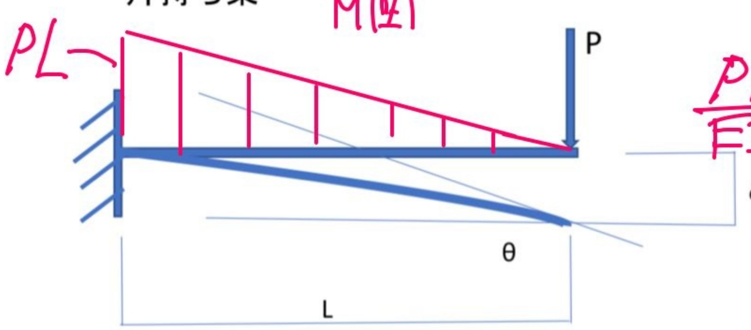
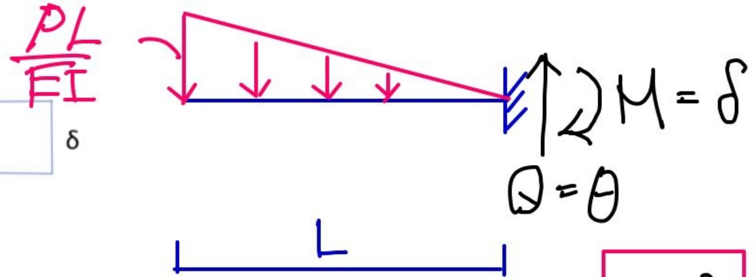
たわみ公式の解説
・片持ち梁、単純梁の公式(集中荷重)

