1.) $\mathbb{E}[(x - \mathbb{E}[x])^2] = \int (x - \mathbb{E}[x])^2 \rho(x)\, dx$

$= \int (x^2 - 2x\,\mathbb{E}[x] + (\mathbb{E}[x])^2)\rho(x)dx$

$= \int x^2 \rho(x)dx + \int(-2x\mathbb{E}[x] + (\mathbb{E}[x])^2)\rho(x)dx$

$= \mathbb{E}[x^2] + \int \mathbb{E}[x](-2x + \mathbb{E}[x])\rho(x)dx$

$= \mathbb{E}[x^2] + \mathbb{E}[x](-2\mathbb{E}[x] + \mathbb{E}[x])$

$= \mathbb{E}[x^2] - (\mathbb{E}[x])^2$