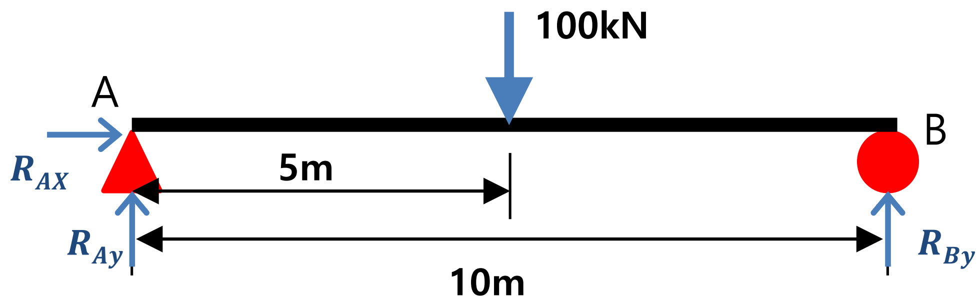
구조역학기초 2

부천대학교 토목공학과 박영훈 교수

Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

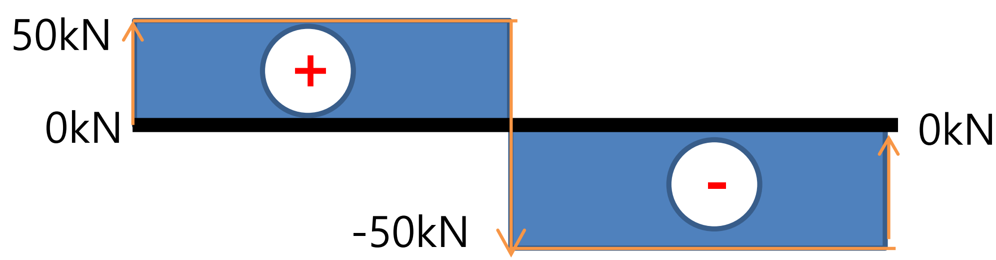
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 1)



M_A + = 0, (100kN X 5m) - (R_{By} X 10m) = 0, R_{By} = 50kN

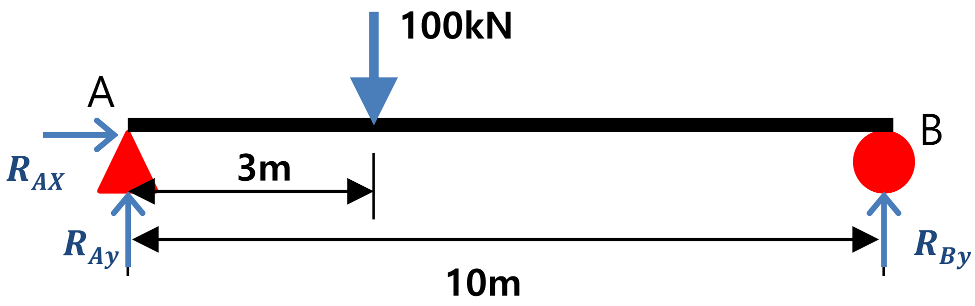
F_y = 0, R_{Ay} + R_{By} = 100kN, R_{Ay} = 50kN

F_X = 0, R_{AX} = 0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

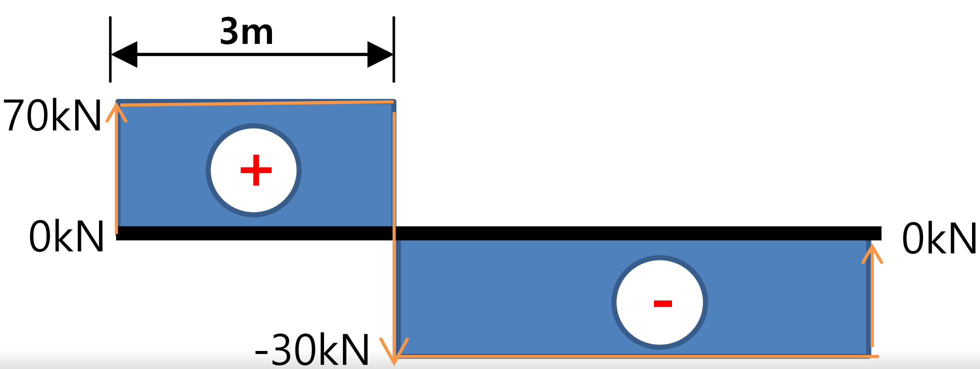
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 2)



$\curvearrowright M_A +$ = 0, (100kN X 3m) - (R_{By} X 10m) = 0, R_{By} = 30kN

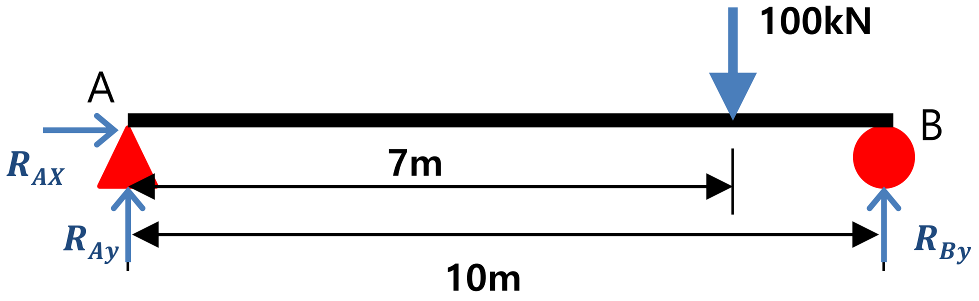
$\uparrow F_y$ = 0, $R_{Ay} + R_{By}$ = 100kN, R_{Ay} = 70kN

$\rightarrow F_X$ = 0, R_{AX} = 0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

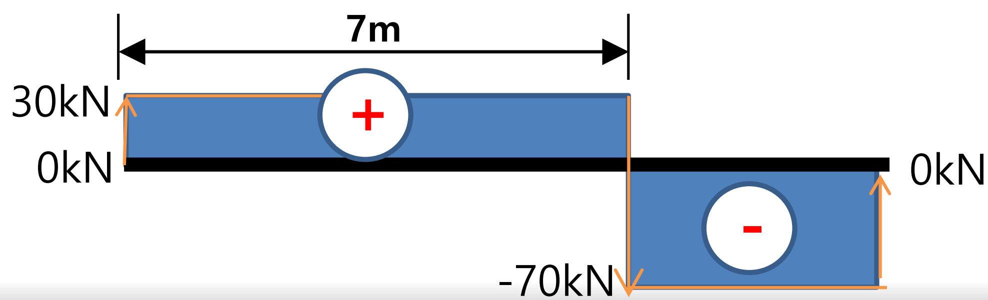
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 3)



M_A + ↻ = 0, (100kN X 7m) - (R_{By} X 10m) = 0, R_{By} = 70kN

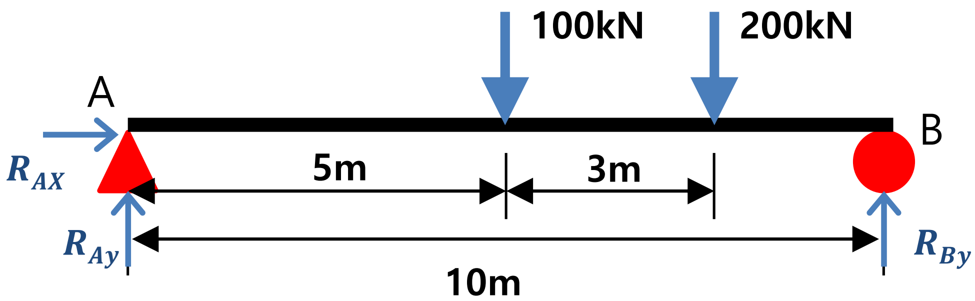
↑ F_y = 0, R_{Ay} + R_{By} = 100kN, R_{Ay} = 30kN

→ F_X = 0, R_{AX} = 0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

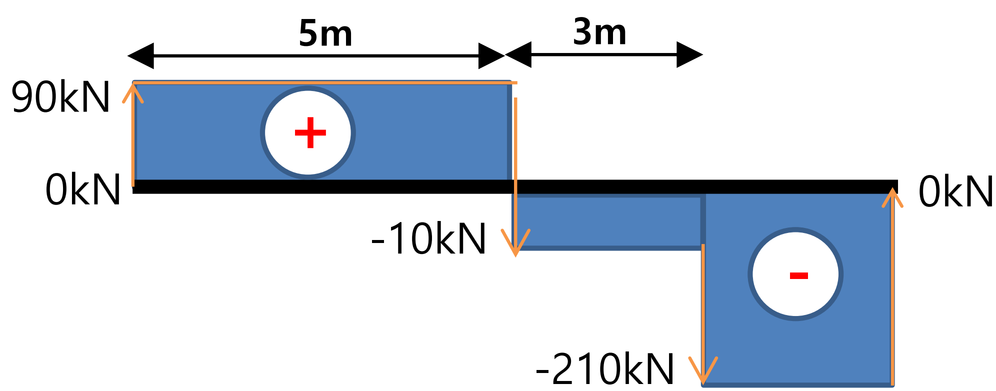
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 4)



M_A + ↻ = 0, (100kN X 5m) + (200kN X 8m) - (R_{By} X 10m) = 0, R_{By} = 210kN

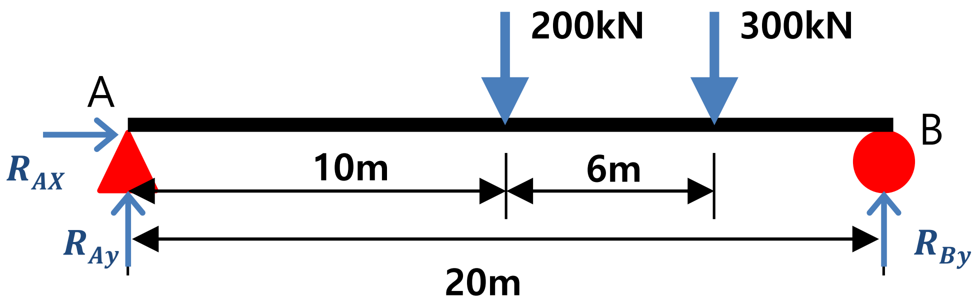
↑ F_y = 0, R_{Ay} + R_{By} = 300kN, R_{Ay} = 90kN

→ F_X = 0, R_{AX} = 0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

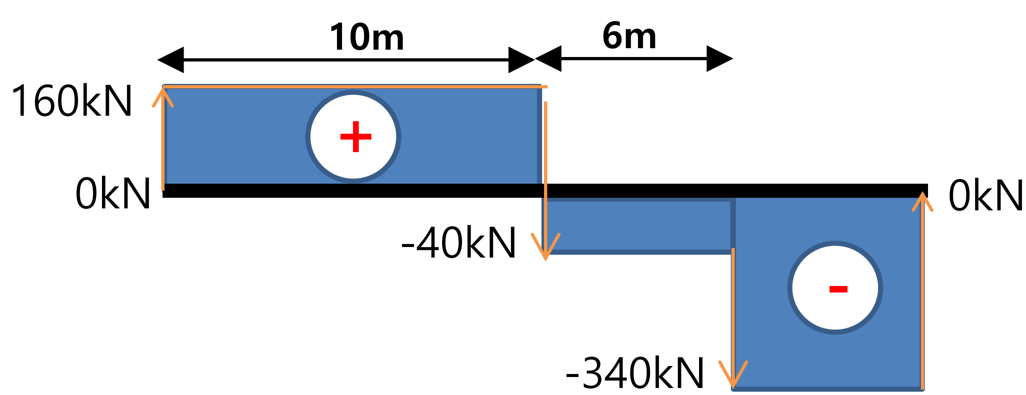
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 5)



M_A + ↻ = 0, (200kN X 10m) + (300kN X 16m) - (R_{By} X 20m) = 0, R_{By} = 340kN

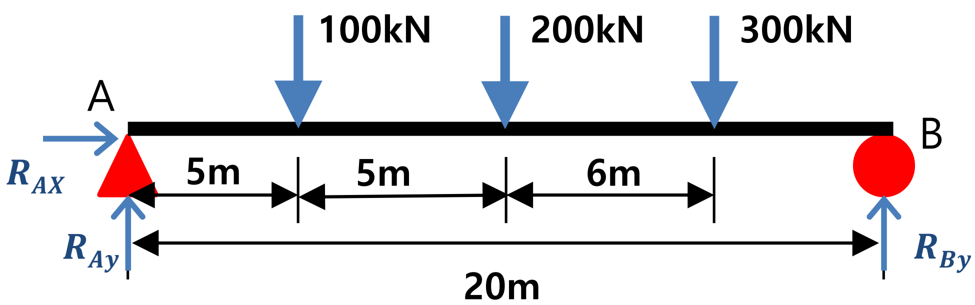
↑ F_y = 0, R_{Ay} + R_{By} = 500kN, R_{Ay} = 160kN

→ F_X = 0, R_{AX} = 0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

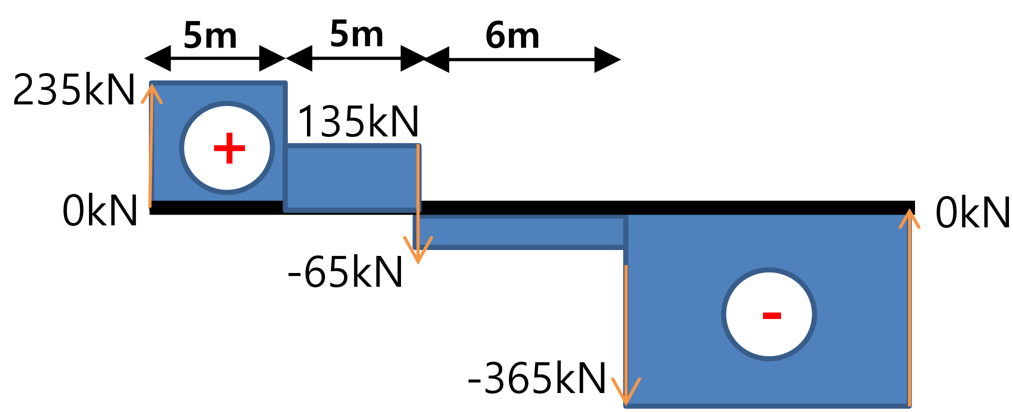
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 6)



M_A + ↻ = 0, (100kN X 5m)+(200kN X 10m)+(300kN X 16m)-(R_{By} X 20m)=0, R_{By} = 365kN

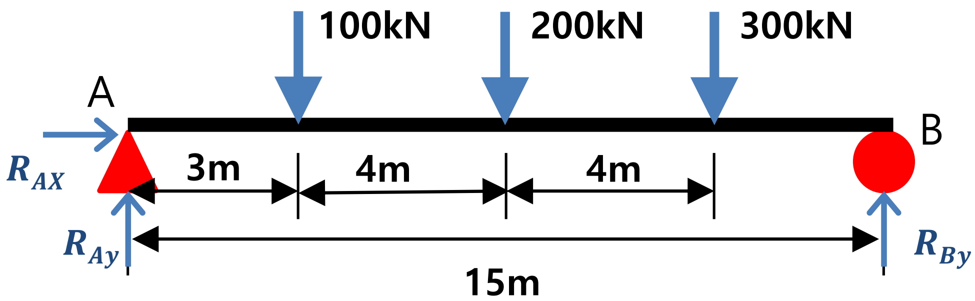
↑ F_y = 0, $R_{Ay} + R_{By}$ = 600kN, R_{Ay} = 235kN

→ F_X = 0, R_{AX} = 0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

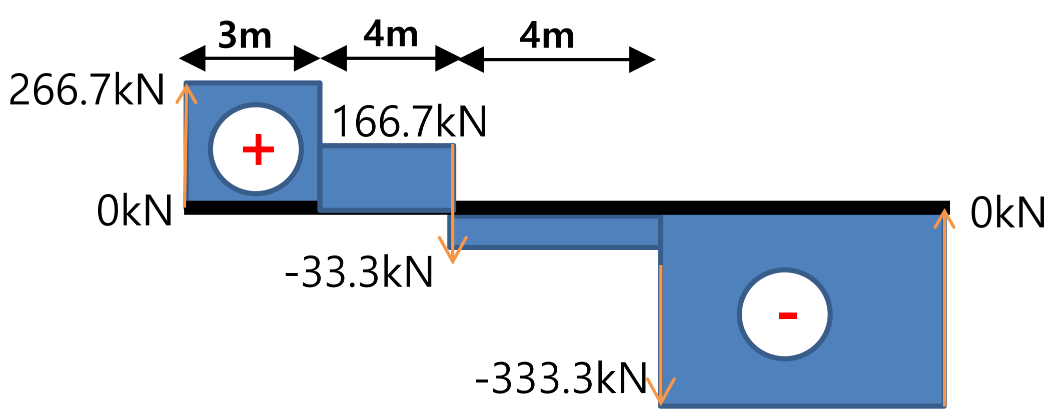
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 7)



M_A + ↻ = 0, $(100kN \times 3m)+(200kN \times 7m)+(300kN \times 11m)-(R_{By} \times 15m)=0$, $R_{By} = 333.3kN$

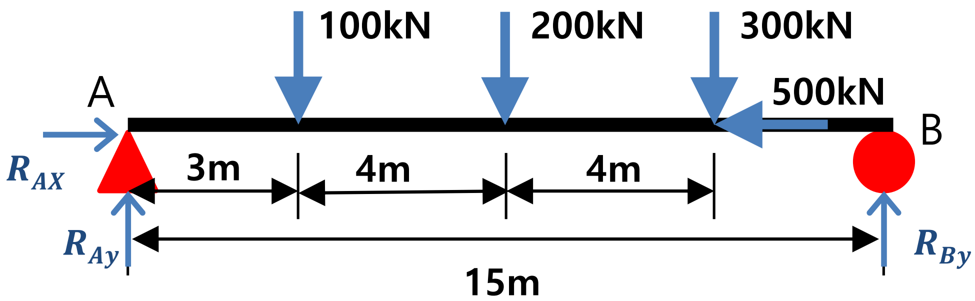
↑ $F_y = 0$, $R_{Ay} + R_{By} = 600kN$, $R_{Ay} = 266.7kN$

→ $F_X = 0$, $R_{AX} = 0$



I .2 전단력도 (Shear Force Diagram ; S. F. D)

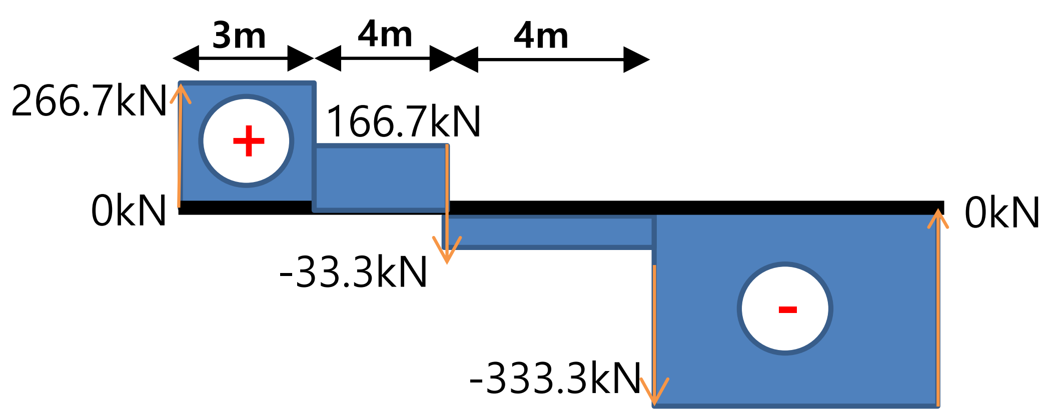
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 8)



