Woodbury Matrix Identity	$(A+UCV)^{-1} = A^{-1} - A^{-1}U(C^{-1}+VA^{-1}U)^{-1}VA^{-1}$
Sherman Morrison Formula	Given **invertible** $A \in R^{n\times n}$ and $u, v \in R^n$ vectors. Then $A+uv^T$ is invertible iff $1+v^TA^{-1}u \neq 0$. Then $(A+uv^T)^{-1} = A^{-1} - \frac{A^{-1}uv^TA^{-1}}{1+v^TA^{-1}u}$
Cauchy Schwarz Inequality	$\lvert\langle U,V\rangle\rvert \leq \langle U,U\rangle\dot{\langle} V,V\rangle$
Markov Inequality	X is a non-negative rv and $a>0$ then $P(X \geq a) \leq \frac{E(X)}{a}$
Minkowski inequality	$\lVert f+g\rVert_p \leq \lVert f\rVert_p + \lVert g\rVert_p$
Holder Inequality	Let $p, q \in [1,\infty], 1/p + 1/q = 1$. Then for all real/complex functions $f, g, \lVert fg\rvert_1 \leq \lVert f\rVert_p \lVert g\rVert_q$
Jensen Inequality	Given X is a rv and ϕ is convex. Then $\phi(E(X)) \leq E(\phi(X))$
Johnson Lindenstrauss Property	A distribution on matrices $S \in R^{k\times n}$ has (ϵ, δ, l)-JL moment property if $\forall x \in R^n, \lvert x\rvert_2 = 1$, $E_S(\lvert\lvert Sx\rvert_2^2 - 1\rvert^l) \leq \epsilon^l\delta$
Hoeffding Ineq	Let $X_1, \cdots, X_n$ be independent rv in $[0,1]$. Let $\bar{X} = \frac{1}{n}\sum_i X_i$. Then $P(\bar{X} - E(\bar{X}) \geq t) \leq \exp(-2nt^2)$
Chebyshev Inequality	$P(\lvert X - E(X)\rvert \geq a) \leq \frac{Var(X)}{a^2}$
Golden Thompson	For Hermitian matrices A,B $tr\exp(A+B) \leq tr(\exp(A)\exp(B))$