your name here:

1. a), Let \( f(\lambda) = e^{\lambda B} A e^{-\lambda B} = \sum_{n=0}^{\infty} \frac{d^n f}{d \lambda^n} |_{\lambda = 0} \frac{\lambda^n}{n!} \), show that \( \frac{df(\lambda)}{d\lambda} = [B, f(\lambda)] \), and b) \( \frac{d^n f(\lambda)}{d \lambda^n} = [B, \frac{d^{n-1} f(\lambda)}{d \lambda^{n-1}}] \). c), Show that \( f(\lambda = 1) = e^{B} A e^{-B} = \sum_{n=0}^{\infty} \frac{(L_B)^n A}{n!} \). Here \( L_B A = [B, A] \) and \( (L_B)^n A = [B, (L_B)^{n-1} A] \) for \( n \geq 2 \).

2. a), Show that \( L_B x = d \) for \( B = -ipd/\hbar \). b), Use the result of the problem 1 to show that \( U^{-1} x U = x + d \), with \( U \equiv e^{-ipd/\hbar} \). Here \( p \) and \( x \) are the the momentum and position operators respectively.