Exercise 1. Find all values of $m$ so that the function $y = e^{mx}$ is a solution of the DE:
$$y'' - 12y' + 35y = 0.$$ 

Exercise 2. Given that $y = \sin[\ln\left(\frac{x}{1-x}\right) + c]$; $(c \in \mathbb{R})$ is a one-parameter family of solutions of the DE:
$$(x - x^2)y' = \sqrt{1 - y^2},$$
find two singular solutions of this DE.

Exercise 3.
(a) Find a region $R$ of the $xy$-plane on which the following IVP:
$$y' = \sqrt{y^2 - 9 + \sqrt{x^2 + 3x - 2 + \frac{1}{x - (1/2)}}, \quad y(x_0) = y_0}$$
has a unique solution on an appropriate open interval containing $x_0$, for all $(x_0, y_0) \in R$.
(b) For $(x_0, y_0) = \left(\frac{3}{2}, 4\right)$, find the largest interval on which the solution is defined. What is the largest interval on which the solution may be defined?.

Exercise 4. Solve the IVP:
$$\left[(x - x^2)y' = 1 + y^2, \quad y\left(\frac{1}{2}\right) = 1\right].$$
What is the largest interval on which the solution is defined?.