

# 「力学計算塾」

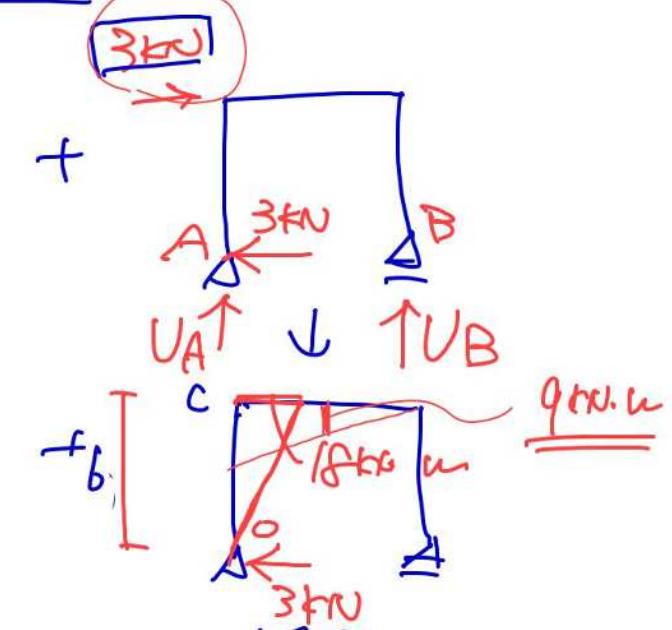
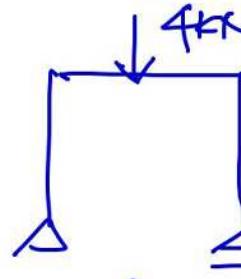
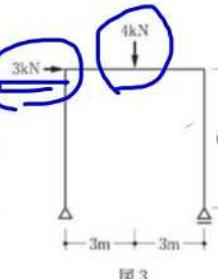
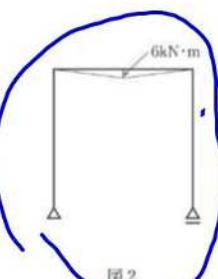
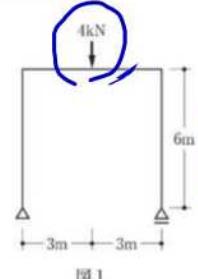
## スリーピンジラーメン攻略

### (全2回)

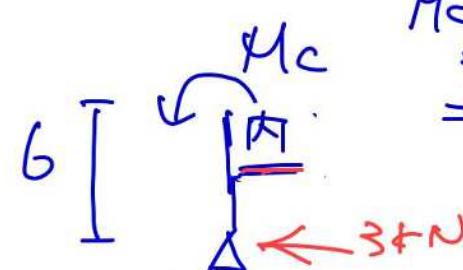
1. スリーピンジラーメンの応力の求め方
2. 山形スリーピンジラーメンの応力の求め方

