

$$1. y = e^{2x} \quad y = e^u \quad u = 2x \rightarrow \frac{dy}{dx} = 2e^u = \boxed{2e^{2x}}$$

$$\frac{dy}{du} = e^u \quad \frac{du}{dx} = 2$$

$$2. y = e^{x^2+1} \quad y = e^u \quad u = x^2+1 \rightarrow \frac{dy}{dx} = 2xe^u = \boxed{2xe^{x^2+1}}$$

$$\frac{dy}{du} = e^u \quad \frac{du}{dx} = 2x$$

$$3. y = e^{\sin x} \quad y = e^u \quad u = \sin x \rightarrow \frac{dy}{dx} = (\cos x)e^u = \boxed{(\cos x)e^{\sin x}}$$

$$\frac{dy}{du} = e^u \quad \frac{du}{dx} = \cos x$$

$$4. y = e^{x^3 - \cos 2x} \quad y = e^u \quad u = x^3 - \cos 2x$$

$$\frac{dy}{du} = e^u \quad \frac{du}{dx} = 3x^2 + 2\sin 2x$$

$$\boxed{\frac{dy}{dx} = (e^{x^3 - \cos 2x})(3x^2 + 2\sin 2x)}$$

$$5. y = e^{\tan^3 x} \quad y = e^u \quad u = \tan^3 x$$

$$u = v^3 \quad v = \tan x$$

$$\frac{dy}{du} = e^u \quad \frac{du}{dv} = 3v^2 \quad \frac{dv}{dx} = \sec^2 x$$

$$\boxed{\frac{dy}{dx} = e^{\tan^3 x} (3\tan^2 x)(\sec^2 x)}$$

$$6. y = 2^{3x} \quad y = 2^u \quad u = 3x$$

$$\frac{dy}{du} = 2^u (\ln 2) \quad \frac{du}{dx} = 3$$

$$\boxed{\frac{dy}{dx} = 3(2^{3x})(\ln 2)}$$

$$7. y = 3^{\left(\frac{1}{4}x\right)} \quad y = 3^u \quad u = \frac{1}{4}x$$

$$\frac{dy}{du} = 3^u (\ln 3) \quad \frac{du}{dx} = \frac{1}{4}$$

$$\boxed{\frac{dy}{dx} = \frac{3^{\frac{1}{4}x} (\ln 3)}{4}}$$

$$8. y = 4^{\sec x}$$

$$y = 4^u$$

$$u = \sec x$$

$$\frac{dy}{du} = 4^u (\ln 4) \quad \frac{du}{dx} = \sec x \tan x$$

$$\boxed{\frac{dy}{dx} = 4^{\sec x} (\ln 4) (\sec x \tan x)}$$

$$9. y = 5^{x^2 \cot x}$$

$$y = 5^u$$

$$u = x^2 \cot x$$

$$\frac{dy}{du} = 5^u (\ln 5) \quad \frac{du}{dx} = x^2 (-\csc^2 x) + 2x \cot x$$

$$\boxed{\frac{dy}{dx} = (5^{x^2 \cot x}) (\ln 5) (2x \cot x - x^2 \csc^2 x)}$$

$$10. y = 10^{\csc 10x}$$

$$y = 10^u$$

$$u = \csc 10x$$

$$u = \csc v \quad v = 10x$$

$$\frac{dy}{du} = 10^u (\ln 10) \quad \frac{du}{dv} = -\csc v \cot v \quad \frac{dv}{dx} = 10$$

$$\boxed{\frac{dy}{dx} = (10^{\csc 10x}) (\ln 10) (-10 \csc 10x \cot 10x)}$$