

Math in Moscow, 2014-15 academic year**Ordinary differential equations** (<http://math-info.hse.ru/s14/12>)**Exercises for lesson 4 (03/05/2015)***Ilya Schurov***Problem 1.** For every of the following 1-form, plot direction field defined by equation $\omega = 0$.

- (a) $\omega = 2 dx + 4 dy$
- (b) $\omega = 2x dx + 2y dy$
- (c) $\omega = 2y dx - 3x dy$
- (d) $\omega = 2y dx + 5x dy$

Problem 2. Solve the following equations:

- (a) $(2x + 3x^2y)dx + (x^3 - 3y^2)dy = 0$;
- (b) $2xy dx + (x^2 - y^2) dy = 0$;
- (c) $\dot{x} = \frac{t(9tx^2-2)}{x(4x^2-6t^3)}$;
- (d) $e^{-y}dx - (2y + xe^{-y})dy = 0$.

Problem 3. Consider equation $\ddot{x} = -1$ (free fall). Write the corresponding system of 1-st order ODEs, draw its vector field and phase curves.