1. $m(a+bY) = a + bm(Y)$

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

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

$$= \frac{1}{N}Na + b\frac{1}{N}\sum_{i=1}^{N} y_i = a + bm(Y) = m(a+bY)$$

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

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

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

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

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

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

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

$$= b^2\sum(x_i - m(X))(x_i - m(X)) = b^2 cov(X,X)$$

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

4. The median of transformed variable that is non decreasing can shift the median, This also applies to quantiles, IQR, and range. Arcsinx will shift the distribution of values, which can change median.

5. This is not always true, as both the symmetry and median can be effected unless it is a linear transformation