M_A + ↻ = 0, (100kN X 3m)+(200kN X 7m)+(300kN X 11m)-(R_{By} X 15m)=0, R_{By} = 333.3kN

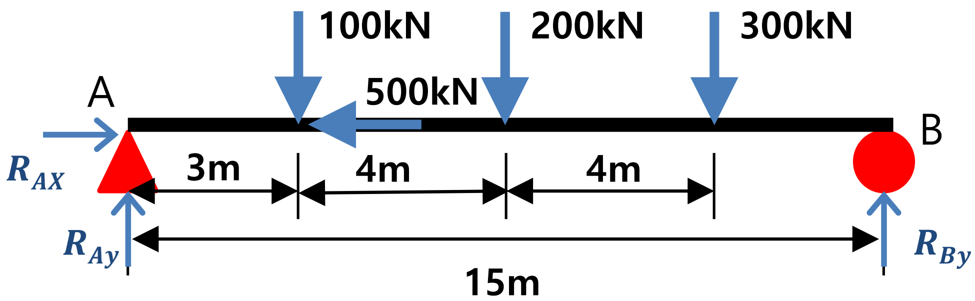
↑ F_y = 0, R_{Ay} + R_{By} = 600kN, R_{Ay} = 266.7kN

→ F_X = 0, R_{AX}–500kN=0, R_{AX}=500kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

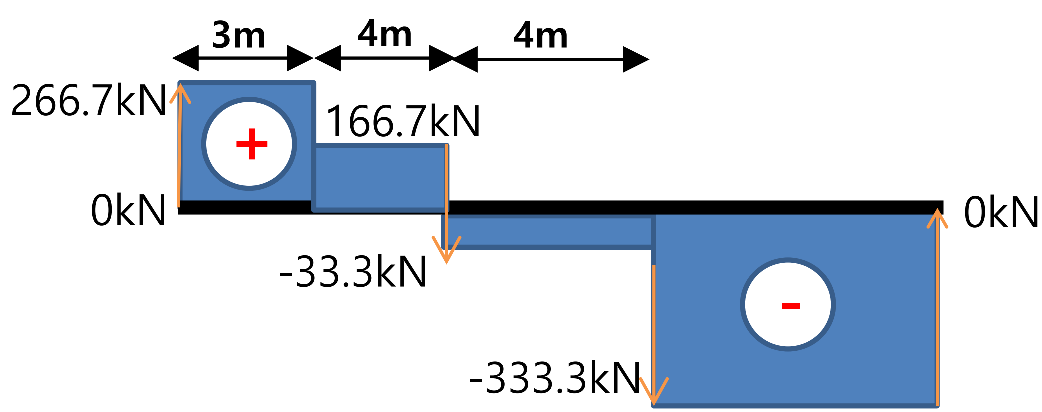
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 9)



M_A + = 0, (100kN X 3m)+(200kN X 7m)+(300kN X 11m)-(R_{By} X 15m)=0, R_{By} = 333.3kN

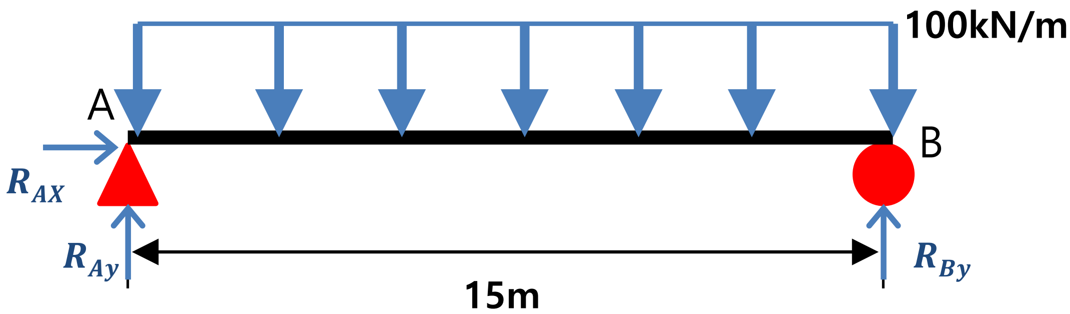
F_y = 0, $R_{Ay} + R_{By}$ = 600kN, R_{Ay} = 266.7kN

F_X = 0, R_{AX}–500kN=0, R_{AX}=500kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

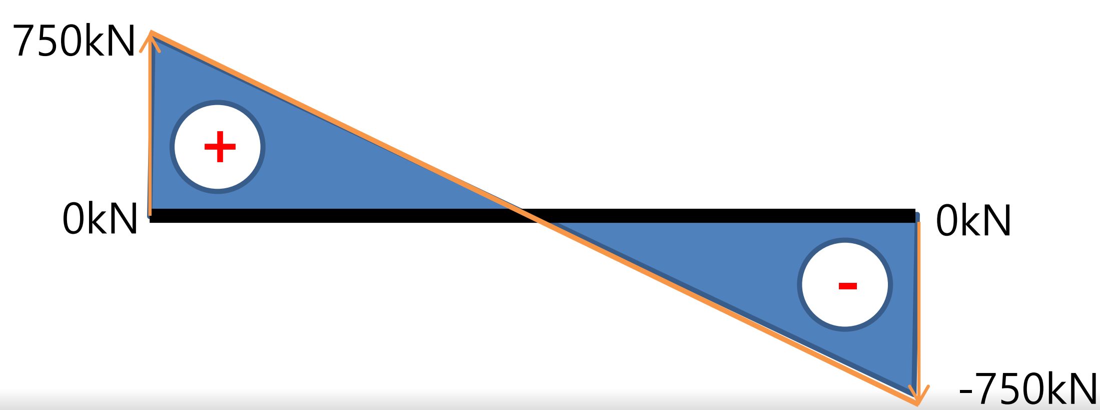
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 10)



M_A + ↻ = 0, (100kN X 15m X 7.5m) - (R_{By} X 15m)=0, R_{By} = 750kN

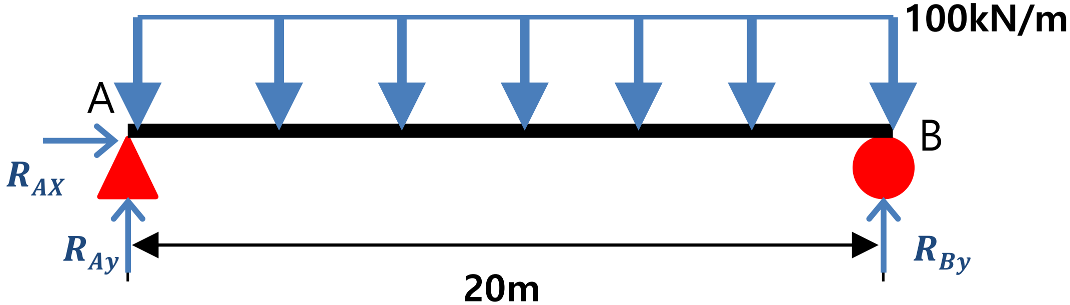
↑ F_y = 0, R_{Ay} + R_{By} = 1,500kN, R_{Ay} = 750kN

→ F_X = 0, R_{AX}=0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

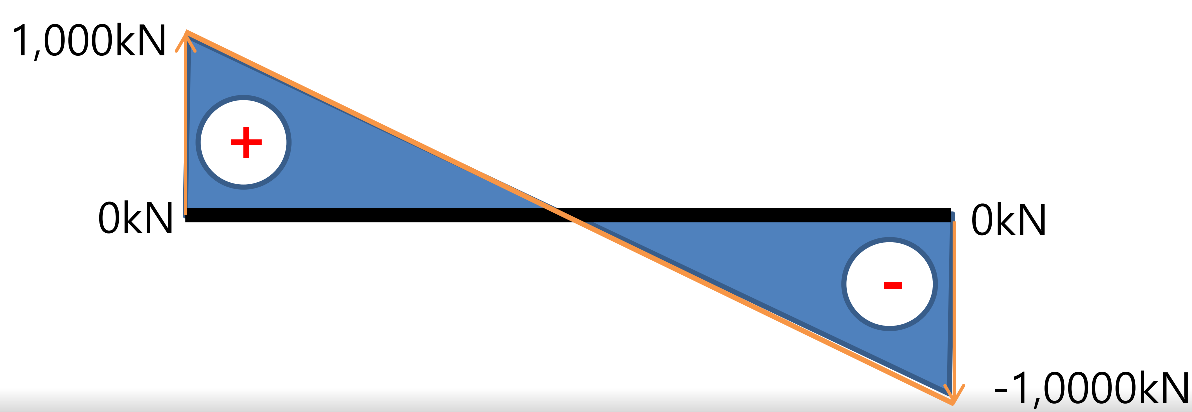
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 11)



M_A + ↻ = 0, (100kN X 20m X 10m) - (R_{By} X 20m)=0, R_{By} = 1,000kN

↑ F_y = 0, R_{Ay} + R_{By} = 2,000kN, R_{Ay} = 1,000kN

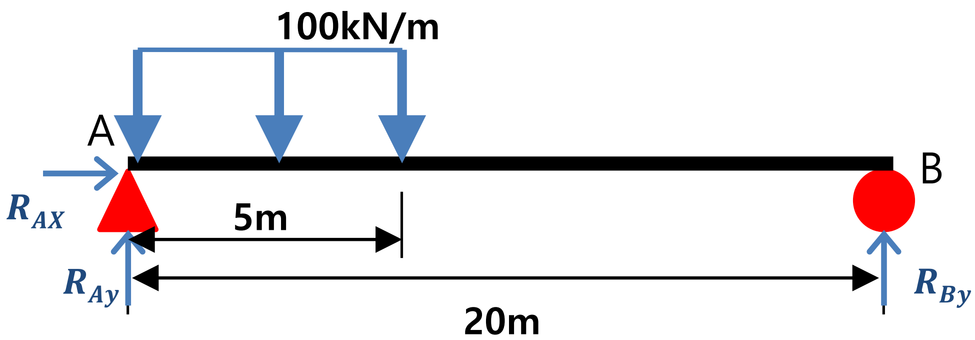
→ F_X = 0, R_{AX}=0



Ⅰ. 보의 휨응력과 전단응력

Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

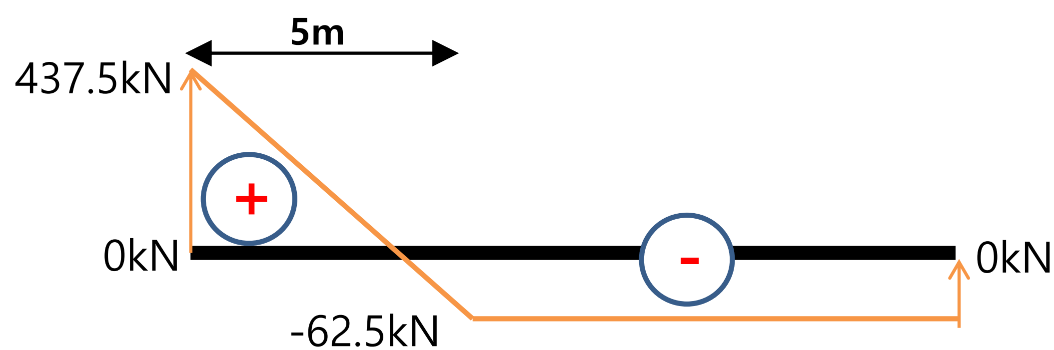
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 12)



M_A + (↻) = 0, (100kN X 5m X 2.5m) - (R_{By} X 20m)=0, R_{By} = 62.5kN

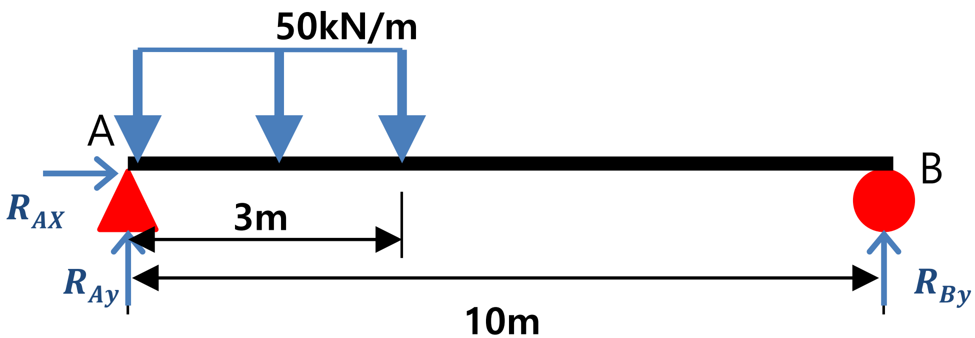
↑F_y = 0, R_{Ay} + R_{By} = 500kN, R_{Ay} = 437.5kN

→F_X = 0, R_{AX}=0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

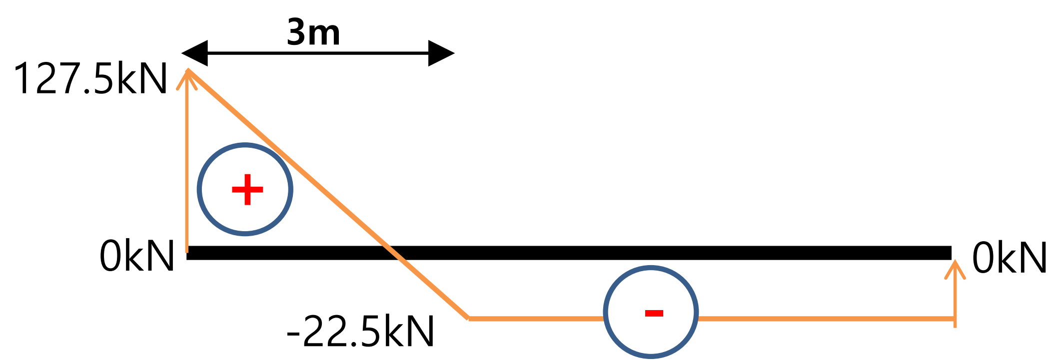
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 13)



M_A + = 0, (50kN X 3m X 1.5m) - (R_{By} X 10m)=0, R_{By} = 22.5kN

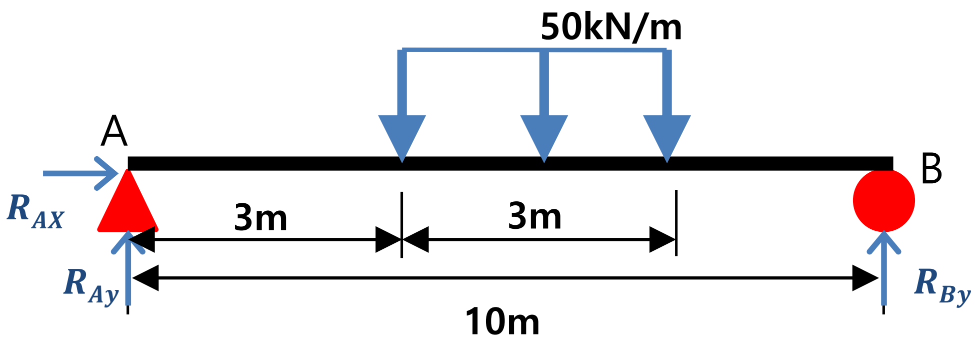
F_y = 0, R_{Ay} + R_{By} = 150kN, R_{Ay} = 127.5kN

F_X = 0, R_{AX}=0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

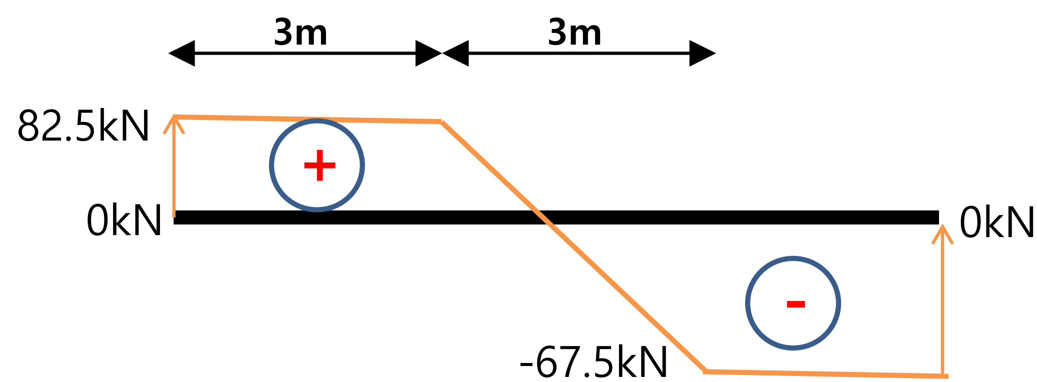
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 14)



M_A + ↻ = 0, (50kN X 3m X (3+1.5)m) - (R_{By} X 10m)=0, R_{By} = 67.5kN

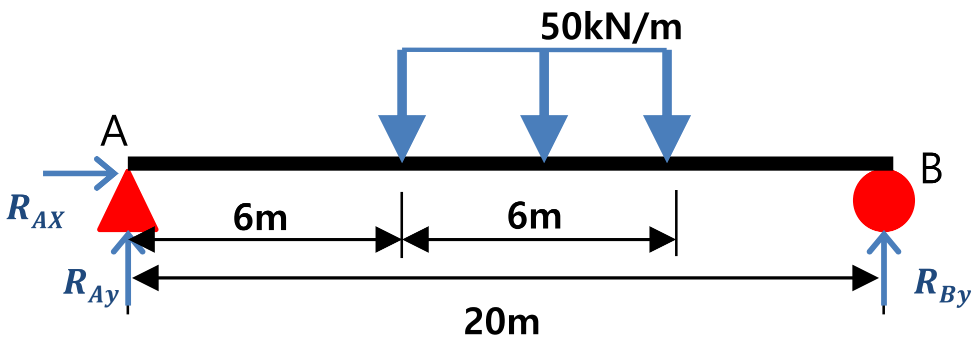
↑F_y = 0, R_{Ay} + R_{By} = 150kN, R_{Ay} = 82.5kN

→F_X = 0, R_{AX}=0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

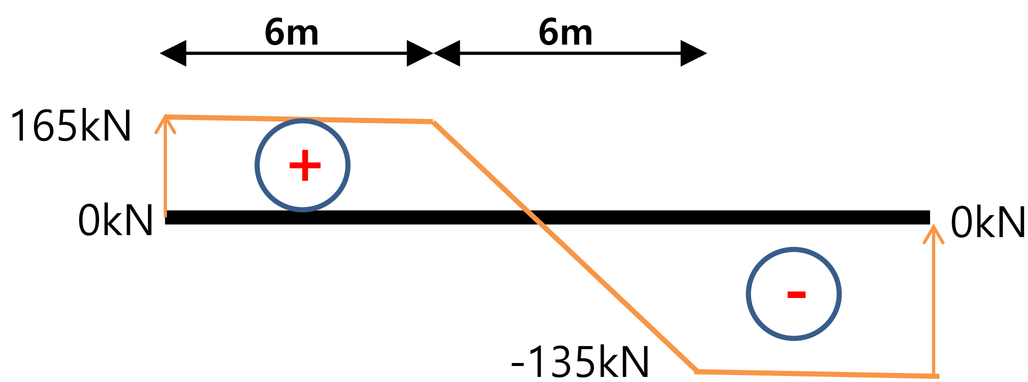
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 15)