・片持ち梁

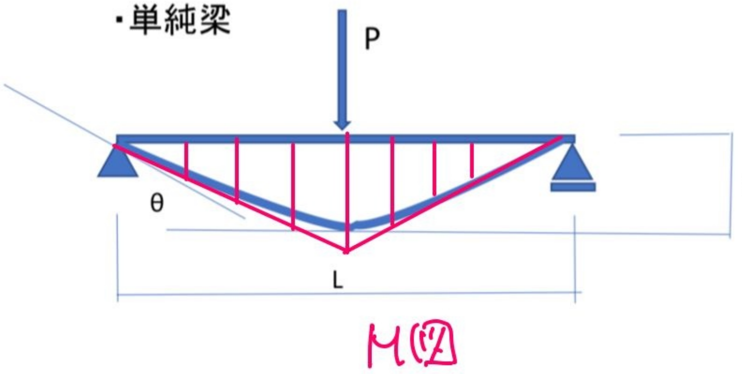




$$Q = \frac{PL}{EI}\cdot L\cdot\frac{1}{2} = \boxed{\frac{PL^2}{2EI}} = \theta$$

$$M = \frac{PL^2}{2EI}\cdot\frac{2L}{3} = \boxed{\frac{PL^3}{3EI}} = \delta$$

・単純梁



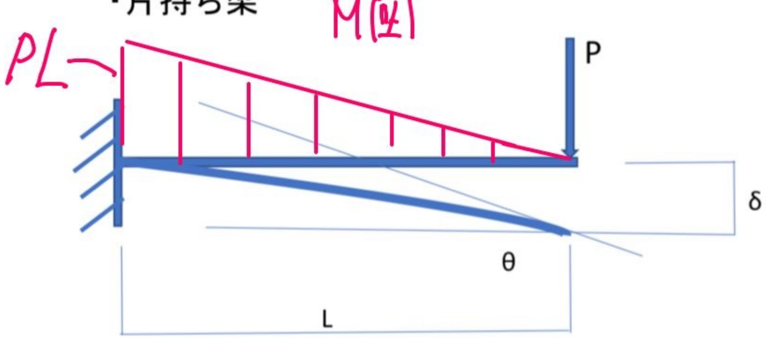
たわみ公式の解説

・片持ち梁、単純梁の公式（集中荷重）

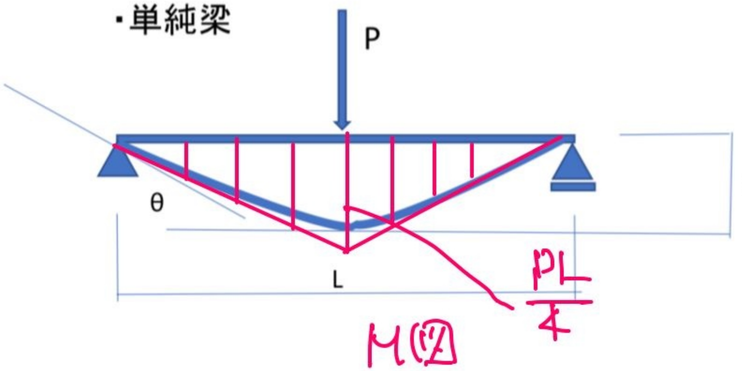
$$Q = \frac{PL}{4EI}\cdot\frac{L}{2}\cdot\frac{1}{2} = \boxed{\frac{PL^2}{16EI}} = \theta$$

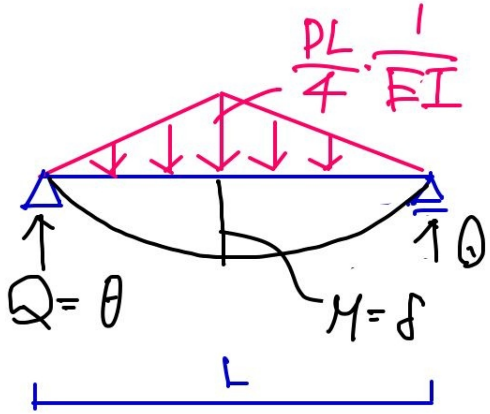
$$M = Q\cdot\frac{L}{3} = \frac{PL^2}{16EI}\cdot\frac{L}{3} = \boxed{\frac{PL^3}{48EI}} = \delta$$

・片持ち梁

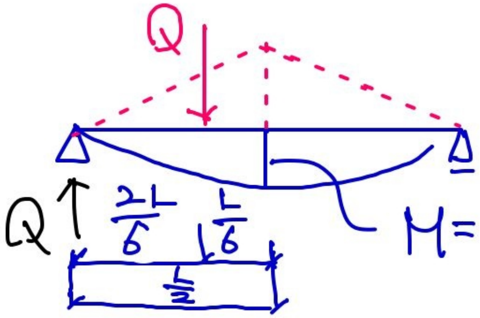


・単純梁





$$Q = \frac{PL}{4EI}\times\frac{L}{2}\times\frac{1}{2}$$



$$Q\cdot\frac{L}{3}$$

$$\Uparrow$$

$$M = Q\times\frac{L}{2} - Q\times\frac{L}{6} = Q\left(\frac{L}{2}-\frac{L}{6}\right)$$

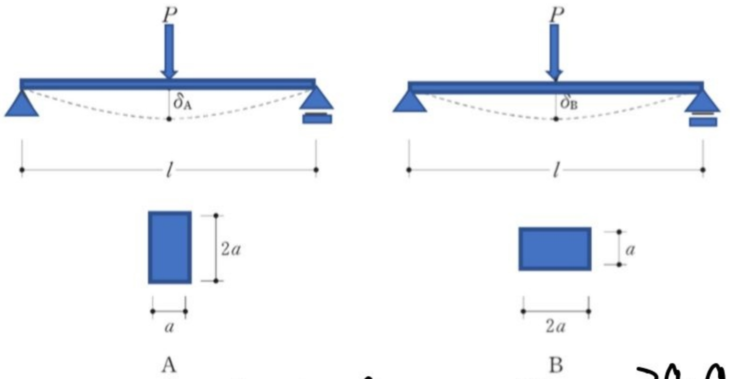
H28-No2

梁のたわみの比を求める問題

・単純梁＋集中荷重　δAとδBの比を求める

手順

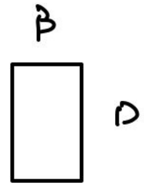
1. たわみ公式を書く
2. 断面二次モーメントを求める
3. たわみ公式に代入して求める



