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33 YEARS IN SERVICE

1) differentiate $y = 4\sin(6/x^2)$ from the first principle.

Apply the constant multiple rule
$d/dx\,(c \cdot f(x)) = c \cdot d/dx\,(f(x))$ with
$c = 4$ and

$f(x) = \sin\left(\frac{6}{x^2}\right)$

$d/dx\left(4\sin \frac{6}{x^2}\right) = 4\left(\frac{d}{dx}\right)\left(\sin\left(\frac{6}{x^2}\right)\right)$

$d/dx\left[\sin\left(\frac{6}{x^2}\right)\right]$

The derivative of sine is $d/dx\,(\sin(u))$
$= \cos(u)$

$4\,d/du\,(\sin(u))\,d/dx\left(6/x^2\right)$
$= 4\cos(u)\frac{d}{dx}\left(6/x^2\right)$

$\cos\left(\frac{6}{x^2}\right) \cdot 6 \cdot \frac{d}{dx}\left[\frac{1}{x^2}\right]$

$6\cos\left(\frac{6}{x^2}\right)(-2)x^{-3}$

$= \frac{-12\cos(6/x^2)}{x^3}$

2) $x = 4t^3 - t^2$
$dx/dt = 12t^2 - 2t$
$dx = (12t^2 - 2t)dt$
$A = \int_a^b y\,dx$

$x = 4t^3 - t^2$
$y = t^3 + 2t^2$
at $t = 1$
$t = 3$

$A = \int_1^3 (t^4 + 2t^2)(12t^2 - 2t)dt$

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$$= \int_1^3 (12t^6 - 2t^5 + 24t^4 + 4t^3)\,dt.$$

$$= \left[\frac{12}{7}t^7 - \frac{\cancel{2}t^6}{\cancel{6}_{3}} + \frac{24t^5}{5} + \frac{\cancel{4}t^4}{\cancel{4}}\right]_1^3$$

$$= \left[\frac{12t^7}{7} + \frac{t^6}{3} + \frac{24t^5}{5} + t^4\right]_1^3$$

Where $t = 1$

$$= \left[\frac{12 \times 1^7}{7} + \frac{1^6}{3} + \frac{24 \times 1^5}{5} + 1^4\right]$$