M_A + (↻) = 0, (50kN X 6m X (6+3)m) - (R_{By} X 20m)=0, R_{By} = 135kN

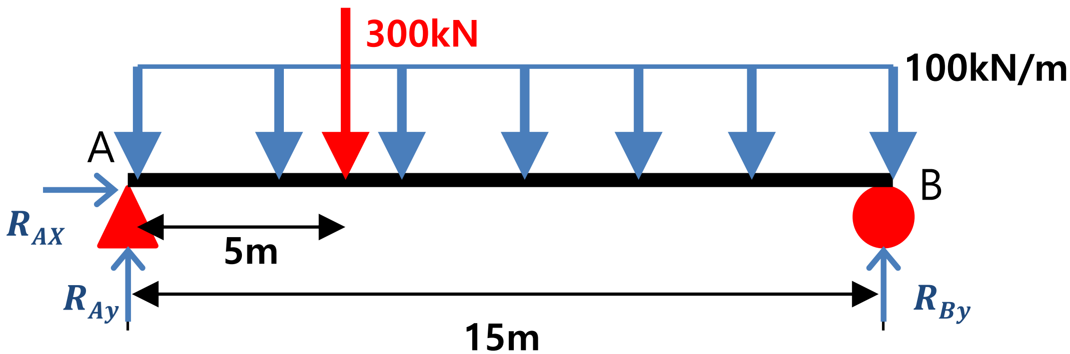
(↑) F_y = 0, $R_{Ay} + R_{By}$ = 300kN, R_{Ay} = 165kN

(→) F_X = 0, R_{AX}=0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

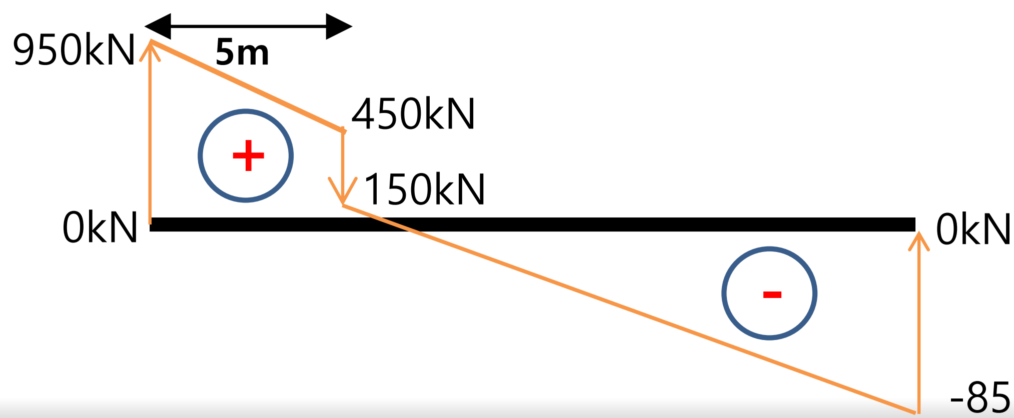
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 16)



M_A + = 0, (100kN X 15m X 7.5m) + (300kN X 5m) - (R_{By} X 15m)=0, R_{By} = 850kN

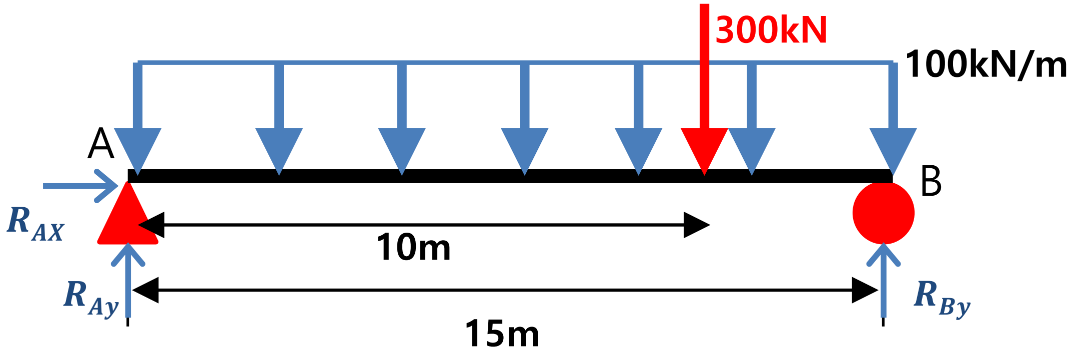
F_y = 0, R_{Ay} + R_{By} = 1,500kN+300kN, R_{Ay} = 950kN

F_X = 0, R_{AX}=0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

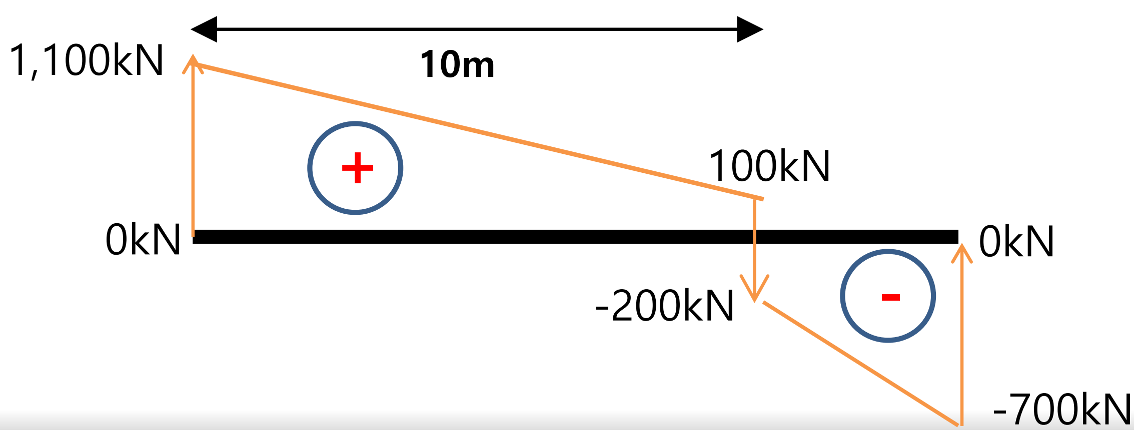
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 17)



M_A + ↻ = 0, (100kN X 15m X 7.5m) + (300kN X 10m) - (R_{By} X 15m)=0, R_{By} = 700kN

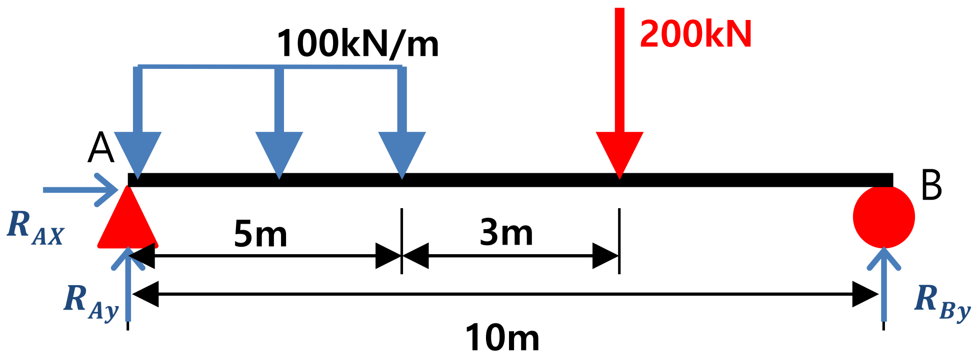
↑ F_y = 0, R_{Ay} + R_{By} = 1,500kN+300kN, R_{Ay} = 1,100kN

→ F_X = 0, R_{AX}=0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

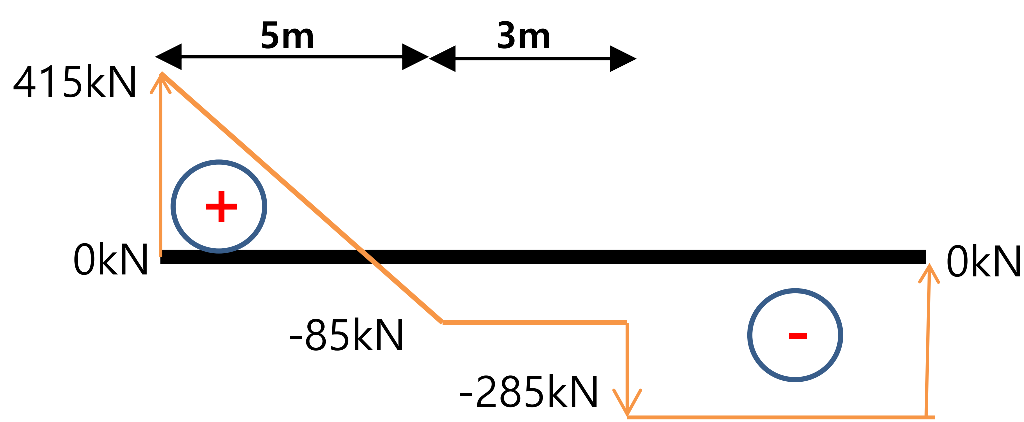
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 18)



M_A + = 0, (100kN X 5m X 2.5m) + (200kN X 8m) - (R_{By} X 10m)=0, R_{By} = 285kN

F_y = 0, R_{Ay} + R_{By} = 700kN, R_{Ay} = 415kN

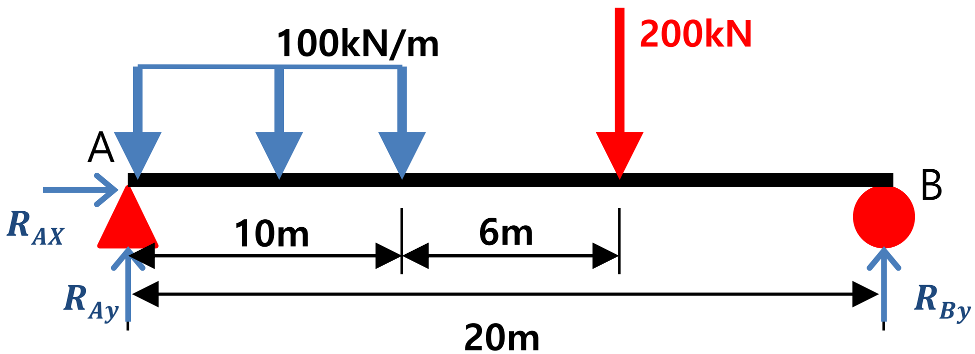
F_X = 0, R_{AX}=0



Ⅰ. 보의 휨응력과 전단응력

Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

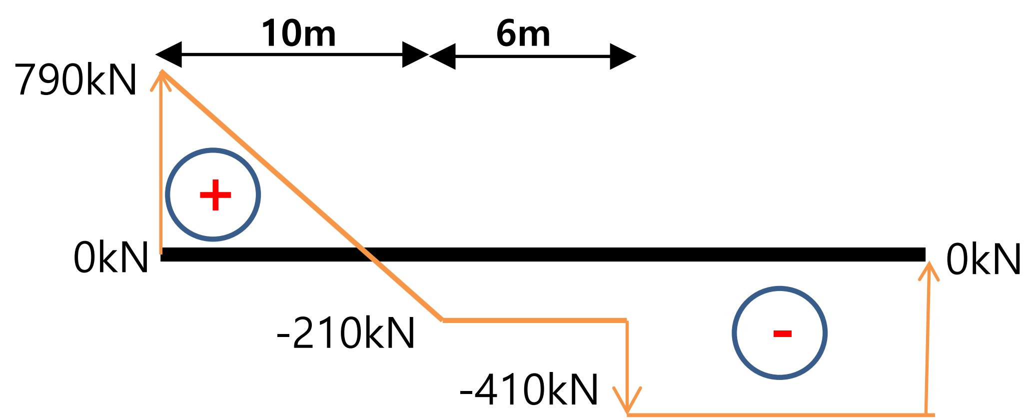
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 19)



M_A + = 0, (100kN X 10m X 5m) + (200kN X 16m) - (R_{By} X 20m)=0, R_{By} = 410kN

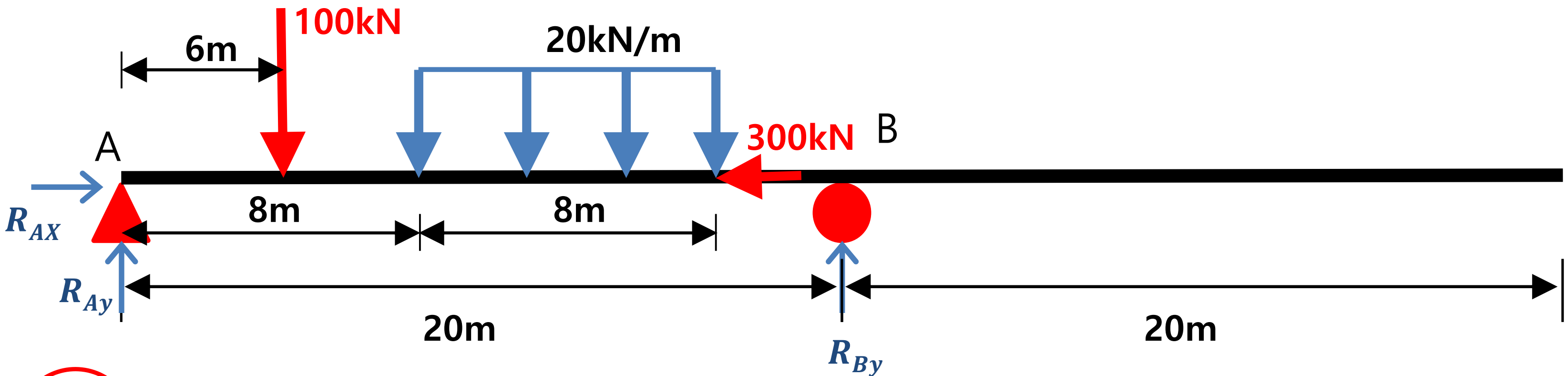
F_y = 0, R_{Ay} + R_{By} = 1,000kN+200kN, R_{Ay} = 790kN

F_X = 0, R_{AX}=0



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

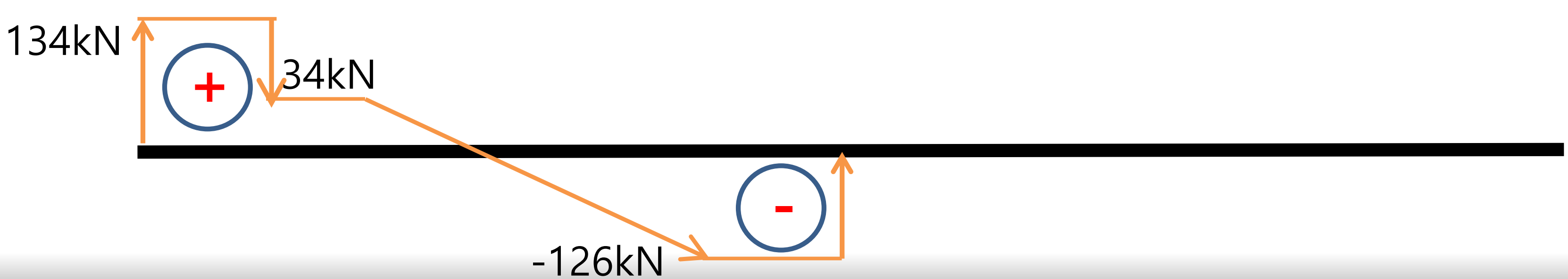
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 20)



M_A + ↻ = 0, (160kN X (8+4)m) + (100kN X 6m) - (R_{By} X 20m) = 0, R_{By} = 126kN

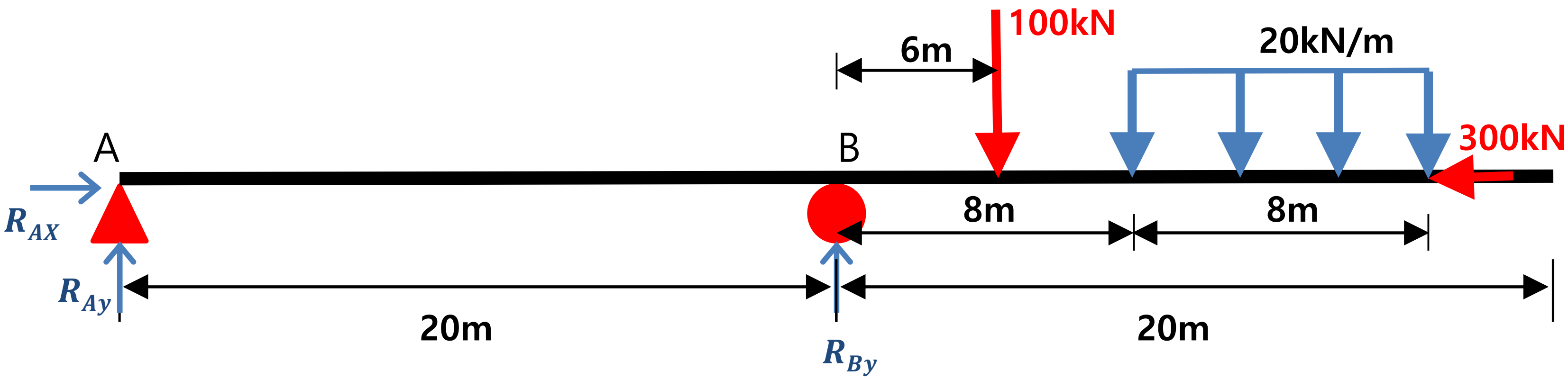
↑ F_y = 0, R_{Ay} + R_{By} = 260kN, R_{Ay} = 134kN

→ F_X = 0, R_{AX} - 300kN =0, R_{AX} =300kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

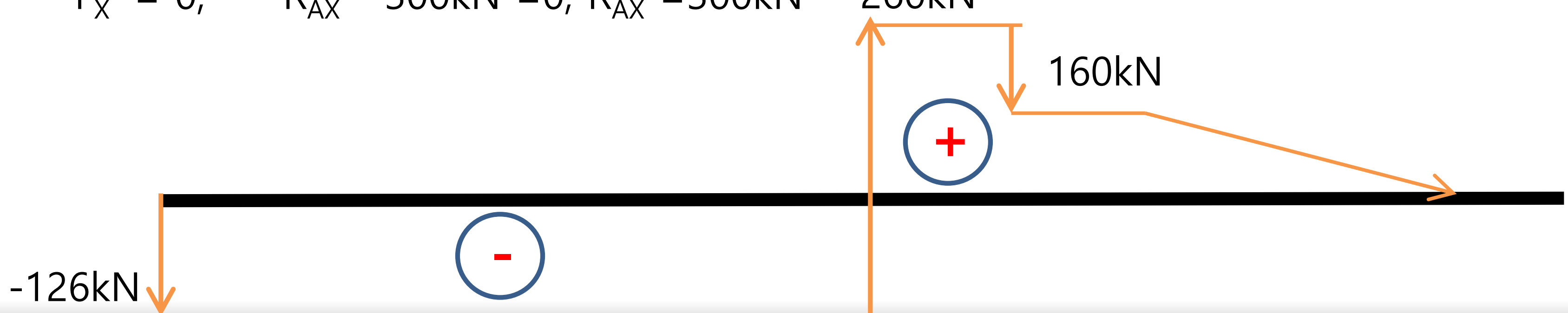
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 21)



$\sum M_A$ (+↻) = 0, (160kN X (28+4)m) + (100kN X (20+6)m) - (R_{By} X 20m) = 0, R_{By} = 386kN

↑ F_y = 0, $R_{Ay} + R_{By}$ = 260kN, R_{Ay} = -126kN(부반력)