## 宿題

2級-R03 図1の状態の曲げモーメント図は図2に示される、これを基に図3の状態の曲げモーメント図を選ぶ。



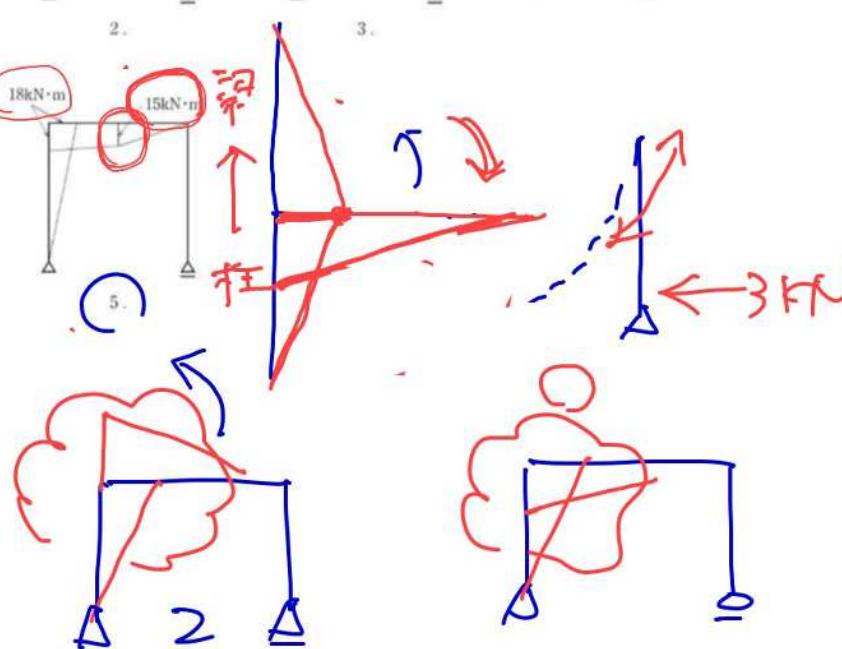
$$M_c = 3 \times 6 = 18 \text{ KN-m}$$



$$\sum M_c = 0$$

$$-M_c + 3 \times 6 = 0$$

$$M_c = 18 \text{ KN-m}$$

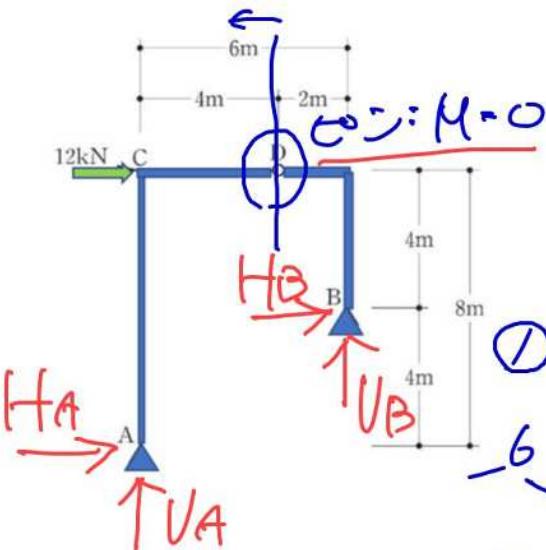


2級-H29

A点、B点に生じる鉛直反力VA, VBと水平反力HA, HBの値

C-D間のせん断力の絶対値を求める。

(水平方向は左向き「+」)



スリービニシラ-Xニ

反力の求め方と静定ランナーの特徴と  
少し違います。

1. 反力

$$\textcircled{1} \quad \sum X = 0 \text{ なり}$$

$$\begin{aligned} & \rightarrow \rightarrow \rightarrow \\ & H_A + H_B + 12 = 0 \\ & H_A + H_B = -12 \end{aligned}$$

$$\textcircled{2} \quad \sum Y = 0 \text{ なり}$$

$$\begin{aligned} & \uparrow \uparrow \uparrow \\ & V_A + V_B = 0 \\ & V_B = +12 \end{aligned}$$

$$\textcircled{3} \quad \sum M_B = 0 \text{ なり}$$

$$\begin{aligned} & -H_A \times 4 + V_A \times 6 + 12 \times 4 = 0 \\ & -4H_A + 6V_A + 48 = 0 \end{aligned}$$

$$\textcircled{4} \quad F = 4 \text{ ケル}$$

$$\begin{aligned} & -8H_A - 48 = 0 \\ & H_A = -6 \end{aligned}$$

	$H_A$	$H_B$	$Q_{CD}$ の絶対値
1.	+3 kN	+9 kN	6 kN
2.	+3 kN	+9 kN	8 kN
3.	+4 kN	+8 kN	8 kN
4.	+4 kN	+8 kN	12 kN
5.	+6 kN	+6 kN	12 kN

