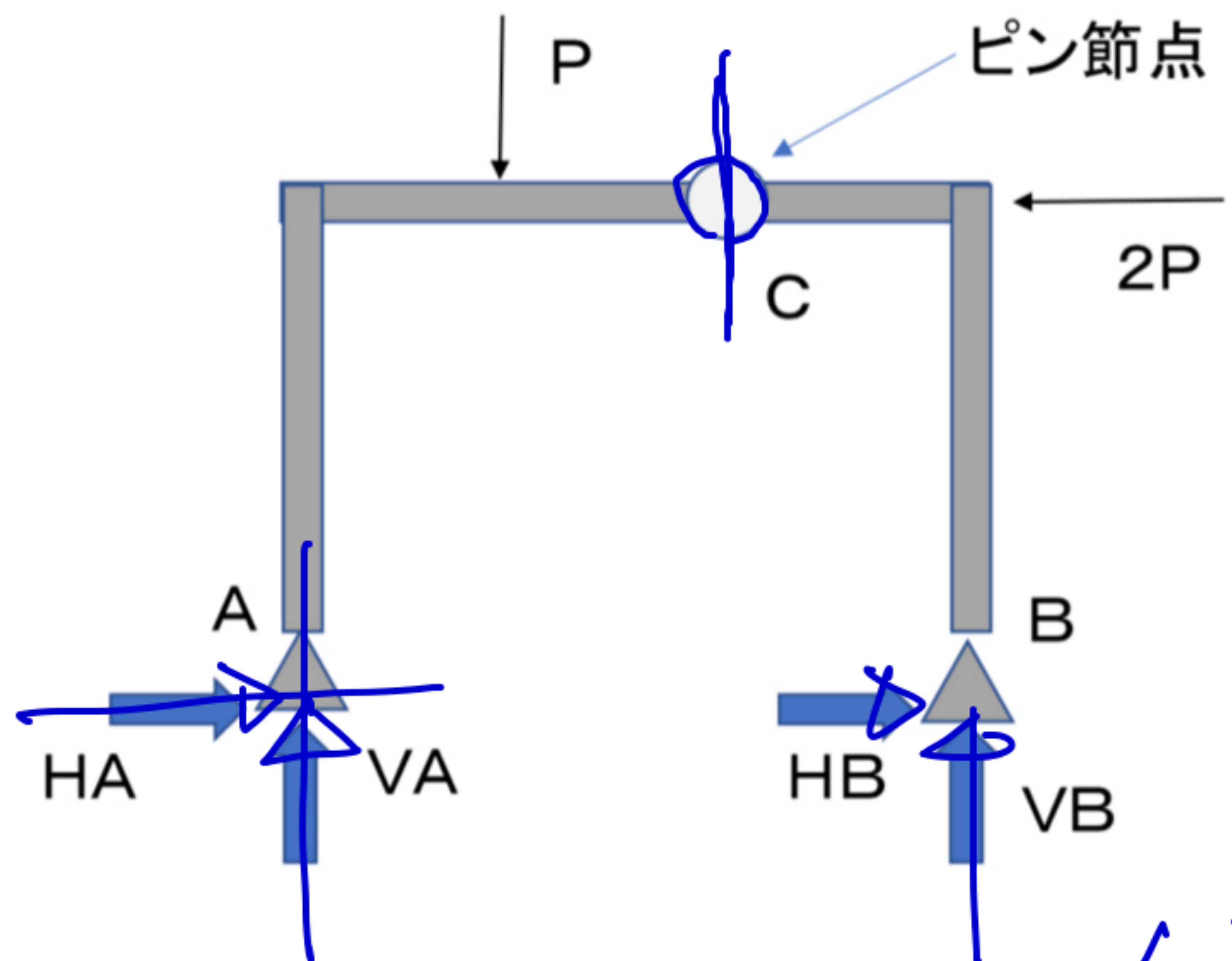
2. スリーヒンジラーメンとは

2つの支点がいずれもピン支点で、架構内に1か所ピン節点があるラーメン架構



2. 力のつり合い式を用いて反力を求める

つり合い式:

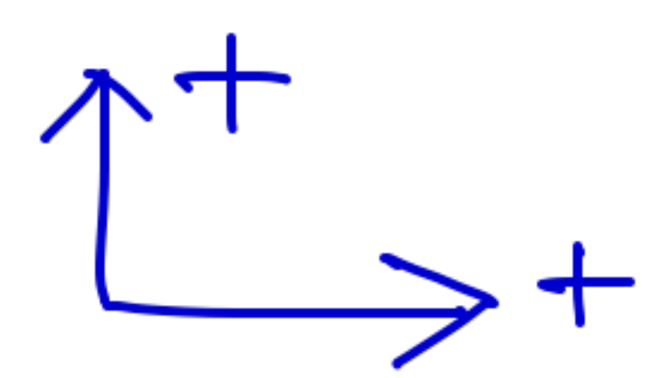
1. ΣX=0
2. ΣY=0
3. ΣMB=0

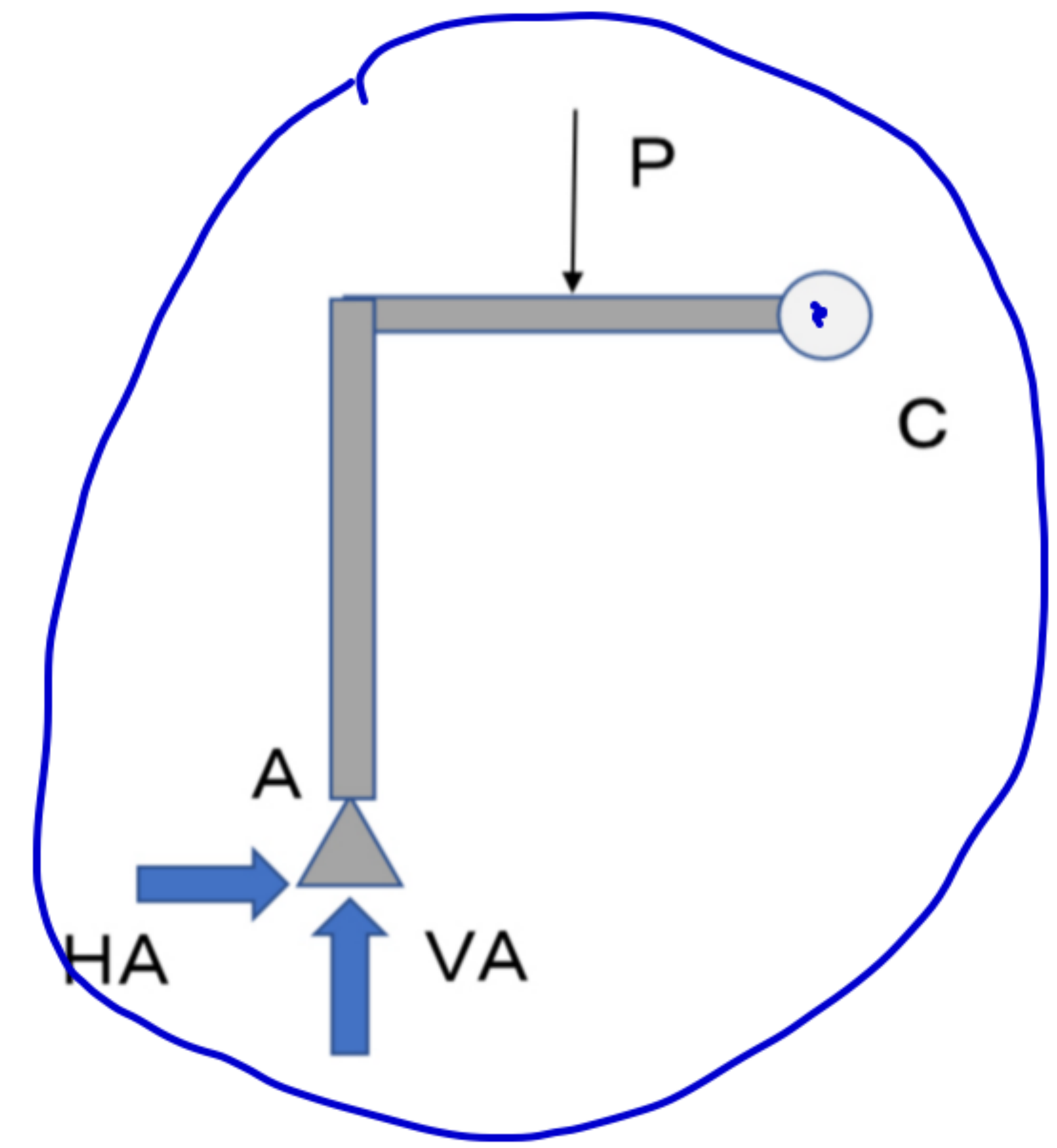
＋ +

つり合い式:

