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Please show your work!

1) If  $f(x) = e^x$  and  $f_{ave}$  is the average value of  $f$  on the interval  $[0, h]$ , find  $\lim_{h \rightarrow 0} f_{ave}$  .

2) Find

a)  $\int \sin(\ln x) dx$  .

b)  $\int_0^{\frac{\pi}{4}} \sec^4 \theta \tan^4 \theta d\theta$  .

c)  $\int \frac{dx}{x^2 + a^2}$ ,  $a \neq 0$  .