$$\begin{aligned} & 8V_A = -96 \\ & V_A = -12 \text{ (下)} \end{aligned}$$

$$\begin{aligned} & -8H_A + 4V_A = 0 \\ & H_A = -6 \end{aligned}$$

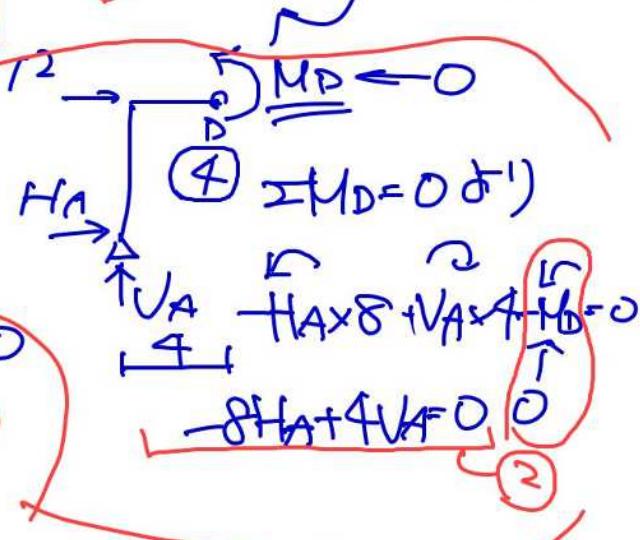
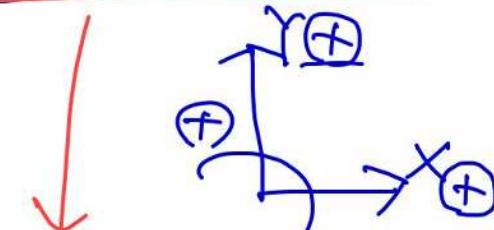
DX2

$$\begin{aligned} & -8H_A + 12V_A + 96 = 0 \\ & -8H_A + 4V_A = 0 \end{aligned}$$

$$8V_A = -96$$

$$\textcircled{1} \quad F = 4 \text{ ケル}$$

$$\begin{aligned} & -8H_A - 48 = 0 \\ & H_A = -6 \end{aligned}$$

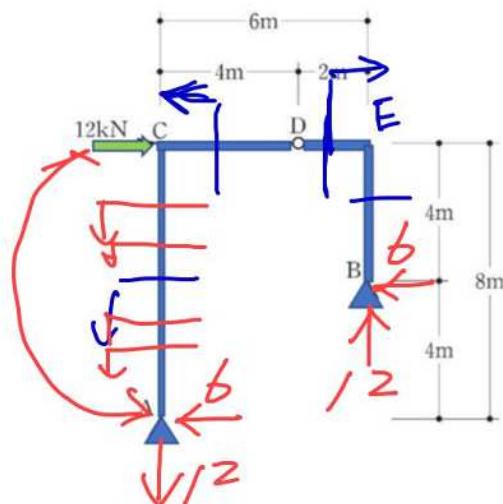


$$\textcircled{4} \quad \sum M_D = 0 \text{ なり}$$

$$\begin{aligned} & \uparrow \uparrow \uparrow \uparrow \uparrow \\ & V_A + H_A \times 8 + V_A \times 4 + H_D = 0 \\ & -8H_A + 4V_A = 0 \end{aligned}$$

2級-H29

A点、B点に生じる鉛直反力VA, VBと水平反力HA, HBの値、C-D間のせん断力の絶対値を求める。



$H_A$	$H_B$	$Q_{CD}$ の絶対値
+3 kN	+9 kN	6 kN
+3 kN	+9 kN	8 kN
+4 kN	+8 kN	8 kN
+4 kN	+8 kN	12 kN
+6 kN	+6 kN	12 kN

(+) Diagram showing a free body diagram of the beam segment CD. A clockwise moment of 12 is applied at point D. A horizontal force  $Q_{CD}$  acts to the right at point C. A horizontal force of 6 acts to the left at point D. A vertical force of 12 acts downwards at point C.

$$\sum Y = 0 \text{ より} \\ -Q_{CD} - 12 = 0 \\ Q_{CD} = -12 \text{ kN}$$

(-) Diagram showing a free body diagram of the beam segment AC. A horizontal force  $Q_{AC}$  acts to the right at point C. A horizontal force of 6 acts to the left at point A. A vertical force of 12 acts downwards at point C.

