**Name**: [1 pt]

**Problem 1**. If $x = e^{\arctan t}$, find $\dfrac{dx}{dt}$. [5 pts]

$$\frac{dx}{dt} = \frac{d}{dt}\left(e^{\arctan t}\right)$$

$$= e^{\arctan t} \cdot \frac{d}{dt}(\arctan t) \quad \text{(chain rule)}$$

$$= e^{\arctan t} \cdot \frac{1}{1+t^2}$$

$$= \frac{e^{\arctan t}}{1+t^2}$$

**Problem 2**. Find the derivative of $y = \ln\left(\dfrac{\sec x}{\sqrt{x^2+1}}\right)$. [5 pts]

$$y = \ln\left(\frac{\sec x}{\sqrt{x^2+1}}\right) = \ln(\sec x) - \ln\left(\sqrt{x^2+1}\right)$$

$$= \ln(\sec x) - \ln(x^2+1)^{1/2}$$

$$= \ln(\sec x) - \frac{1}{2}\ln(x^2+1)$$

$$\Rightarrow y' = [\ln(\sec x)]' - \frac{1}{2}[\ln(x^2+1)]'$$

$$= \frac{1}{\sec x} \cdot [\sec x]' - \frac{1}{2} \cdot \frac{1}{x^2+1} \cdot (x^2+1)'$$

$$= \frac{\cancel{\sec x}\,\tan x}{\cancel{\sec x}} - \frac{1}{\cancel{2}} \cdot \frac{1}{x^2+1} \cdot \cancel{2}x$$

$$= \tan x - \frac{x}{x^2+1}$$