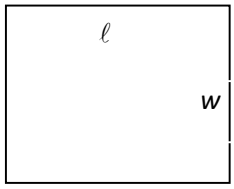
PROBLEM 2.3



l = 5420 ft, w = 1510 ft

$A = l.w$

$\frac{\partial A}{\partial l} = w$, $\frac{\partial A}{\partial w} = l$

Max $\sigma_A = \pm 0.1$ acre $= \pm 0.1 * 43560 = 4356$ ft^2

Let relative precision $= \frac{1}{N}$, then

$$\frac{1}{N} = \frac{1}{\frac{l}{\sigma_l}} = \frac{1}{\frac{w}{\sigma_w}} , \rightarrow \sigma_l = \frac{l}{N} , \quad \sigma_w = \frac{w}{N}$$

From the law of propagation of random errors,

$$\sigma_A^2 = (\frac{\partial A}{\partial l})^2 \cdot \sigma_l^2 + (\frac{\partial A}{\partial w})^2 \cdot \sigma_w^2$$

Substitute the values of σ_A, $\frac{\partial A}{\partial l}$, $\frac{\partial A}{\partial w}$, σ_l and σ_w in the above equation,

$$\rightarrow (4356)^2 = w^2 \cdot \frac{l^2}{N^2} + l^2 \cdot \frac{w^2}{N^2} = \frac{2\, l^2\, w^2}{N^2} \rightarrow N = 2657$$

$\therefore$ Relative precision at 1σ level $\cong \frac{1}{2700}$