1. $m(x) = \frac{1}{N}\sum_{i=1}^{n} a_i$

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

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

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2. $cov(x, a+bY) = b\,cov(x,y)$

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

$\#1$ $m(a+bY) = a + bm(y)$

$$\frac{1}{N}\sum_{i=1}^{N}(x - m(x))(a + by_i - (a + bm(y))$$

$$= \frac{1}{N}\sum_{i=1}^{N}(x - m(x))b(y - m(y))$$

$$= b \cdot \frac{1}{N}\sum_{i=1}^{N}(x - m(x))(y - m(y))$$

$$= b\,cov(x,y)$$

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3. $cov(a+bX), a+bX) = b^2 cov(x,y)$, $cov(x,x) = \delta^2$

$$\Rightarrow \frac{1}{N}\sum_{i=1}^{N}(a+bx_i) - m(a+bX))^2$$

$$= \frac{1}{N}\sum(a+bx_i) - (a + b\,m(x))^2 = \frac{1}{N}\sum_{i=1}^{N} b(x_i - m(x))^2$$

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

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

$$= \delta^2$$