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MATH 104

Due 3/04/19

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

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

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

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

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

$\frac{dy}{dx} = \frac{(x+1)^2 (x-2)^{1/2}}{(2x-1)(x+3)^{3/2}}\left[\frac{2}{x+1} + \frac{1}{2x-4} - \frac{2}{2x-1} - \frac{3}{2x+6}\right]$

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

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

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

$x^{3/2}$

5 $\int \frac{2x}{\sqrt{4x^2-1}} \, dx$

$u = \sqrt{4x^2-1}$

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

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

$x^2 = \frac{u^2+1}{4}$

$x = \sqrt{\frac{u^2+1}{4}}$

$dx = \frac{1}{2}\left(\frac{u^2+1}{4}\right)^{-1/2} \cdot \frac{u}{2}$

$\frac{dx}{du} = \frac{u}{4}\left(\frac{u^2+1}{4}\right)^{-1/2}$

$\frac{dx}{du} = \frac{u}{4}\left(\frac{u^2+1}{4}\right)^{-1/2}$

$\cancel{2}\left(\cancel{2}\left(\frac{u^2+1}{4}\right)^{1/2} \cdot \frac{u\,du}{4^2}\left(\frac{u^2+1}{4}\right)^{-1/2}\right.$

$\frac{1}{2}\left(\frac{u^2+1}{4}\right)^{1/2 - 1/2} du$

$\frac{1}{2}\int du$

$= \frac{u}{2} + c$

$= \frac{\sqrt{4x^2-1}}{2} + c$

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

$$\frac{dy}{dx} = y\left[1 + \frac{2\cos 2x}{\sin 2x} - \frac{5}{2x}\right]$$

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

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

$u = 3m+1$

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

$dn = 3\,dm$

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

$4 \sec^2(u)\,du/3$

$4/3 \sec^2(u)\,du$

$4/3 \tan u + c$

$= 4/3 \tan(3m+1) + c$

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

$u = \sqrt{3t^2 - 1}$

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

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

$t^2 = \frac{u^2+1}{}$

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$$t = \sqrt{\frac{u^2+1}{3}}$$

$$\frac{dt}{du} = \frac{1}{2}\left(\frac{u^2+1}{3}\right)^{-1/2} \cdot \frac{2u}{3}$$

$$\frac{dt}{du} = \frac{u}{3}\left(\frac{u^2+1}{3}\right)^{-1/2}$$

$$dt = \frac{udu}{3}\left(\frac{u^2+1}{3}\right)^{-1/2}$$

$$dt = \int 2\left(\frac{u^2+1}{3}\right)^{1/2} \cdot u \cdot \frac{udu}{3}\left(\frac{u^2+1}{3}\right)^{-1/2}$$

$$= \frac{2}{3}\int u^2\left(\frac{u^2+1}{3}\right)^{1/2 - 1/2} du$$

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

$$= \frac{2}{3}\left(\frac{u^3}{3}\right) + C$$

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

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

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