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MATH 3113  
Quiz 2

**INSTRUCTIONS:** Please show your work. This quiz is closed-book and notes are not allowed.

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- 1.** [4 points] Use separation of variables to find the general solution of

$$(1 - x^2) \frac{dy}{dx} + x(y - a) = 0$$

$$\begin{aligned} \int \frac{dy}{y - a} &= \int \frac{-x}{1 - x^2} dx \\ \ln(|y - a|) &= \int \frac{1}{2} \frac{1}{1 - x^2} d(1 - x^2) \\ \ln(|y - a|) &= \frac{1}{2} \ln(|1 - x^2|) + C \\ y - a &= \pm e^C \sqrt{1 - x^2} \\ y &= A \sqrt{1 - x^2} + a \end{aligned}$$

- 2.** [6 points] Determine whether there exists a unique solution for the following IVP: **Show your work and reasoning!**

(1)  $\frac{dy}{dx} = 2x^2y^2, \quad y(1) = -1$

(2)  $\frac{dy}{dx} = \sqrt[3]{y}, \quad y(0) = 0$

(2) is from HW2.

(1): Since  $2x^2y^2$  and  $D_y(2x^2y^2) = 4x^2y$  are continuous everywhere, there exists a unique solution at a neighborhood containing the point  $(1, -1)$ .