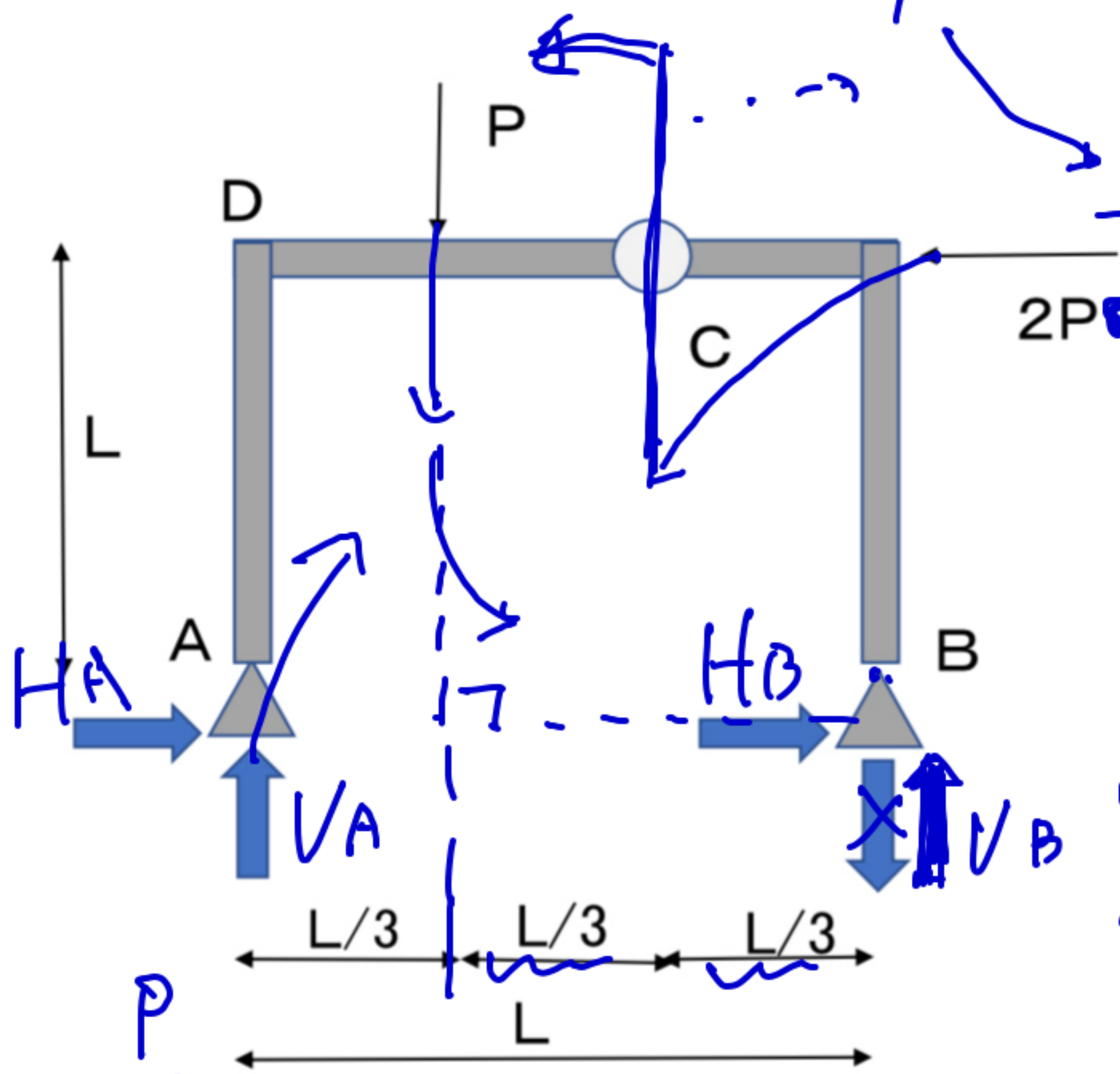
4. ΣMC=0

1. 反力の向きを+に仮定





5. 応力図を描く



・ΣX=0より

$H_A + H_B - 2P = 0$

$H_A + H_B = 2P$

・ΣY=0より

$V_A + V_B - P = 0$

$V_A + V_B = P$ ← 代入 $\left(V_A = \frac{8}{3}P\right)$

・$\Sigma M_B = 0$ より

$V_A \cdot L - P \times \frac{2}{3}L - 2P \times L = 0$

$V_A L \underbrace{- \frac{2}{3}PL - 2PL}_{} = 0$

$\underbrace{-\frac{2}{3}PL - \frac{6}{3}PL}_{-\frac{8}{3}PL}$

$V_A L = \frac{8}{3}PL$

$V_A = +\frac{8}{3}P \uparrow$

$\frac{13}{9}P + H_B = 2P$

$H_B = 2P - \frac{13}{9}P$

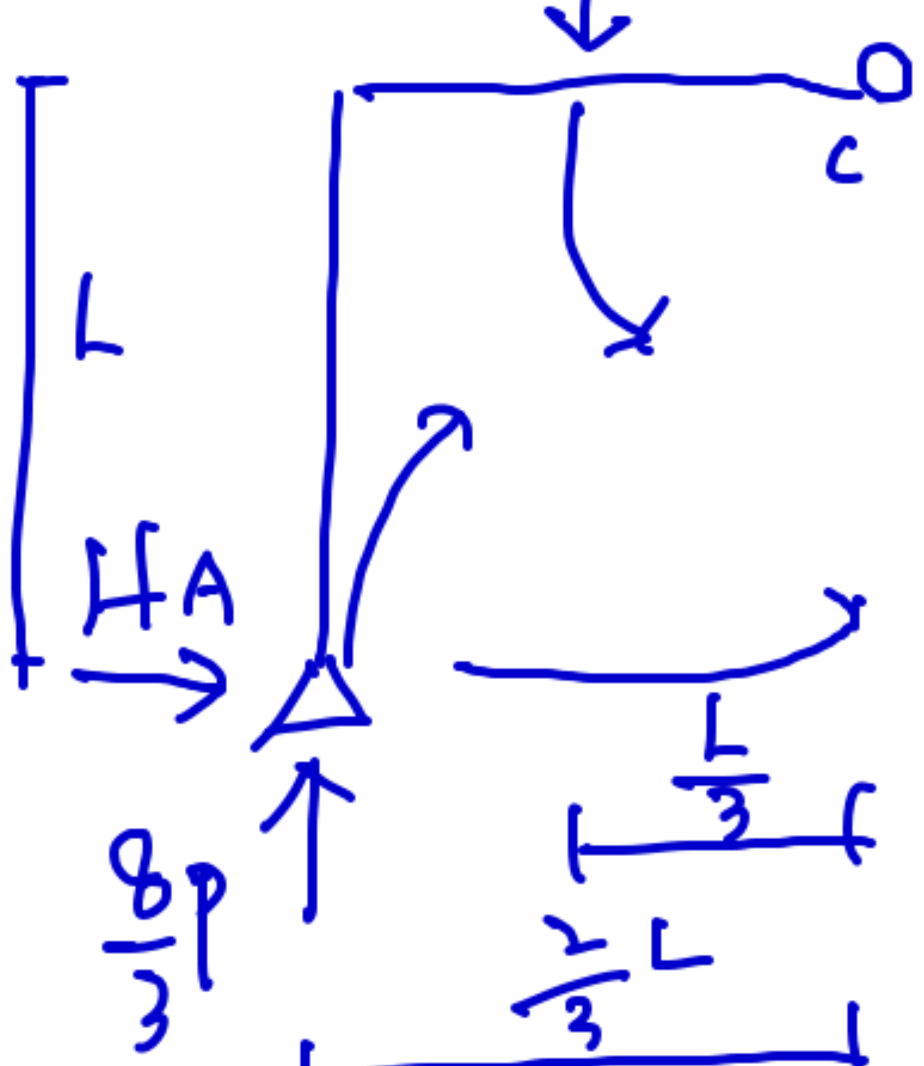
$= \frac{18-13}{9} = \frac{5}{9}P(\rightarrow)$

$\frac{8}{3}P + V_B = P$

$V_B = P - \frac{8}{3}P$

$= -\frac{5}{3}P(\downarrow)$

モーメント = 力×キョリ



・$\Sigma M_C = 0$ より

$-H_A \times L + \underbrace{\frac{8}{3}P \times \frac{2}{3}L - P \times \frac{L}{3}}_{\frac{16}{9} - \frac{3}{9} = \frac{13}{9}} = 0$

