3. $f(\theta) = \ln(\cos\theta) \quad \Rightarrow \quad f'(\theta) = \dfrac{1}{\cos\theta}\dfrac{d}{d\theta}(\cos\theta) = \dfrac{-\sin\theta}{\cos\theta} = -\tan\theta$

6. $f(x) = \ln\sqrt[5]{x} = \ln x^{1/5} = \frac{1}{5}\ln x \quad \Rightarrow \quad f'(x) = \dfrac{1}{5}\cdot\dfrac{1}{x} = \dfrac{1}{5x}$

9. $f(x) = \sin x\ln(5x) \quad \Rightarrow \quad f'(x) = \sin x\cdot\dfrac{1}{5x}\cdot\dfrac{d}{dx}(5x) + \ln(5x)\cdot\cos x$

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

12. $F(y) = y\ln(1+e^y) \quad \Rightarrow \quad F'(y) = y\cdot\dfrac{1}{1+e^y}\cdot e^y + \ln(1+e^y)\cdot 1 = \dfrac{ye^y}{1+e^y} + \ln(1+e^y)$

15. $y = \ln\left|2 - x - 5x^2\right| \quad \Rightarrow \quad y' = \dfrac{1}{2-x-5x^2}\cdot(-1-10x) = \dfrac{-10x-1}{2-x-5x^2}$ or $\dfrac{10x+1}{5x^2+x-2}$

18. $y = [\ln(1+e^x)]^2 \quad \Rightarrow \quad y' = 2[\ln(1+e^x)]\cdot\dfrac{1}{1+e^x}\cdot e^x = \dfrac{2e^x\ln(1+e^x)}{1+e^x}$

21. $f(x) = \dfrac{x}{1-\ln(x-1)} \quad \Rightarrow$

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

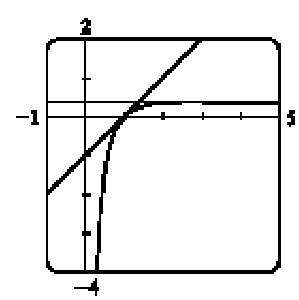
$$= \frac{2x-1-(x-1)\ln(x-1)}{(x-1)[1-\ln(x-1)]^2}$$

$\mathrm{Dom}(f) = \{x \mid x-1>0 \text{ and } 1-\ln(x-1)\neq 0\} = \{x \mid x>1 \text{ and } \ln(x-1)\neq 1\}$

$= \{x \mid x>1 \text{ and } x-1\neq e^1\} = \{x \mid x>1 \text{ and } x\neq 1+e\} = (1, 1+e)\cup(1+e,\infty)$

24. $y = \dfrac{\ln x}{x} \quad \Rightarrow \quad y' = \dfrac{x(1/x)-\ln x}{x^2} = \dfrac{1-\ln x}{x^2}$.

$y'(1) = \dfrac{1-0}{1^2} = 1$ and $y'(e) = \dfrac{1-1}{e^2} = 0 \quad \Rightarrow$ equations of tangent lines are $y - 0 = 1(x-1)$ or $y = x-1$ and $y - 1/e = 0(x-e)$ or $y = 1/e$.



27. $y = (2x+1)^5(x^4-3)^6 \quad \Rightarrow \quad \ln y = \ln\big((2x+1)^5(x^4-3)^6\big) \quad \Rightarrow \quad \ln y = 5\ln(2x+1) + 6\ln(x^4-3) \quad \Rightarrow$

$\frac{1}{y}\,y' = 5 \cdot \frac{1}{2x+1} \cdot 2 + 6 \cdot \frac{1}{x^4-3} \cdot 4x^3 \quad \Rightarrow$

$y' = y\left(\frac{10}{2x+1} + \frac{24x^3}{x^4-3}\right) = (2x+1)^5(x^4-3)^6\left(\frac{10}{2x+1} + \frac{24x^3}{x^4-3}\right).$

[The answer could be simplified to $y' = 2(2x+1)^4(x^4-3)^5(29x^4+12x^3-15)$, but this is unnecessary.]

32. $y = x^{\cos x} \quad \Rightarrow \quad \ln y = \ln x^{\cos x} \quad \Rightarrow \quad \ln y = \cos x \ln x \quad \Rightarrow \quad \frac{1}{y}y' = \cos x \cdot \frac{1}{x} + \ln x \cdot (-\sin x) \quad \Rightarrow$

$y' = y\left(\frac{\cos x}{x} - \ln x \sin x\right) \quad \Rightarrow \quad y' = x^{\cos x}\left(\frac{\cos x}{x} - \ln x \sin x\right)$

38. $x^y = y^x \quad \Rightarrow \quad y\ln x = x\ln y \quad \Rightarrow \quad y \cdot \frac{1}{x} + (\ln x)\cdot y' = x \cdot \frac{1}{y} \cdot y' + \ln y \quad \Rightarrow \quad y'\ln x - \frac{x}{y}y' = \ln y - \frac{y}{x} \quad \Rightarrow$

$y' = \frac{\ln y - y/x}{\ln x - x/y}$

39. $f(x) = \ln(x-1) \quad \Rightarrow \quad f'(x) = 1/(x-1) = (x-1)^{-1} \quad \Rightarrow \quad f''(x) = -(x-1)^{-2} \quad \Rightarrow \quad f'''(x) = 2(x-1)^{-3} \quad \Rightarrow$

$f^{(4)}(x) = -2 \cdot 3(x-1)^{-4} \quad \Rightarrow \quad \cdots \quad \Rightarrow \quad f^{(n)}(x) = (-1)^{n-1} \cdot 2 \cdot 3 \cdot 4 \cdot \cdots \cdot (n-1)(x-1)^{-n} = (-1)^{n-1}\frac{(n-1)!}{(x-1)^n}$