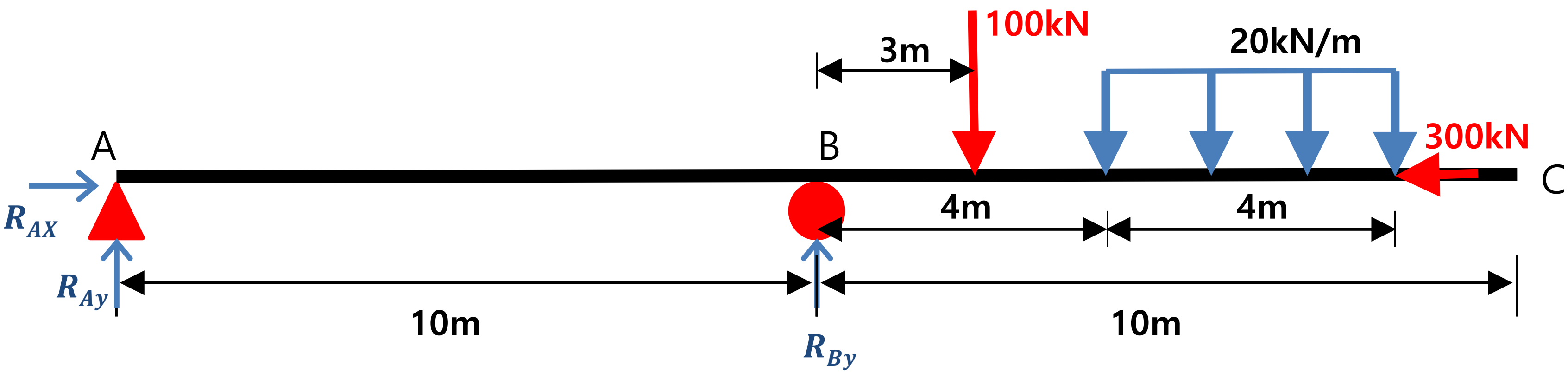
→ F_X = 0, R_{AX} - 300kN =0, R_{AX} =300kN



Ⅰ. 보의 휨응력과 전단응력

Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

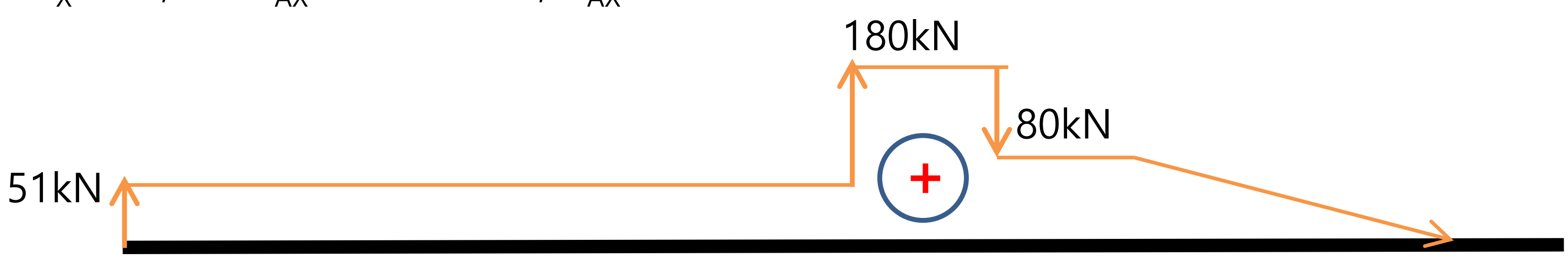
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 22)



M_A + = 0, (80kN X (14+2)m) + (100kN X (10+3)m) - (R_{By} X 20m) = 0, R_{By} = 129kN

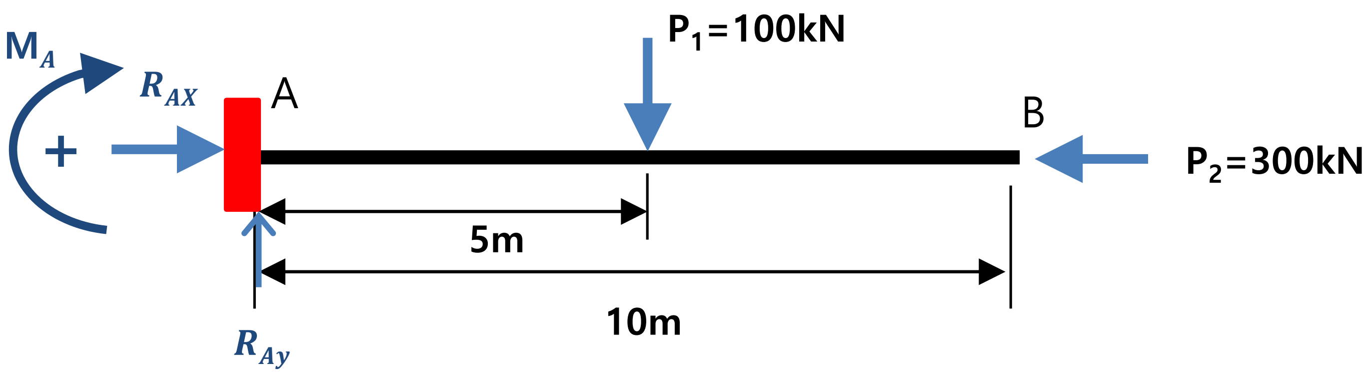
F_y = 0, $R_{Ay} + R_{By}$ = 180kN, R_{Ay} = 51kN

F_X = 0, R_{AX} - 300kN =0, R_{AX} =300kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

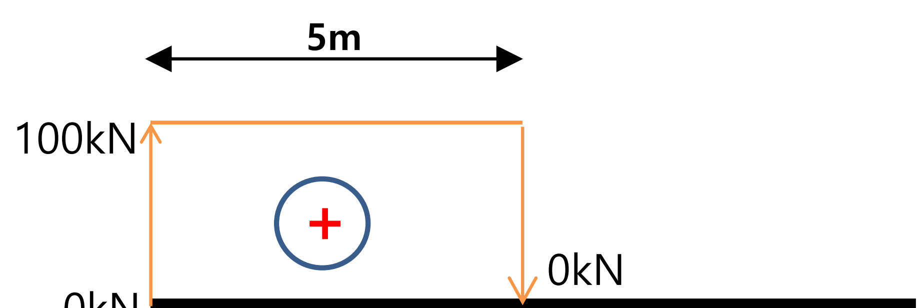
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 23)



↻ M_A + = 0, M_A + (100kN X 5m) = 0, M_A = -500kN•m

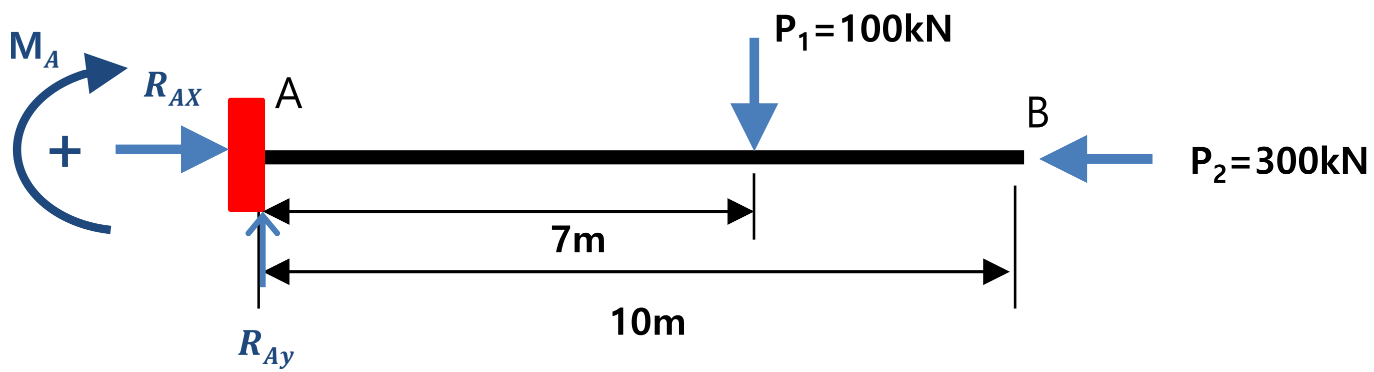
↑ F_y = 0, R_{Ay} – 100kN=0, R_{Ay} = 100kN

→ F_X = 0, R_{AX} - 300kN =0, R_{AX} = 300kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

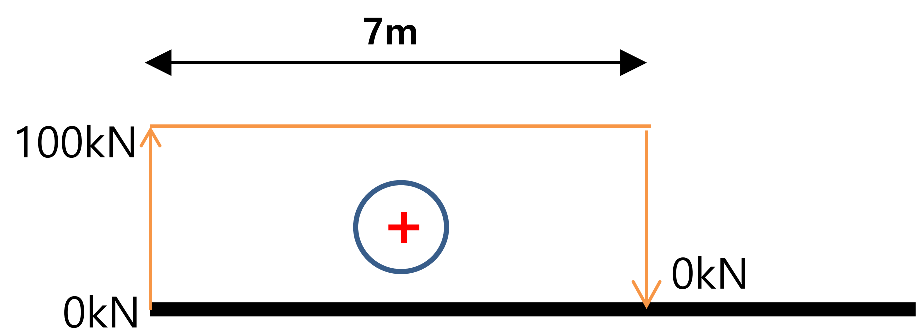
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 24)



M_A + ↻ = 0, M_A + (100kN X 5m) = 0, M_A = -500kN•m

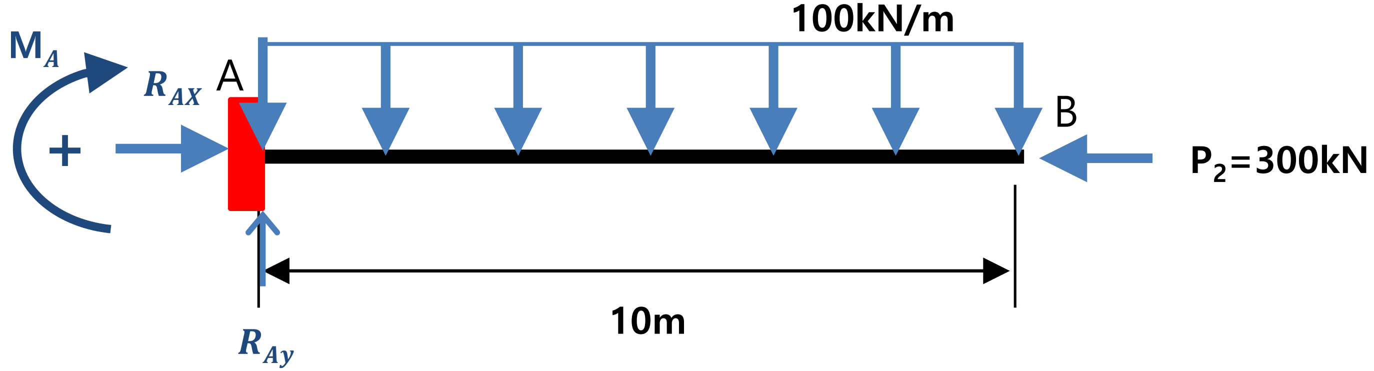
↑ F_y = 0, R_{Ay} – 100kN=0, R_{Ay} = 100kN

→ F_X = 0, R_{AX} - 300kN =0, R_{AX} = 300kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

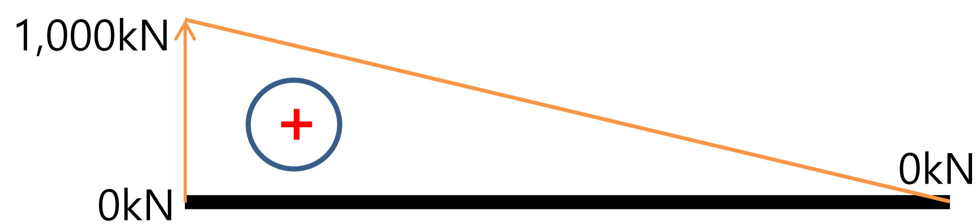
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 25)



M_A + ↻ = 0, M_A + (100kN/m X 10m X 5m) = 0, M_A = -5,000kN•m

↑ F_y = 0, R_{Ay} – (100kN/m X 10m)=0, R_{Ay} = 1,000kN

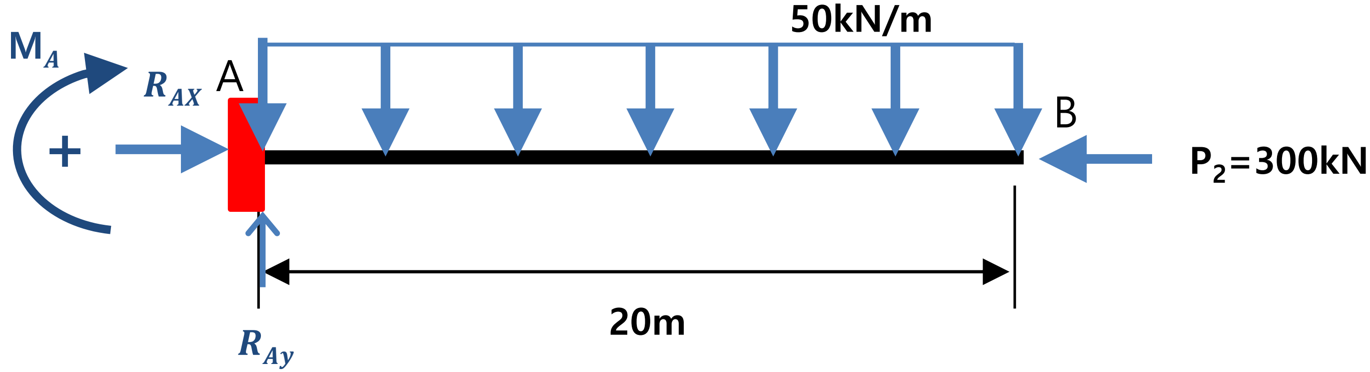
→ F_X = 0, R_{AX} - 300kN =0, R_{AX} = 300kN



Ⅰ. 보의 휨응력과 전단응력

Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

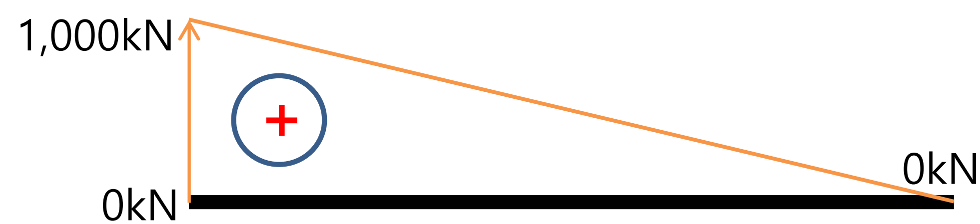
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 26)



M_A + ↻ = 0, M_A + (50kN/m X 20m X 10m) = 0, M_A = -10,000kN•m

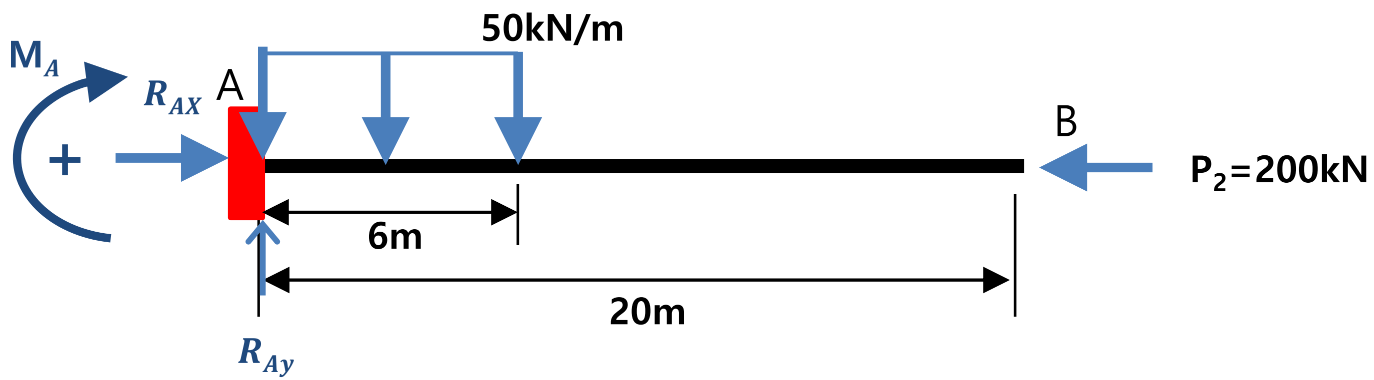
↑F_y = 0, R_{Ay} – (50kN/m X 20m)=0, R_{Ay} = 1,000kN

→F_X = 0, R_{AX} - 300kN =0, R_{AX} = 300kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

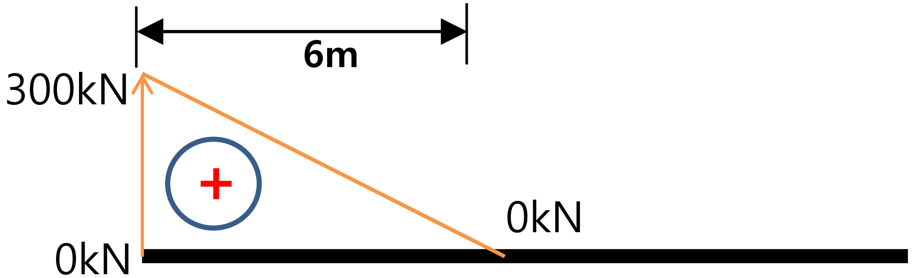
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 27)



M_A + ↻ = 0, M_A + (50kN/m X 6m X 3m) = 0, M_A = -900kN•m

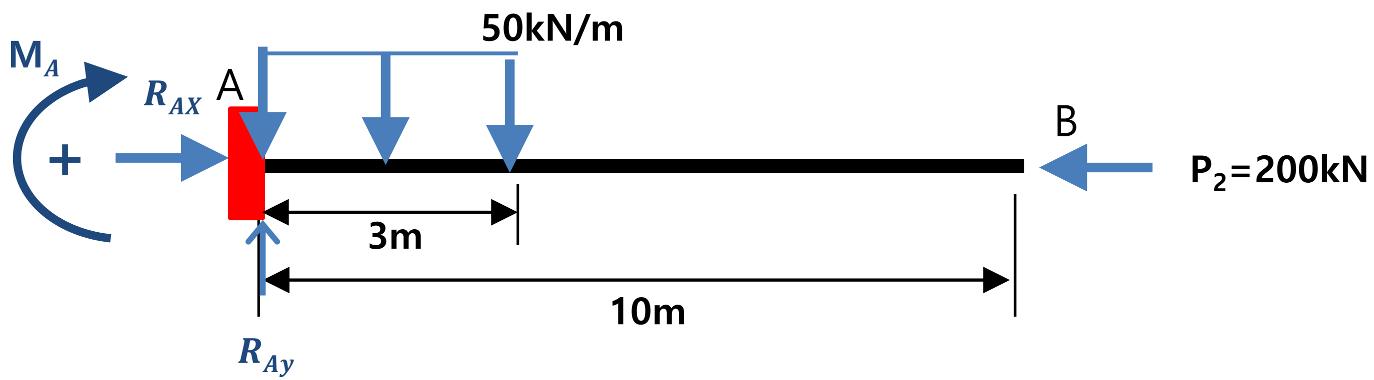
↑ F_y = 0, R_{Ay} – (50kN/m X 6m)=0, R_{Ay} = 300kN