公式

$$\delta = \frac{PL^3}{48EI}$$

$$I = \frac{BD^3}{12}$$



$$I_A = \frac{a \cdot 2a \cdot 2a \cdot 2a}{12} = \frac{8}{12}a^4 = 4I_B$$

$$I_B = \frac{2a \cdot a \cdot a \cdot a}{12} = \frac{2}{12}a^4$$

$$\delta_A = \frac{PL^3}{48E\,4I_B}$$

$$\delta_B = \frac{PL^3}{48E\,I_B}$$

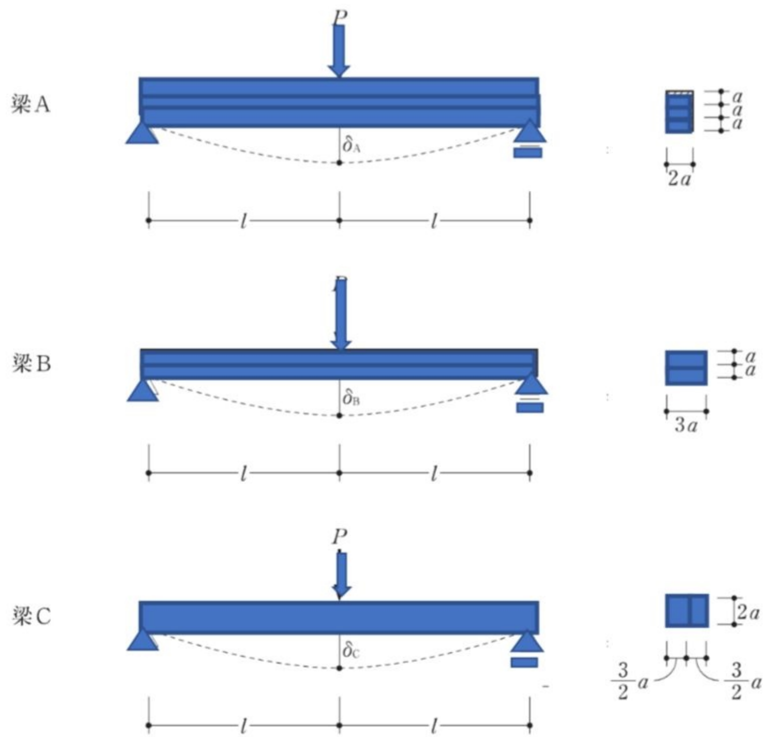
$$\delta_A : \delta_B = \frac{1}{4} : 1$$

$$= 1 : 4$$

R04-No2

梁のたわみの比を求める問題

・単純梁＋集中荷重　δA、δB、δCの比を求める



$$I_A = 3\times\frac{2a\cdot a\cdot a\cdot a}{12} = \frac{6}{12}a^4$$

$$I_B = 2\times\frac{3a\cdot a\cdot a\cdot a}{12} = \frac{6}{12}a^4$$

$$I_C = 2\times\frac{\frac{3}{2}a\cdot 2a\cdot 2a\cdot 2a}{12} = \frac{24}{12}a^4$$

