[nex24] **Propagation of statistical uncertainty.**

From a given stochastic variable X with probability distribution $P_X(x)$ we can calculate the probability distribution of the stochastic variable $Y = f(X)$ via the relation

$$P_Y(y) = \int dx\, P_X(x)\delta\left(y - f(x)\right).$$

Show by systematic expansion that if $P_X(x)$ is sufficiently narrow and $f(x)$ sufficiently smooth, then the mean values and the standard deviations of the two stochastic variables are related to each other as follows:

$$\langle Y\rangle = f(\langle X\rangle), \qquad \sigma_Y = |f'(\langle X\rangle)|\sigma_X.$$