Homework 18, Calculus I, Fall 2008

§7.4#3)

$$\frac{d}{dx}\left[\sin(\ln(x))\right] = \cos(\ln(x))\frac{d}{dx}\left[\ln(x)\right]$$
$$= \boxed{\frac{1}{x}\cos(\ln(x))}$$

§7.4#7)

$$\frac{d}{dx}\left[\sqrt[5]{\ln(x)}\right] = \frac{1}{5}\left(\ln(x)\right)^{-4/5}\frac{d}{dx}\left[\ln(x)\right]$$
$$= \boxed{\frac{1}{5x}\left[\ln(x)\right]^{-4/5}}$$

§7.4#11)

$$\frac{d}{dt}\left\{\ln\left[\frac{(2t+1)^3}{(3t-1)^4}\right]\right\} = \frac{d}{dt}\left\{3\ln(2t+1) + 4\ln(3t-1)\right\}$$
$$= \frac{3}{2t+1}\frac{d}{dt}(2t+1) + \frac{4}{3t-1}\frac{d}{dt}(3t-1)$$
$$= \boxed{\frac{6}{2t+1} + \frac{12}{3t-1}}$$

§7.4#13) Use log properties when possible!

$$\frac{d}{dx}\left[\ln\left(x\sqrt{x^2-1}\right)\right] = \frac{d}{dx}\left[\ln(x) + \frac{1}{2}\ln(x^2-1)\right]$$
$$= \frac{1}{x} + \frac{1}{2(x^2-1)}\frac{d}{dx}(x^2-1)$$
$$= \boxed{\frac{1}{x} + \frac{x}{x^2-1}}$$

§7.4#17)

$$\frac{d}{dt}\left(t^3 - 3^t\right) = \boxed{3t^2 - \ln(3)\,3^t}$$

Notice $3^t = e^{\ln(3^t)} = e^{\ln(3)t}$ so the chain rule gives $\ln(3)$ from $\frac{d}{dt}(e^u) = e^u\frac{du}{dt}$.

§7.4 #25

$$\frac{d}{dx}\left[5^{-1/x}\right] = \ln(5)\, 5^{-1/x} \frac{d}{dx}\left[\frac{-1}{x}\right]$$

$$= \boxed{\frac{\ln(5)\, 5^{-1/x}}{x^2}}$$