Question 1

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

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

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

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

$= a + b\cdot m(x)$

2) $cov(x,y) = \frac{1}{n}\sum_{i=1}^{n}(x_i - m(x))\cdot(y_i - m(y))$

$cov(x, a+by) = \frac{1}{n}\sum_{i=1}^{n}(x_i - m(x))\cdot((a+by_i) - m(a+by))$

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

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

$= b\left(\frac{1}{n}\sum_{i=1}^{n}(x_i - m(x))\cdot(y_i - m(y))\right)$

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

3) $cov(a+bx, a+bx) = b\,cov(x, a+bx)$

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

$= b^2\,cov(x,x)$

$= b^2 s^2$