$$\sum X = 0 \text{ より} \\ Q_{AC} - 6 = 0 \\ Q_{AC} = 6 \text{ kN}$$

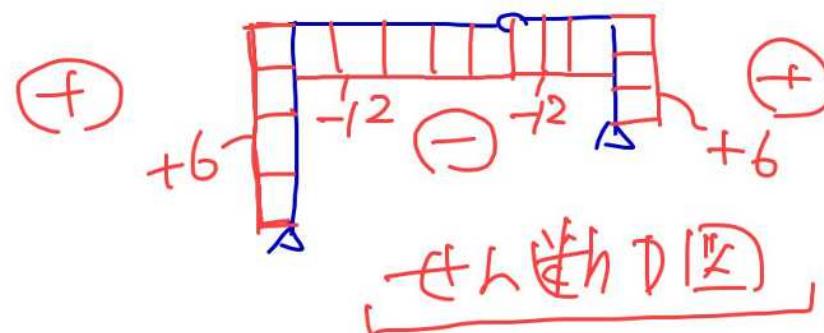
時計回り図

(+) Diagram showing a free body diagram of the beam segment DF. A vertical force of 12 acts upwards at point F. A vertical force  $Q_{DF}$  acts downwards at point D. A horizontal force of 6 acts to the left at point D.

$$\sum Y = 0 \\ Q_{DF} + 12 = 0 \\ Q_{DF} = -12 \text{ kN}$$

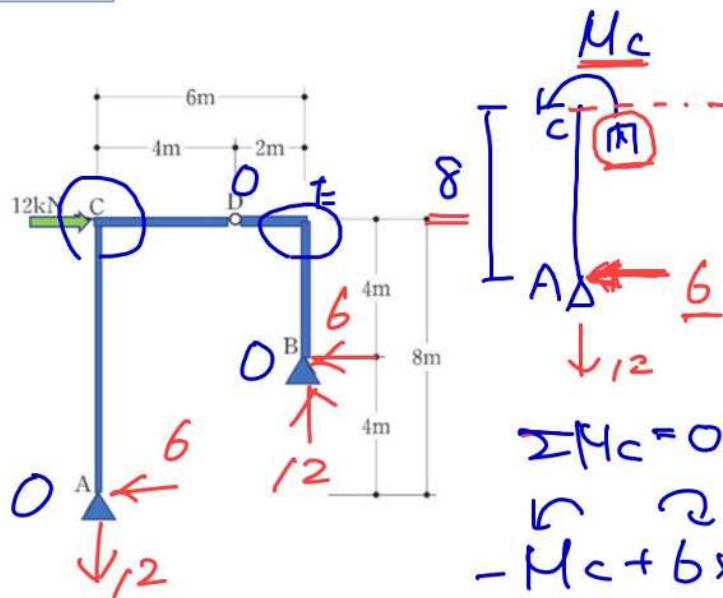
(-) Diagram showing a free body diagram of the beam segment BE. A horizontal force  $Q_{BE}$  acts to the right at point E. A horizontal force of 6 acts to the left at point B. A vertical force of 12 acts upwards at point E.

$$\sum X = 0 \text{ より} \\ Q_{BE} - 6 = 0 \\ Q_{BE} = 6 \text{ kN}$$



2級-H29

A点、B点に生じる鉛直反力VA, VBと水平反力HA, HBの値、C-D間のせん断力の絶対値を求める。

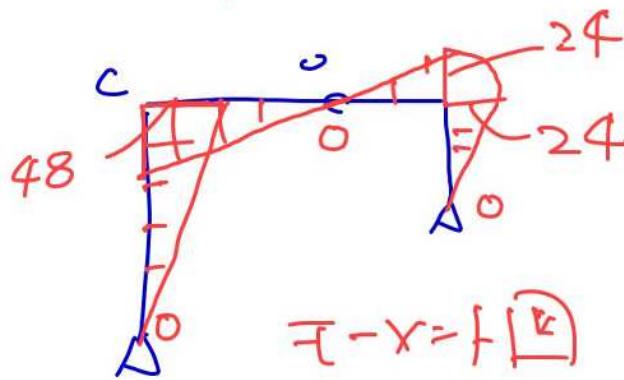


	$H_A$	$H_B$	$Q_{CD}$ の絶対値
1.	+3 kN	+9 kN	6 kN
2.	+3 kN	+9 kN	8 kN
3.	+4 kN	+8 kN	8 kN
4.	+4 kN	+8 kN	12 kN
5.	+6 kN	+6 kN	12 kN