1．$\delta_A < \delta_B = \delta_C$

2．$\delta_A = \delta_B < \delta_C$

3．$\delta_B = \delta_C < \delta_A$

4．$\delta_C < \delta_A = \delta_B$

Iが大きいほどδは小さい

$$\delta = \frac{PL^3}{48EI}$$

$$I_C > I_A = I_B$$

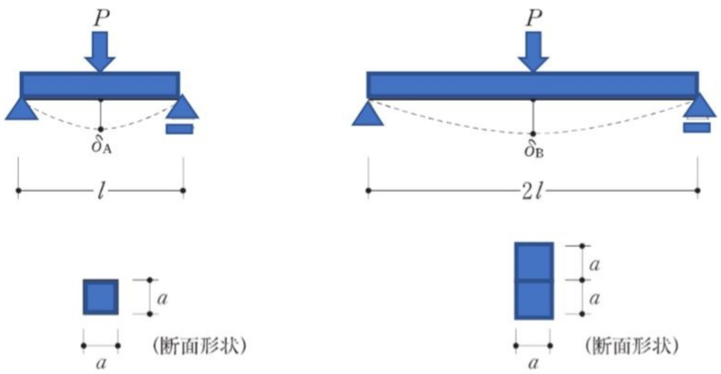
$$\Downarrow$$

$$\delta_C < \delta_A = \delta_B$$

H29-No2

梁のたわみの比を求める問題

・単純梁＋集中荷重　δA、δBの比を求める



$$\delta_A : \delta_B = \frac{PL^3}{48EI_A} : 4 \cdot \frac{PL^3}{48EI_A}$$

$$= 1 : 4$$

$$I_A = \frac{a \cdot a \cdot a \cdot a}{12} = \frac{a^4}{12}$$

$$I_B = 2 \cdot I_A$$

$$\delta_A = \frac{PL^3}{48EI_A}$$

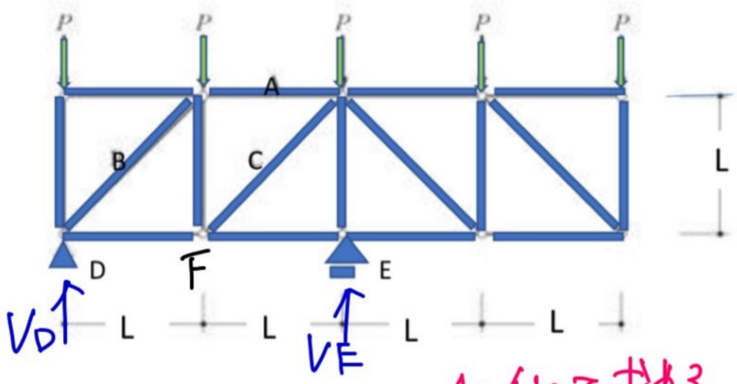
$$\delta_B = \frac{P(2L)^3}{48E\,2I_A}$$

$$= \frac{8PL^3}{48 \cdot E \cdot 2I_A}$$

$$= \frac{4PL^3}{48EI_A}$$

問題演習（R04-No5）

・A,B,C部材に生じる軸方向力NA,NB,NCの大小関係を求める



1．$N_A < N_B < N_C$

2．$N_B < N_A < N_C$

3．$N_C < N_A < N_B$

4．$N_C < N_B < N_A$

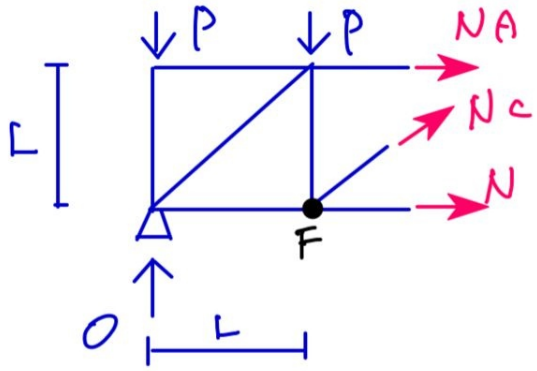
☆ 反力を求める

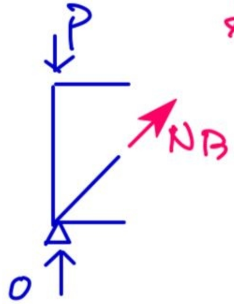
ΣME=0より

$$\underbrace{V_D \times 2L - P\times 2L - P\times L + P\times L + P\times 2L}_{0} = 0$$

$V_D = 0$

☆ 切断して軸方向力を仮定





☆ NAを求める

ΣMF=0より

$N_A \times L - P \times L = 0$

$N_A = P$

☆ NCを求める

ΣY=0より

$$\frac{N_C}{\sqrt{2}} - P - P = 0$$

$$\frac{N_C}{\sqrt{2}} = 2P \qquad N_C = 2\sqrt{2}P$$

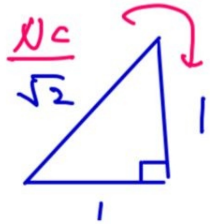
☆ NBを求める

ΣY=0より

$$\frac{N_B}{\sqrt{2}} - P = 0$$

$N_B = \sqrt{2}P$

∴ $N_A < N_B < N_C$



$$1 = \frac{N_C}{\sqrt{2}}$$