$-H_A L + \frac{13}{9}PL = 0$

$H_A L = \frac{13}{9}PL$

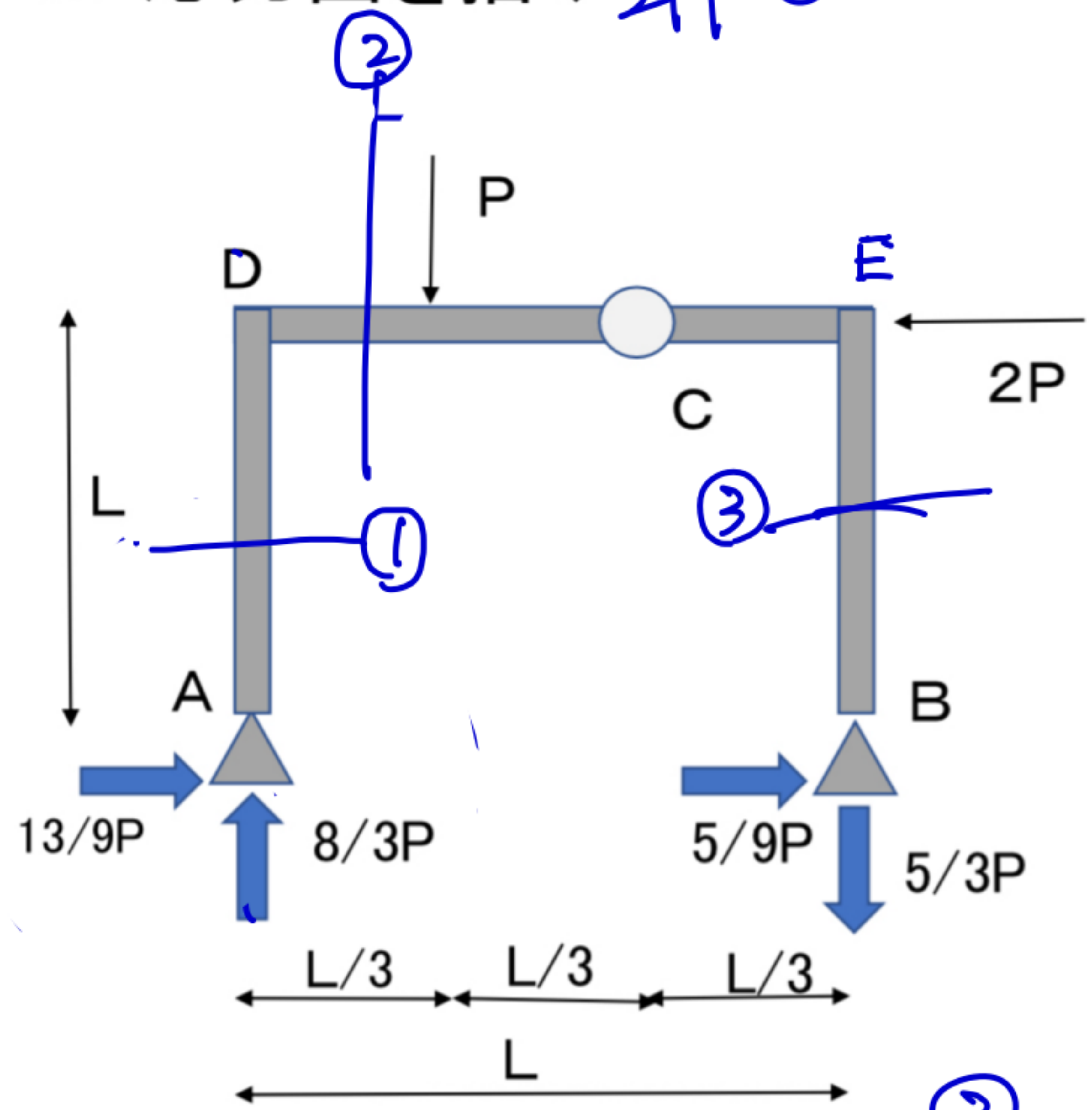
$H_A = \frac{13}{9}P(\rightarrow)$

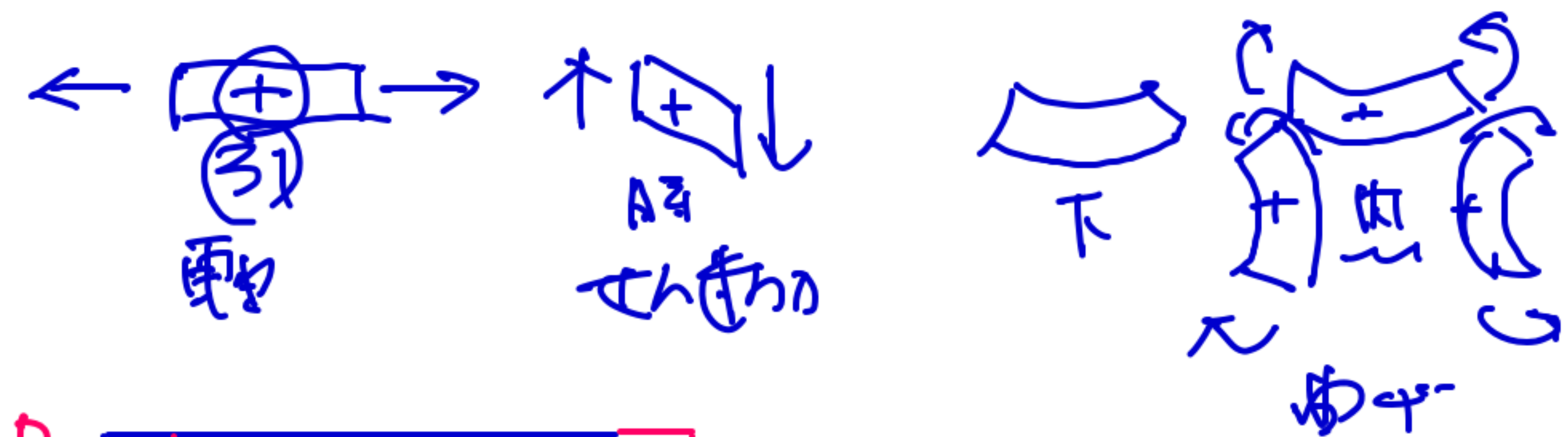
5. 応力図を描く

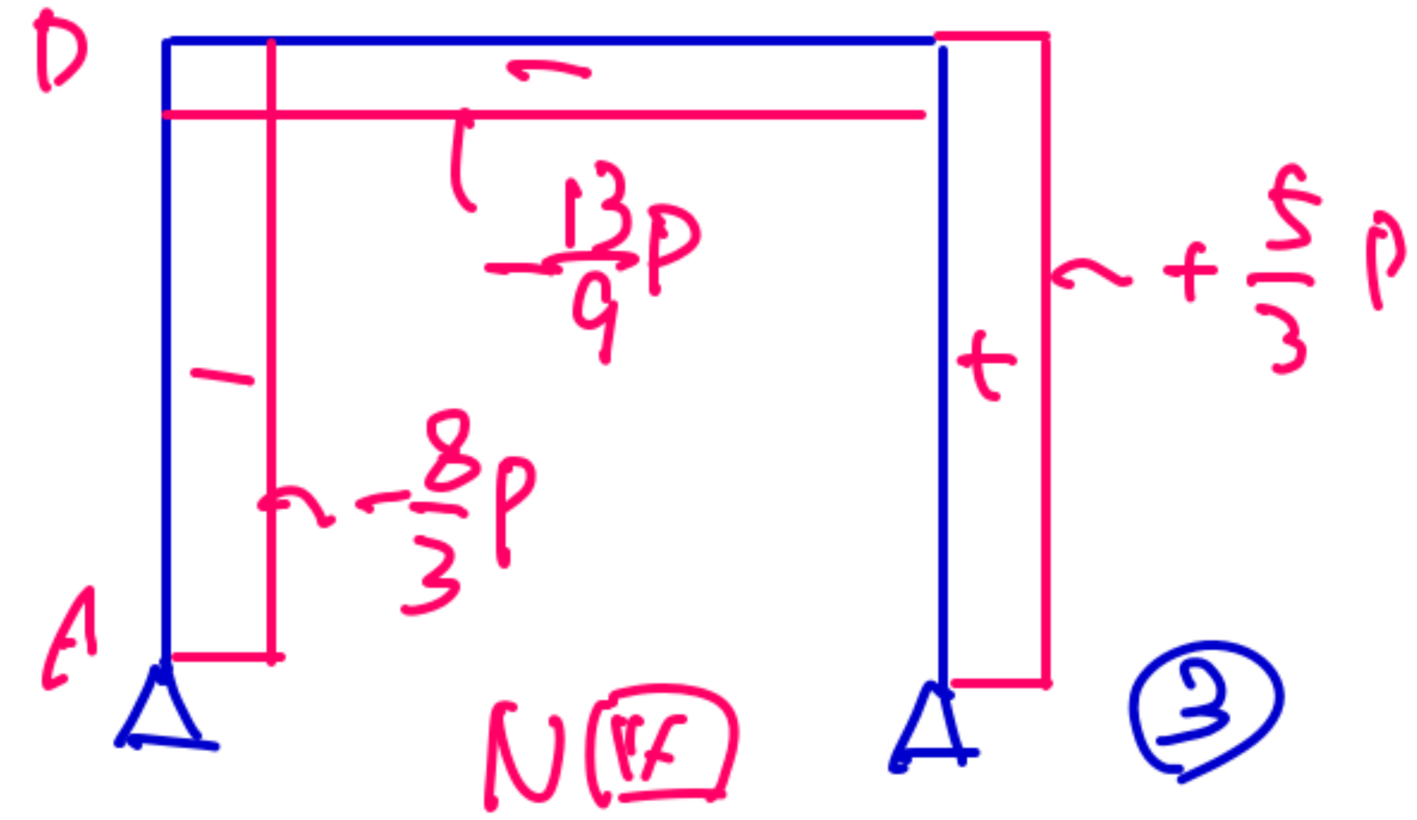
$\Sigma X=0$
$\Sigma Y=0$
$\Sigma M=0$

応力：軸方向力(N)、せん断力、曲げモーメント

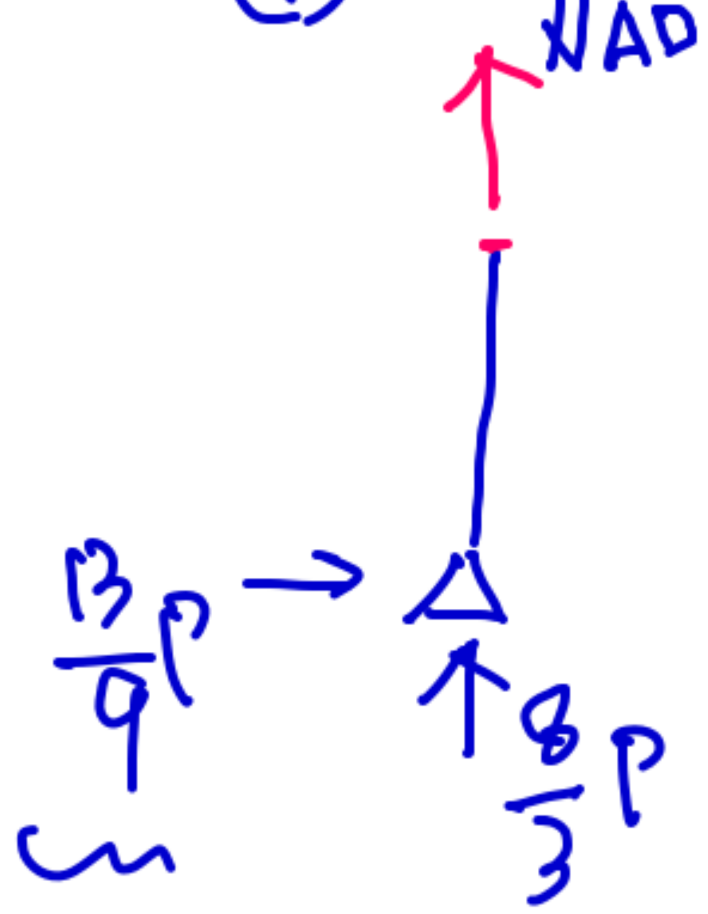
1. 切断する
2. 応力+に仮定
3. つり合い式







①

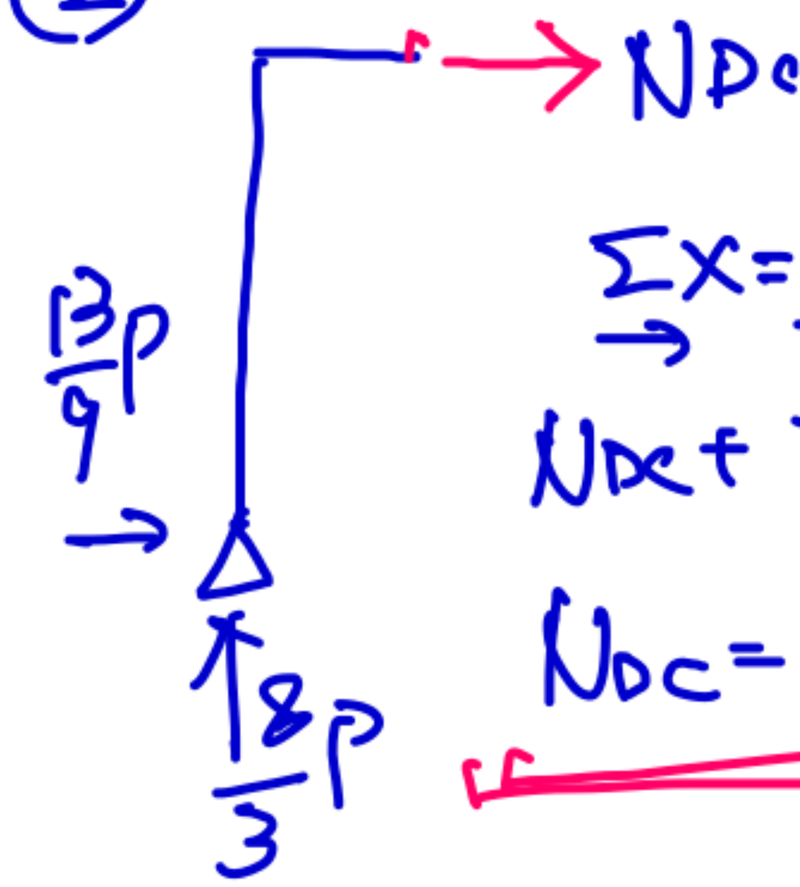


$\Sigma Y=0$ より

$N_{AD} + \frac{8}{3}P = 0$

$N_{AD} = -\frac{8}{3}P$ (圧)

