Math 104.

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$$\lim_{x \to 0} \left(\frac{4x^2 - \sin x}{x^3} \right)$$

Using L' Hopital's rule.

$$\lim_{x \to 0} \left(\frac{8x - \cos x}{3x^2} \right)$$ for the 1st derivative.

$$\lim_{x \to 0} \left(\frac{8 + \sin x}{6x} \right)$$ for second derivative.

$$\lim_{x \to 0} \left(\frac{\cos x}{6} \right) = \frac{\cos(0)}{6} = \frac{1}{6}$$

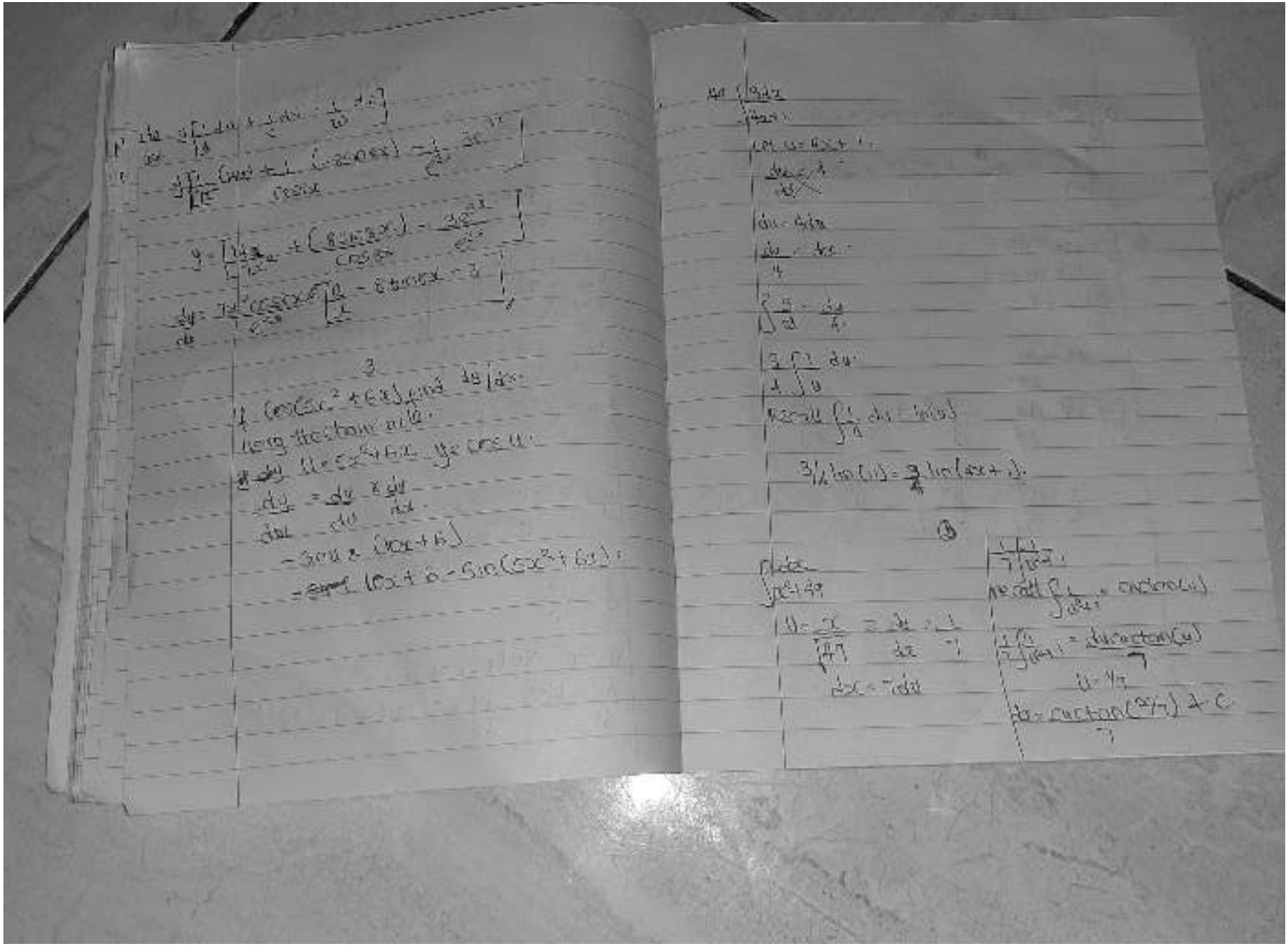
② $y = \frac{7x^2 \cos 8x}{e^{3x}}$

Solution.

$y = \frac{uv}{w}$

$u = 7x^2$ $v = \cos 8x$ $w = e^{3x}$.

$\frac{du}{dx} = 14x$ $\frac{dv}{dx} = -8\sin 8x$ $w = 3e^{3x}$.



① $\int e^{6x} + 9x^3 \cdot \sin 7x + \cos 8x \, dx$

$\left[\frac{e^{6x}}{6} + \frac{9x^4}{4} + \frac{\cos 7x}{7} + \frac{\sin 8x}{8}\right] + C$

② $\int x\sqrt{9+x^2}\,dx$

let $u = 9+x^2$

$\frac{du}{dx} = 2x$

$dx = \frac{du}{2x}$

$\int x\sqrt{u}\,\frac{du}{2x} = \int u^{1/2} \cdot \frac{du}{2} = \frac{1}{2}\int u^{1/2}\,du$

$\frac{1}{2} \cdot \frac{u^{3/2}}{3/2} = \frac{u^{3/2}}{2 \cdot 3/2} = \frac{u^{3/2}}{3} = \frac{(9+x^2)^{3/2}}{3}$