3 $$\sum_{i=1}^{N} r_i = \sum_{i=1}^{N}(x_i - \bar{x}) = \sum_{i=1}^{N} x_i - \sum_{i=1}^{N} \bar{x}$$

$$= N\bar{x} - N\bar{x} = \underline{\underline{0}}$$

4.1.1 $$\overline{x'} = \sum_{i=1}^{N} x_i + a = \sum_{i=1}^{N} x_i + \sum_{i=1}^{N} a = \sum_{i=1}^{N} x_i + Na$$

$$= \frac{1}{N}\sum_{i=1}^{N} x_i + a = \underline{\underline{\bar{x} + a}} \quad [\text{given } x \to x' = x + a]$$

4.1.2 $$\overline{x'} = \frac{1}{N}\sum_{i=1}^{N} \lambda x_i = \frac{\lambda}{N}\sum_{i=1}^{N} x_i = \underline{\underline{\lambda \bar{x}}} \quad [\text{given } x \to x' = \lambda x]$$

4.2.1 $$s^2_{x'} = \frac{1}{N-1}\sum_{i=1}^{N}\left(x'_i - \overline{x'}\right)^2$$

$$= \frac{1}{N-1}\sum_{i=1}^{N}\left(x_i + a - (\bar{x} + a)\right)^2 \quad \Big| \quad \frac{1}{N-1} = m$$

$$= m \sum_{i=1}^{N}\left(x_i - \bar{x} + a - a\right)^2$$

$$= m \sum_{i=1}^{N}\left(x_i - \bar{x}\right)^2 = \underline{\underline{s^2_x}} \quad [\text{given } x \to x' = x + a]$$

4.2.2 $$s^2_{x'} = \frac{1}{N-1}\sum_{i=1}^{N}\left(x'_i - \overline{x'}\right)^2 = \frac{1}{N-1}\sum_{i=1}^{N}\left(\lambda x_i - \lambda\bar{x}\right)^2$$

$\frac{1}{N-1} = m \Big|$ $$= m \sum_{i=1}^{N}\left(\lambda(x_i - \bar{x})\right)^2 = m\sum_{i=1}^{N}\lambda^2 (x_i - \bar{x})^2$$

$$= \lambda^2 m \sum_{i=1}^{N}\left(x_i - \bar{x}\right)^2 = \underline{\underline{\lambda^2 s^2_x}} \quad [\text{given } x \to x' = \lambda x]$$