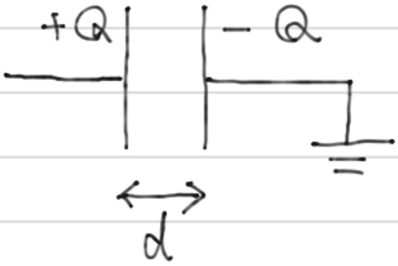
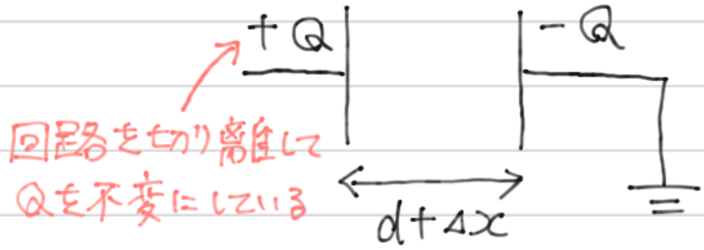
270

(イ) $C = \varepsilon_0 \dfrac{S}{d}$



(ロ) $C' = \varepsilon_0 \dfrac{S}{d+\Delta x}$

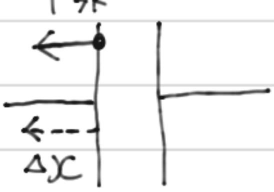


$$U = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2}\frac{Q^2}{\varepsilon_0 \frac{S}{d}} = \frac{Q^2}{2\varepsilon_0 S}d \quad /\!/ \text{(イ)}$$

$$U'_{(U+\Delta U)} = \frac{1}{2}\frac{Q^2}{C'} = \frac{1}{2}\frac{Q^2}{\varepsilon_0 \frac{S}{d+\Delta x}} = \frac{Q^2}{2\varepsilon_0 S}(d+\Delta x) \quad /\!/ \text{(ロ)}$$

(ハ)
$$\Delta U = U' - U = \frac{Q^2}{2\varepsilon_0 S}(d+\Delta x) - \frac{Q^2}{2\varepsilon_0 S}d = \frac{Q^2}{2\varepsilon_0 S}\Delta x \quad /\!/ \text{(ハ)}$$

(ニ)



$W_{外} = F_{外} \cdot \Delta x$ となり、これが ΔU と等しいので

$$\Delta U = F_{外}\Delta x \quad /\!/ \text{(ニ)}$$

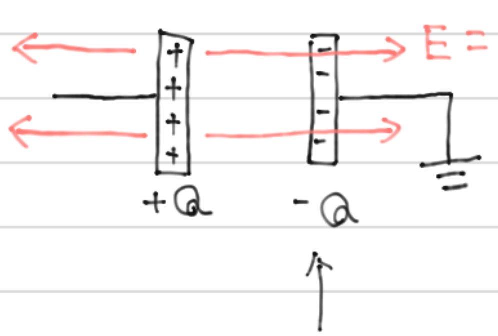
$$\Rightarrow \frac{Q^2}{2\varepsilon_0 S}\Delta x = F_{外}\Delta x$$

$$\therefore F_{外} = \frac{Q^2}{2\varepsilon_0 S}$$

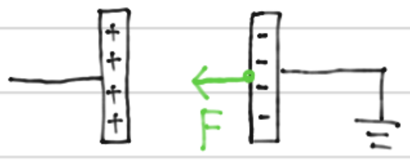
(ホ) $F_{外}$ が極板間引力 F とつりあっているので

$$F = \frac{Q^2}{2\varepsilon_0 S} \quad /\!/$$

270 別解（大切）



−Q が $\frac{Q}{2\varepsilon_0 S}$ の電場内にある



よって極板間引力 F は

$$F = Q \cdot \frac{Q}{2\varepsilon_0 S}$$

$$= \frac{Q^2}{2\varepsilon_0 S}$$ (ホ)