EXERCISES 12.1 (submit by 01.07.2016)

1. Using isoclines, sketch direction fields for the following ODEs:
   (a) $y' = \frac{y}{x}$
   (b) $y' = -\frac{y}{x}$
   (c) $y' = y - x^2$

2. Find differential equations satisfied by the following families of curves.
   (a) $y = e^{Cx}$
   (b) $x^2 + Cy^2 = 2y$
   (c) $x = ay^2 + by + c$.

3. Find general solutions (in explicit or implicit form) to the following ODEs. Afterwards, find all the solutions satisfying the corresponding additional condition.
   (a) $y' = 3\sqrt[3]{y^2}$; $y(2) = 0$.
   [Note that there is more than one solution to this initial value problem!]
   (b) $y' = e^{x+y}$; $y'(1) = 1$.
   (c) $y' \cot x + y = 2$; $\lim_{x\to 0} y(x) = -1$.
   (d) $xy' + y = y^2$; $y(1) = \frac{1}{2}$.
   (e) $3y^2y' + 16x = 2xy^3$; $y(x)$ is bounded for all $x \in \mathbb{R}$.