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

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

$$\frac{d}{dx}(\ln y) = \frac{d}{dx}(3e^x) + \frac{d}{dx}(\ln \sin 2x) - \frac{d}{dx}(\ln x^{5/2})$$

$$\frac{1}{y} \frac{dy}{dx} = \frac{1}{3e^x} (3e^x) + \frac{1}{\sin 2x} (\cos 2x) - \frac{1}{x^{5/2}} \left( \frac{5}{2} x^{3/2} \right)$$

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

Multiplying both sides by  $y$ .

$$\frac{1}{y} \frac{dy}{dx} \times y = y \left( 1 + \frac{\cos 2x}{\sin 2x} - \frac{5/2 x^{3/2}}{x^{5/2}} \right)$$

$$\therefore \frac{dy}{dy} = \frac{3e^x \sin 2x}{x^{5/2}} \left( 1 + \cot 2x - \frac{5/2 x^{3/2}}{x^{5/2}} \right)$$

Integration

$$1) \int 4 \sec^2(3mt+1) dm$$

$$u = 3mt+1$$

$$du = 3 dm$$

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

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

$$\frac{4}{3} \int \sec^2 u \, dy$$

$$\frac{4}{3} \tan u + C$$

$$\frac{4}{3} \tan(3mt+1) + C_{//}$$

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

$$u = 3t^2 - 1$$

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

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

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

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

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

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

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

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

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

$$u = 4x^2 - 1$$

$$dy = 8x dx$$

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

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

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

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

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

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

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