→ F_X = 0, R_{AX} - 200kN =0, R_{AX} = 200kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

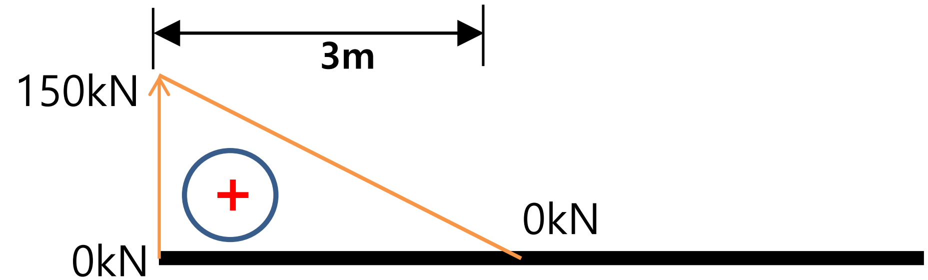
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 28)



$M_A + \curvearrowright = 0$, M_A + (50kN/m X 3m X 1.5m) = 0, M_A = -225kN•m

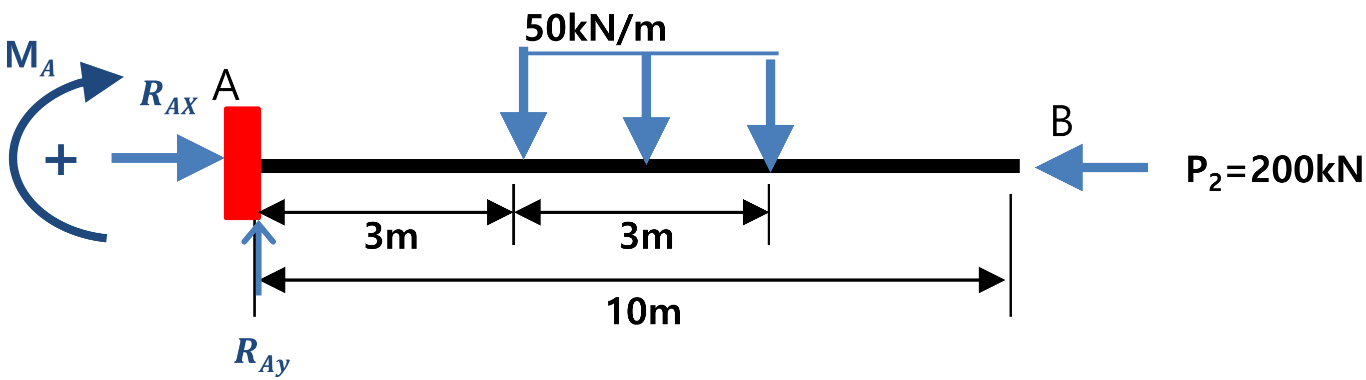
$\uparrow F_y = 0$, R_{Ay} – (50kN/m X 3m)=0, R_{Ay} = 150kN

$\rightarrow F_X = 0$, R_{AX} - 200kN =0, R_{AX} = 200kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

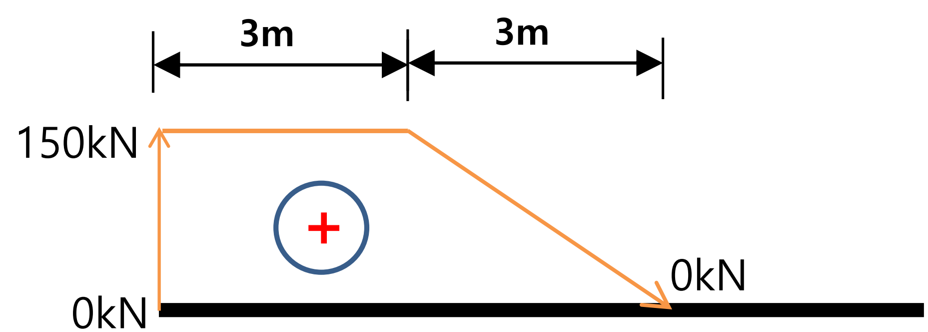
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 29)



M_A + ↻ = 0, M_A + (50kN/m X 3m X (3+1.5)m) = 0, M_A = -675kN•m

↑ F_y = 0, R_{Ay} – (50kN/m X 3m)=0, R_{Ay} = 150kN

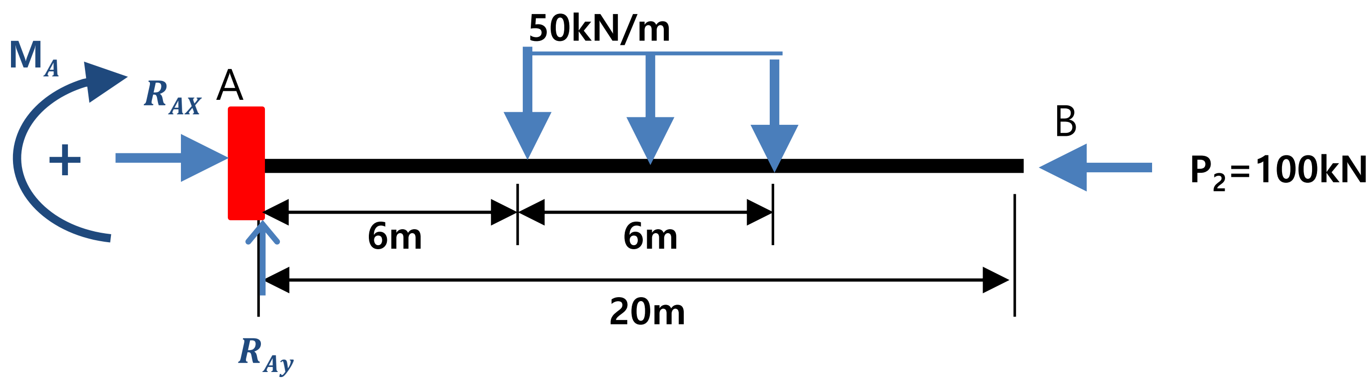
→ F_X = 0, R_{AX} - 200kN =0, R_{AX} = 200kN



Ⅰ. 보의 휨응력과 전단응력

Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

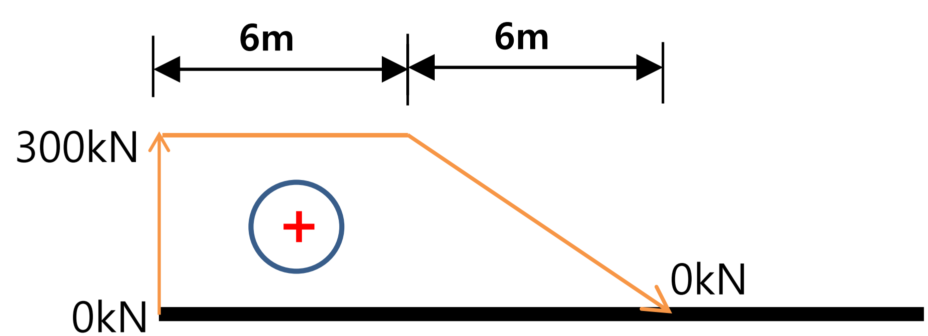
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 30)



$M_A + \curvearrowright = 0$, M_A + (50kN/m X 6m X (6+3)m) = 0, M_A = -2,700kN•m

$\uparrow F_y = 0$, R_{Ay} – (50kN/m X 6m)=0, R_{Ay} = 300kN

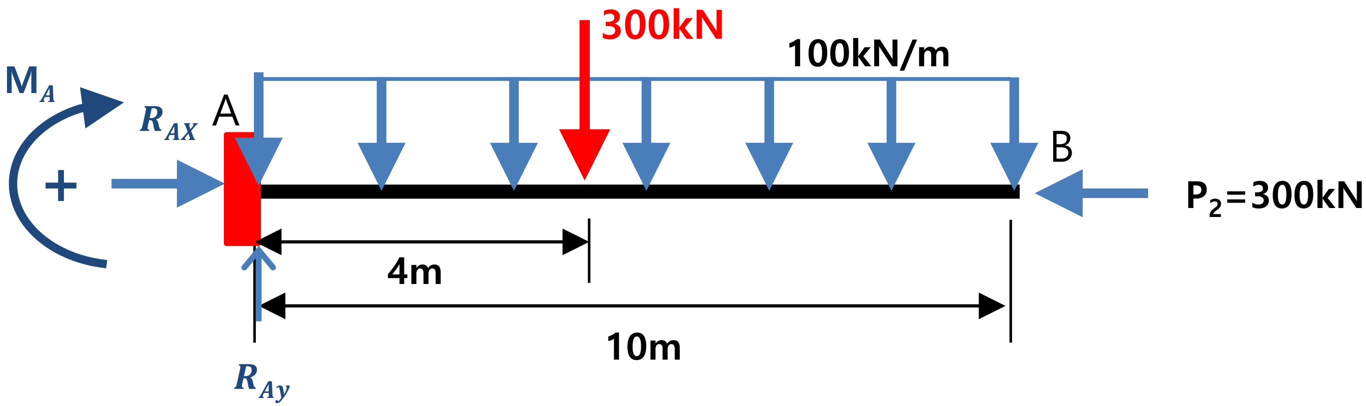
$\rightarrow F_X = 0$, R_{AX} - 100kN =0, R_{AX} = 100kN



Ⅰ. 보의 휨응력과 전단응력

Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

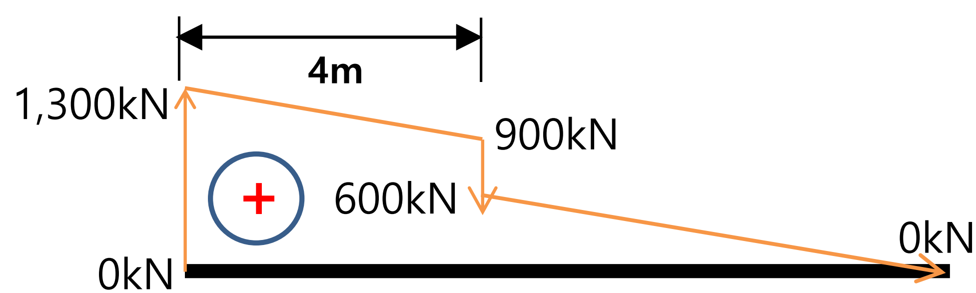
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 31)



M_A + ↻ = 0, M_A + (100kN/m X 10m X 5m) + (300kN X 4m) = 0, M_A = -6,200kN•m

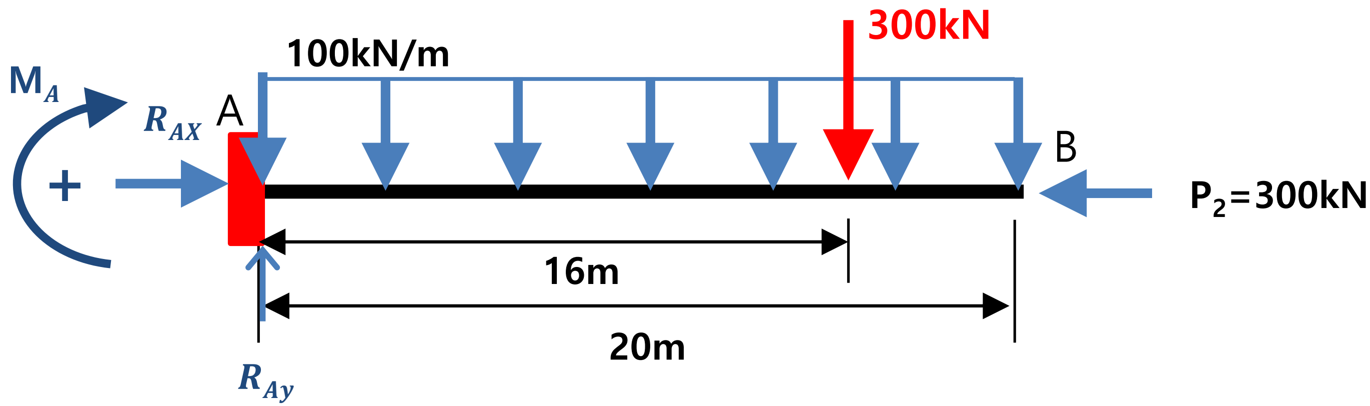
↑F_y = 0, R_{Ay} – (100kN/m X 10m) – 300kN = 0, R_{Ay} = 1,300kN

→F_X = 0, R_{AX} - 300kN =0, R_{AX} = 300kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

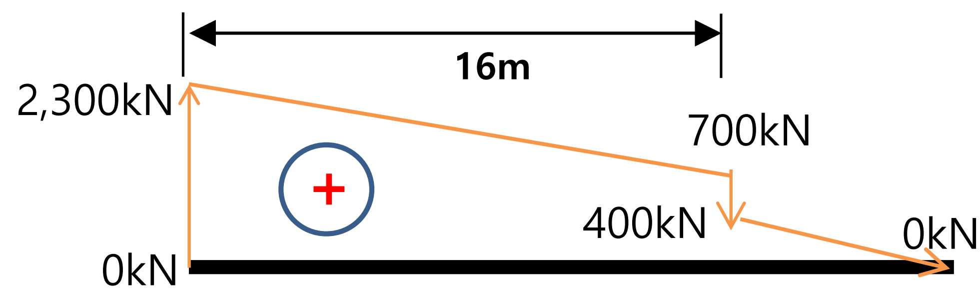
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 32)



M_A + = 0, M_A + (100kN/m X 20m X 10m) + (300kN X 16m) = 0, M_A = -24,800kN•m

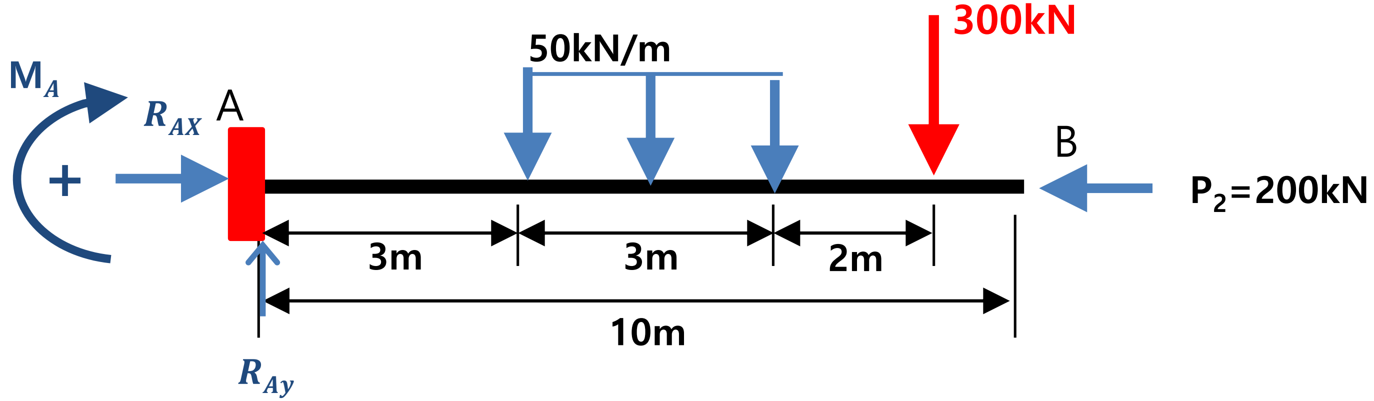
F_y = 0, R_{Ay} – (100kN/m X 20m) – 300kN = 0, R_{Ay} = 2,300kN

F_X = 0, R_{AX} - 300kN =0, R_{AX} = 300kN



Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

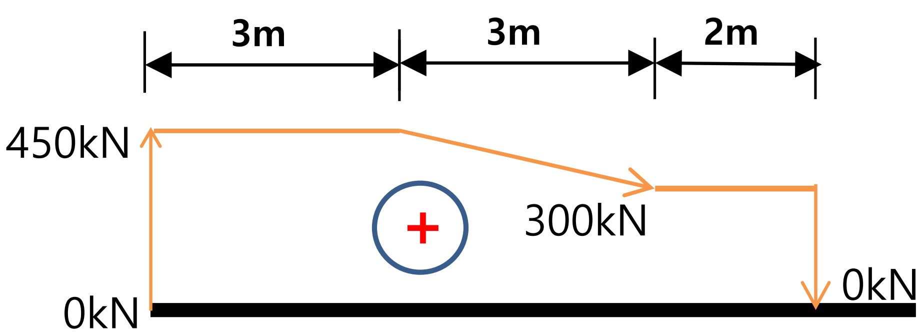
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 33)



M_A + ↻ = 0, M_A + (50kN/m X 3m X (3+1.5)m) + (300kN X 8m) = 0, M_A = -3,075kN•m

↑ F_y = 0, R_{Ay} – (50kN/m X 3m) – 300kN = 0, R_{Ay} = 450kN

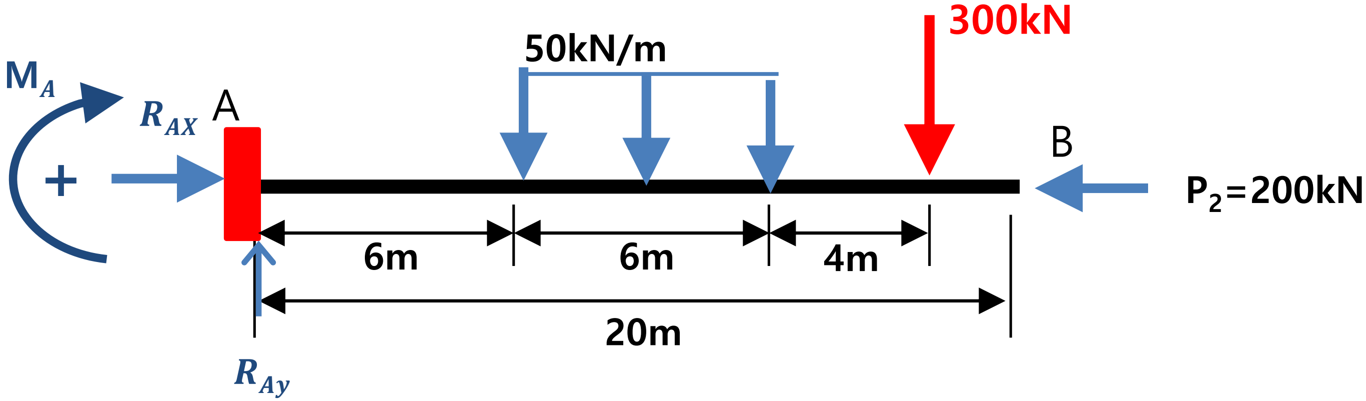
→ F_X = 0, R_{AX} - 200kN =0, R_{AX} = 200kN



Ⅰ. 보의 휨응력과 전단응력

Ⅰ.2 전단력도 (Shear Force Diagram ; S. F. D)

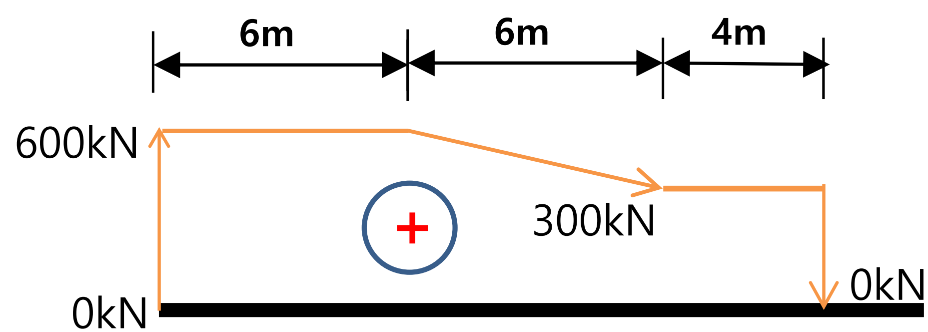
- 구조물 부재 각 단면의 전단력을 나타내는 선도 (예제 34)



