

—Review WU:

$$1) y = \ln \sqrt{x^3 + x^2 + 1}$$

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

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

$$2) y = \frac{\sqrt{x+1} (2-x)^3}{(x+5)^8}$$

$$\ln y = \ln \left(\frac{\sqrt{x+1} (2-x)^3}{(x+5)^8} \right)$$

$$\ln y = \ln \sqrt{x+1} + \ln (2-x)^3 - \ln (x+5)^8$$

$$\ln y = \frac{1}{2} \ln(x+1) + 3 \ln(2-x) - 8 \ln(x+5)$$

$$y \left(\frac{1}{y} \frac{dy}{dx} \right) = \left(\frac{1}{2(x+1)} - \frac{3}{2-x} - \frac{8}{x+5} \right) y$$

$$\frac{dy}{dx} = \left(\frac{1}{2(x+1)} - \frac{3}{2-x} - \frac{8}{x+5} \right) (\ln \sqrt{x^3 + x^2 + 1})$$

$$3) \begin{array}{r|rrrr} 2 & 1 & -3 & 0 & 8 \\ & \downarrow & 2 & -2 & -4 \\ \hline & 1 & -1 & -2 & 4 \end{array} \int x^2 - x - 2 + \frac{4}{x-2} dx$$

$$= \frac{x^3}{3} - \frac{x^2}{2} - 2x + 4 \ln |x-2| + C$$

$$4) \int \frac{1-3y}{\sqrt{2y-3y^2}} dy \quad \begin{aligned} u &= 2y-3y^2 \\ du &= (2-6y)dy \\ \frac{1}{2} du &= (1-3y)dy \end{aligned}$$

$$\frac{1}{2} \int u^{-1/2} du$$

$$= \frac{1}{2} \cdot 2 u^{1/2} = u^{1/2} + C = \sqrt{2y-3y^2} + C$$

$$5) \int \frac{6x+1}{3x} dx = \int \frac{6x}{3x} dx + \int \frac{1}{3x} dx$$

$$= \int 2 dx + \frac{1}{3} \int \frac{1}{x} dx = 2x + \frac{1}{3} \ln|x| + C$$

$$6) \int_1^{e^6} \frac{\sqrt{\ln x}}{x} dx \quad \begin{aligned} u &= \ln x \\ du &= \frac{1}{x} dx \end{aligned}$$

$$u(1) = \ln 1 = 0$$

$$u(e^6) = \ln e^6 = 6$$

$$\int_0^6 u^{1/2} du = \frac{2}{3} u^{3/2} \Big|_0^6 = \frac{2}{3} (6)^{3/2} - 0$$

$$= \frac{2}{3} \cdot (\sqrt{6})^3$$

$$7) \lim_{x \rightarrow 6^-} \ln(6-x) = -\infty$$

ln(small)

$$8) g(x) = \int_1^{\ln \sqrt{x}} (t^3 + 3) dt$$

$$g'(x) = \left((\ln \sqrt{x})^3 + 3 \right) \cdot \frac{1}{\sqrt{x}} \cdot \frac{1}{2} x^{-1/2}$$

$$= \left((\ln \sqrt{x})^3 + 3 \right) \cdot \left(\frac{1}{2x} \right)^{\sqrt{x}}$$

$$9) \int \frac{x+1}{x^2+2x+1} dx = \int \frac{x+1}{(x+1)^2} dx = \int \frac{1}{x+1} dx$$

$$= \ln|x+1| + C$$

$$10) \frac{dy}{dx} = \frac{2x}{x^2-9} \quad (0, 4)$$

$$\int dy = \int \frac{2x}{x^2-9} dx \quad \begin{array}{l} u = x^2 - 9 \\ du = 2x dx \end{array}$$

$$y = \int \frac{1}{u} du$$

$$y = \ln|x^2-9| + C$$

$$4 = \ln|0-9| + C$$

$$4 = \ln 9 + C$$

$$C = 4 - \ln 9$$

$$y = \ln|x^2-9| + 4 - \ln 9$$

$$12) \int_0^1 \frac{1-\cos x}{x-\sin x} dx$$

$$\begin{array}{l} u = x - \sin x \\ du = (1 - \cos x) dx \\ u(0) = 0 - 0 = 0 \\ u(1) = 1 - \sin 1 \end{array}$$

$$\int_0^{1-\sin 1} \frac{1}{u} du$$

$$\ln|u| \Big|_0^{1-\sin 1}$$

$$\ln|1-\sin 1| - \ln 0$$

no solution

$$11) y^2 + \ln(xy) = 2 \quad (e, 1)$$

$$2y \frac{dy}{dx} + \frac{1}{x} + \frac{1}{y} \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} \left(2y + \frac{1}{y} \right) = -\frac{1}{x}$$

$$\frac{dy}{dx} = \frac{-1}{x \left(2y + \frac{1}{y} \right)}$$

$$\frac{-1}{e(2+1)} = \frac{-1}{3e}$$

$$y - 1 = \frac{-1}{3e} (x - e)$$