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16/ENG 06/012

1. $y = \left[(x+1)^2 (x-2)^{1/2}\right] / \left[(2x-1)(x-3)^{4/3}\right]$

Recall

$u\frac{dv}{dx} + v\frac{du}{dx}$

U: equ1 $= \left[(x+1)^2 (x-2)^{1/2}\right]$
$= u \quad v$

Let $w = x+1$ $\qquad$ $u = w^2$

$\frac{dw}{dx} = 1$ $\qquad$ $\frac{du}{dw} = 2w$

$\frac{dw}{dx} \cdot \frac{du}{dw} = 2w = \frac{du}{dx} = 2(x+1)$

Let $w = (x-2)$ $\qquad$ $v = (w)^{1/2}$

$\frac{dw}{dx} = 1$ $\qquad$ $v = \frac{1}{2} w^{-1/2} = \frac{1}{2}\frac{1}{w^{1/2}}$

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

$= \frac{1}{2}\frac{(x+1)^2}{(x-2)^{1/2}} + 2(x-2)^{1/2}(x+1)$

V: equ2 $\left[(2x-1)(x-3)^{4/3}\right]$
$u \quad v$

$\frac{du}{dx} = 2$ $\qquad$ $\frac{dv}{dx} = \frac{4}{3}(x-3)^{1/3}$

$u\frac{dv}{dx} + v\frac{du}{dx}$

$= \frac{4}{3}(2x-1)(x-3)^{1/3} + 2(x-3)^{4/3}$

$$\frac{V\frac{du}{dx} - U\frac{dv}{dx}}{V^2}$$

$$= \frac{1}{2}\frac{(x+1)^2}{(x+2)^{1/2}} + 2(x-2)^{1/2}(x+1) \Big/ \frac{4}{3}(2x-1)(x-2)^{1/3} + 2(x-3)^{4/3}$$

$\underline{du}$

$$\left[\frac{1}{2}(2x-1)(x-3)^{4/3}\frac{(x+1)^2}{(x-2)^{1/2}} + 2(x-2)^{1/2}(x+1) - \frac{4}{3}(x+1)^2(x-2)^{1/2}(2x-1)(x-3)^{1/3} + 2(x-3)^{4/3}\right] \Big/ \left[(2x-1)(x-3)^{4/3}\right]^2$$

$$\frac{\left[\frac{1}{2}(2x-1)(x-3)^{4/3}\frac{(x+1)^2}{(x-2)^{1/2}} + 2(x-2)^{1/2}(x+1)\right] - \left[\frac{4}{3}(x+1)^2(x-2)^{1/2}(2x-1)(x-3)^{1/3} + 2(x-3)^{4/3}\right]}{\left[(2x-1)(x-3)^{4/3}\right]^2}$$

$\int 2x (3x^2 - 1)^{1/2}$

$u = 3x^2 - 1$

$\frac{du}{dx} = 6x$

$du = 6x\,dx$

$dx = du/6x$

$\int 2x \times (u)^{1/2} \, du/6x$

$\frac{1}{3} \int u^{1/2} du = \frac{1}{3} \times \frac{u^{1/2+1}}{1/2+1} + c$

$\frac{1}{3} \times \frac{2}{3} u^{3/2} + c$

$= \frac{2}{9} u^{3/2} + c$

$= \frac{2}{9} (3x^2 - 1)^{3/2} + c$

$\int \frac{2x}{(4x^2-1)^{1/2}} = \int 2x (4x^2 - 1)^{-1/2} dx$

$u = 4x^2 - 1$

$du = 8x\,dx$

$dx = \frac{du}{8x}$

$= \int 2x (u)^{-1/2} \frac{du}{8x}$

$= \frac{1}{4} \int u^{-1/2} du$

$= \frac{1}{4} \times \frac{u^{-1/2+1}}{-1/2+1}$

$= \frac{1}{4} \times \frac{u^{1/2}}{1/2}$ $\quad \frac{1}{4} \times 2u^{1/2} = \frac{1}{2} u^{1/2} = \frac{1}{2}(4x^2 - 1)^{1/2}$

$$\frac{1}{y}\frac{dy}{dx} = \frac{e^{x}}{3e^{x}} + \frac{\cos x}{\sin x} - \frac{\frac{1}{2}x^{-1/2}}{x^{1/2}}$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{1}{3} + \cot 2x - \frac{1}{2x}$$

$$\frac{dy}{dx} = \frac{[3e^{x}\sin 2x]}{[x^{1/2}]}\left[\frac{1}{2} + \cot 2x - \frac{1}{2x}\right]$$

5. $\int 4\sec^2(3x+1)\,dx$

$u = 3x+1$

$du = 3dx$

$dx = \frac{du}{3}$

$\int 4\sec^2 u \, du/3$

$4/3 \int \sec^2 u \, du$

Integral of $\sec^2 u = \tan u + c$

$4/3 \tan u + c$

$4/3 \tan(3x+1) + c$