Physics 412—Discrete and Continuous Bases **Winter 2020**

Complete the following table.

	Discrete Basis $\{\|a_i\rangle\}$	**Coordinate Basis** $\{\|x\rangle\}$	**Momentum Basis** $\{\|p\rangle\}$
(1)	$A\|a_i\rangle = a_i\|a_i\rangle$	$\hat{X}\|x\rangle = x\|x\rangle$	$\hat{P}\|p\rangle = p\|p\rangle$
(2)	$\langle a_i\|a_j\rangle = \delta_{ij}$	$\langle x\|x'\rangle = \delta(x-x')$	$\langle p\|p'\rangle = \delta(p-p')$
(3)	$c_i = \langle a_i\|\Psi\rangle$	$\psi(x) = \langle x\|\psi\rangle$	$\phi(p) = \langle p\|\psi\rangle$
(4)	$\|\Psi\rangle = \sum_i c_i\|a_i\rangle$	$\|\psi\rangle = \int \|x\rangle\psi(x)\,dx$	$\|\psi\rangle = \int \|p\rangle\phi(p)dp$
(5)	$\|\Psi\rangle \leftrightarrow \begin{bmatrix} c_1 \\ c_2 \\ \vdots \\ c_n \end{bmatrix}$	$\|\psi\rangle \leftrightarrow \psi(x) = \langle x\|\psi\rangle$	$\|\psi\rangle \leftrightarrow \phi(p)$
(6)	$\langle\Psi\| \leftrightarrow \begin{bmatrix} c_1^* & c_2^* & \cdots & c_n^* \end{bmatrix}$	$\langle\psi\| \leftrightarrow \psi^*(x) = \langle\psi\|x\rangle$	$\langle\psi\| \leftrightarrow \phi^*(p)$
(7)	$\mathcal{P}(a_i) = \|\langle a_i\|\Psi\rangle\|^2$	$\mathcal{P}([x_0,x_1]) = \int_{x_0}^{x_1} \|\psi(x)\|^2 dx$	$\mathcal{P}([p_0,p_1]) = \int_{p_0}^{p_1} \|\phi(p)\|^2 dp$
(8)	$I = \sum_i \|a_i\rangle\langle a_i\|$	$I = \int \|x\rangle\langle x\|\,dx$	$I = \int \|p\rangle\langle p\|\,dp$
(9)	$D_{ij} = \langle a_i\|D\|a_j\rangle$	$D_{x,x'} = \langle x\|D\|x'\rangle$	$D_{p,p'} = \langle p\|D\|p'\rangle$