Quiz 5

1. Find
$$\int \frac{3x}{e^{4x}}\, dx.$$

Solution: Consider $\int \frac{3x}{e^{4x}}\, dx = \int 3xe^{-4x}\, dx$. Integration by parts:

- Let $u = 3x$ and $dv = e^{-4x}dx$.
- Then $du = 3dx$ and
- $v = \int e^{-4x}dx = \int e^{-4x}\ \ \frac{d(-4x)}{-4} = \frac{e^{-4x}}{-4} + C.$ By setting $C = 0$ $\Rightarrow$ $v = \frac{e^{-4x}}{-4}$.

$$\begin{aligned}
\int \frac{3x}{e^{4x}}\, dx = \int 3xe^{-4x}\, dx &= uv - \int v\, du \\
&= (3x)\left[\frac{e^{-4x}}{-4}\right] - \int \frac{e^{-4x}}{-4} 3dx \\
&= -\frac{3}{4}xe^{-4x} + \frac{3}{4}\int e^{-4x}dx \\
&= -\frac{3}{4}xe^{-4x} + \frac{3}{4}\int e^{-4x}\ \ \frac{d(-4x)}{-4} \\
&= -\frac{3}{4}xe^{-4x} + \frac{3}{4}\left[\frac{e^{-4x}}{-4}\right] + C \\
&= -\frac{3}{4}xe^{-4x} - \frac{3}{16}e^{-4x} + C
\end{aligned}$$

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