1. $m(X) = \frac{1}{n}\sum_{i=1}^{n} x_i \quad X = a + bX$

$m(X) = \frac{1}{n}\sum_{i=1}^{n}(a + bx_i)$

$m(X) = \frac{1}{n}\sum_{i=1}^{n} a + \frac{1}{n}\sum_{i=1}^{n} bx_i$

$m(X) = \frac{na}{n} + b\left(\frac{1}{n}\sum_{i=1}^{n} x_i\right)$

$m(X) = a + bm(X)$

2. $cov(X,Y) = \frac{1}{N}\sum_{i=1}^{N}(x_i - m(X))(y_i - m(Y))$

$m(Y) = a + bm(Y)$

$cov(X,Y) = \frac{1}{N}\sum_{i=1}^{N}(x_i - m(X))(Y - m(Y))$

$cov(X,Y) = \frac{1}{N}\sum_{i=1}^{N}(x_i - m(x))(a + bY - (a + bm(Y))) = \frac{1}{N}\sum_{i=1}^{N}(x_i - m(X))(bY - bm(Y))$

$= b\,cov(X,Y)$

$cov(X, a + bY) = b\,cov(X,Y)$

3. $s^2 = \frac{1}{N}\sum_{i=1}^{N}(x_i - m(x))^2$

$cov(X,X) = s^2 = \frac{1}{N}\sum_{i=1}^{N}(x_i - m(x))^2$

$X = a + bx_N$

$m(X) = \frac{1}{N}\sum_{i=1}^{N}(a + bx_i) \qquad m(X) = a + bm(X)$

$s_X^2 = \frac{1}{N}\sum_{i=1}^{N}(X - m(Y))^2 \qquad s_X^2 = \frac{1}{N}\sum_{i=1}^{N}(a + bX - (a + bm(X)))^2$

$= \frac{1}{N}\sum_{i=1}^{N}(bx_i - bm(X))^2$

$= b^2\left(\frac{1}{N}\sum_{i=1}^{N}(X - m(X))^2\right)$

$s_X^2 = b^2 s^2$

$cov(a + bX, a + bX) = b^2 s^2$