I.

1) $y = \ln x$

$y' = \frac{1}{x}$

2) $y = \ln(4x)$

$y' = \frac{1}{4x} \cdot 4 = \frac{1}{x}$

3) $y = \ln(x^3 - 3x)$

$y' = \frac{1}{x^3 - 3x} \cdot 3x^2 - 3$

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

$y' = \frac{1}{\frac{x^2}{1-x}} \cdot \frac{2x(1-x) - -1x^2}{(1-x)^2}$

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

$y' = \frac{1-x}{x^2} \cdot \frac{2x - x^2}{(1-x)^2}$

$y' = \frac{2x - x^2}{x^2(1-x)}$

5) $y = \log_3 x$

$y' = \frac{1}{x \ln 3}$

6) $y = \log_4(5x)$

$y' = \frac{1}{5x \ln 4} \cdot 5 = \frac{1}{x \ln 4}$

7) $y = \log_6\left(\frac{3}{x}\right)$

$y' = \frac{1}{\frac{3}{x} \ln 6} \cdot -3x^{-2}$

$y' = \frac{x}{3 \ln 6} \cdot \frac{-3}{x^2}$

$y' = \frac{-1}{x \ln 6}$

8) $y = \log_2\left(\frac{\sin x}{x^5}\right)$

$y' = \frac{1}{\frac{\sin x}{x^5} \ln 2} \cdot \frac{\cos x(x^5) - 5x^4 \sin x}{x^{10}}$

$y' = \frac{x^5}{\ln 2 \sin x} \cdot \frac{x^5 \cos x - 5x^4 \sin x}{x^{10}}$

$y' = \frac{x^5}{\ln 2 \sin x} \cdot \frac{x^4(x \cos x - 5 \sin x)}{x^{10}}$

$y' = \frac{x \cos x - 5 \sin x}{x \ln 2 \cdot \sin x}$

9) $y = e^x$

$y' = e^x$

10) $y = e^{6x-8}$

$y' = e^{6x-8} \cdot 6$

$y' = 6e^{6x-8}$

11) $y = e^{\tan x}$

$y' = e^{\tan x} \cdot \sec^2 x$

12) $y = e^{\frac{3+5x}{x^3}}$

$y' = e^{\frac{3+5x}{x^3}} \left(\frac{5x^3 - 3x^2(3+5x)}{(x^3)^2} \right)$

$y' = e^{\frac{3+5x}{x^3}} \left(\frac{5x^3 - 9x^2 - 15x^3}{x^6} \right)$

$y' = e^{\frac{3+5x}{x^3}} \left(\frac{-10x^3 - 9x^2}{x^6} \right)$

13) $y = 4^x$

$y' = 4^x \ln 4$

14) $y = 10^x$

$y' = 10^x \ln 10$

15) $y = \frac{1}{2}^x$

$y' = \frac{1}{2}^x \ln(\frac{1}{2})$

16) $y = 9^x$

$y' = 9^x \ln 9$

17) $y = 5^{6x}$

$y' = 5^{6x} \ln(5) \cdot 6 = 6 \cdot \ln(5)\, 5^{6x}$

8) $y = 2^{x^2}$

$y' = 2^{x^2} \ln(2)\, 2x$

19) $y = 5^{e^x}$

$y' = 5^{e^x} \ln(5) e^x$

20) $y = 3^{\cos x + 3x^4}$

$y' = 3^{\cos x + 3x^4} \ln(3) (-\sin x + 12x^3$

II.

21. $1 \cdot y + y'x = 5$

$y' = \frac{5 - y}{x}$

22) $3x^2y^2 + 2yy'x^3 + y' = 1$

$y' = \frac{1 - 3x^2y^2}{2yx^3 + 1}$

23) $\sin(y) = 3x^5$

$\cos(y) y' = 15x^4$

$y' = \frac{15x^4}{\cos(y)}$

24) $\tan(y) = 3x + y$

$\sec^2(y)y' = 3 + y'$

$\sec^2(y)y' - y' = 3$

$y'(\sec^2(y) - 1) = 3$

$y' = \frac{3}{\sec^2(y) - 1}$

25) $\cos(1/y) = y^2 - 4x$

$-\sin(1/y)(-y^{-2})y' = 2yy' - 4$

$\frac{\sin(1/y)}{y^2}y' - 2yy' = -4$

$y'\left(\frac{\sin(1/y)}{y^2} - 2y\right) = -4$

$y' = \frac{-4}{\frac{\sin(1/y)}{y^2} - 2y}$

26) $y\csc(1/y) = 2x$

$y'\csc(1/y) + -\csc(1/y)\cot(1/y)(-y^{-2})y' \cdot y = 2$

$y'\left(\csc(1/y) + \frac{y\csc(1/y)\cot(1/y)}{y^2}\right) = 2$

$y'\left(\csc(1/y) + \frac{\csc(1/y)\cot(1/y)}{y}\right) = 2$

$y' = \frac{2}{\csc(1/y) + \frac{\csc(1/y)\cot(1/y)}{y}}$

27) $e^y = 4x$

$e^y y' = 4$

$y' = \frac{4}{e^y}$

28) $3^y = 3x^2$

$3^y \ln(3) y' = 6x$

$y' = \frac{6x}{3^y \ln(3)}$

29) $2x^4 = \log_2 y$

$8x^3 = \frac{1}{y \ln(2)} \cdot y'$

$y' = 8x^3 y \ln(2)$

30) $\ln(y^4) = 3x$

$\frac{1}{y^4} \cdot 4y^3 \cdot y' = 3$

$\frac{4}{y} y' = 3$

$y' = \frac{3y}{4}$

31) $\ln(1/y^3) = 3y - 6x$

$\frac{1}{1/y^3}(-3y^{-4}) y' = 3y' - 6$

$\frac{y^3}{-3y^4} y' - 3y' = -6$

$y'\left(-\frac{1}{3y} - 3\right) = -6$

$y' = \frac{-6}{-\frac{1}{3y} - 3}$

32) $\log_4(\sec y) = 3 - yx$

$\frac{1}{\sec y \ln 4} \cdot \sec(y)\tan(y) \cdot y' = -(y'x + 1 \cdot y)$

$\frac{\tan(y)}{\ln 4} y' = -y'x - y$

$\frac{\tan(y)}{\ln(4)} y' + y'x = -y$

$y'\left(\frac{\tan(y)}{\ln(4)} + x\right) = -y$

$y' = \frac{-y}{\frac{\tan(y)}{\ln(4)} + x}$

33) $(1, \pi)$

$1 \cdot y^3 + 3y^2 y' x + 2\sin(y) y' = 2$

$\pi^3 + 3\pi^2 y' \cdot 1 + 2\sin(\pi) y' = 2$

$\pi^3 + 3\pi^2 y' + 0 = 2$

$3\pi^2 y' = 2 - \pi^3$

$y' = \frac{2 - \pi^3}{3\pi^2} \approx -.9797$

$y - \pi = -.9797(x - 1)$

34) $f(23) = \log_3(27) = 3$

$(23, 3)$

$f'(x) = \frac{1}{(x+4)\ln 3}$

$f'(23) = \frac{1}{27 \ln 3} \approx .0337$

$y - 3 = .0337(x - 27)$

35) $4y^3 y' + 3x^2 = 2y y' + 11$

$4(1)^3 y' + 3(0)^2 = 2(1) y' + 11$

$4y' = 2y' + 11 \quad y' = 11/2$

$2y' = 11$

$y - 1 = 11/2 (x - 0)$