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Complete the following problems. Show all work to receive full credit.

1. Evaluate the following derivatives:

$$\begin{aligned} \text{(a)} \quad & \frac{d}{dt} \left( \frac{1 + (\ln t)^2}{1 - (\ln t)^2} \right) \\ &= \frac{\frac{2 \ln t}{t} (1 - (\ln t)^2) - (-\frac{2 \ln t}{t} (1 + (\ln t)^2))}{(1 - (\ln t)^2)^2} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & \frac{d}{dx} \left( \ln \left( \frac{e^x}{1 + e^x} \right) \right) \\ &= \frac{1 + e^x}{e^x} \left( \frac{2^x(1 + e^x) - e^x(e^x)}{(1 + e^x)^2} \right) \\ &= \frac{1 + e^x}{e^x} \left( \frac{e^x + e^{2x} - e^{2x}}{(1 + e^x)^2} \right) \\ &= \frac{1 + e^x}{e^x} \left( \frac{e^x}{(1 + e^x)^2} \right) \\ &= \frac{1}{1 + e^x} \end{aligned}$$

2. Evaluate the following integrals:

$$\begin{aligned} \text{(a)} \quad & \int_2^{16} \frac{dx}{2x\sqrt{\ln x}} \\ &= \sqrt{\ln x} \Big|_2^{16} \\ &= \sqrt{\ln 16} - \sqrt{\ln 2} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & \int \frac{e^r}{1 + e^r} dr \\ &= \ln |1 + e^r| + C \end{aligned}$$