$M_A + \curvearrowright = 0$, $M_A + (50kN/m \times 6m \times (6+3)m) + (300kN \times 16m) = 0$, $M_A = -7,500kN \cdot m$

$\uparrow F_y = 0$, $R_{Ay} - (50kN/m \times 6m) - 300kN = 0$, $R_{Ay} = 600kN$

$\rightarrow F_X = 0$, $R_{AX} - 200kN = 0$, $R_{AX} = 200kN$

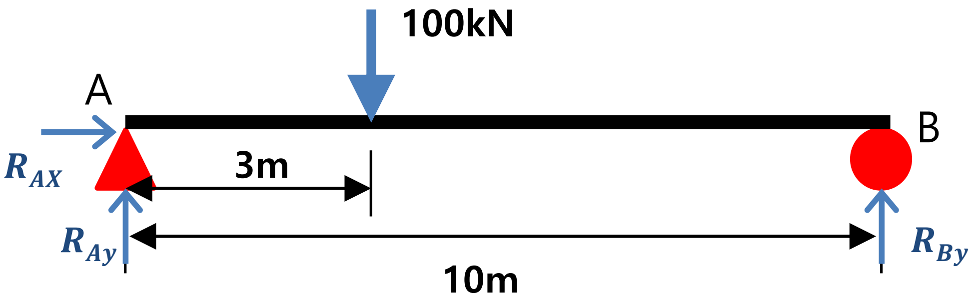


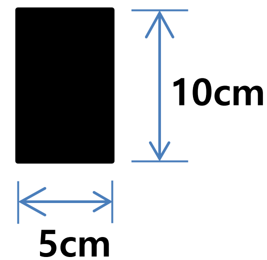
Ⅰ. 보의 휨응력과 전단응력

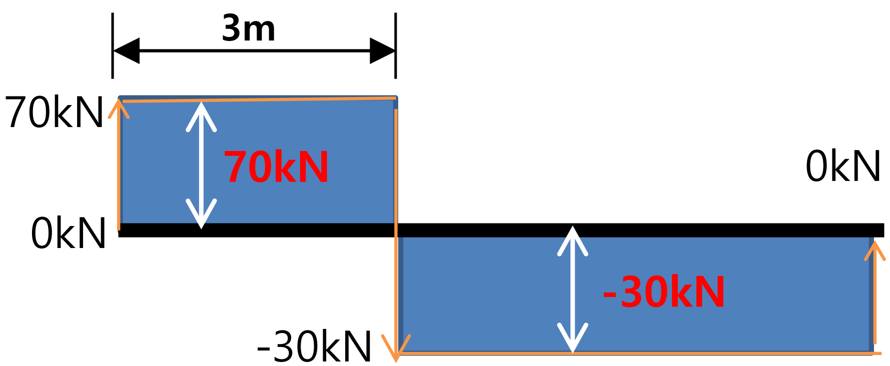
Ⅰ.2 전단 응력 (Shear Stress)

$$\tau = \frac{SQ}{Ib}$$

- I : 2차 모멘트, b : 단면폭, S : 전단력, Q : 1차 모멘트







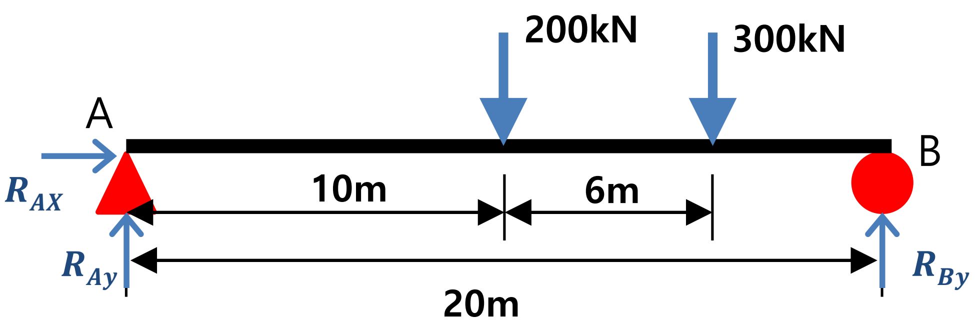
- I $=\frac{bh^3}{12} = \frac{(0.05)(0.1)^3}{12}$ =0.000004166m^4
- b =0.05m
- Q $=\frac{bh^2}{2} = \frac{(0.05)(0.1)^2}{2}$ =0.00025m^3

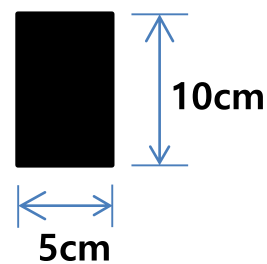
$$\tau = \frac{SQ}{Ib} = \frac{(70)(0.00025)}{(0.000004166)(0.05)} = 84{,}013\ kN/m^2$$

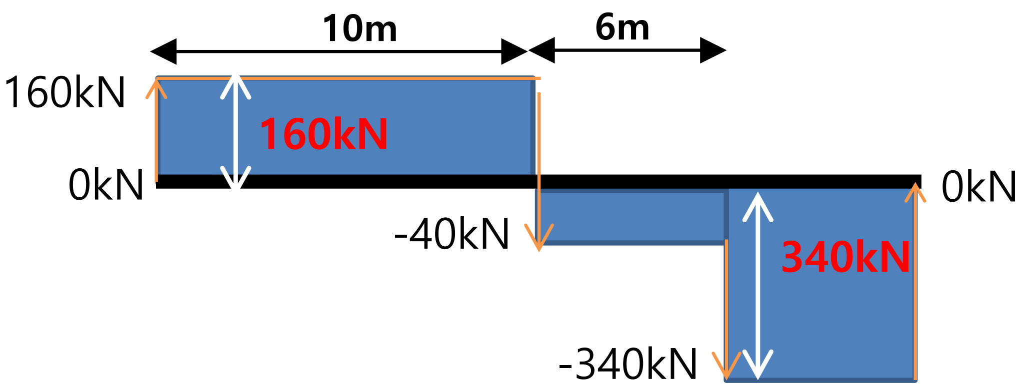
$$\tau = \frac{SQ}{Ib} = \frac{(-30)(0.00025)}{(0.000004166)(0.05)} = -36{,}005\ kN/m^2$$

Ⅰ.2 전단 응력 (Shear Stress)

$\tau = \dfrac{SQ}{Ib}$ - I : 2차 모멘트, b : 단면폭, S : 전단력, Q : 1차 모멘트





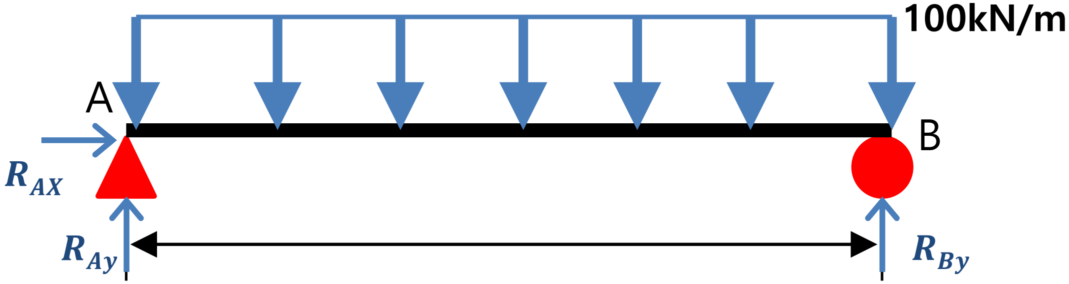


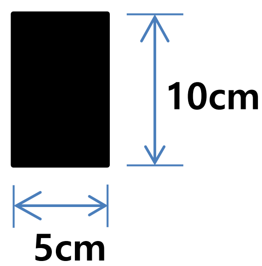
- $I = \dfrac{bh^3}{12} = \dfrac{(0.05)(0.1)^3}{12} = 0.000004166 m^4$
- $b = 0.05m$
- $Q = \dfrac{bh^2}{2} = \dfrac{(0.05)(0.1)^2}{2} = 0.00025 m^3$

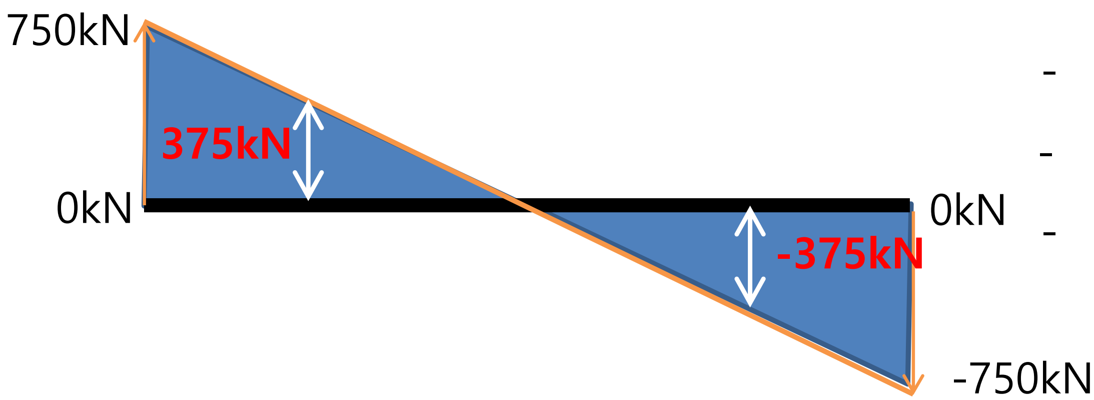
$$\tau = \frac{SQ}{Ib} = \frac{(160)(0.00025)}{(0.000004166)(0.05)} = 192{,}030\ kN/m^2 \quad \tau = \frac{SQ}{Ib} = \frac{(-340)(0.00025)}{(0.000004166)(0.05)} = -408{,}065\ kN/m^2$$

Ⅰ.2 전단 응력 (Shear Stress)

$\tau = \frac{SQ}{Ib}$ - I : 2차 모멘트, b : 단면폭, S : 전단력, Q : 1차 모멘트



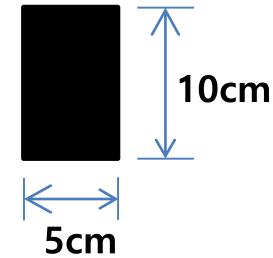




- $I = \frac{bh^3}{12} = \frac{(0.05)(0.1)^3}{12} = 0.000004166 m^4$
- $b = 0.05 m$
- $Q = \frac{bh^2}{2} = \frac{(0.05)(0.1)^2}{2} = 0.00025 m^3$

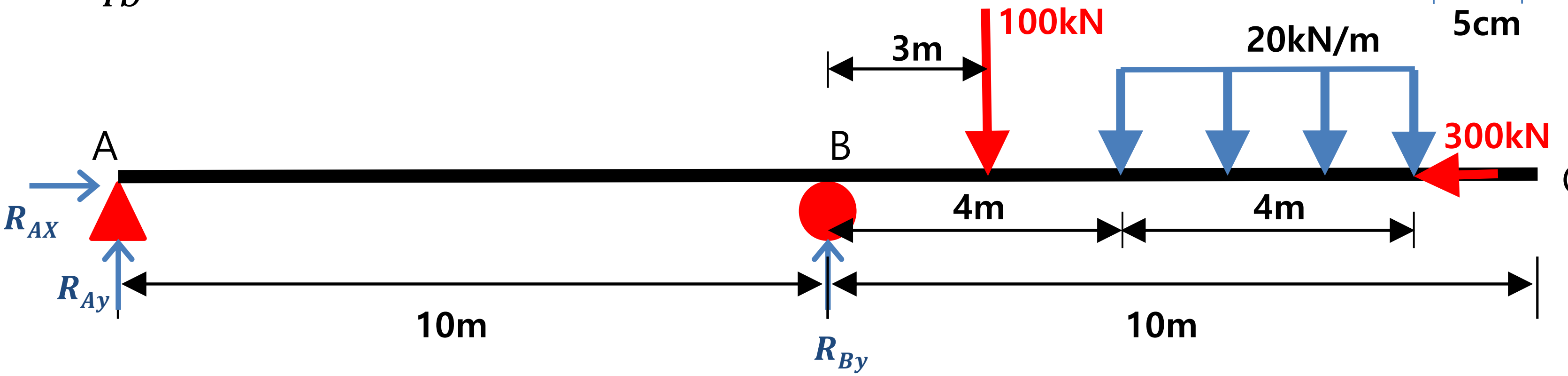
$$\tau = \frac{SQ}{Ib} = \frac{(375)(0.00025)}{(0.000004166)(0.05)} = 450{,}072\ kN/m^2 \quad \tau = \frac{SQ}{Ib} = \frac{(-375)(0.00025)}{(0.000004166)(0.05)} = -450{,}072\ kN/m^2$$

Ⅰ.2 전단 응력 (Shear Stress)

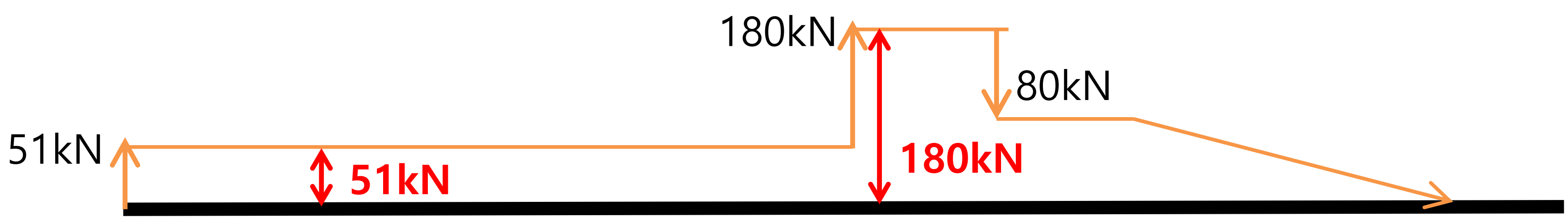


$$\tau = \frac{SQ}{Ib}$$

- I : 2차 모멘트, b : 단면폭, S : 전단력, Q : 1차 모멘트



- I $= \frac{bh^3}{12} = \frac{(0.05)(0.1)^3}{12}$ = 0.000004166m^4
- b = 0.05m
- Q $= \frac{bh^2}{2} = \frac{(0.05)(0.1)^2}{2}$ = 0.00025m^3

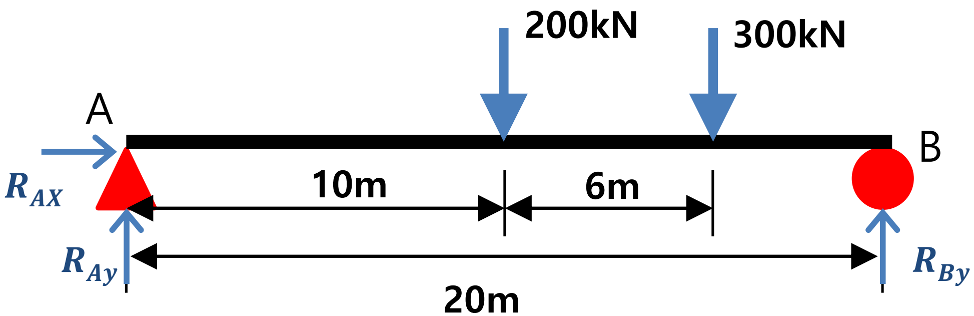


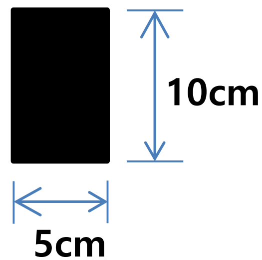
$$\tau = \frac{SQ}{Ib} = \frac{(51)(0.00025)}{(0.000004166)(0.05)} = 61{,}209\ kN/m^2$$

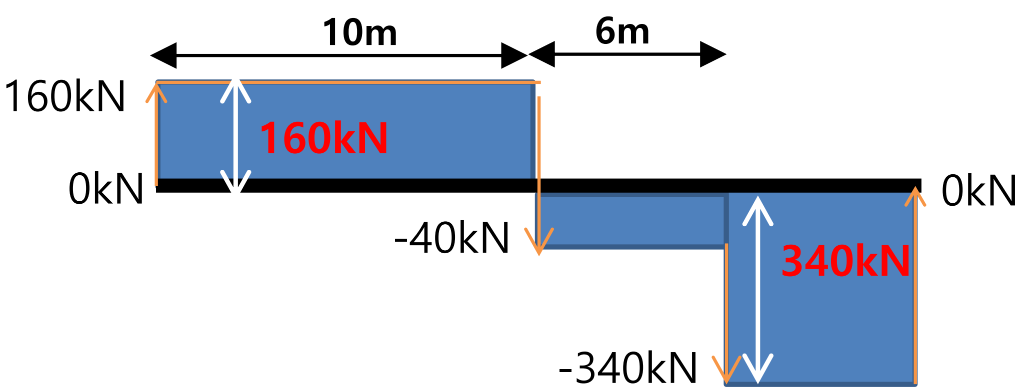
$$\tau = \frac{SQ}{Ib} = \frac{(180)(0.00025)}{(0.000004166)(0.05)} = 216{,}034 kN/m^2$$

Ⅰ.2 전단 응력 (Shear Stress)

$\tau = \dfrac{SQ}{Ib}$ - I : 2차 모멘트, b : 단면폭, S : 전단력, Q : 1차 모멘트





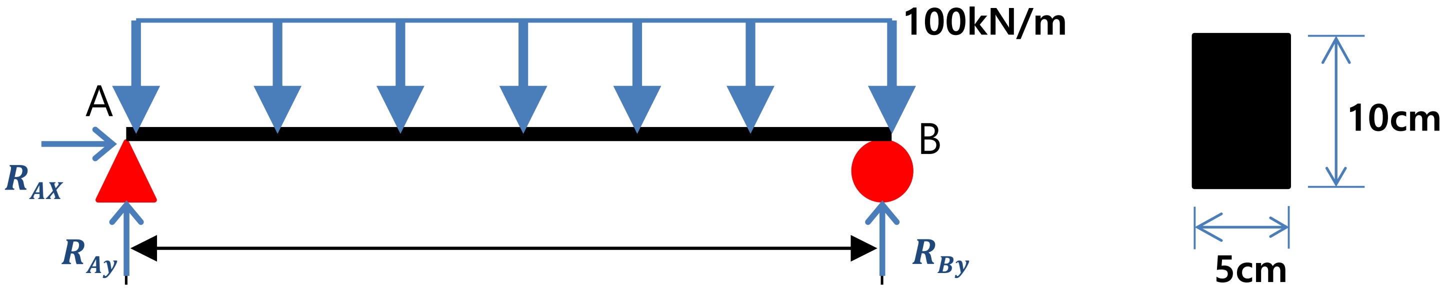


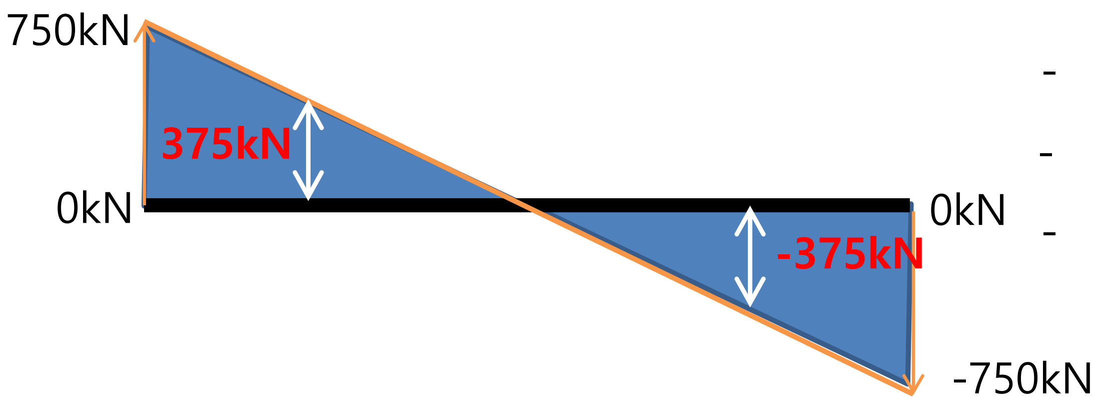
- $I = \dfrac{bh^3}{12} = \dfrac{(0.05)(0.1)^3}{12} = 0.000004166m^4$
- $b = 0.05m$
- $Q = \dfrac{bh^2}{2} = \dfrac{(0.05)(0.1)^2}{2} = 0.00025m^3$

