1. Give examples of A and B 2×2 matrices, such that

   a) no two of matrices $e^A e^B, e^B e^A$ and e^{A+B} agree

   b) $AB \neq BA$, but still $e^A e^B = e^A e^B = e^{A+B}$

   c) $e^A e^B = e^B e^A \neq e^{A+B}$

   d) $e^A e^B \neq e^B e^A = e^{A+B}$

2. $e^{i(v \cdot \sigma)} = ?$

3. Prove, that $\det e^X = e^{\operatorname{Tr} X}$ for any matrix

4. Using the Golden-Thompson-Lieb inequality, prove

   a) the Golden-Thompson inequality

   a) that if $BC = CB$, then $\operatorname{Tr} e^{A+B+C} \leq \operatorname{Tr} e^A e^B e^C$

Deadline: October 27.

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