1. $m(a+bX) = a + b \times m(X)$

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

$$= \frac{1}{N} \left(N a + b \sum_{i=1}^{N} x_i \right)$$

$$= a + b \cdot \frac{1}{N} \sum_{i=1}^{N} x_i$$

$$= a + b \, m(X)$$

2. $cov(X, X) = s^2$

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

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

$$= s^2$$

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

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

$$m(a+bY) = a + b(mY)$$

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

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

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

4. $\quad cov\left(a+bX, a+bY\right) = b^2 cov(X, Y)$

$$cov\left(a+bX, a+bY\right)$$
$$= b\,cov\left(X, a+bY\right)$$
$$= b\left[b\,cov(X, Y)\right]$$
$$= b^2\,cov\left(X, Y\right)$$

$$cov\left(bX, bX\right) = b^2 s^2$$

5.

$$med\left(a+bX\right) = a+b\,med\left(X\right)$$

$$IQR = Q3 - Q1$$
$$IQR\left(a+bX\right) = b\,IQR(X)$$

6. $\quad X=0 \quad X=2$

$$m(X)=1$$
$$\left(m(X)\right)^2 = 1$$

$$m(X^2) = (0^2 + 2^2)/2 = 2$$

$$m\left(X^2\right) \neq \left(m(X)\right)^2$$

$X=0 \quad X=4$

$$m(X) = 2$$
$$\sqrt{m(x)} \approx 1.41$$

$$m\left(\sqrt{x}\right) = (0+2)/2 = 1$$
$$m\sqrt{x} \neq \sqrt{m(x)}$$