Question#37497 - Mathematics - Differential Calculus

If $y = e^{ax}\cos^3 x \sin^2 x$ **find** $\frac{dy}{dx}$

Solution:

Using

Product Rule

$$\frac{d}{dx}\left(f(x)\cdot g(x)\cdot h(x)\right) = f(x)\cdot g(x)\cdot\frac{d}{dx}\left(h(x)\right) + f(x)\cdot h(x)\cdot\frac{d}{dx}\left(g(x)\right) + h(x)\cdot g(x)\cdot\frac{d}{dx}\left(f(x)\right)$$

Power rule

$$\frac{dx^n}{dx} = nx^{n-1}$$

$$\frac{d}{dx}\sin x = cosx$$

$$\frac{d}{dx}cosx = -\sin x$$

The chain rule

If $h(x) = f\left(g(x)\right)$, then

$$\frac{dh}{dx} = \frac{dh}{dg}\cdot\frac{dg}{dx}$$

$$\frac{d}{dx}e^x = e^x$$

$$\frac{dy}{dx} = e^{ax}\cos^3 x\frac{d}{dx}(\sin^2 x) + e^{ax}\sin^2 x\frac{d}{dx}(\cos^3 x) + \cos^3 x\sin^2 x\frac{d}{dx}(e^{ax}) =$$

$$= e^{ax}\cdot\cos^3 x\cdot 2\sin x\cdot\cos x + e^{ax}\cdot\sin^2 x\cdot 3\cos^2 x\cdot(-\sin x) + \cos^3 x\cdot\sin^2 x\cdot a\cdot e^{ax}$$

Answer:

$$\boldsymbol{\frac{dy}{dx} = e^{ax}\cdot\cos^2 x\sin x\left(2\sin x\cdot\cos^2 x - 3\sin^2 x + a\sin x\cdot\cos x\right)}$$