

Q1

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

$$1) m(X) = E[X]$$

-expected value

$$2) m(a + bX) = E[a + bX]$$

$$3) E[a + bX] = E[a] + E[bX]$$

$$E[a] = a$$

-a is constant

$$E[bX] = b \times E[X] = b \times m(X) - b \text{ is constant}$$

$$\checkmark 4) m(a + bX) = a + b \times m(X)$$

-sub for values

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

$$1) \text{cov}(X, Y) = E[(X - m(X))(Y - m(Y))]$$

$$2) \text{cov}(X, a + bY) = E[(X - m(X)) \times (a + bY - m(a + bY))]$$

$$m(a + bY) = a + b \cdot m(Y)$$

$$3) \text{cov}(X, a + bY) = E[(X - m(X)) \times (a + bY - (a + b \cdot m(Y)))]$$

$$b(Y - m(Y))$$

$$4) \text{cov}(X, a + bY) = E[(X - m(X)) \times b(Y - m(Y))]$$

$$5) \text{cov}(X, a + bY) = b \times E[(X - m(X)) \times (Y - m(Y))] - \text{factor constants}$$

$$\cancel{E[(X - m(X)) \times (Y - m(Y))]}$$

b/c b is constant

$$\checkmark 6) \text{cov}(X, a + bY) = \text{cov}(X, Y) - \text{simplify}$$

$$\checkmark 6) \text{cov}(X, a + bY) = b \times \text{cov}(X, Y)$$

$$3. \text{cov}(a + bX, a + bX) = b^2 \text{cov}(X, X)$$

$$\text{cov}(X, X) = S^2$$

$$1) \text{cov}(a + bX, a + bX) = E[(a + bX - m(a + bX))(a + bX - m(a + bX))]$$

$$m(a + bX) = E[a + bX]$$

-mean of (a + bX)

$$m(a + bX) = a + b \cdot m(X)$$

-a is constant

$$2) \text{cov}(a + bX, a + bX) = E[(a + bX - (a + b \cdot m(X)))(a + bX - (a + b \cdot m(X)))] - \text{sub for values}$$

$$3) a + bX - (a + b \cdot m(X)) = b(X - m(X)) - \text{simplify}$$

$$4) \text{cov}(a + bX, a + bX) = E[b(X - m(X)) \times b(X - m(X))]$$

$$5) b^2 \times E[(X - m(X))^2] - \text{factor } b^2$$

$$\text{var}(X)$$

-var(X) = S^2 = cov(X, X)

$$6) \text{cov}(a + bX, a + bX) = b^2 \times S^2$$

-any covariance of X w/

$$\checkmark 7) \text{cov}(a + bX, a + bX) = b^2 \times (\text{cov}(X, X)) \text{ itself is its variance}$$