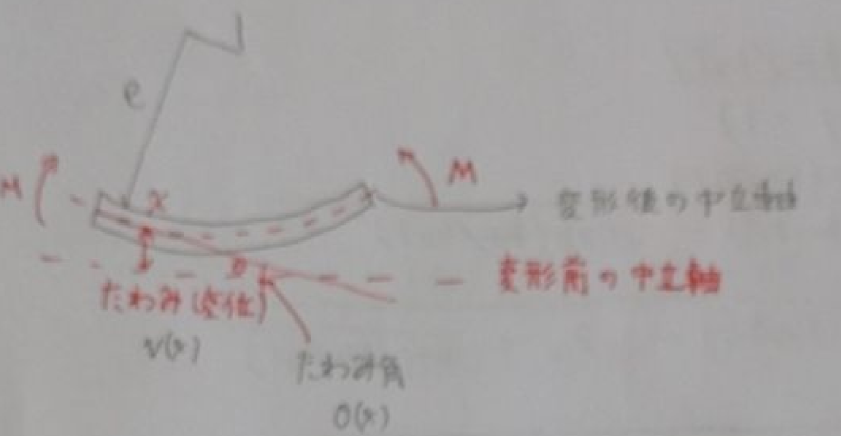
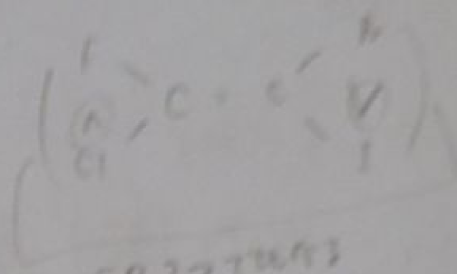
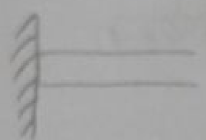
材料の力学　第11講

たわみ曲線



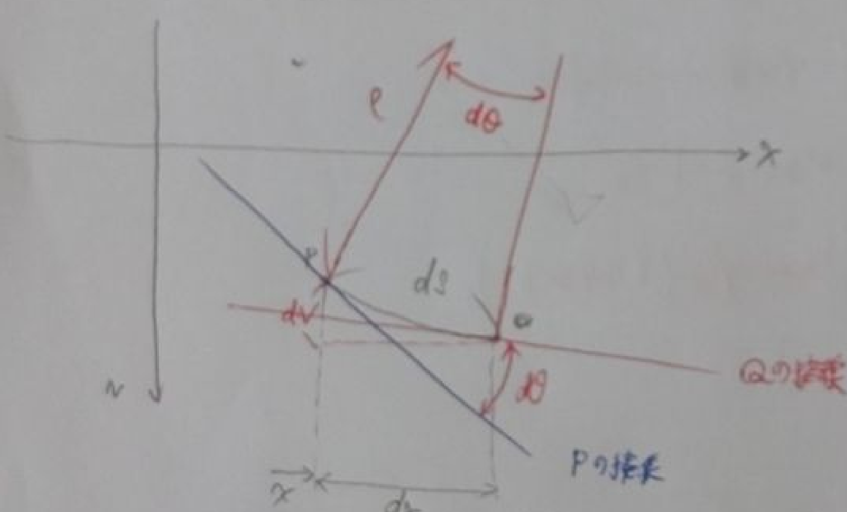




$$\begin{cases} Q(0) = R_A \\ M(0) = M_A \\ \theta(0) = 0 \\ v(0) = 0 \end{cases}$$

符号は注意

$$\begin{cases} Q(0) = R_A \\ M(0) = 0 \\ \theta(0) = ? \\ v(0) = 0 \end{cases}$$



$\rho \times d\theta = dS \rightarrow \frac{d\theta}{dS} = \frac{1}{\rho}$

$\rightarrow \frac{d\theta}{dx} = \frac{1}{\rho}$

(微小変形)　($dS \fallingdotseq dx$)

$\tan\theta \fallingdotseq \theta$

$\tan\theta = \frac{dv}{dx}$

$$\frac{d\theta}{dx} = \frac{d\left(\frac{dv}{dx}\right)}{dx} = \frac{d^2v}{dx^2} = \frac{1}{\rho} = \frac{M}{EI}$$

$$\frac{d^2v}{dx^2} = \frac{M(x)}{EI}$$

v軸は下に正 → 2階微分負だと下に凸

$$\frac{d^2v}{dx^2} = -\frac{1}{EI}M(x)$$

$y = x^3$

たわみ(変位)　$v(x)$

↓ 微分

たわみ角　$\theta(x)$

↓ 微分して ×(×−EI)

BMD　$M(x)$

↓ 微分

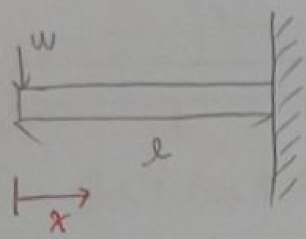
SFD　$Q(x)$

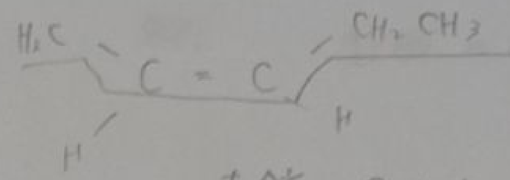
↓ 微分

分布荷重　$w(x)$

[例]

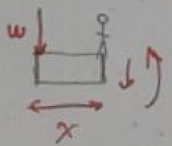
wx





直鎖のCは5コ

$M(x) = -Wx$



$\theta(x) = -\frac{1}{EI}\left(-\frac{1}{2}wx^2 + C_1\right)$

$\theta(l) = 0$ より.

$-\frac{1}{EI}\left(-\frac{1}{2}wl^2 + C_1\right) = 0$

$C_1 = \frac{1}{2}wl^2$

$\theta(x) = -\frac{1}{EI}\left(-\frac{1}{2}wx^2 + \frac{1}{2}wl^2\right)$

$v(x) = -\frac{1}{EI}\left(-\frac{1}{6}wx^3 + \frac{1}{2}wl^2x + C_2\right)$

$v(l) = 0$ なので

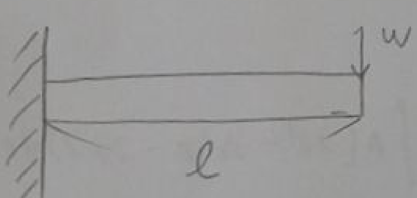
$\cancel{-\frac{1}{EI}}\left(-\frac{1}{6}wl^3 + \frac{1}{2}wl^3 + C_2\right) = 0$

$v(0) = \frac{1}{3EI}wl^3$

$C_2 = -\frac{1}{3}wl^3$

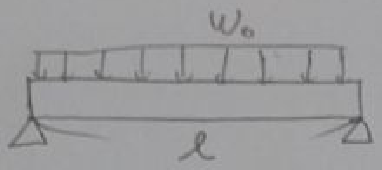
課題

①



作用点の変位を求めよ.

②



最大たわみを求めよう.