②

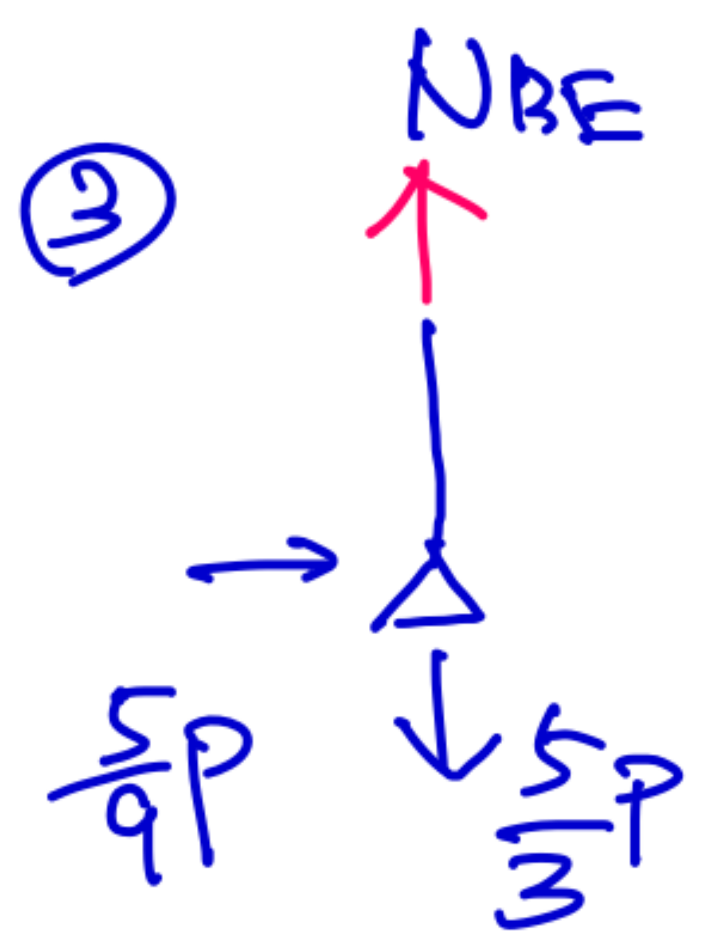


$\Sigma X=0$

$N_{DC} + \frac{13}{9}P = 0$

$N_{DC} = -\frac{13}{9}P$ (圧)

③

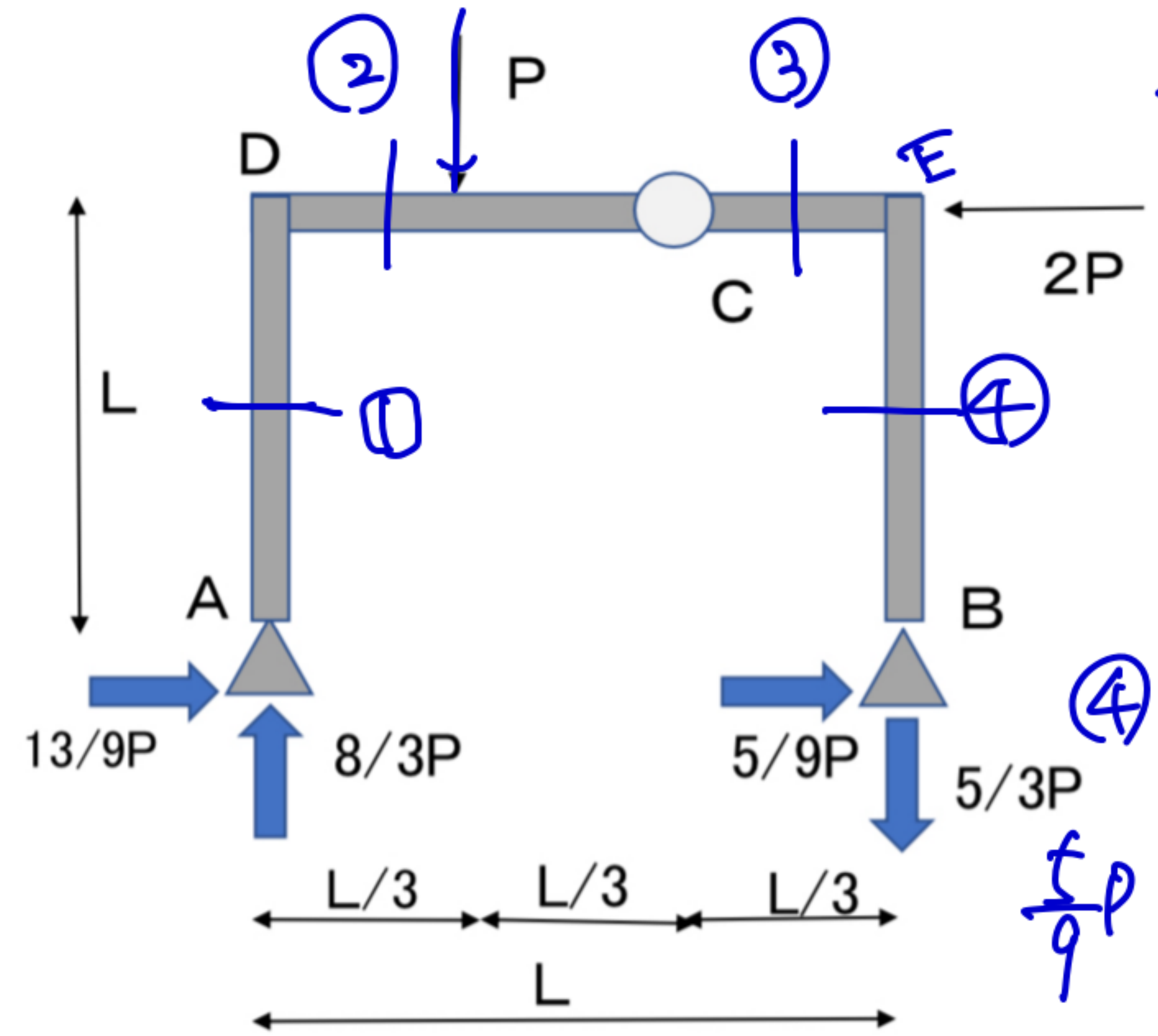


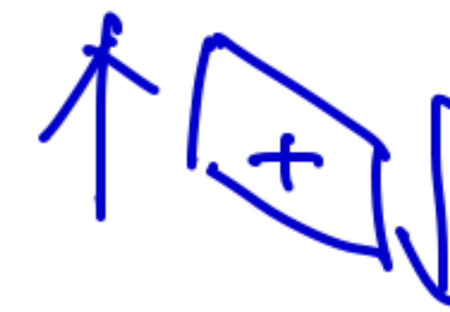
$\Sigma Y=0$

$N_{BE} - \frac{5}{3}P = 0$

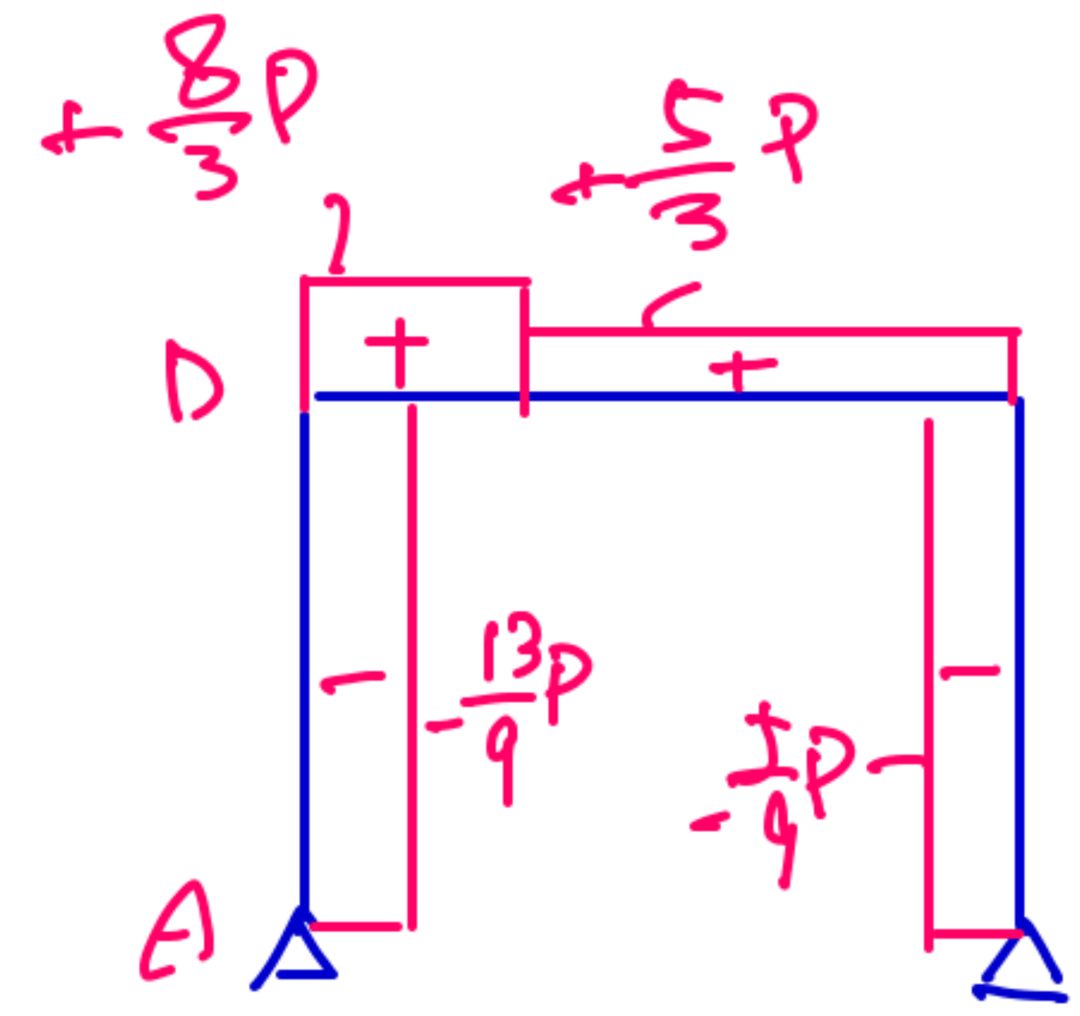
$N_{BE} = \frac{5}{3}P$ (引)

