#3-6

2. $\frac{d}{dx}(x \cdot \ln x - x) = \frac{x}{x} + \ln x - 1$
$= \ln x$

3. $\frac{d}{dx} \sin(\ln x) = \cos(\ln x) \cdot \frac{1}{x}$

4. $\ln(\sin^2 x) = \frac{1}{\sin^2 x} \cdot 2(\sin x) \cdot \cos x$

5. $\ln\left(\frac{1}{x}\right) = \ln(x^{-1}) = \frac{1}{x^{-1}} \cdot -x^{-2} \cdot 1$

6. $\frac{1}{\ln x} = (\ln x)^{-1} = -1(\ln x)^{-2} \cdot \frac{1}{x}$

7. $\log_{10}(x^3+1) = \frac{1}{\ln 10 \cdot (x^3+1}$

8. $\log_5(xe^x) = \frac{1}{\ln 5 \cdot (xe^x)} \cdot (xe^x + e^x)$

9. $\sin x \cdot \ln(5x) = \frac{1}{5x} \cdot \sin x + \cos x \ln(5x)$

10. $\frac{v}{1+\ln v}$ $\frac{1+\ln v - \frac{1}{v} \cdot v}{(1+\ln v)^2} = \frac{\ln v}{(1+\ln v)^2}$

11. $\ln(x\sqrt{x^2-1}) = \frac{1}{(x\sqrt{x^2-1})} \cdot \left(\frac{1}{2\sqrt{x^2-1}} \cdot x + \sqrt{x^2-1}\right)$

12. $\ln(x + \sqrt{x^2-1}) = \frac{1}{x+\sqrt{x^2-1}} \cdot \left(1 + \left(\frac{1}{2\sqrt{x^2-1}} \cdot 2x\right)\right)$

13. $\ln\left(\frac{(2y+1)^5}{\sqrt{y^2+1}}\right) = \frac{\sqrt{y^2+1}}{(2y+1)^5} \cdot 5(2y+1) \cdot \left(\frac{1}{2\sqrt{y^2+1}} \cdot 2 \cdot (2y+1)\right)$

15. $\ln(\ln(s)) = \frac{1}{\ln s} \cdot \frac{1}{s}$

~~16.~~ 39.

$(x^2+2)^2(x^4+4)^4 = y$

$\ln(y) = \ln((x^2+2)^2 \cdot (x^4+4)^4)$

$\ln(y) = 2 \cdot \ln(x^2+2) + 4 \cdot \ln(x^4+4)$

$\frac{1}{y} = 2 \cdot \frac{1}{x^2+2} \cdot 2 + 4 \cdot \frac{1}{x^4+4} \cdot 4x^3$

$= \left(\frac{4}{x^2+2} + \frac{16x^3}{x^4+4}\right)y$

41. $\ln y = \ln((x-1)/(x^4+1))^{.5}$

$\ln y = \frac{1}{2} \cdot (\ln(x-1) - \ln(x^4+1))$

$\frac{d}{dy}\ \frac{1}{y} = \frac{1}{2}\left(\frac{1}{x-1} - \frac{1}{x^4+1} \cdot 4x^3\right)$

$= \frac{y}{2}\left(\frac{1}{x-1} - \frac{4x^3}{x^4+1}\right)$

43. $y = x^x = \ln y = x \ln x$

$\frac{1}{y} = \frac{1}{x} \cdot x + \ln x$

$= (1 + \ln x)y$

45. $y = x^{\sin x} = \ln y = \sin x \cdot \ln x$

$\frac{1}{y} = \frac{1}{x} \cdot \sin x + \cos x \ln x$

$= \left(\frac{\sin x}{x} + \cos x \ln x\right)y$