \dot{x} = y^2 - 2ty - 2y - x \\ \dot{y} = 2x + 2t^2 + e^{2t-2y} \end{cases}$

16. $x_0 = \cos t, \quad y_0 = 2\sin t$
$\begin{cases} \dot{x} = \ln\left(2 + 2\sin^2\frac{t}{2}\right) - \frac{y}{2} \\ \dot{y} = (4 - x^2)\cos t - 2x\sin^2 t - \cos^3 t \end{cases}$

Investigate the stability of the zero solution using the Hurwitz condition

17. $y''' + y'' + y' + 2y = 0$
18. $y''' + 2y'' + 2y' + 3y = 0$
19. $y^{(4)} + 2y'' + 4y'' + 3y' + 2y = 0$
20. $y^{(4)} + 2y'' + 3y'' + 7y' + 2y = 0$
21. $y^{(4)} + 13y'' + 16y'' + 55y' + 76y = 0$
22. $y^{(4)} + 8y'' + 14y'' + 36y' + 45y = 0$
23. $y^{(5)} + 2y^{(4)} + 5y'' + 6y'' + 5y' + 2y = 0$
24. $y^{(5)} + 4y^{(4)} + 9y'' + 16y'' + 19y' + 13y = 0$
25. $y^{(5)} + 4y^{(4)} + 16y'' + 25y'' + 13y' + 9y = 0$
26. $y^{(5)} + 5y^{(4)} + 15y'' + 48y'' + 44y' + 74y = 0$
27. $y^{(5)} + 2y^{(4)} + 14y'' + 36y'' + 23y' + 68y = 0$