① $f(x) = 2e^x + 3\ln x$

$f'(x) = 2e^x + 3\left(\frac{1}{x}\right)$

② $g(x) = 5e^x - 6\ln\frac{1}{x}$

$g(x) = 5e^x - 6\ln x^{-1}$

$g(x) = 5e^x + 6\ln x$

$g'(x) = 5e^x + 6\left(\frac{1}{x}\right)$

③ $h(x) = 4e^x - 3x^e + 4ex^2$

$h'(x) = 4e^x - 3ex^{e-1} + 8ex$

④ $y = \ln e - 7e^x + 9x^e$

$y' = 0 - 7e^x + 9ex^{e-1}$

⑤ $h(x) = e^5 \ln e \rightarrow$ just a #

$h'(x) = 0$

⑥ $f(x) = \ln x^3 = 3\ln x$

$f'(x) = 3\left(\frac{1}{x}\right)$

⑦ $g(x) = (\ln x)^5$

$g'(x) = 5(\ln x)^4\left(\frac{1}{x}\right)$

⑧ $y = 3\ln\sqrt[3]{x^2}$

$y = 3\ln x^{2/3}$

$y = 2\ln x$

$y = 2\left(\frac{1}{x}\right)$

⑨ $h(x) = 3(\ln x)^4$

$h'(x) = 12(\ln x)^3\left(\frac{1}{x}\right)$

⑩ $y = x^4 \ln x$

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

$y' = x^3 + 4x^3 \ln x$

⑪ $f(x) = 2x\ln x$

$f'(x) = (2x)\left(\frac{1}{x}\right) + (2)(\ln x)$

$f'(x) = 2 + 2\ln x$

⑫ $g(x) = 7xe^x$

$g'(x) = 7xe^x + 7e^x$

⑬ $h(x) = x^7 e^x$

$h'(x) = x^7 e^x + 7x^6 e^x$

⑭ $y = \frac{e^x}{9-x^2}$

$y' = \frac{(9-x^2)(e^x) - (-2x)(e^x)}{(9-x^2)^2}$

⑮ $f(x) = \frac{2x-3}{e^x}$

$f'(x) = \frac{(e^x)(2) - (e^x)(2x-3)}{e^{2x}}$

⑯ $y = \frac{\ln x}{2x^5}$

$y' = \frac{(2x^5)\left(\frac{1}{x}\right) - (10x^4)(\ln x)}{4x^{10}}$

$y' = \frac{2x^4 - 10x^4\ln x}{4x^{10}}$

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

$y' = (\ln x)\left(-\frac{5}{2}x^{-6}\right) + \left(\frac{1}{x}\right)\left(\frac{1}{2}x^{-5}\right)$

⑰ $h(x) = \frac{8-x}{\ln x^2} = \frac{8-x}{2\ln x}$

$h'(x) = \frac{(2\ln x)(-1) - \left(\frac{2}{x}\right)(8-x)}{(2\ln x)^2}$

or $h(x) = (8-x)(2\ln x)^{-1}$

$h'(x) = (8-x)\left[-1(2\ln x)^{-2}\left(\frac{2}{x}\right)\right] + (-1)(2\ln x)^{-1}$

⑱ $g(x) = (3-2x)^3 e^x$

$g'(x) = (3-2x)^3 e^x + \left[3(3-2x)^2(-2)\right]e^x$

⑲ $f(x) = \left[2e^x(2x^2-4)\right]^3$

$f'(x) = 3\left[2e^x(2x^2-4)\right]^2\left[(2e^x)(4x) + (2e^x)(2x^2-4)\right]$

⑳ $y = (x+3)^4 \ln x$

$y' = (x+3)^4\left(\frac{1}{x}\right) + \left[4(x+3)^3(1)\right](\ln x)$

㉑ $f(x) = \left(\frac{3}{2x} + e^5\right)(\ln x)^5$

$f(x) = \left(\frac{3}{2}x^{-1} + e^5\right)(\ln x)^5$

$f'(x) = \left(\frac{3}{2}x^{-1} + e^5\right)\left[5(\ln x)^4\left(\frac{1}{x}\right)\right] + \left(-\frac{3}{2}x^{-2}\right)(\ln x)^5$

㉒ $y = x\ln x^3$

$y = 3x\ln x$

$y' = (3x)\left(\frac{1}{x}\right) + (3)(\ln x)$

$y' = 3 + 3\ln x$

㉓ $g(x) = 3x(\ln x)^3$

$g'(x) = (3)\left[3(\ln x)^2\left(\frac{1}{x}\right)\right] + (3)(\ln x)^3$

㉔ $y = (4-5e^x)^4$

$y' = 4(4-5e^x)^3(-5e^x)$

㉕ $f(x) = \sqrt[3]{2-3\ln x}$

$f(x) = (2-3\ln x)^{\frac{1}{3}}$

$f'(x) = \frac{1}{3}(2-3\ln x)^{-\frac{2}{3}}\left[(-3)\left(\frac{1}{x}\right)\right]$

