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

$$m(x) = \frac{1}{N}\sum_{i=1}^{N} x_i$$

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

$$m(a+bX) = \frac{1}{N}\sum a + \frac{1}{N}\sum bX_i$$

$$m(a+bX) = a+b \times \frac{1}{N}\sum X_i = a+bm(x)$$

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

$$cov(x, a+bY) = \frac{1}{N}\sum(x_i - m(x))((a+by_i) - m(a+bY))$$

$$\cancel{cov(X, a+bY) = \frac{1}{N}\sum(x_i - m(x))(b(y_i - m(Y)))}$$

$$cov(X, a+bY) = \frac{1}{N}\sum(x_i - m(x))(b(y_i - m(Y)))$$

$$cov(X, a+bY) = b \times \frac{1}{N}\sum(x_i - m(x))(y_i - m(Y))$$

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

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

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

$$\cancel{cov(a+bX, a+bX) = b \times cov(X, a+bX)}$$

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

4. Yes, when x is transformed by g the median of x will still be the midpoint of the transformed values.

5. No. In general $m(g(x)) \neq g(m(x))$