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Mat 104
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$4\sec^2(3m+1)\,dm$

Let $u = 3m+1$

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

$du = 3dm$

$dm = du/3$

$\int 4\sec^2(3m+1)\,dm$.

$4\int \sec^2 u \cdot \frac{du}{3}$

$\frac{4}{3}\int \sec^2 u \cdot du = \frac{4}{3}\tan u + c = \frac{4}{3}(3m+1) + c$

2 $2t(3t^2-1)^{1/2}$

let $u = 3t^2 - 1$

$$\frac{du}{dt} = 6t$$

$$dt = \frac{du}{6t}$$

$$\int 2t(3t^2-1)^{1/2}\,dt$$

$$\int 2t\,u^{1/2}\,dt = \int 2t\,u^{1/2}\,\frac{du}{6t}$$

$$= \frac{1}{3}\int u^{1/2}\,du$$

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

$$= \frac{2}{9}u^{3/2} = \frac{2}{9}(3t^2-1)^{3/2} + C$$

3) $\int 2x(4x^2-1)^{-1/2}\,dx$

Let $u = 4x^2 - 1$

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

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

$$= \int 2x\,U^{-1/2}\,dx$$

$$= \int 2x\,U^{-1/2}\,\frac{du}{8x}$$

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

$$= \frac{1}{4} \times \frac{U^{1/2}}{1/2}$$

$$= \frac{1}{2}U^{1/2}$$

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

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

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

$$\frac{1}{y}\cdot\frac{dy}{dx} = \left[\frac{1}{(x+1)^2} \times 2(x+1) + \frac{1}{(x-2)^{1/2}} \times \tfrac{1}{2}(x-2)^{-1/2}\right] - \left[\frac{1}{2x-1} \times 2 + \frac{1}{(x-3)^{4/3}} \times \tfrac{4}{3}(x-3)^{1/3}\right]$$

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

$$\frac{1}{y}\cdot\frac{dy}{dx} = \left[\frac{2}{x+1} + \frac{1}{2x-4} - \frac{2}{2x-1} + \frac{4}{3(x-3)}\right]$$

$$\frac{dy}{dx} = \frac{(x+1)^2 (x-2)^{1/2}}{(2x-1)(x+3)^{3/2}}\left[\frac{2}{x+1} + \frac{1}{2x-4} - \frac{2}{2x-1} - \frac{4}{3x-9}\right]$$

$$y = \frac{3e^k \sin 2k}{k^{5/2}}$$

$$\ln y = \ln 3e^k + \ln \sin 2k - \ln k^{5/2}$$

$$\frac{1}{y} \cdot \frac{dy}{dx} = \frac{1}{3e^k} \times 3e^k + \frac{1}{\sin 2k} \times 2\cos 2k - \frac{1}{k^{5/2}} \times 5/2 k^{3/2}$$

$$\frac{dy}{dx} = \frac{3e^k \sin 2k}{k^{5/2}} \left[\frac{3e^k}{3e^k} + \frac{2\cos 2k}{\sin 2k} - \frac{5k^{3/2}}{2k^{5/2}} \right]$$

$$\frac{dy}{dx} = \frac{3e^k \sin 2k}{k^{5/2}} \left[1 + \frac{2}{\tan 2k} - \frac{5}{2k} \right]$$

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