㉖ $g(x) = (x-3)e^x$

$g'(x) = (1-3)e^x + (1)(e^x)$

$g'(x) = xe^x - 3e^x + e^x$

$g'(x) = xe^x - 2e^x$

$xe^x - 2e^x = 0$

$e^x(x-2) = 0$

$e^x = 0$ has no solution

$x-2=0$

$x=2$

(26) $y = \sqrt{3\ln x^5} + 3\ln e^2$

$y = (15\ln x)^{1/2} + 3\ln e^2$

$y = (15\ln x)^{1/2} + 6$

$y' = \frac{1}{2}(15\ln x)^{-1/2}\left[(15)\left(\frac{1}{x}\right)\right]$

(27) $f(x) = 10x + \ln 10x$

$f(x) = 10x + \ln 10 + \ln x$

$f'(x) = 10 + 0 + \frac{1}{x}$

$f'(x) = 10 + \frac{1}{x}$

(28) $y = 2 + 3\ln\frac{2}{x}$

$y = 2 + 3[\ln 2 - \ln x]$

$y = 2 + 3\ln 2 - 3\ln x$

$y' = 0 + 0 - 3\left(\frac{1}{x}\right)$

$y' = -\frac{3}{x}$

(29) $f(x) = \ln\frac{4}{x^3}$

$f(x) = \ln 4 - \ln x^3$

$f(x) = \ln 4 - 3\ln x$

$f'(x) = 0 - 3\left(\frac{1}{x}\right)$

$f'(x) = -\frac{3}{x}$

(30) $g(x) = x + 5\ln 6x$

$g(x) = x + 5[\ln 6 + \ln x]$

$g(x) = x + 5\ln 6 + 5\ln x$

$g'(x) = 1 + 0 + 5\left(\frac{1}{x}\right)$

$g'(x) = 1 + \frac{5}{x}$

(31) $y = 3 + \ln x \;;\; x = 1$

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

$y'(1) = \frac{1}{1} = 1 = m$

$y(1) = 3 + \ln 1 = 3 \quad (1,3)$

$y = mx + b$

$3 = (1)(1) + b$ → $y = 1x + 2$

$3 = 1 + b$

$2 = b$

(32) $y = 3e^x \;;\; x = 0$

$y' = 3e^x$

$y'(0) = 3e^0 = 3 = m$

$y(0) = 3e^0 = 3 \quad (0,3)$

$y = mx + b$

$3 = (3)(0) + b$ → $y = 3x + 3$

$3 = b$

(33) $y = \ln x^3 = 3\ln x \;;\; x = e^2$

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

$y'(e^2) = \frac{3}{e^2} = m$

$y(e^2) = 3\ln e^2 = 6\ln e = 6$

$(e^2, 6)$

$y = mx + b$

$6 = \left(\frac{3}{e^2}\right)(e^2) + b$ → $y = \left(\frac{3}{e^2}\right)x + 3$

$6 = 3 + b$

$3 = b$

(34) $h(x) = 2 + e^x \;;\; x = 1$

$h'(x) = e^x$

$h'(1) = e^1 = e = m$

$h(1) = 2 + e^1 = 2 + e$

$(1, 2+e)$ → $y = ex + 2$

$y = mx + b$

$2 + e = (e)(1) + b$

$2 = b$

(35) $f(x) = 5x - 2x\ln x$

$f'(x) = 5 - [2x(\frac{1}{x}) + 2\ln x]$

$f'(x) = 5 - 2 - 2\ln x = 3 - 2\ln x$

$3 - 2\ln x$ | $e^{3/2} = x$

$3 = 2\ln x$

$\frac{3}{2} = \ln x$

(36) $g(x) = \frac{e^x}{x^2}$

$g'(x) = \frac{x^2e^x - 2xe^x}{x^4}$

$x^2e^x - 2xe^x = 0$ → $x = 0$ (extraneous), $x - 2 = 0$ → $x = 2$

$xe^x(x-2) = 0$ → $e^x = 0$ ↳ n.s.

(37) $h(x) = x^2(3 - \ln x)$

$h'(x) = (x^2)\left(-\frac{1}{x}\right) + (2x)(3 - \ln x)$

$h'(x) = -x + 6x - 2x\ln x$

$h'(x) = 5x - 2x\ln x$

$x(5 - 2\ln x) = 0$

$x = 0$ (extraneous) → $5 - 2\ln x = 0$

$5 = 2\ln x$

$\frac{5}{2} = \ln x$

$e^{5/2} = x$

(38) $y = \frac{x^3}{e^x}$

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

$3x^2e^x - x^3e^x = 0$

$x^2e^x(3 - x) = 0$

$x^2 = 0$ → $x = 0$ | $e^x = 0$ ↳ n.s | $3 - x = 0$ → $3 = x$

(39) $f(x) = \frac{\ln x}{x}$

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

$1 - \ln x = 0$

$1 = \ln x$

$e^1 = x$ → $x = e$

#40 is on the front →