1. Compute the derivatives of the following functions with respect to t. Recall the hyperbolic functions satisfy $\sinh t = (e^t - e^{-t})/2$ and $\cosh t = (e^t + e^{-t})/2$.

   (a) $u = t^2 e^{3t}$

   (b) $v = e^{\tan t}$

   (c) $y = \sinh t$

   (d) $y = \cosh t$

2. Solve the following integrals.

   (a) $\displaystyle\int \frac{x}{x^2 - 4}\, dx$

   (b) $\displaystyle\int \frac{1}{x^2 - 4}\, dx$

   (c) $\displaystyle\int \frac{1}{x^2 + 4}\, dx$

3. Find $\frac{\partial y}{\partial u}$ and $\frac{\partial y}{\partial v}$ given that $y = u^2 e^v + \sin(3u + 2v)$.

4. Given that $w = e^{xy}$, $x = t \ln t$, and $y = e^t$, use the multivariable chain rule to compute $\frac{dw}{dt}$. You may leave your answer in terms of the intermediate variables x and y.

5. [1.1.22] A spherical raindrop evaporates at a rate proportional to its surface area. Write a differential equation for the volume V of the raindrop as a function of time t. (Hint: recall the formulas for volume $V = \frac{4\pi}{3} r^3$ and surface area $S = 4\pi r^2$ of a sphere as a function of the radius r; use these to express S as a function of V.)