

Exercises in ODE and modeling MMG511/TMV162. Spring 2018.

Exercises in stability by linearization

Investigate stability of the zero solution by linearization.

$$899. \begin{cases} x' = 2xy - x + y \\ y' = 5x^4 + y^3 + 2x - 3y \end{cases}$$

$$900. \begin{cases} x' = x^2 + y^2 - 2x \\ y' = 3x^2 - x + 3y \end{cases}$$

$$901. \begin{cases} x' = e^{x+2y} - \cos(3x) \\ y' = \sqrt{4+8x} - 2e^y \end{cases}$$

$$902. \begin{cases} x' = \ln(4y + e^{-3x}) \\ y' = 2y - 1 + \sqrt[3]{1-6x} \end{cases}$$

$$903. \begin{cases} x' = \ln(3e^y - 2\cos(x)) \\ y' = 2e^x - \sqrt[3]{8+12y} \end{cases}$$

Answers: 899:stable; 900:unstable; 901: unstable; 902: stable; 903: unstable;

Find all equilibrium points and investigate their stability.

$$915. \begin{cases} x' = y - x^2 - x \\ y' = 3x - x^2 - y \end{cases}$$

$$916. \begin{cases} x' = (x-1)(y-1) \\ y' = xy - 2 \end{cases}$$

$$917. \begin{cases} x' = y \\ y' = \sin(x+y) \end{cases}$$

$$918. \begin{cases} x' = \ln(-x+y^2) \\ y' = x - y - 1 \end{cases}$$

$$919. \begin{cases} x' = 3 - \sqrt{4+x^2+y} \\ y' = \ln(x^2-3) \end{cases}$$

$$920. \begin{cases} x' = e^y - e^x \\ y' = \sqrt{3x+y^2} - 2 \end{cases}$$

$$921. \begin{cases} x' = \ln(1+y+\sin(x)) \\ y' = 2 + \sqrt[3]{3\sin(x)-8} \end{cases}$$

$$922. \begin{cases} x' = -\sin(y) \\ y' = 2x + \sqrt{1-3x-\sin(y)} \end{cases}$$

Answers: 915: (0,0) -unstable, (1,2) -stable. 916: (1,2) and (2,1) -unstable;
 917: $(2k\pi, 0)$ unstable, $((2k+1)\pi, 0)$ stable; 918: (3, 2)-unstable, (0, -1) - stable;
 919: (2, 1) - stable, (-2, 1) - unstable; 920: (1, 1)- unstable, (-4, -4) - stable; 921:
 $(2k\pi, 0)$ - unstable, $((2k+1)\pi, 0)$ - stable; 922 $(-1, 2k\pi)$ - stable, $(-1, (2k+1)\pi)$
 -unstable.