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

differentiating both sides of the equation

$$\frac{d}{dx}(y) = \frac{d}{dx}\left(\frac{3e^x \sin(2x)}{x^{5/2}}\right)$$

~~For the right side,~~

$$\cancel{\frac{12e^x x^{5/2}\cos(2x) + 6e^x x^{5/2}\sin(2x) - 15e^x x^{3/2}\sin(2x)}{2x^5}}$$

For right side,

$$= 3\frac{d}{dx}\left(\frac{e^x \sin(2x)}{x^{5/2}}\right)$$

using quotient rule, $f(x) = e^x \sin 2x$
$g(x) = x^{5/2}$

$$= 3\frac{x^{5/2}\frac{d}{dx}[e^x \sin(2x)] - e^x \sin(2x)\frac{d}{dx}[x^{5/2}]}{(x^{5/2})}$$

multiplying the exponents in $(x^{5/2})^2$

$$= 3\frac{x^{5/2}\frac{d}{dx}[e^x \sin(2x)] - e^x \sin(2x)\frac{d}{dx}[x^{5/2}]}{x^5}$$

using product rule,

$$3\frac{-e^x \sin(2x)\frac{d}{dx}[x^{5/2}]}{x^5}$$

multiplying by $\frac{2}{2}$,

$$= 3\frac{-e^x \sin(2x)\left(\frac{5}{2}x^{\frac{5}{2}-1\cdot\frac{2}{2}}\right)}{x^5}$$

combine -1 and $\frac{2}{2}$

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

$$= 3\frac{-e^x \sin(2x)\left(\frac{5}{2}x^{\frac{5}{2}}\right)}{x^5}$$

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

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

simplifying,

$$= \frac{12e^x x^{5/2}\cos(2x) + 6e^x x^{5/2}\sin(2x) - 15e^x x^{3/2}\sin(2x)}{2x^5}$$

By setting the left side equal to the right,

$$\frac{12e^x x^{5/2}\cos(2x) + 6e^x x^{5/2}\sin(2x) - 15e^x x^{3/2}\sin(2x)}{2x^5}$$

Answer

$$= \frac{12e^x x^{5/2}\cos(2x) + 6e^x x^{5/2}\sin(2x) - 15e^x x^{3/2}\sin(2x)}{2x^5}$$ //

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18/ENG04/074
ELECTRICAL/ELECTRONIC ENGINEERING

C/A

ⓐ $2x/(4x^2-1)^{1/2}$

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

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

$u = 4x^2-1$, $\frac{du}{dx} = 8x$

$\frac{1}{8}du = x\,dx$

$2\int \frac{1}{u^{1/2}} \cdot \frac{1}{8}du$

$2\int \frac{1}{8u^{1/2}}\,du$

$2\left(\frac{1}{8}\int \frac{1}{u^{1/2}}\,du\right)$

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

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

$\frac{1}{4}(2u^{1/2}+c)$

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

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

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

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

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

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

Let $u = 3t^2-1$, $\frac{1}{6}du = t\,dt$

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

$= 2\int \frac{1}{u^{1/2}} \cdot \frac{1}{6}du$

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

$= 2\left(\frac{1}{6}\int \frac{1}{u^{1/2}}\,du\right)$

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

$= \frac{1}{3}(2u^{1/2}+c)$

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

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

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

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

Let $u = 3m+1$

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

So, $\frac{1}{3}du = dm$

$= 4\int \sec^2(u)\frac{1}{3}du$

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

$= 4\left(\frac{1}{3}\int \sec^2(u)\,du\right)$

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

$= \frac{4}{3}(\tan(u)+c)$

$= \frac{4}{3}\tan(u) + c$

$= \frac{4}{3}\tan(3m+1) + c$