

Ch.3 Problems

3.1 Residual is the difference between the most probable value and any observed value of a quantity.

Error is the difference between an observed value for a quantity and its true value.

3.2 Uncertainty of survey is that it's not possible to get exact value from measurement. Thus, there's always error and adjustment of scale by setting certain significant number.

3.5 Precision : high degree of consistency
Accuracy : Precision $\oplus$ target's center
plus

3.7 (a) $\bar{M} = 65.401$

(b) $v = \bar{M} - M$ $\sum v^2 = 7.7 \times 10^{-5}$

$$\sigma = \sqrt{\frac{\sum v^2}{n-1}} = \sqrt{\frac{7.7 \times 10^{-5}}{9-1}}$$

$$= \pm 0.003$$

(c) $\sigma_m = \frac{\sigma}{\sqrt{n}} = \frac{0.003}{\sqrt{9}}$

$$= \pm 0.001$$

3.12 (a) $E_{90} = 1.6449 \sigma$

$$= \pm 1.6449 (0.001)$$

$$= \pm 0.00164$$

(b) $E_{95} = 1.9599 \sigma$

$$= \pm 1.9599 (0.001)$$

$$= \pm 0.00196$$

3.17

$$23^{\circ} 30' 00'' = 23.5^{\circ}$$

$$23^{\circ} 29' 40'' = 23.494^{\circ}$$

$$23^{\circ} 30' 15'' = 23.504^{\circ}$$

$$23^{\circ} 29' 50'' = 23.497^{\circ}$$

$$23^{\circ} 30' 05'' = 23.501^{\circ}$$

$$23^{\circ} 29' 55'' = 23.499^{\circ}$$

$$(a) \bar{m} = 23.499^{\circ}$$

$$(b) v = \bar{m} - m \quad \sum v^2 = 5.9 \times 10^{-5}$$

$$\sigma = \sqrt{\frac{\sum v^2}{n-1}} = \sqrt{\frac{5.9 \times 10^{-5}}{6-1}}$$

$$= \pm 0.0034$$

$$(c) \sigma_m = \frac{\sigma}{\sqrt{n}} = \pm 0.0014$$

3.18

$$\sigma_1 = \pm 0.010 \text{ A}$$

$$\sigma_2 = \pm 0.020 \text{ A}$$

3.21 (a) $n = 15$, $\sigma = \pm 0.015 \text{ ft}$

$$\sigma_m = \pm \frac{0.015}{\sqrt{15}} = \pm 0.0039 \text{ ft}$$

(b) $n = 28$, $\sigma = \pm 5 \text{ mm}$

$$\sigma_m = \pm \frac{5}{\sqrt{28}} = \pm 0.9 \text{ mm}$$

3.23 (a) Total length

$$= 236.57 + 608.99 + 426.87$$

$$= 1272.4 \text{ ft}$$

$$SD = \pm \sqrt{0.01^2 + 0.01^2 + 0.01^2}$$

$$= \pm 0.02 \text{ ft}$$

(b) Total length

$$= 688.980 + 1274.865 + 2542.373$$

$$= 4506.22 \text{ m}$$

$$SD = \pm \sqrt{0.003^2 + 0.003^2 + 0.005^2}$$

$$= \pm 0.007 \text{ m}$$