Ibe Chidera
Computer Engineering
19/ENG02/1020
MAT 104

Differentiation.

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

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

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

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

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

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

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

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

Find the log of both sides

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

Differenting with respect to $x$

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

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

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

Multiplying both sides by $y$

$$\frac{1}{y}\frac{dy}{dx} \times y = y\left[\frac{3e^x}{3e^x} + \frac{\cos 2x}{\sin 2x} - \frac{5/2\, x^{3/2}}{x^{5/2}}\right]$$

$$dy/dx = y\left[1 + \frac{\cos 2x}{\sin 2x} - 5/2\, x^{3/2}\right]$$

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

Integration

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

$u = 3m + 1$

$du = 3d\, m$

$dm = du/3$

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

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

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

$4/3 \tan u + c$

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

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

$u = 3t^2 - 1$

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

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

$$\int 2t \times (u)^{1/2} \frac{du}{3}$$

$$\int 1/3 \times u^{1/2}$$

Multiplying both sides by $y$

$$\frac{1}{y}\frac{dy}{dx} \times y = y\left[\frac{3e^x}{3e^x} + \frac{\cos 2x}{\sin 2x} - \frac{5/2\,x^{3/2}}{x^{5/2}}\right]$$

$$dy/dx = y\left[1 + \frac{\cos 2x}{\sin 2x} - 5/2\,x^{3/2}\right]$$

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Integration

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

$u = 3m+1$

$du = 3d\,m$

$dm = du/3$

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

Integration of S

$= \tan u +$

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

$4/3 \tan u + c$

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

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

$u = 3t^2 - 1$

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

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

$\int 2t \times (u)^{1/2} \frac{du}{3}$

$\int 1/3 +$

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

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

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

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

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

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

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

$u = 4x^2 - 1$

$du = 8x \, dx$

$dx = du / 8x$

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

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

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

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

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

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

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

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

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

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

Find the log of both sides

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Differentiating with respect to $x$

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

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

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