$$\frac{12}{7} + \frac{1}{3} + \frac{24}{5} + \frac{1}{1}$$

$$\frac{180 + 35 + 504 + 105}{105}$$

$$= \frac{824}{105}\,4$$

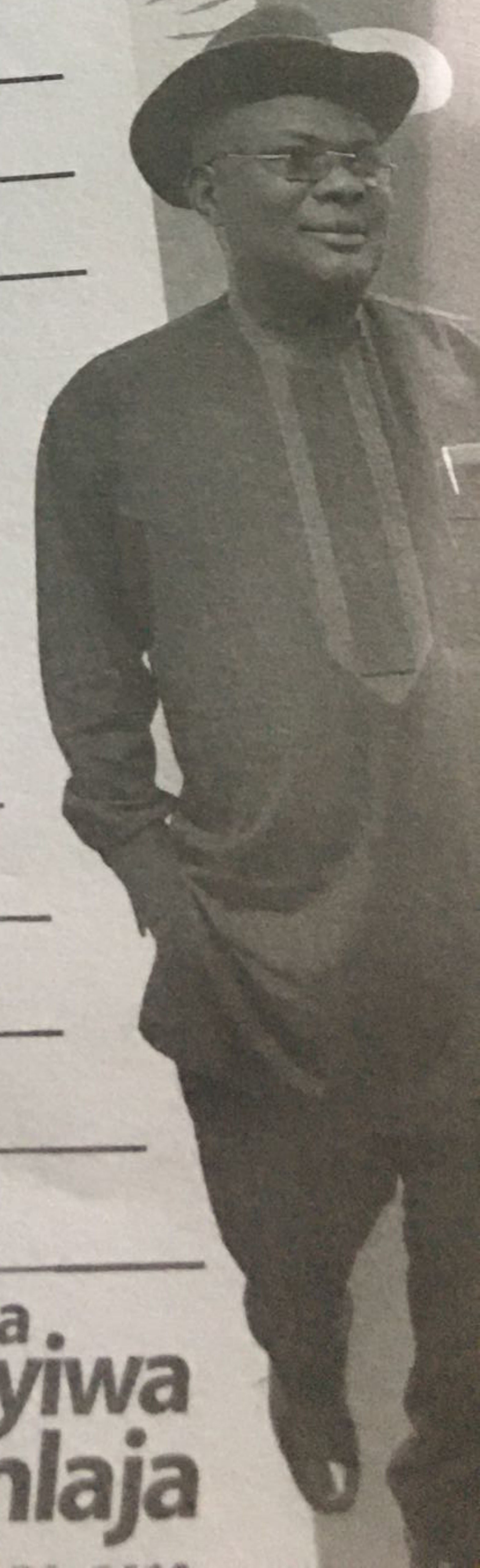
Where $t = 3$

$$= \left[\frac{12}{7} \times 3^7 + \frac{3^6}{3} + \frac{24}{5} \times 3^5 + 3^4\right]$$

$$\frac{12 \times 2187}{7} + \frac{729}{3} + \frac{24}{5} \times 243 + 81$$

$$\frac{26244}{7} + \frac{243}{1} + \frac{5832}{5} + \frac{81}{1}$$

$$\frac{131220 + 8505 + 40824 + 2835}{35}$$



$$= \frac{183,384}{35} \quad 4.$$

3) If $x = 4^3 - t^2$ and $y = t^4 + 2t^2$ find dy/dx

Soln

Formula $- dy/dx\,(x) = \dfrac{\frac{dy(t)}{dt}}{\frac{dx(t)}{dt}}$

$$\frac{dy(t)}{dt} = \frac{d}{dt}(t^4 + 2t^2)$$

$$\frac{d(t^4)}{dt} + \frac{d(2t^2)}{dt}$$

$$\frac{d(t^4)}{dt} + \frac{d(2t^2)}{dt}$$

$$\frac{d(t^4)}{dt} = 4 \cdot t^{4-1}$$

$$4 \cdot t^3 + \frac{d(2 \cdot t^2)}{dt}.$$

$$4 \cdot t^3 + \frac{2(t^2)}{dt}.$$

$$4 \cdot t^3 + 2 \cdot 2t.$$

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$$dy/dt\,(t) = 4 \cdot t^3 + 4 \cdot t$$

Calculate the derivates

$$\frac{dx(t)}{dt}.$$

$$\frac{d(4 \cdot t^3)}{dt} + \frac{d(-t^2)}{dt}.$$

$\frac{d(t^3)}{dt} = 3t^{3-1}$

$= 4 \cdot 3 \cdot t^{3-1} + \frac{d(-t^2)}{dt}$.

Simular terms

$4 \cdot 3 \cdot t^2 + \frac{d(-t^2)}{dt}$

find simular terms

$12 \cdot t^2 + \frac{d(-t^2)}{dt}$

$12 \cdot t^2 - \frac{d(t^2)}{dt}$

$\frac{d(t^2)}{dt} = 2 \cdot t^{2-1}$

$12 \cdot t^2 - 2 \cdot t^{2-1}$

$= 12 \cdot t^2 - 2 \cdot t$

we have

$\frac{d\,x(t)}{dt} = 12 \cdot t^2 - 2 \cdot t$

$\frac{dy(x)}{dx} = \frac{\frac{dy(t)}{dt}}{\frac{dx(t)}{dt}} = \frac{4 \cdot t^3 + 4 \cdot t}{12 \cdot t^2 - 2 \cdot t}$

$= \frac{4t^3 + 4t}{12t^2 - 2t}$.