

Instructions: Show all work. Use exact answers unless otherwise asked to round.

1. Use the Existence and Uniqueness Theorem to determine where the differential equation $y' = 2x\sqrt{1-y^2}$, $y(0) = 0$ is guaranteed to have a unique solution. Sketch a graph, and place the initial condition on the graph.

$$f(x) = 2x\sqrt{1-y^2}$$

$$1-y^2 \geq 0$$

$$1 \geq y^2$$

$$-1 \leq y \leq 1$$

$$f_y(x) = 2x \cdot \frac{1}{2}(1-y^2)^{-1/2} \cdot (-2y)$$

$$1-y^2 > 0$$

$$-1 < y < 1$$