$\sum M_C = 0$

$$-M_C + 6 \times 8 = 0$$

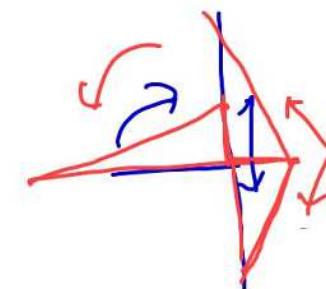
$$M_C = 48 \text{ kN.m (内)}$$



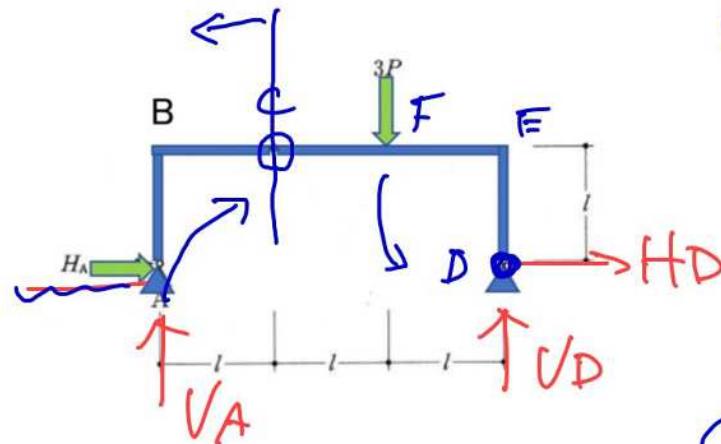
$\sum M_E = 0$

$$+M_E + 6 \times 4 = 0$$

$$M_E = -24 \text{ kNm (外)}$$



H24-No3

A点の水平反力 $H_A$ を求める。更にB点の曲げモーメントを求める。

$$\textcircled{1} \quad \sum M_D = 0 \quad \text{より}$$

$$+V_A \times 3L - 3P \times L = 0$$

$$3V_A L = 3P L$$

$$\underline{V_A = P (\uparrow)}$$

$$\textcircled{2} \quad \sum Y = 0 \quad \text{より}$$

$$V_A + V_D - 3P = 0$$

(P)

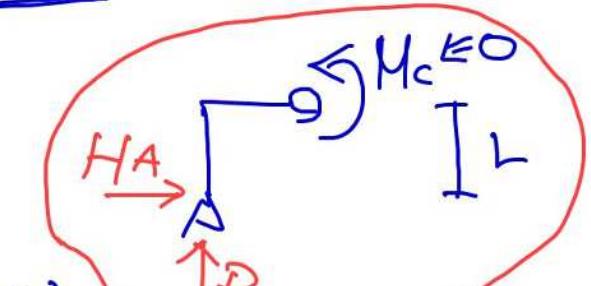
$$\underline{V_D = 2P (\downarrow)}$$

\textcircled{3}

$$\sum X = 0$$

$$H_A + H_D = 0$$

$$\underline{H_D = -P (\leftarrow)}$$

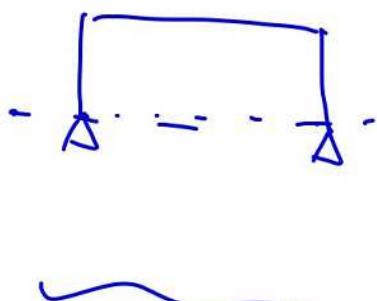
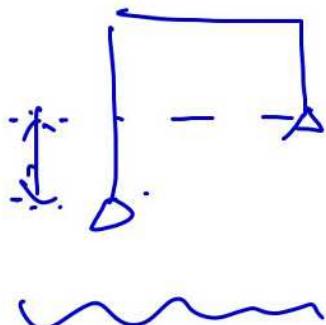


