



length plus girth = 108 in

$$\Rightarrow l + 2(h+w) = 108$$

size of rectangular parallelepiped =
 $l \cdot h \cdot w$

$$\therefore \quad \mathcal{F} = l \cdot h \cdot w \quad \phi = l + 2(h+w) = 108$$

we need find $\max \mathcal{F}(l, h, w) = lhw$
when l, h, w are related by $\phi(l, h, w)$

$$\phi = l + 2h + 2w = 108$$

$$\Rightarrow \quad \mathcal{F} = \mathcal{F} + \lambda \phi$$

$$\mathcal{F} = lhw + \lambda(l + 2h + 2w)$$

to find largest rectangular parallelepiped
 $\frac{d\mathcal{F}}{dl} = 0$, $\frac{d\mathcal{F}}{dh} = 0$, $\frac{d\mathcal{F}}{dw} = 0$

$$\Rightarrow \quad hw + \lambda(l + 2h + 2w) = 0 \quad \textcircled{1}$$

$$lw + \lambda(l + 2 + 2w) = 0 \quad \textcircled{2}$$

$$lh + \lambda(l + 2h + 2) = 0 \quad \textcircled{3}$$

I have to find λ , l_{\max} , h_{\max} , and w_{\max}