

Answer on Question#38095 – Math - Calculus

To differentiate composite functions we have to use the Chain rule. We know that composite functions are functions of a function. That is, if f and g are functions, then the chain rule expresses the derivative of the composite function $f \circ g$ in terms of the derivatives of f and g and the product of functions – as follows:

$$(f \circ g)' = (f' \circ g) \cdot g'$$

For example, if we have $y = f(t)$ and $t = g(x)$, then the derivative of y with respect to x is:

$$\frac{dy}{dx} = \frac{dy}{dt} \cdot \frac{dt}{dx}$$

Let $y = \sin(3x^4)$. Differentiate y with respect to x .

Let $3x^4 = t$, then $y = \sin t$. Using the Chain rule

$$\frac{dy}{dx} = \frac{dy}{dt} \cdot \frac{dt}{dx}$$

$$\frac{dy}{dt} = \cos t$$

$$\frac{dt}{dx} = 3 \cdot 4x^3 = 12x^3$$

Then

$$\frac{dy}{dx} = \cos t \cdot 12x^3 = 12x^3 \cos 3x^4$$

So we use composite differentiation if we have **composite functions** or functions of a function.