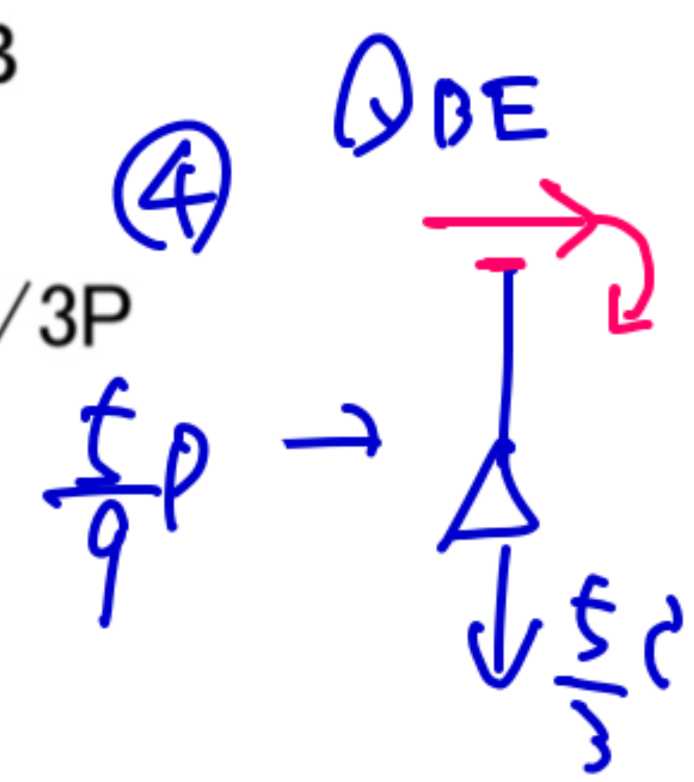
5. 応力図を描く





せん断力

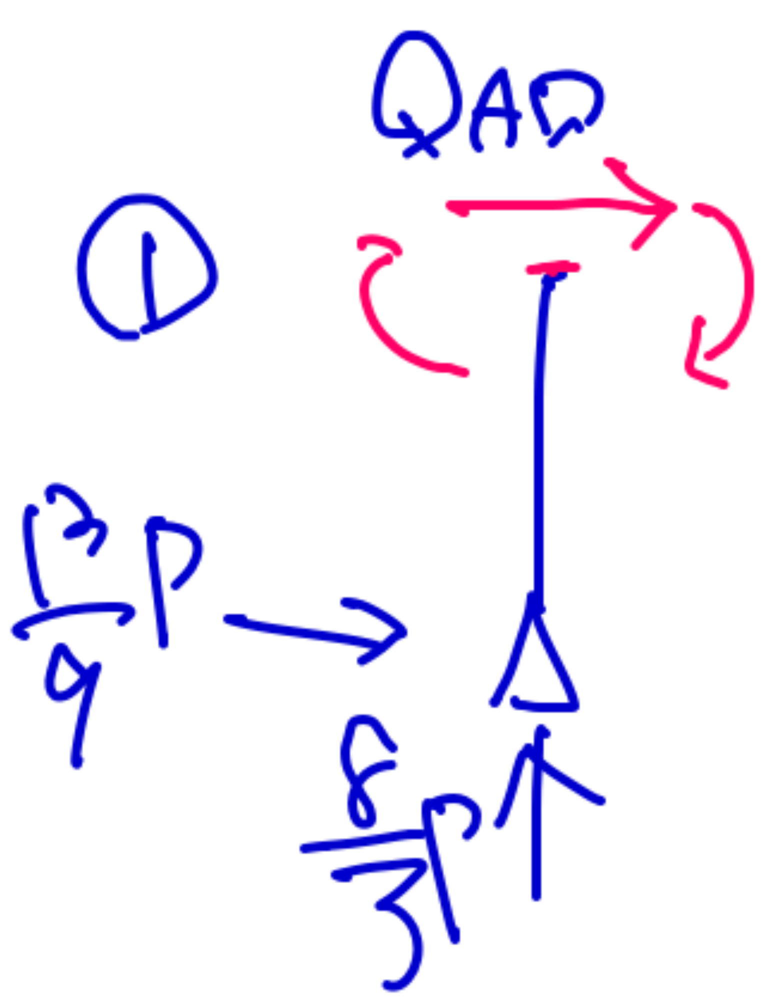




$\Sigma X = 0$

$Q_{BE} + \frac{5}{9}P = 0$

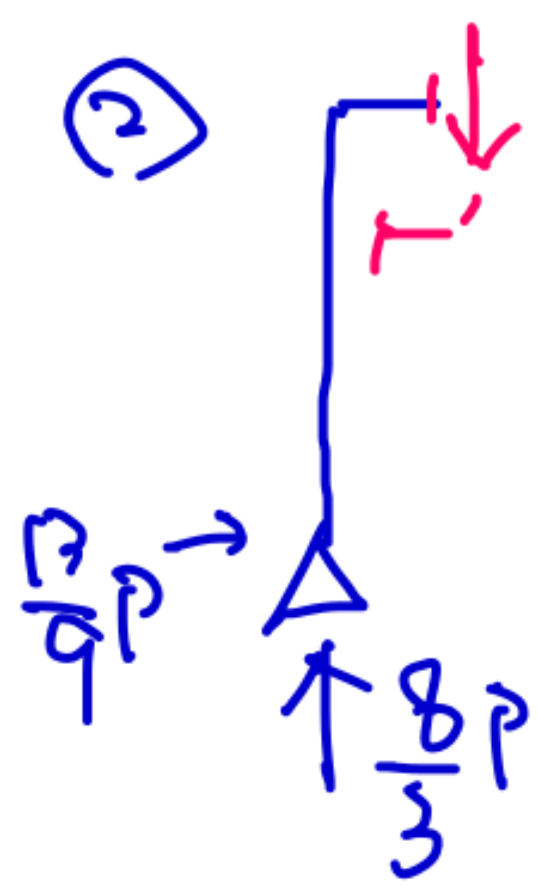
$Q_{BE} = -\frac{5}{9}P$



$\Sigma X = 0$ より

$Q_{AD} + \frac{13}{9}P = 0$

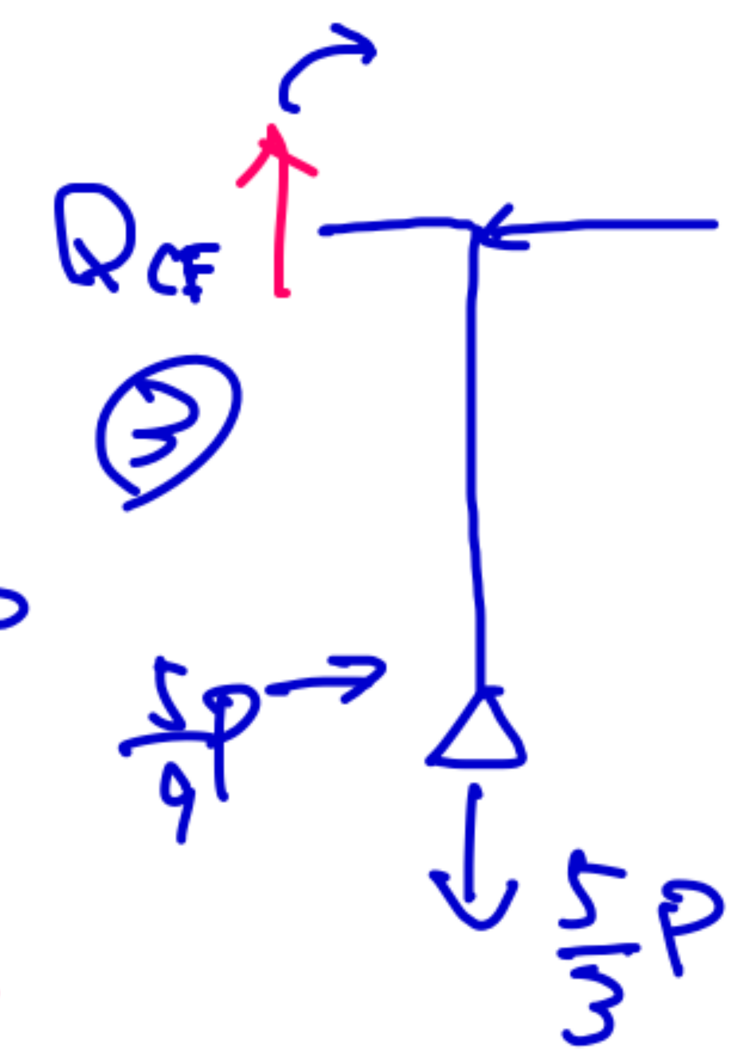
$Q_{AD} = -\frac{13}{9}P$



$\Sigma Y = 0$ より

$-Q_{DC} + \frac{8}{3}P = 0$

