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Exam 1 Question 1 427J

1. Compute the unique solution to the I.V.P.

$$\frac{dy}{dt} = \frac{\sqrt{1-y^2}}{t}, \quad y(e^4) = 0.$$

NOTE: Use separable equations and leave your solution implicit.

$dt \cdot \frac{dy}{dt} = \frac{\sqrt{1-y^2}}{t}\, dt$

$dy = \frac{\sqrt{1-y^2}}{t}\, dt$

$\int \frac{1}{\sqrt{1-y^2}}\, dy = \int \frac{1}{t}\, dt$

$\arcsin(y) = \ln(t) + C$

When $y(e^4) = 0$

$\arcsin(0) = \ln(e^4) + C$

$0 = 4 + C$

$-4 = C$

$\therefore \arcsin(y) = \ln(t) - 4$