

Math in Moscow, 2014-15 academic year**Ordinary differential equations** (<http://math-info.hse.ru/s14/12>)**Exercises for lesson 10 (04/23/2015)***Ilya Schurov***Problem 1.** Solve the following systems of ODE. Determine type of the singular point.

(a) $\dot{x} = 2x + y, \quad \dot{y} = 3x + 4y;$

(b) $\dot{x} = x + y, \quad \dot{y} = y;$

(c) $\dot{x} = x - 3y, \quad \dot{y} = 3x + y.$

Problem 2. Solve an equation $\dot{x} = Ax$ for

(a) $A = \begin{pmatrix} 1 & -2 \\ 2 & -3 \end{pmatrix}$. Determine type of the singular point.

(b) $A = \begin{pmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \\ 3 & -1 & -2 \end{pmatrix}$.

(c) $A = \begin{pmatrix} 2 & 1 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix}$.

Problem 3. Find $\exp \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ using series expansion for matrix exponential.