$Q_{DC} = \frac{8}{3}P$

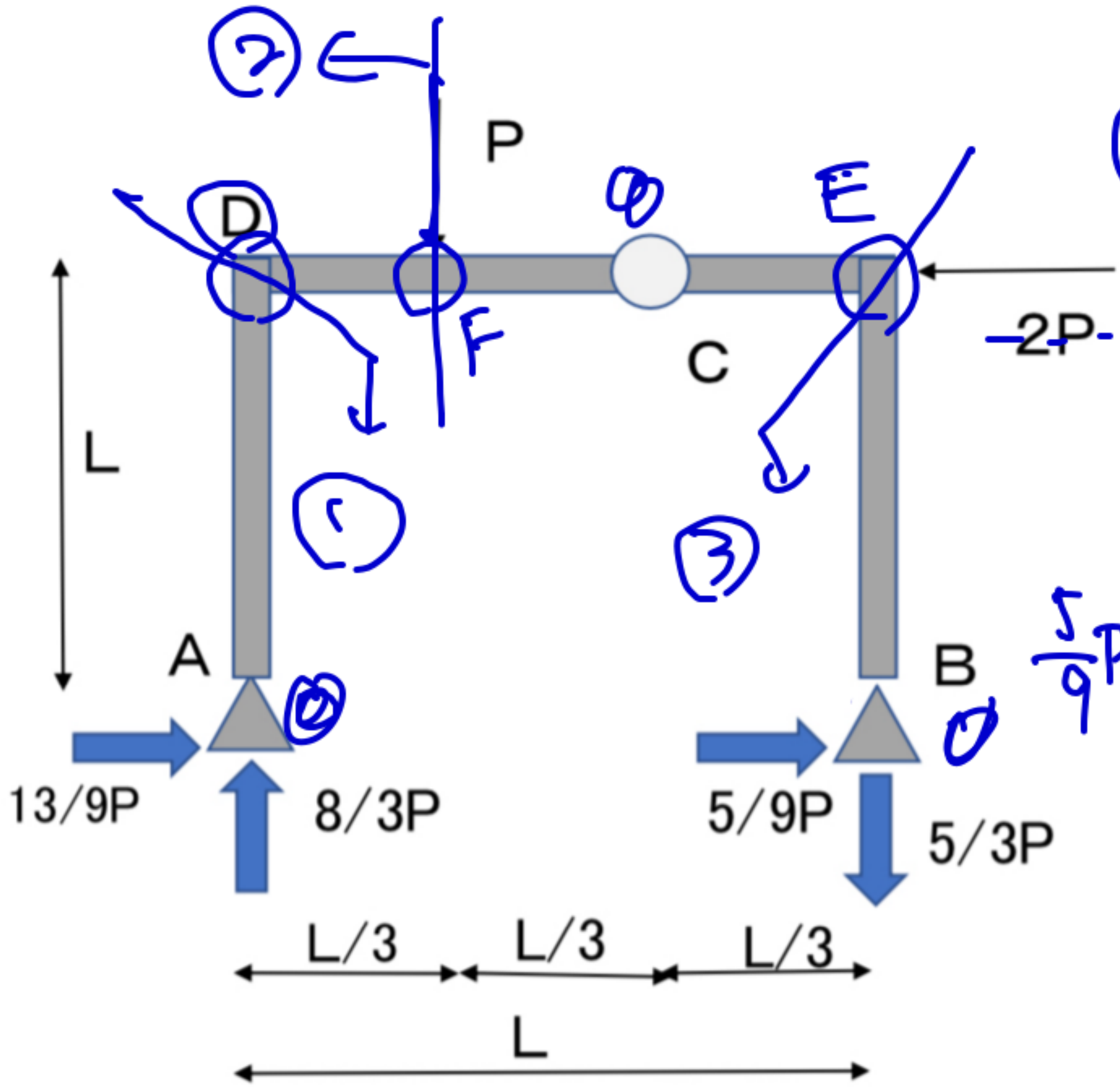


$\Sigma Y = 0$ より

$Q_{CE} - \frac{5}{3}P = 0$

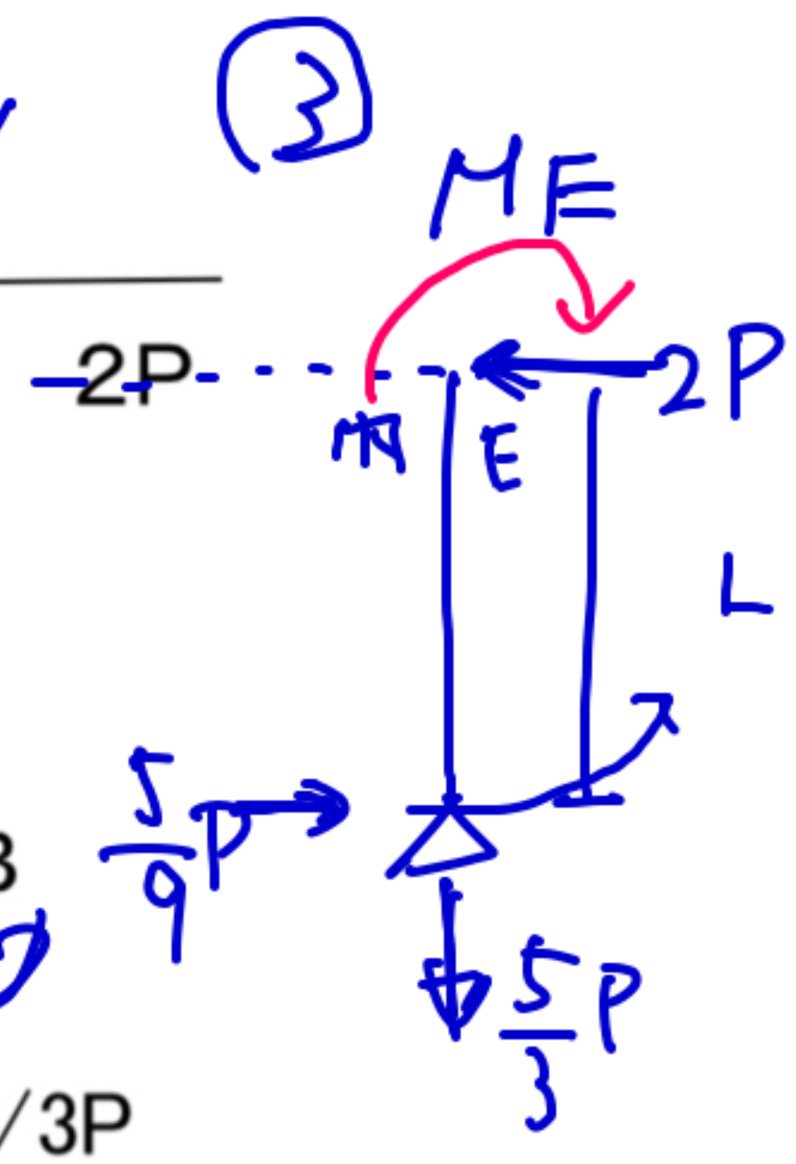
$Q_{CE} = \frac{5}{3}P$

5. 応力図を描く



曲げモーメント

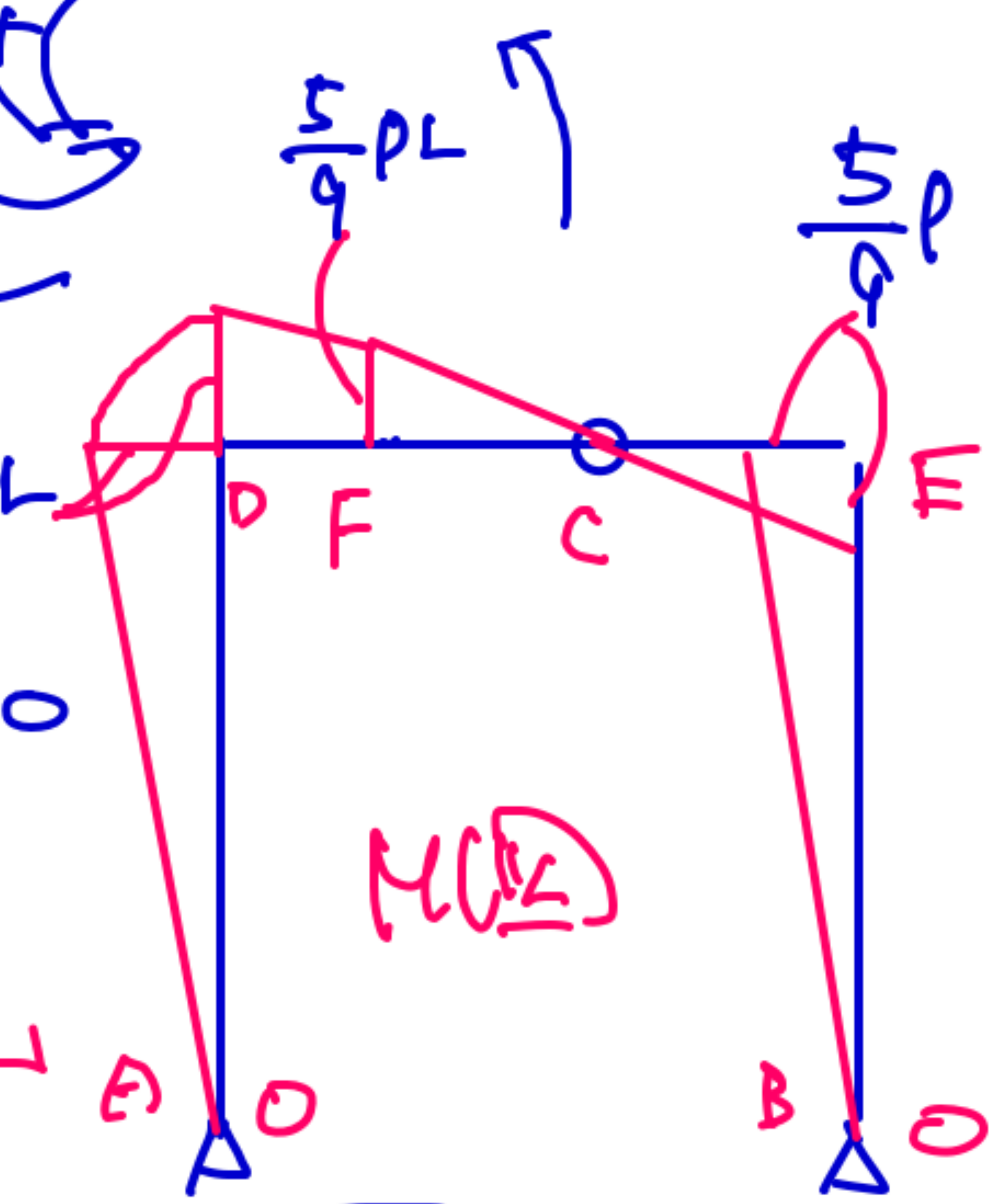
③



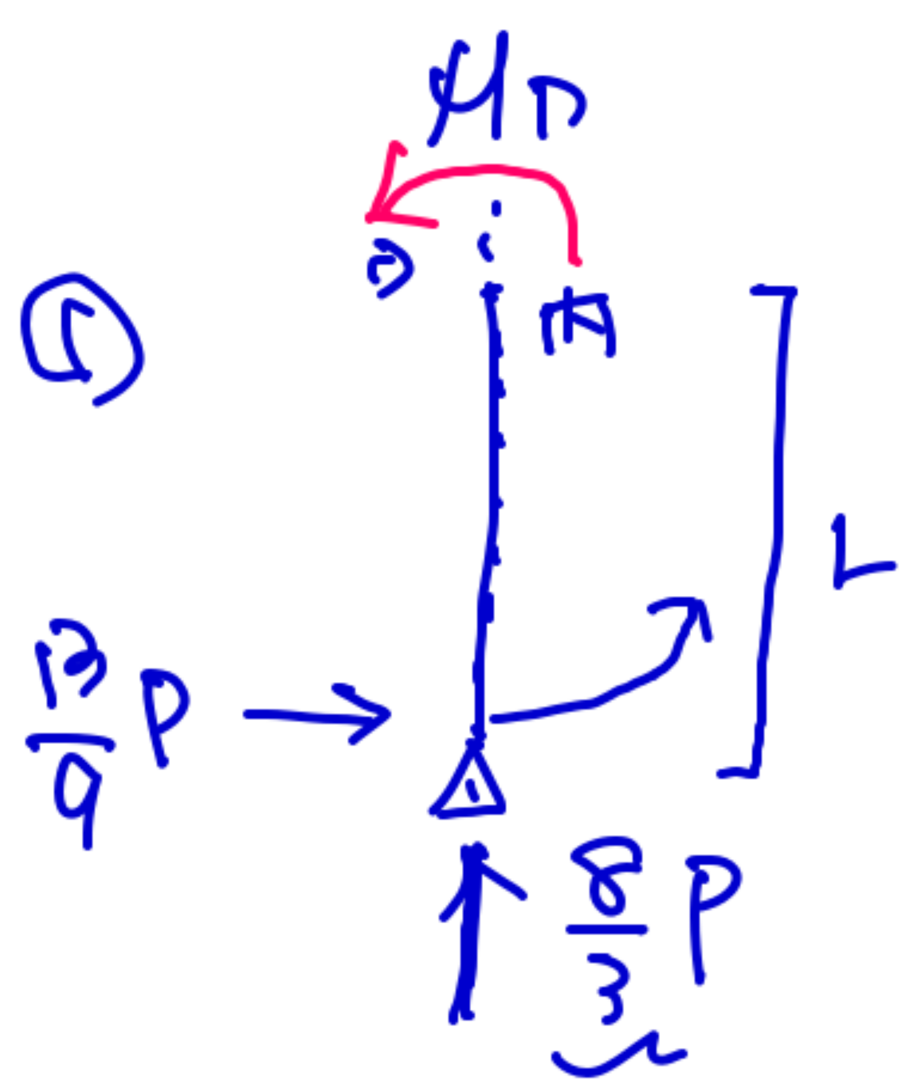
$\Sigma M_E = 0$

$M_E - \frac{5}{9}P \times L = 0$

$M_E = \frac{5}{9}PL$ (内)



①

