$$n \quad vs \quad n-1$$

$$R_i = (x_i - \bar{x}) \qquad\qquad \sum_{i=1}^{n} R_i = \sum_{i=1}^{n} (x_i - \bar{x})$$

$$s^2 = \sum_{i=1}^{n} R_i^2 \Big/ n-1 \qquad\qquad = \sum_{i=1}^{n} x_i - \sum_{i=1}^{n} \bar{x}$$

$$s^2 = \frac{\sum_{i=1}^{n} R_i^2}{n-1} \qquad\qquad = n \cdot \frac{\sum_{i=1}^{n} x_i}{n} - \bar{x} \sum_{i=1}^{n}$$

$$= \frac{\sum_{i=1}^{n-1} R_i^2 + R_n^2}{n-1} \qquad\qquad = n \cdot \bar{x} - \bar{x} \cdot n$$

$$\qquad\qquad\qquad\qquad\qquad\qquad = 0.$$

$$= \frac{\sum_{i=1}^{n-1} R_i^2 + \left[\sum_{i=1}^{n-1} R_i \right]^2}{n-1} \qquad\qquad \sum_{i=1}^{n} R_i = 0$$

$$\therefore \sum_{i=1}^{n-1} R_i + R_n = 0$$

since actually the numerator is written in terms of $n-1$ data points, it is logical that the avg is obtained by dividing it with $n-1$ and not by n

$$\therefore R_n = -\sum_{i=1}^{n-1} R_i$$

$$\therefore R_n^2 = \left[\sum_{i=1}^{n-1} R_i \right]^2$$

or $n-2$ or $n-3$.