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Question: Evaluate $\int_0^8 \frac{\log_4(x+8)}{x+8}\ dx$

Solution: Recall that , $\log_a(x) = \log_e(x).\log_a(e)$.

Thus $I = \int_0^8 \frac{\log_4(x+8)}{x+8}\ dx = \log_4(e)\int_0^8 \frac{\log_e(x+8)}{x+8}\ dx$.

Put $u = \log_e(x+8), du = \frac{1}{x+8}dx$ and $u : \ln 8 \to \ln 16$

Now $I = \log_4(e)\int_{\ln 8}^{\ln 16} u\ du = \log_4(e)\left[\frac{u^2}{2}\right]_{\ln 8}^{\ln 16}$

$= \log_4(e)\left[\frac{(\ln 16)^2-(\ln 8)^2}{2}\right]$.