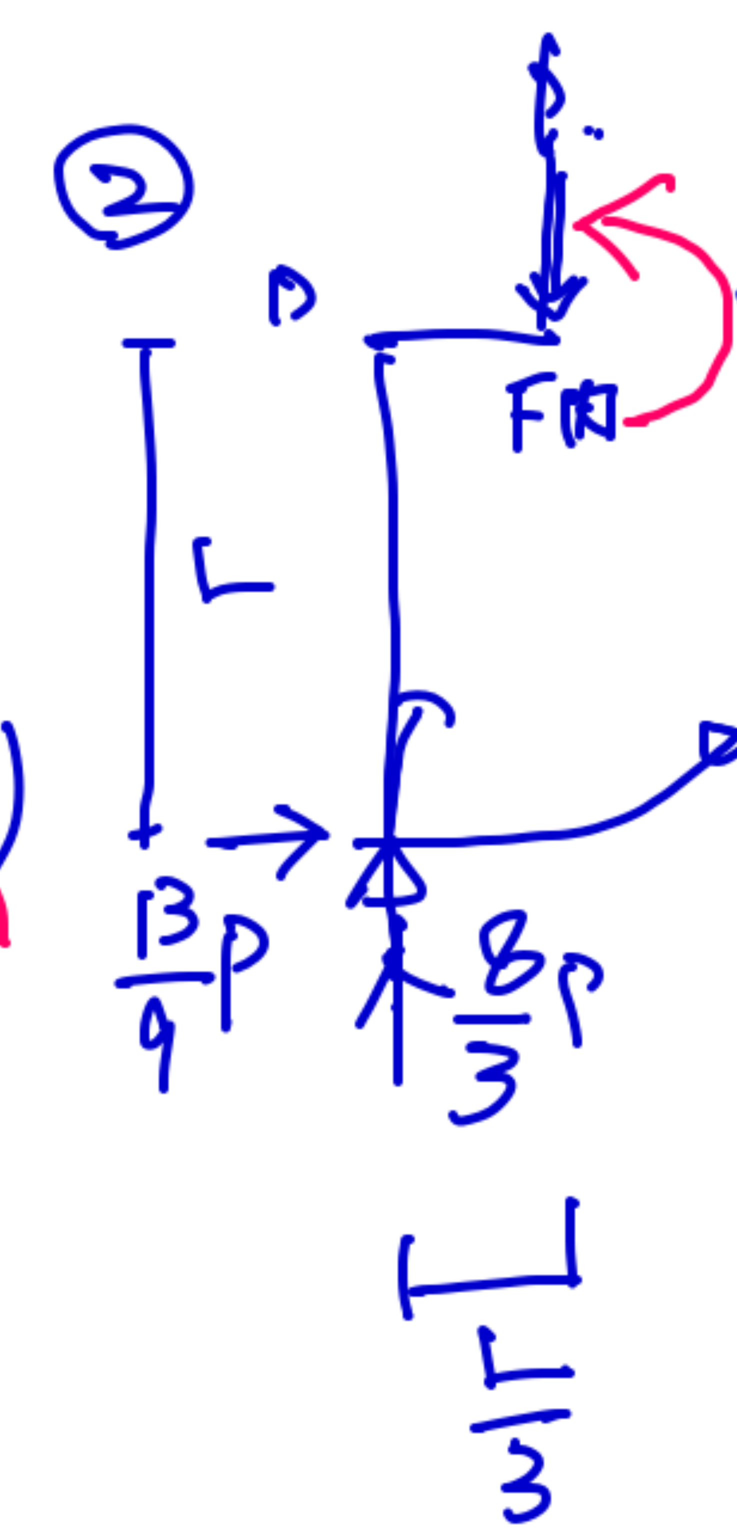


$\Sigma M_D = 0$

$-M_D - \frac{13}{9}P \cdot L = 0$

$M_D = -\frac{13}{9}PL$ (外)

②

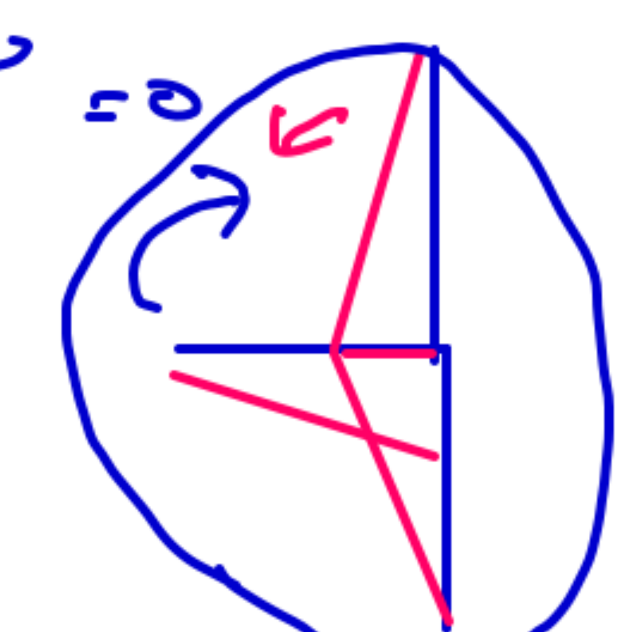


$\Sigma M_F = 0$

$-M_F + \underbrace{\frac{8}{3}P \times \frac{L}{3}}_{} - \frac{13}{9}P \times L = 0$

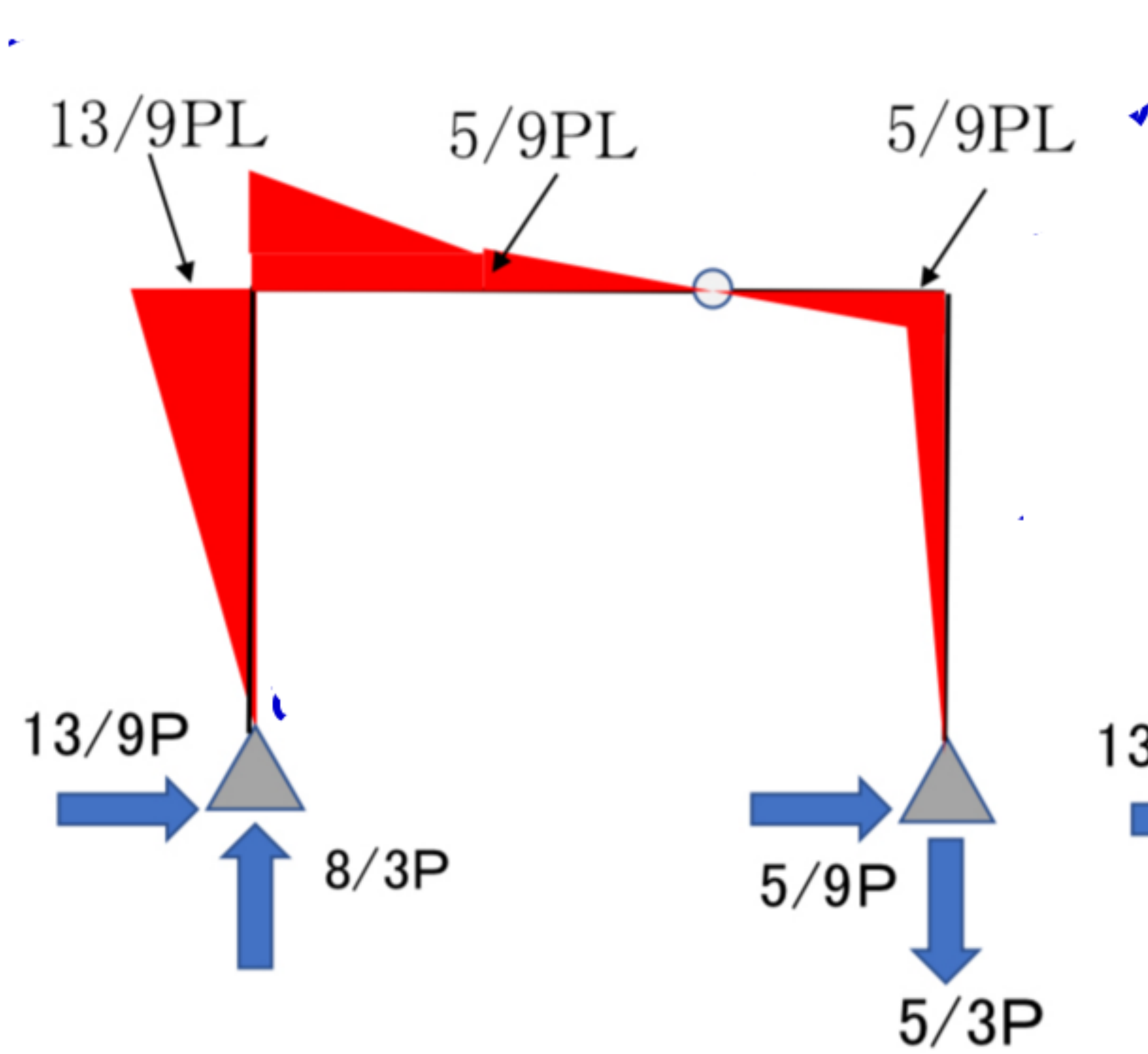
$-M_F \quad \underbrace{\frac{8}{9}PL - \frac{13}{9}PL}_{-\frac{5}{9}PL} = 0$

