

Problem Set 4  
P511—Quantum Mechanics, Fall 2008  
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Due Tuesday, September 30

1.) Suppose we have two operators  $A$  and  $B$  that may not commute. Show that

$$e^A B e^{-A} = B + [A, B] + \frac{1}{2!} [A, [A, B]] + \frac{1}{3!} [A, [A, [A, B]]] + \cdots = \sum_{n=0}^{\infty} \frac{1}{n!} A^n \{B\}$$

where

$$A^0 \{B\} = B, \quad A^1 \{B\} = [A, B], \quad A^2 \{B\} = [A, [A, B]], \quad \text{etc.}$$

2.) Sakurai, problem 1.27

3.) Sakurai, problem 1.28

4.) Sakurai, problem 1.29