

#1

$$y = e^{x \sin 2x}$$

$$y' = e^{x \sin 2x} (x \sin 2x)'$$

$$= e^{x \sin 2x} (2x \cos 2x + \sin 2x)$$

#2

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

$$y' = \frac{1}{2} (1 + 2e^{3x})^{-1/2} (2e^{3x} \cdot 3)$$

#3

$$y = \ln(x + \sqrt{x^2 - 1})$$

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

#4

$$y = \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2}$$

$$\ln y = 2 \ln \sin x + 4 \ln \tan x - 2 \ln(x^2 + 1)$$

$$\frac{1}{y} y' = 2 \frac{1}{\sin x} \cos x + 4 \frac{1}{\tan x} \sec^2 x$$

$$- 2 \frac{1}{x^2 + 1} 2x$$

$$y' = \frac{\sin^2 x \tan^4 x}{(x^2 + 1)^2} \left( \frac{2 \cos x}{\sin x} + 4 \frac{\sec^2 x}{\tan x} - \frac{4x}{x^2 + 1} \right)$$

$$\begin{aligned}
 \#5 \quad & \int \frac{e^{4x}}{x^2} dx && \text{Let } u = 4x \\
 & = - \int e^u du && du = 4 dx \\
 & && -du = 4 dx \\
 & = -e^u + C = -e^{4x} + C
 \end{aligned}$$

$$\begin{aligned}
 \#6 \quad & \int e^x \sqrt{1+e^x} dx && \text{Let } u = 1+e^x \\
 & = \int \sqrt{u} du && du = e^x dx \\
 & = \frac{2}{3} u^{3/2} + C = \frac{2}{3} (1+e^x)^{3/2} + C
 \end{aligned}$$

$$\begin{aligned}
 \#7 \quad & \int \frac{2-x^2}{6x-x^3} dx && \text{Let } u = 6x-x^3 \\
 & = \frac{1}{3} \int \frac{du}{u} && du = (6-3x^2) dx \\
 & && \frac{1}{3} du = (2-x^2) dx \\
 & = \frac{1}{3} \ln|u| + C = \frac{1}{3} \ln|6x-x^3| + C
 \end{aligned}$$

$$\begin{aligned}
 \#8 \quad & \int \frac{(\ln x)^2}{x} dx && \text{Let } u = \ln x \\
 & = \int u^2 du = \frac{1}{3} u^3 + C = \frac{1}{3} (\ln x)^3 + C && du = \frac{1}{x} dx
 \end{aligned}$$

#9

$$\lim_{x \rightarrow 0} \frac{e^x - 1 - x}{x^2} \quad \frac{0}{0}$$

$$= \lim_{x \rightarrow 0} \frac{e^x - 1}{2x} \quad \frac{0}{0}$$

$$= \lim_{x \rightarrow 0} \frac{e^x}{2} = \frac{1}{2}$$

#10

$$\lim_{x \rightarrow 0} (1 - 2x)^{1/x}$$

Let

$$y = (1 - 2x)^{1/x}$$

$$\ln y = \ln (1 - 2x)^{1/x}$$

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

$$\lim_{x \rightarrow 0} \ln y = \lim_{x \rightarrow 0} \frac{\ln(1 - 2x)}{x} \quad \frac{0}{0}$$

$$= \lim_{x \rightarrow 0} \frac{\frac{1}{1-2x}(-2)}{1}$$

$$= -2$$

$$\lim_{x \rightarrow 0} \ln y = -2$$

$$\lim_{x \rightarrow 0} y = e^{-2}$$