**Solution to Problem 10**) a) With reference to Problem 5, the second derivative of $f(x) = e^x$ is $f''(x) = e^x$, which is positive everywhere. Therefore, $e^x$ is a convex cup function. The second derivative of $g(x) = \ln x$ is $g''(x) = -1/x^2$, which is negative on the positive $x$-axis. Therefore, $\ln x$ is a convex cap function.

b) Invoking Jensen's inequality, we conclude that, for the convex cup function $e^x$, one must have $\langle e^x \rangle \geq e^{\langle x \rangle}$, and for the convex cap function $\ln x$, one must have $\langle \ln x \rangle \leq \ln\langle x \rangle$.