Each of the following differential equations are separable. Find a 1-parameter family of solutions. Be careful, justify each step and include the common intervals on which the differential and the solution are valid.

Problem 1

$y' = y$

Problem 2

$\frac{dr}{d\theta} = -\sin\theta$

Problem 3

$(y^2 + 1)\ dx - (x^2 + 1)\ dy = 0$

Problem 4

$e^{y^2}(x^2 + 2x + 1) + xyy' + yy' = 0$

Problem 5

(This one is kinda hard and will probably turn into extra credit) Use your solution to 4 to determine a *function*, f, (and its domain) that satisfies the differential equation, contains the point $(1, 0)$ and is defined only in the first quadrant.