

Answer on Question #82869 – Math – Calculus

Question

Differentiate $y = 3x \cos x + \sin x$ with respect to x .

Solution

Using the Sum Rule, that is,

$$\text{if } f(x) = u(x) + v(x), \text{ then } \frac{df}{dx} = \frac{du}{dx} + \frac{dv}{dx},$$

one gets

$$\frac{dy}{dx} = \frac{d(3x \cos x)}{dx} + \frac{d(\sin x)}{dx}.$$

For $\frac{d(3x \cos x)}{dx}$ use the Product Rule:

$$\text{if } f(x) = u(x) \cdot v(x), \text{ then } \frac{df}{dx} = v \frac{du}{dx} + u \frac{dv}{dx}.$$

We get

$$\frac{dy}{dx} = 3 \cos x \frac{dx}{dx} + 3x \frac{d(\cos x)}{dx} + \frac{d(\sin x)}{dx}.$$

Then use derivatives of functions x , $\sin x$ and $\cos x$:

$$\frac{dx}{dx} = 1, \quad \frac{d(\sin x)}{dx} = \cos x, \quad \frac{d(\cos x)}{dx} = -\sin x.$$

$$\frac{dy}{dx} = 3 \cos x \frac{dx}{dx} + 3x \frac{d(\cos x)}{dx} + \frac{d(\sin x)}{dx} = 3 \cos x - 3x \sin x + \cos x = 4 \cos x - 3x \sin x.$$

Answer: $\frac{dy}{dx} = 4 \cos x - 3x \sin x.$