$M_F = -\frac{5}{9}PL$ (外)



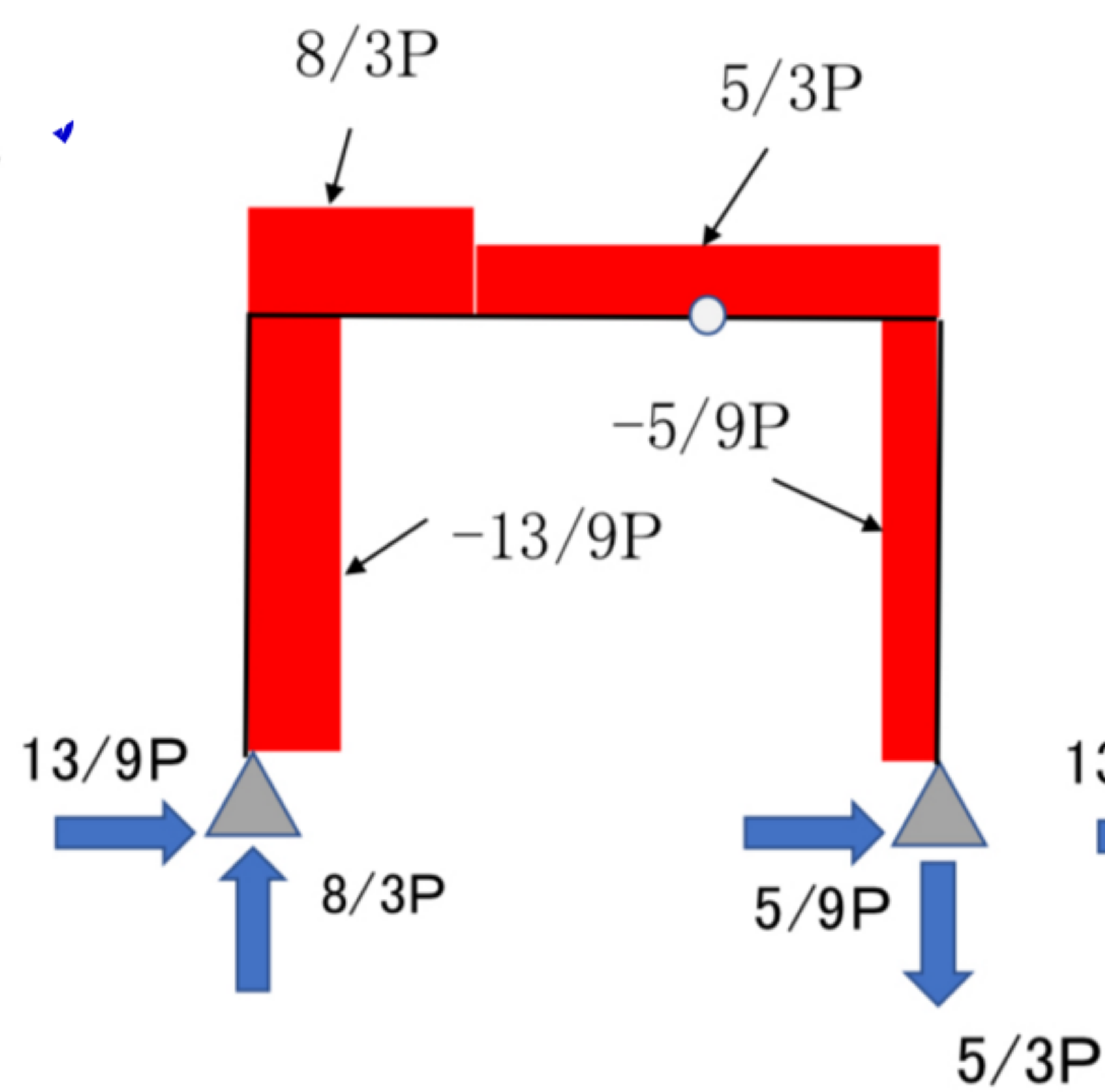
5. 応力図を描く

曲げモーメント図



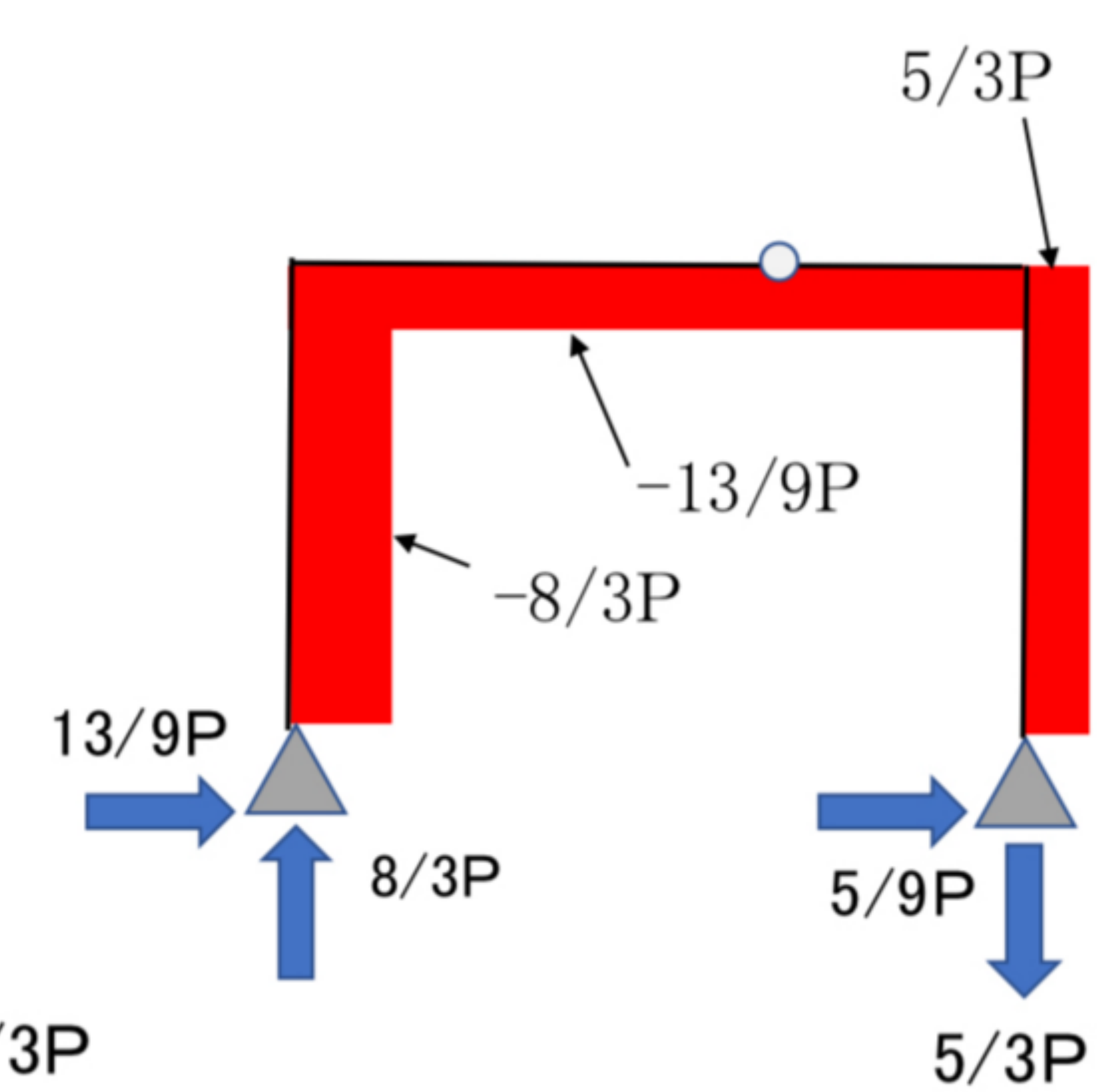
曲げモーメント図は
引張側に描く

せん断力図



せん断力図は
＋を外側に描く

軸方向力図



軸方向力図は
＋を外側に描く

A−D　　QAD

$$-\frac{\frac{13}{9}PL}{L} = -\frac{13}{9}P$$

D−F

$$-\frac{5}{9}PL - -\frac{13}{9}PL = \frac{\frac{8}{9}PL}{\frac{L}{3}} = \frac{8\cdot 3PL}{9L} = \frac{8}{3}P$$

F−E

$$\frac{5}{9}PL - -\frac{5}{9}PL = \frac{\frac{10}{9}PL}{\frac{2}{3}L} = \frac{5}{3}P$$