Differential Equations, Spring 2017
Quiz 2, Feb 3   Name: _____

You must show all your work to receive credit. Calculators are allowed.

Problem 1: (3 points) Find the solution to the IVP

$$x + y\sqrt{x^2+1}\frac{dy}{dx} = 0$$
$$y(0) = -3$$

$$y\sqrt{x^2+1}\ \frac{dy}{dx} = -x$$

$$y\,dy = -x\Big/\sqrt{x^2+1}\ dx$$

$$\int y\,dy = -\int \frac{x}{\sqrt{x^2+1}}\,dx$$

$$\frac{1}{2}y^2 = -\sqrt{x^2+1} + C$$

$$y = \pm\sqrt{C - 2\sqrt{x^2+1}} \qquad IC\ \ y(0) = -3$$
$$\Rightarrow\ need\ y = -\sqrt{\cdots}$$

So
$$y = -\sqrt{C - 2\sqrt{x^2+1}}$$

Then $y(0) = -3 \ \Rightarrow\ \ -3 = y(0) = -\sqrt{C-2}$

$$9 = C-2,\quad C = 11$$

So
$$\boxed{y = -\sqrt{11 - 2\sqrt{x^2+1}}}$$