$$\sum M_C = 0 \quad \text{より}$$

$$-\underline{M_C + P \times L - H_A \times L = 0}$$

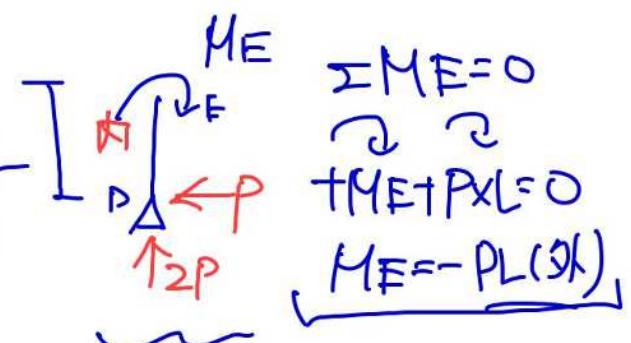
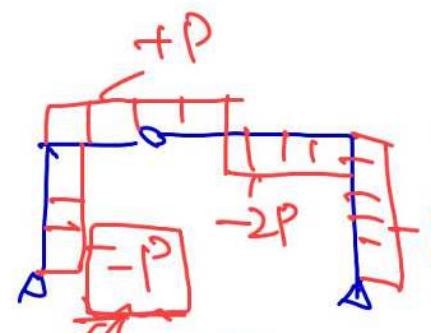
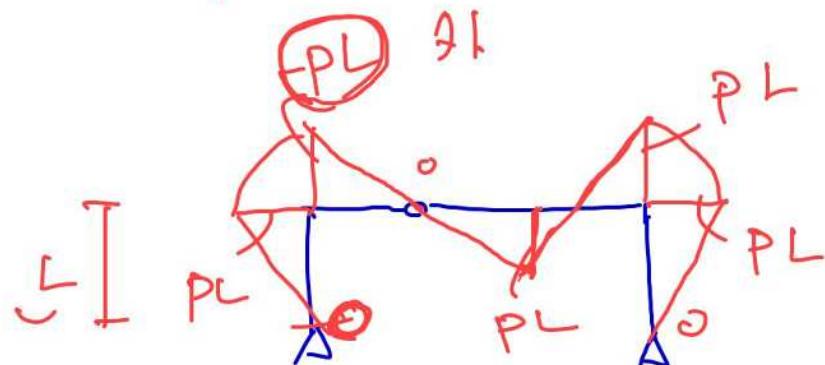
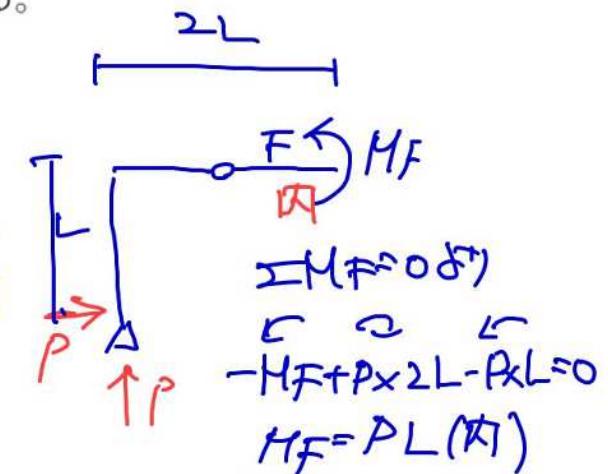
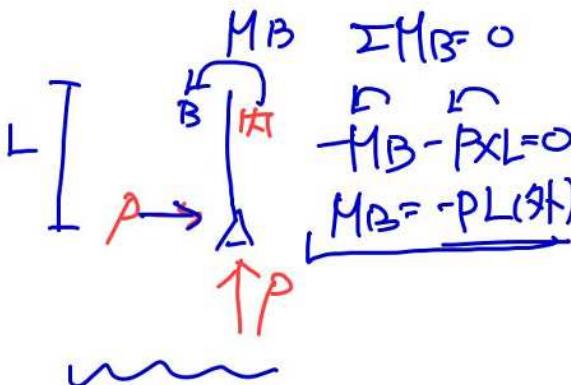
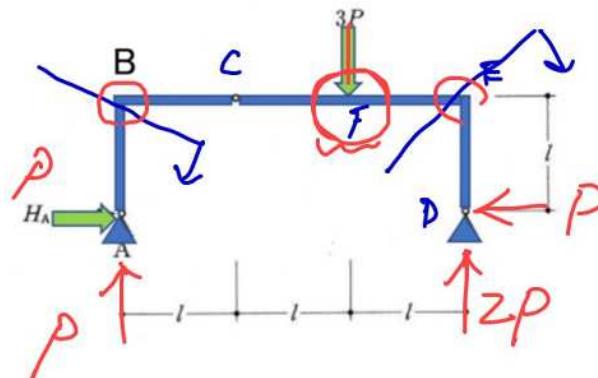
$$\underline{H_A L = PL}$$

