1. (1) 24.775 ± 0.003 (mm)　　SY2303526 杨和骞

(2) 测量结果：$\bar{X} = \frac{X_1 + \cdots + X_9}{n} = 24.77854888$ mm，保留为 24.775 mm

$\therefore 24.775 \pm \frac{0.003}{\sqrt{9}}$ (mm) $= 24.775 \pm 0.001$ (mm)

(3) 粗大误差：利用3σ准则，9次测量均值为 24.775，标准差：$\sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{9-1}} = 0.003$

数据都在 $\bar{X} \pm 3\sigma$ 之内，∴不需剔除。

系统误差：贝塞尔：$\sigma_1 = \sqrt{\frac{\sum v_i^2}{n-1}}$　$\sigma_2 = \sqrt{1.253 \frac{\sum |v_i|}{n(n-1)}}$　$\therefore u = \frac{\sigma_2}{\sigma_1} - 1 = 0.069 < \frac{2}{\sqrt{9}} = 0.71$ ∴没系统误差

置信度90%：$\frac{\hat{\sigma}}{\sqrt{n}} \cdot t_{\frac{\alpha}{2}}(n-1) = \frac{0.003}{\sqrt{9}} \times 1.86 = 0.002$　∴ $[\bar{X} - 0.002, \bar{X} + 0.002] = [24.773, 24.777]$ 单位 mm

2. $P_1 : P_2 = \frac{1}{\sigma_{\bar{X}_1}} : \frac{1}{\sigma_{\bar{X}_2}}$　$\sigma_{\bar{X}_1}^2 = \frac{\sigma^2}{n} = \frac{135.0}{(5-1)}$　$\bar{X}_1 = 7°2'30''$

$\sigma_{\bar{X}_2}^2 = \frac{730}{(5-1)}$　$\bar{X}_2 = 7°2'33''$

$\sigma_{\bar{X}_1} = \frac{\sigma_1}{\sqrt{n}} = \frac{\sqrt{\frac{\sum (x_i - \bar{x})^2}{5-1}}}{\sqrt{5}} = 8.23''$

$\sigma_{\bar{X}_2} = \frac{\sigma_2}{\sqrt{9}} = 6.04''$

$\therefore P_1 : P_2 = 73 : 135$

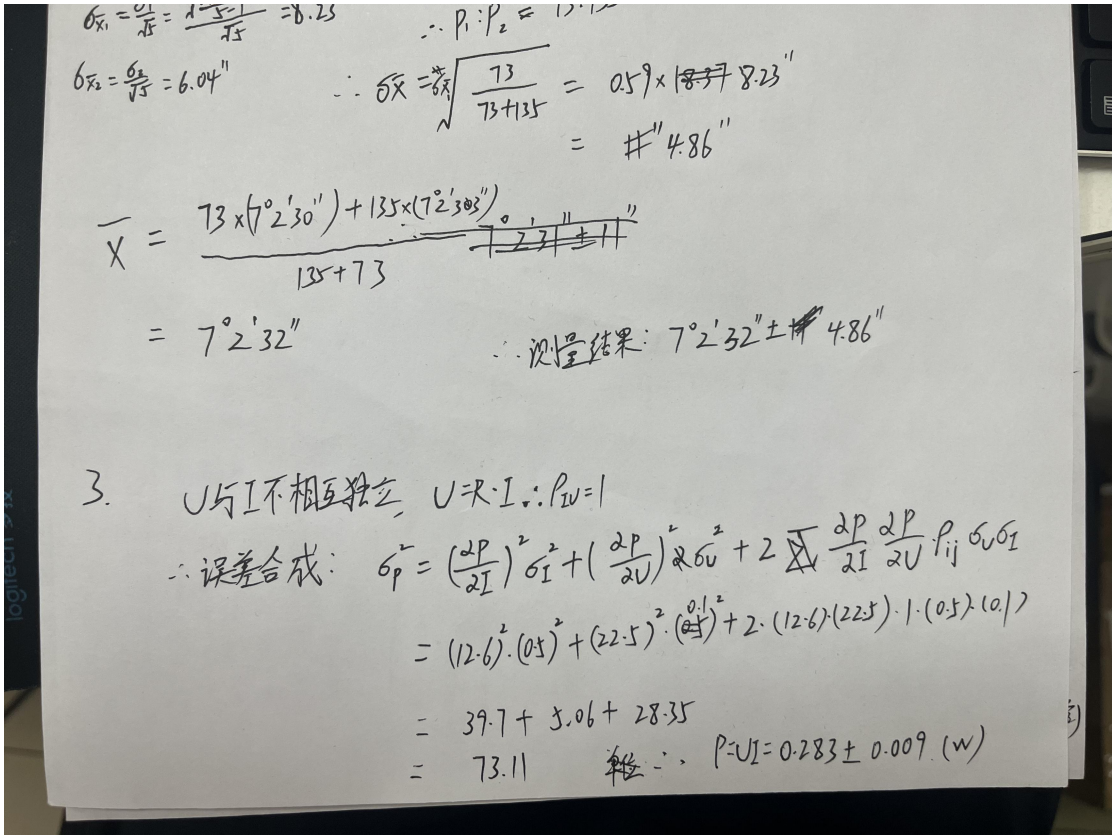
$\therefore \sigma_{\bar{X}} = \sqrt{\frac{73}{73+135}} = 0.59 \times 8.23''$

$= 4.86''$

$\bar{X} = \frac{73 \times (7°2'30'') + 135 \times (7°2'33'')}{135 + 73}$

$= 7°2'32''$

∴测量结果：$7°2'32'' \pm 4.86''$



$\sigma_{x_1} = \frac{\sigma_1}{\sqrt{n_1}} = \frac{\quad}{\sqrt{73}} = 8.23''$ $\quad \therefore P_1 : P_2 =$

$\sigma_{x_2} = \frac{\sigma_2}{\sqrt{n_2}} = 6.04''$ $\quad \therefore \sigma_x = \sqrt{\frac{73}{73+135}} = 0.59 \times 8.23''$

$= 4.86''$

$\bar{x} = \frac{73 \times (7°2'30'') + 135 \times (7°2'30'')}{135+73}$

$= 7°2'32''$ $\quad \therefore$ 测量结果：$7°2'32'' \pm 4.86''$

3. U与I不相互独立，$U = R \cdot I \therefore P_{UI} = 1$

$\therefore$ 误差合成：$\sigma_P^2 = \left(\frac{\partial P}{\partial I}\right)^2 \sigma_I^2 + \left(\frac{\partial P}{\partial U}\right)^2 \sigma_U^2 + 2 \frac{\partial P}{\partial I} \frac{\partial P}{\partial U} \rho_{ij} \sigma_U \sigma_I$

$= (12.6)^2 \cdot (0.5)^2 + (22.5)^2 \cdot \left(\frac{0.1}{4}\right)^2 + 2 \cdot (12.6) \cdot (22.5) \cdot 1 \cdot (0.5) \cdot (0.1)$

$= 39.7 + 3.06 + 28.35$

$= 73.11$ $\quad \therefore P = UI = 0.283 \pm 0.009 \ (W)$