

## A4(b)

### Mean

Let  $Z = X_1 + 2X_2$ . Then, by the linearity of expectation:

$$\mathbb{E}[Z] = \mathbb{E}[X_1 + 2X_2] = \mathbb{E}[X_1] + 2\mathbb{E}[X_2].$$

Since  $\mathbb{E}[X_1] = \mu$  and  $\mathbb{E}[X_2] = \mu$ , we have:

$$\mathbb{E}[Z] = \mu + 2\mu = 3\mu.$$

### Variance

The variance of  $Z$  is:

$$\text{Var}(Z) = \text{Var}(X_1 + 2X_2).$$

Using the variance properties for linear combinations:

$$\text{Var}(Z) = \text{Var}(X_1) + 2^2\text{Var}(X_2).$$

Since  $\text{Var}(X_1) = \sigma^2$  and  $\text{Var}(X_2) = \sigma^2$ , this becomes:

$$\text{Var}(Z) = \sigma^2 + 4\sigma^2 = 5\sigma^2.$$

### Final Results

- **Mean:**

$$\mathbb{E}[Z] = 3\mu.$$

- **Variance:**

$$\text{Var}(Z) = 5\sigma^2.$$

■