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

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

$$\frac{1}{y}\cdot\frac{dy}{dx} = \frac{1}{(x+1)^2}\cdot 2(x+1) + \frac{1}{(x-2)^{\frac{1}{2}}}\cdot\frac{1}{2}(x-2)^{-\frac{1}{2}} - \frac{1}{2x-1}\cdot 2 + \frac{1}{(x+3)^{\frac{3}{2}}}\,\frac{3}{2}(x+2)$$

$$\frac{1}{y}\cdot\frac{dy}{dx} = \frac{2}{x+1} + \frac{1}{2}(x-2)^{-1} - \frac{2}{2x-1} + \frac{3(x+2)^{\frac{1}{2}}}{2(x+3)^{\frac{3}{2}}}$$

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

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

2. $y = [3e^{x} \sin 2x] / [x^{\frac{5}{2}}]$

$\ln y = \ln 3e^{x} + \ln \sin 2x - \ln x^{\frac{5}{2}}$

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

$\frac{1}{y} \cdot \frac{dy}{dx} = 1 + \frac{2\cos 2x}{\sin 2x} - x^{\frac{2}{5}} \cdot \frac{5}{2} x^{\frac{3}{2}}$

$\frac{1}{y} \cdot \frac{dy}{dx} = 1 + 2\cot 2x - \frac{5}{2} x^{\frac{19}{10}}$

$\frac{dy}{dx} = y\left(1 + 2\cot 2x - \frac{5}{2} x^{\frac{19}{10}}\right)$

$\frac{dy}{dx} = [3e^{x} \sin 2x] / [x^{\frac{5}{2}}] \left(1 + 2\cot 2x - \frac{5}{2} x^{\frac{19}{10}}\right)$

Integrate.

3 $4\sec^2(3m+1)$

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

let $u = 3m+1$

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

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

$\int 4\sec^2(u) \frac{du}{3} = \frac{4}{3} \int \sec^2(u)\, du$

$\frac{4}{3} \int \sec^2(u)\, du = \frac{4}{3} [\tan u] + C = \frac{4}{3} [\tan(3m+1)] + C$

4 $\int \left(2t\,(3t^2-1)^{\frac{1}{2}}\right) dt$

let $u = 3t^2 - 1$

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

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

$$\int 2t\,(u)^{\frac{1}{2}} \cdot \frac{du}{6t} = \int u^{\frac{1}{2}} \cdot \frac{du}{3}$$

$$\frac{1}{3} \int u^{\frac{1}{2}} \cdot du = \frac{1}{3}\left[\frac{2u^{\frac{3}{2}}}{3}\right]$$

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

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

5 $\int \left(2x / (4x^2 - 1)^{\frac{1}{2}} \right) dx$

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

let $u = 4x^2 - 1$

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

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

$\int \left(\cancel{2x} (u)^{\frac{1}{2}} \frac{du}{\cancel{8x}} \right) = \frac{1}{4} \int u^{-\frac{1}{2}} du.$

$= \frac{1}{4} \times \frac{1}{2} (u)^{\frac{1}{2}}$

$= \frac{1}{8} (u)^{\frac{1}{2}} + C = \frac{1}{8} (4x^2 - 1)^{\frac{1}{2}} + C$

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