Differential Equations, Math. 308–200. Spring 2011.
Instructor P. Kuchment.
Assignment A3. Due February 10th.

15 points (1 point for each of the problems ## 1–5, 2 points for each of the problems ## 6–10). Show all work.

In the following IVPs determine what the existence and uniqueness theorems can say about existence, domain of existence, and uniqueness of solution.

1.
$$\begin{cases} \ln|t-1|y' - 2ty = t^2 \\ y|_{t=2} = 3 \end{cases}$$

2. The same equation with $y|_{t=1} = 3$

3.
$$\begin{cases} \frac{dv}{ds} + \sqrt[3]{v} = s \\ v|_{s=2} = 0 \end{cases}$$

4. The same equation with $v|_{s=2} = 1$

5.
$$\begin{cases} y' = e^{-\frac{1}{x^2}} y + \sin x \\ u|_{x=0} = 1 \end{cases}$$

Determine the type (**write it down**) and solve the following four equations or IVPs.

6.
$$\begin{cases} (1 + y^2 \sin 2x)dx = 2y \cos^2 x dy \\ y|_{x=0} = 1 \end{cases}$$

7.
$$xy' = \sqrt{x^2 - y^2} + y$$

8.
$$2x^2 y' = y^3 + xy$$

9.
$$e^{-y} = y'(2y + xe^{-y})$$

10. Consider the equation

$$(5x^2y + 6x^3y^2 + 4xy^2)dx + (2x^3 + 3x^4y + 3x^2y)dy = 0$$

(a) Show that the equation is not exact

(b) Multiply the equation by x^ny^m and determine values of n and m that make the resulting equation exact.

(c) Use the solution of the resulting exact equation to solve the original equation.