$$\underline{H_A = P (\rightarrow)}$$



H24-No3

A点の水平反力HAを求める。更にB点の曲げモーメントを求める。



(M固)

$$\frac{-PL}{L} = -P \leftarrow Q$$

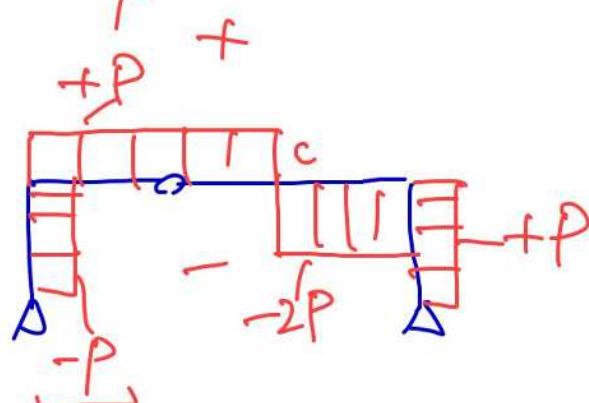
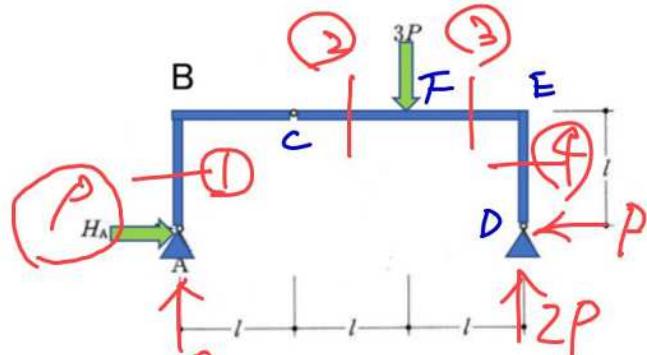
(Q固)

QはMの変化の割合

変化量

H24-No3

A点の水平反力HAを求める。更にB点の曲げモーメントを求める。



$Q$  (回)

①

$$\begin{aligned} Q_{AB} &= P \quad \sum X = 0 \\ Q_{AB} + Q_{AF} + P &= 0 \\ Q_{AF} &= -P \end{aligned}$$

②

$$\begin{aligned} Q_{CF} &= P \quad \sum Y = 0 \\ -Q_{CF} + P &= 0 \\ Q_{CF} &= P \end{aligned}$$

③

$$\begin{aligned} Q_{EF} &= -2P \quad \sum Y = 0 \\ Q_{EF} + 2P &= 0 \\ Q_{EF} &= -2P \end{aligned}$$

④

$$\begin{aligned} Q_{DE} &= P \quad \sum X = 0 \\ Q_{DE} - P &= 0 \\ Q_{DE} &= P \end{aligned}$$

