S–3: I can determine whether two operators are compatible; if they are not compatible I can use the uncertainty principle to set the appropriate limits on measurements of the corresponding physical observables.

<div align="center">

Unsatisfactory   Progressing   Acceptable   Polished

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(1) Given the two Hermitian operators

$$A \leftrightarrow \begin{bmatrix} a & 0 & a \\ 0 & 2a & 0 \\ a & 0 & 3a \end{bmatrix} \quad \text{and} \quad B \leftrightarrow \begin{bmatrix} b & 0 & -ib \\ 0 & -b & 0 \\ ib & 0 & b \end{bmatrix}.$$

(a) Show that A and B are not compatible.

(b) Assume that you have an ensemble of systems in the state

$$|\Psi\rangle \leftrightarrow \frac{1}{\sqrt{2}} \begin{bmatrix} 1 \\ i \\ 0 \end{bmatrix}.$$

Calculate ΔA and ΔB for measurements on this ensemble and show that these measurements would satisfy the uncertainty principle.