$\tau = \dfrac{SQ}{Ib} = \dfrac{(160)(0.00025)}{(0.000004166)(0.05)} = 192{,}030\ kN/m^2$ $\tau = \dfrac{SQ}{Ib} = \dfrac{(-340)(0.00025)}{(0.000004166)(0.05)} = -408{,}065\ kN/m^2$

Ⅰ.2 전단 응력 (Shear Stress)

$\tau = \dfrac{SQ}{Ib}$ - I : 2차 모멘트, b : 단면폭, S : 전단력, Q : 1차 모멘트

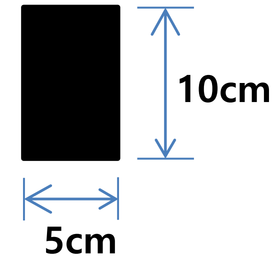




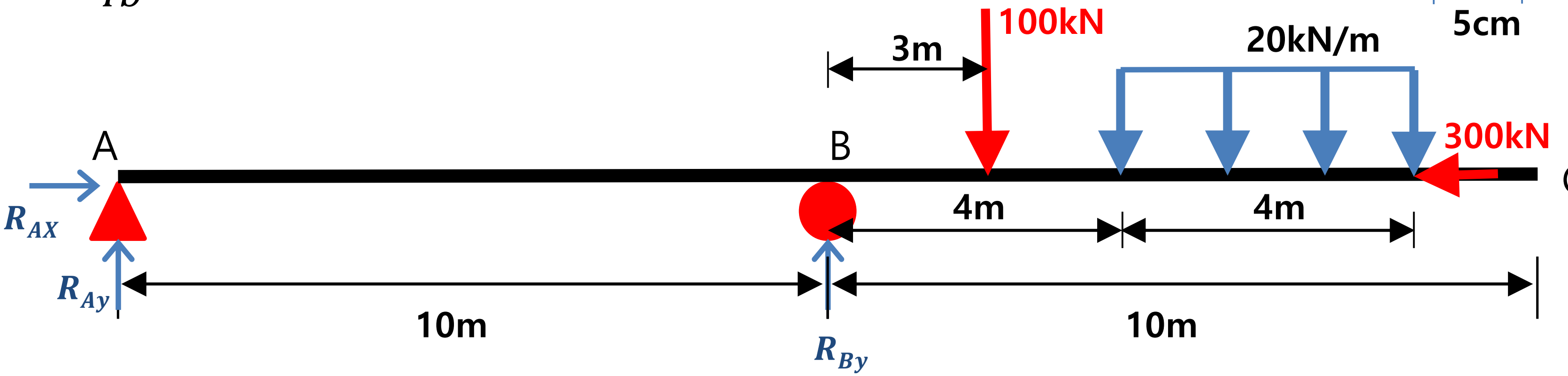
- $I = \dfrac{bh^3}{12} = \dfrac{(0.05)(0.1)^3}{12} = 0.000004166 m^4$
- $b = 0.05 m$
- $Q = \dfrac{bh^2}{2} = \dfrac{(0.05)(0.1)^2}{2} = 0.00025 m^3$

$$\tau = \frac{SQ}{Ib} = \frac{(375)(0.00025)}{(0.000004166)(0.05)} = 450{,}072\ kN/m^2 \quad \tau = \frac{SQ}{Ib} = \frac{(-375)(0.00025)}{(0.000004166)(0.05)} = -450{,}072\ kN/m^2$$

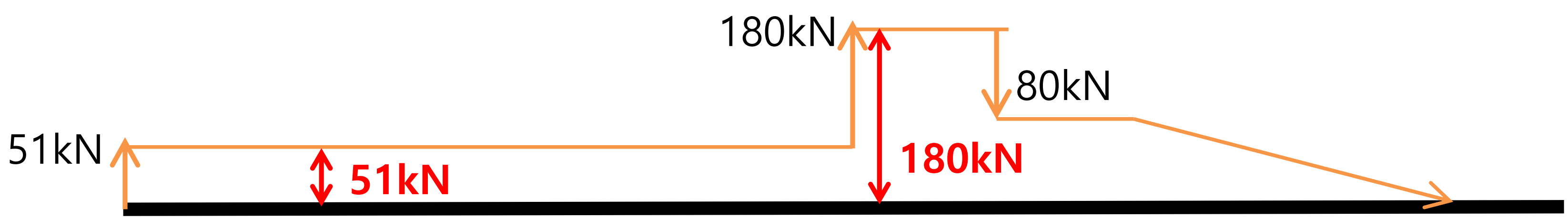
Ⅰ.2 전단 응력 (Shear Stress)



$\tau = \dfrac{SQ}{Ib}$ - I : 2차 모멘트, b : 단면폭, S : 전단력, Q : 1차 모멘트



- $I = \dfrac{bh^3}{12} = \dfrac{(0.05)(0.1)^3}{12} = 0.000004166 m^4$
- $b = 0.05m$
- $Q = \dfrac{bh^2}{2} = \dfrac{(0.05)(0.1)^2}{2} = 0.00025 m^3$

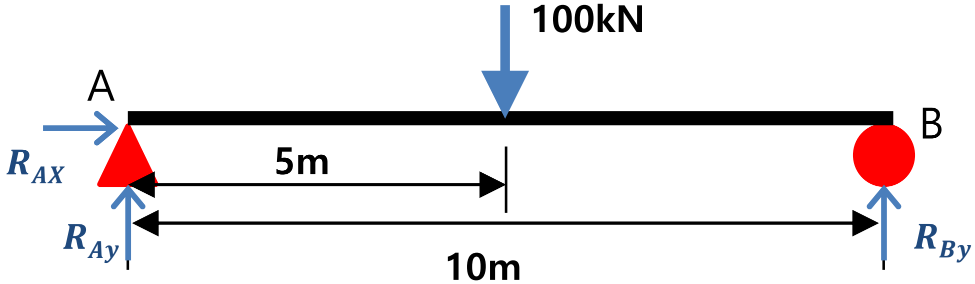


$\tau = \dfrac{SQ}{Ib} = \dfrac{(51)(0.00025)}{(0.000004166)(0.05)} = 61{,}209\ kN/m^2$

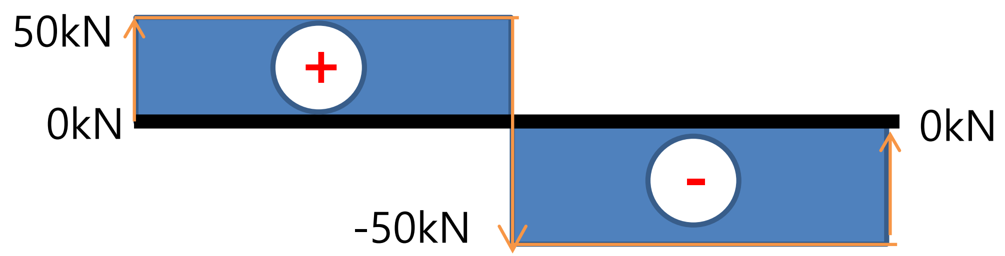
$\tau = \dfrac{SQ}{Ib} = \dfrac{(180)(0.00025)}{(0.000004166)(0.05)} = 216{,}034 kN/m^2$

Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

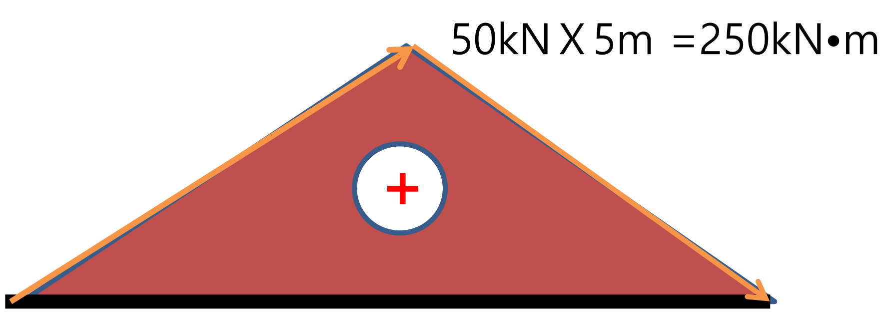
- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 1)



S.F.D

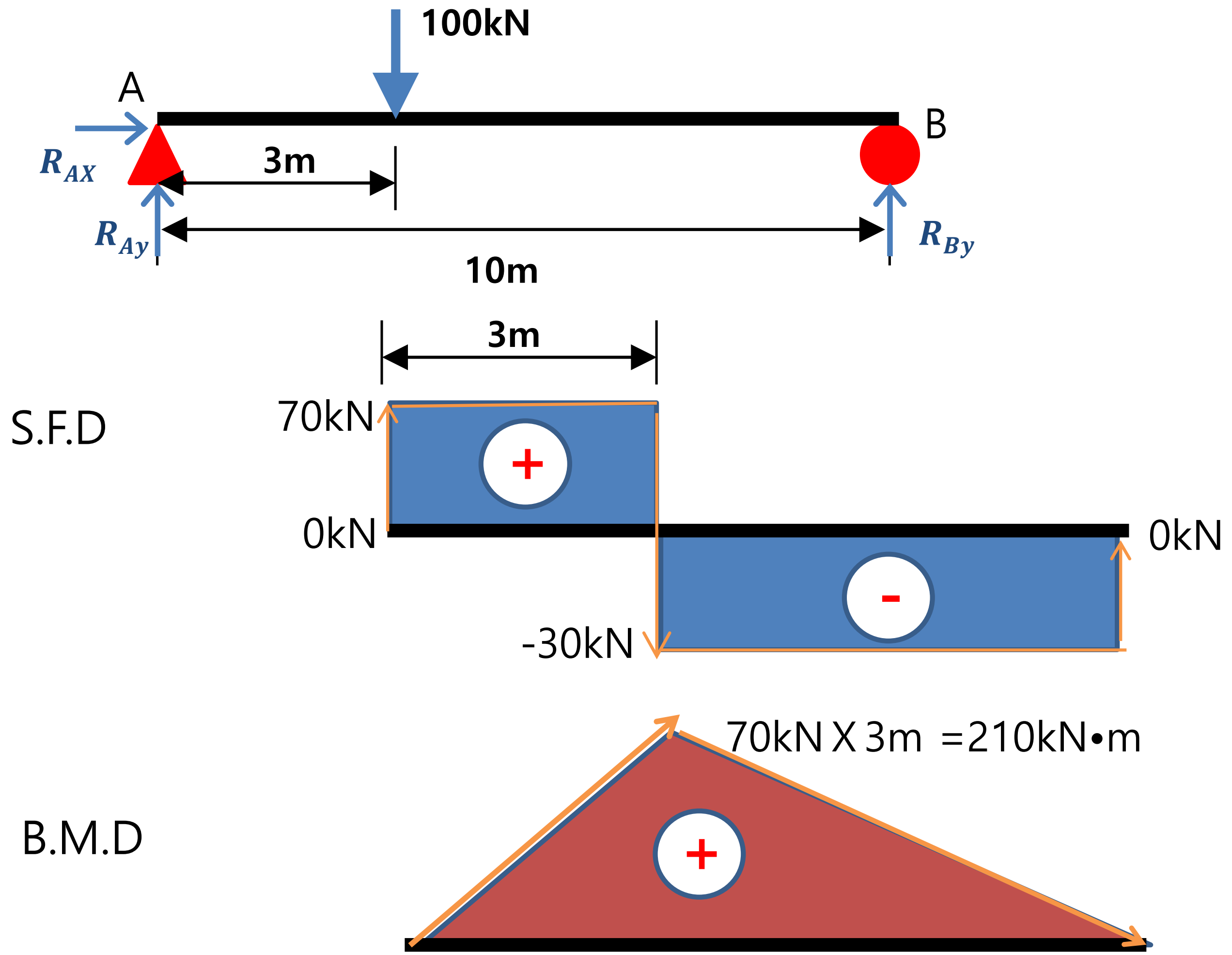


B.M.D



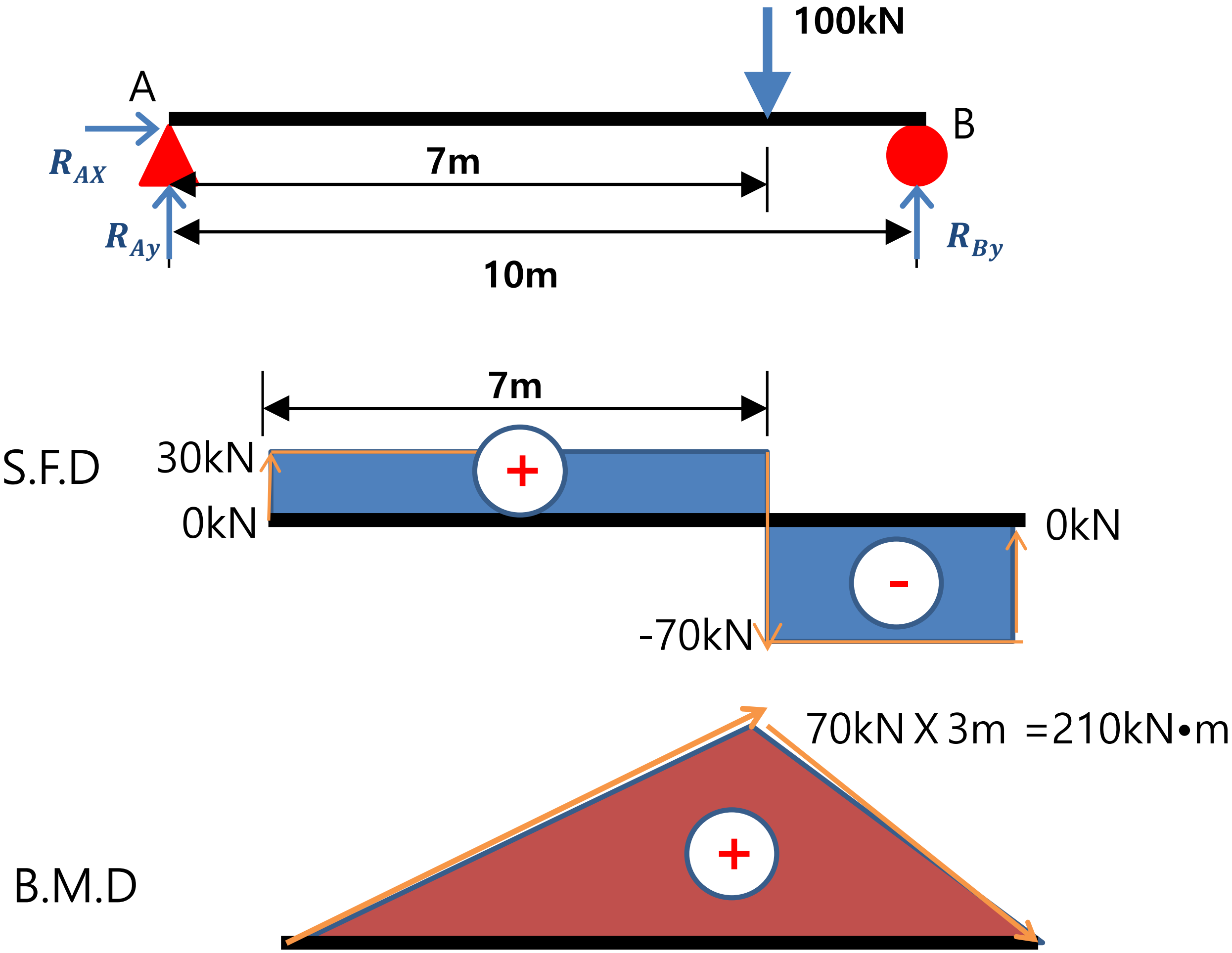
Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 2)



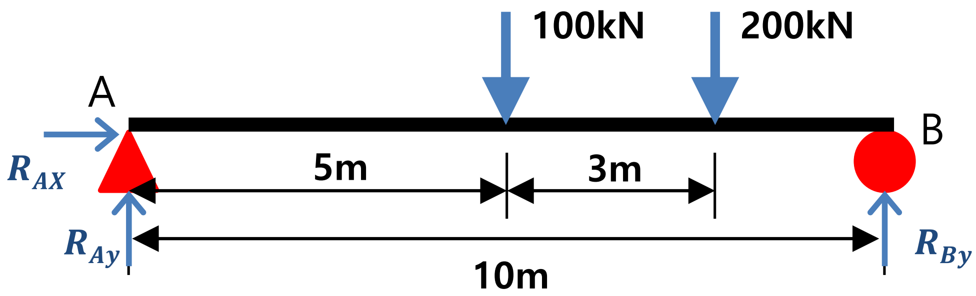
Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

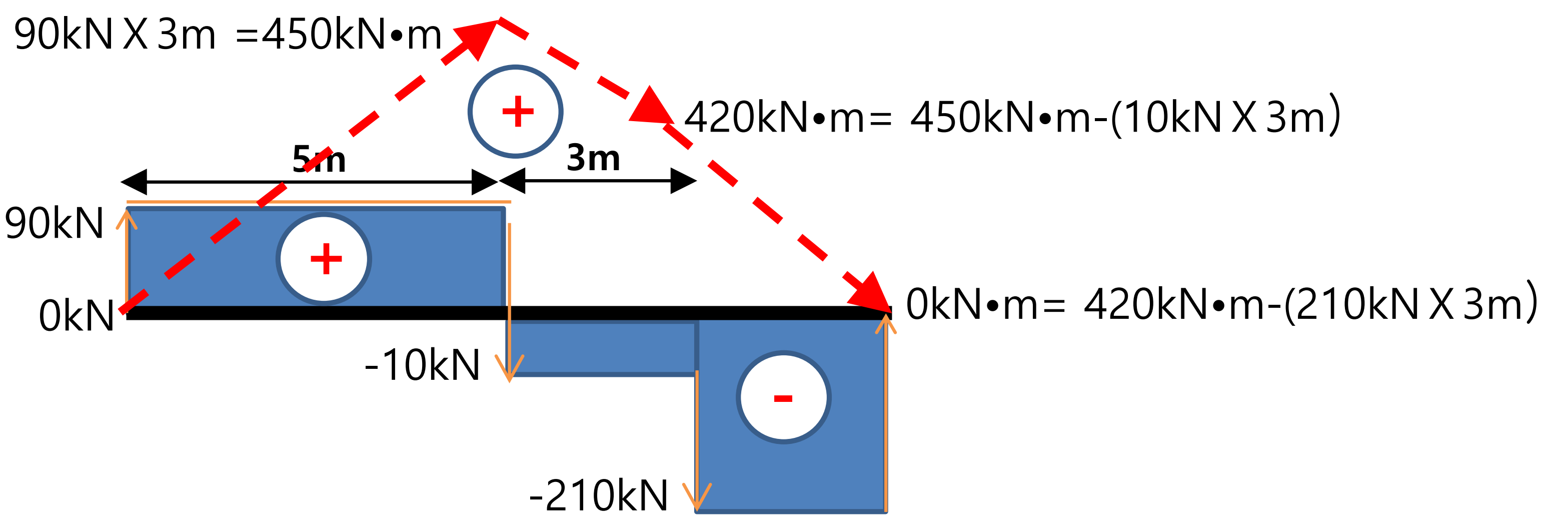
- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 3)



Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

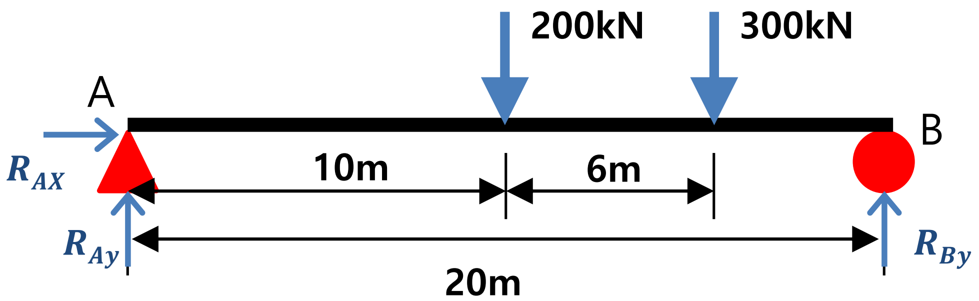
- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 4)

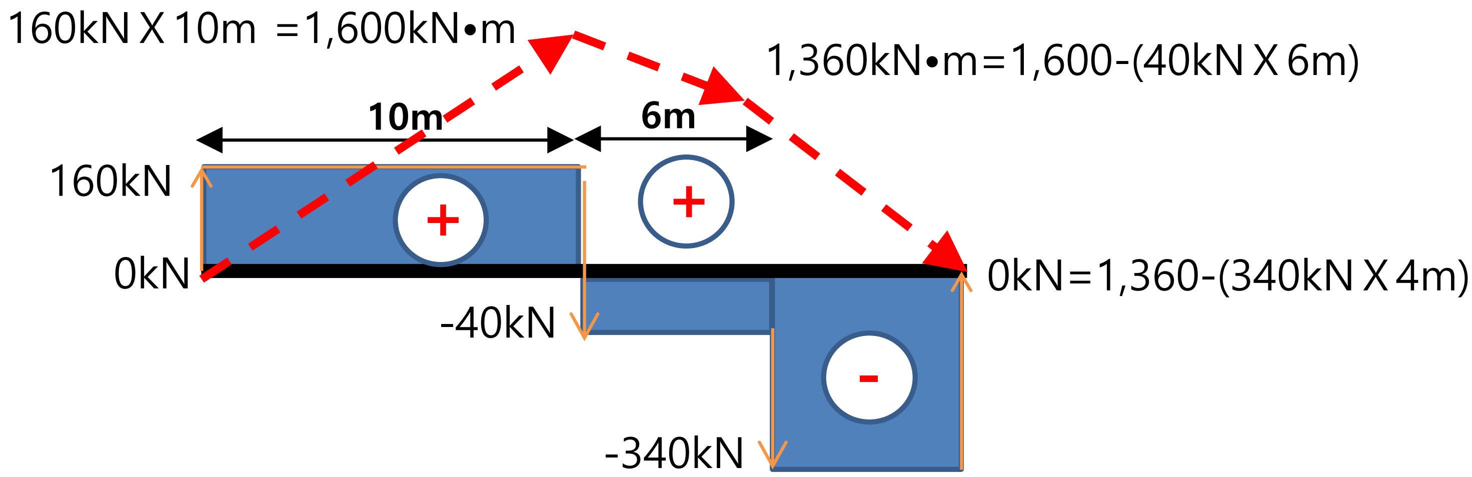




Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

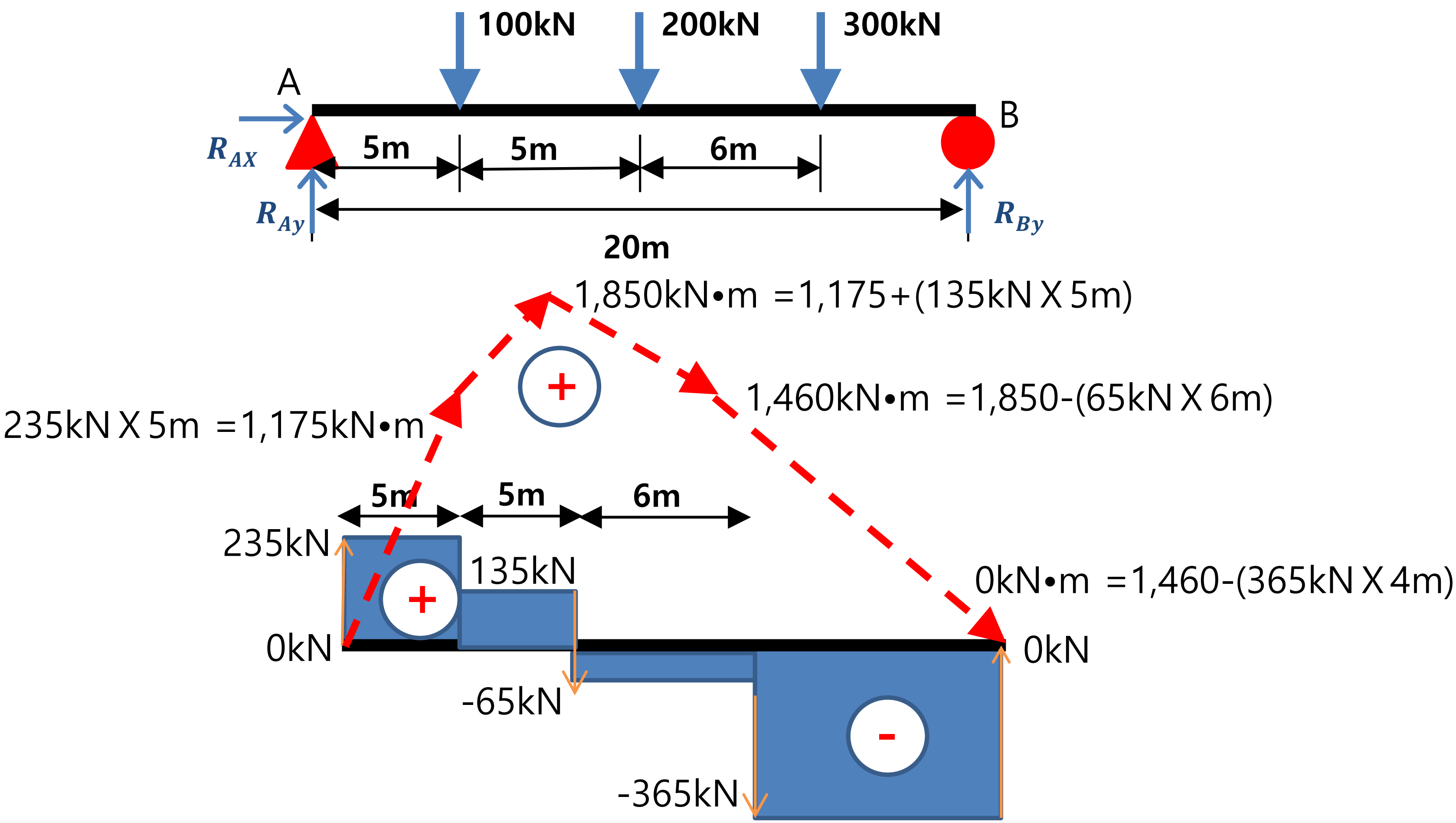
- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 5)





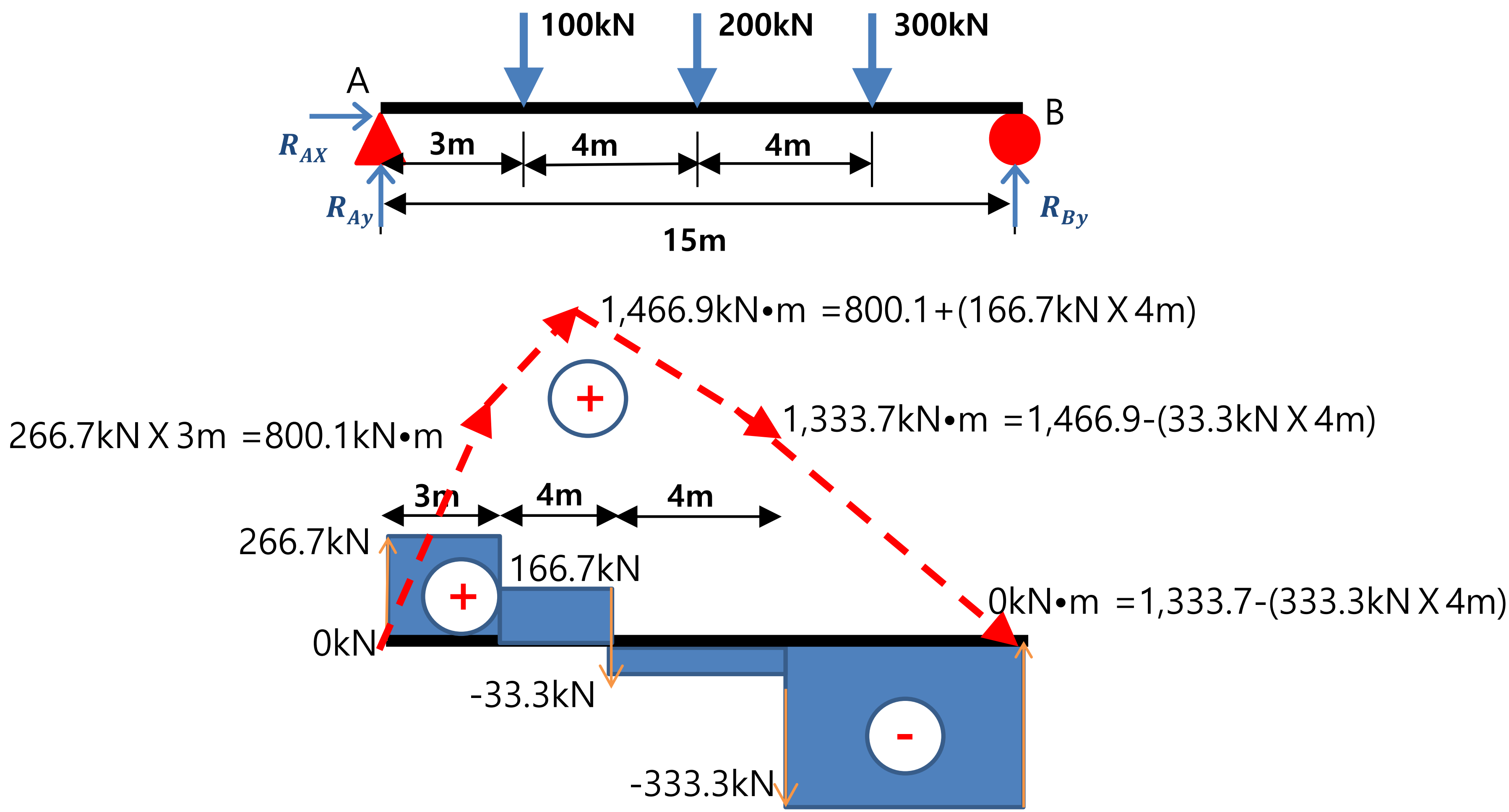
Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 6)



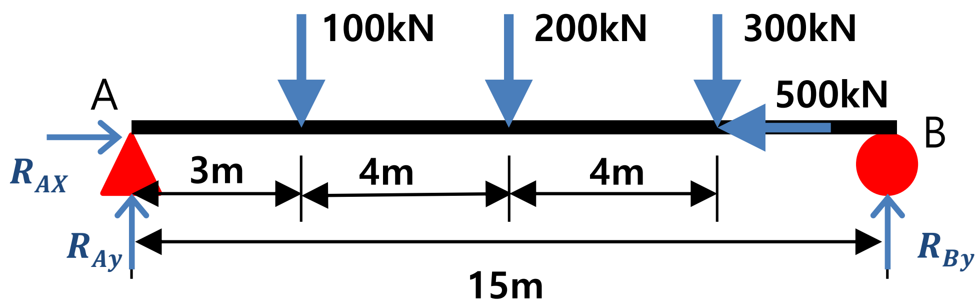
Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

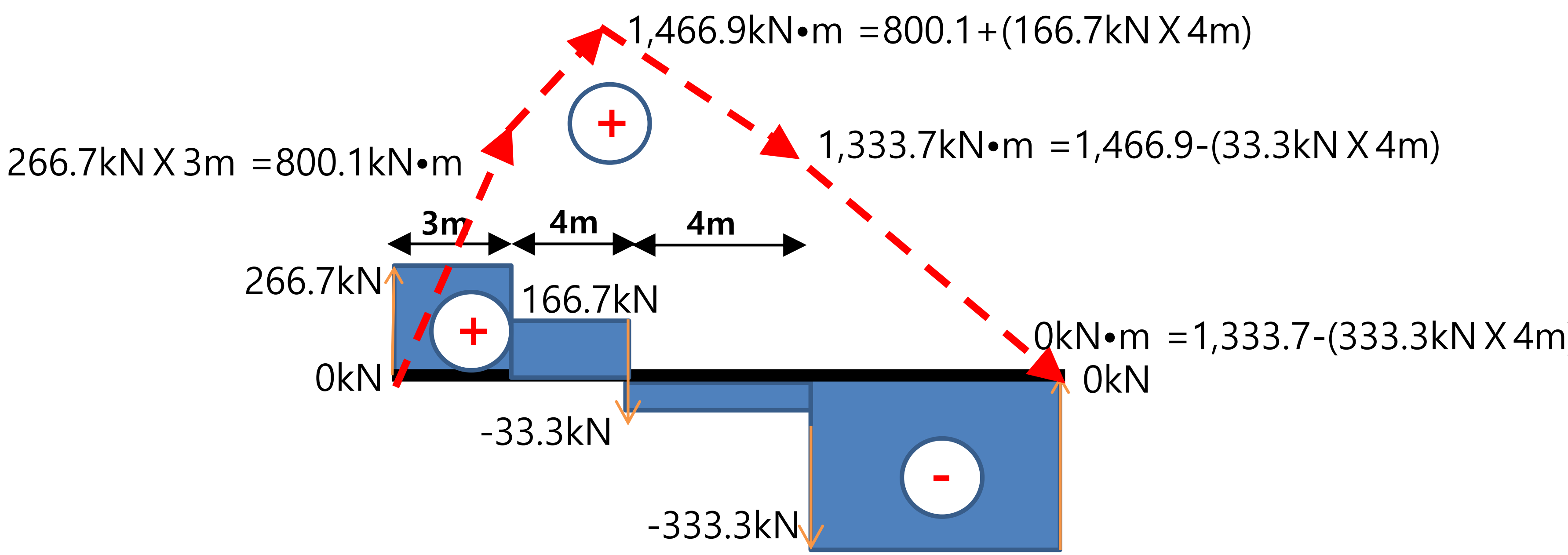
- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 7)



Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

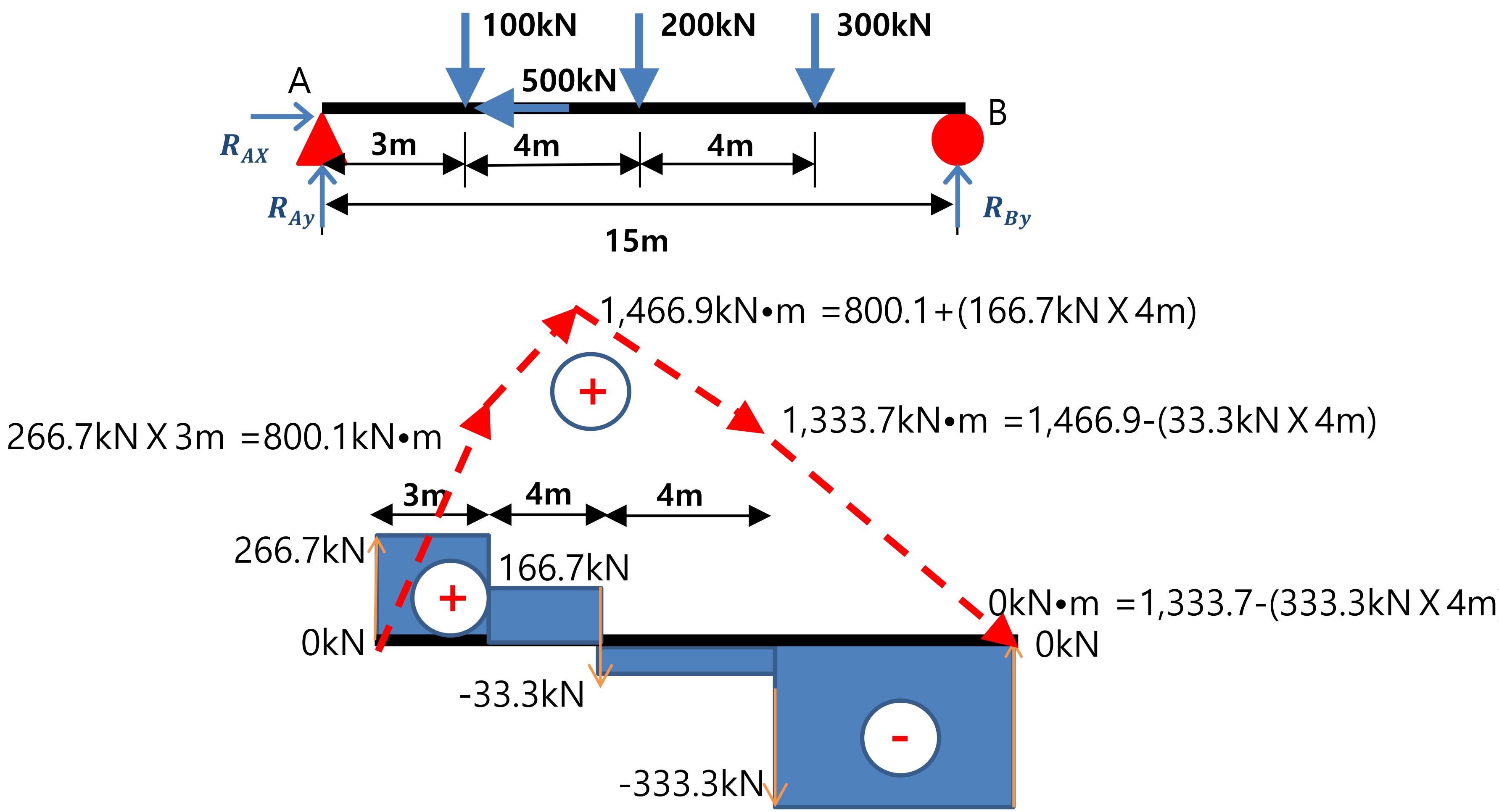
- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 8)





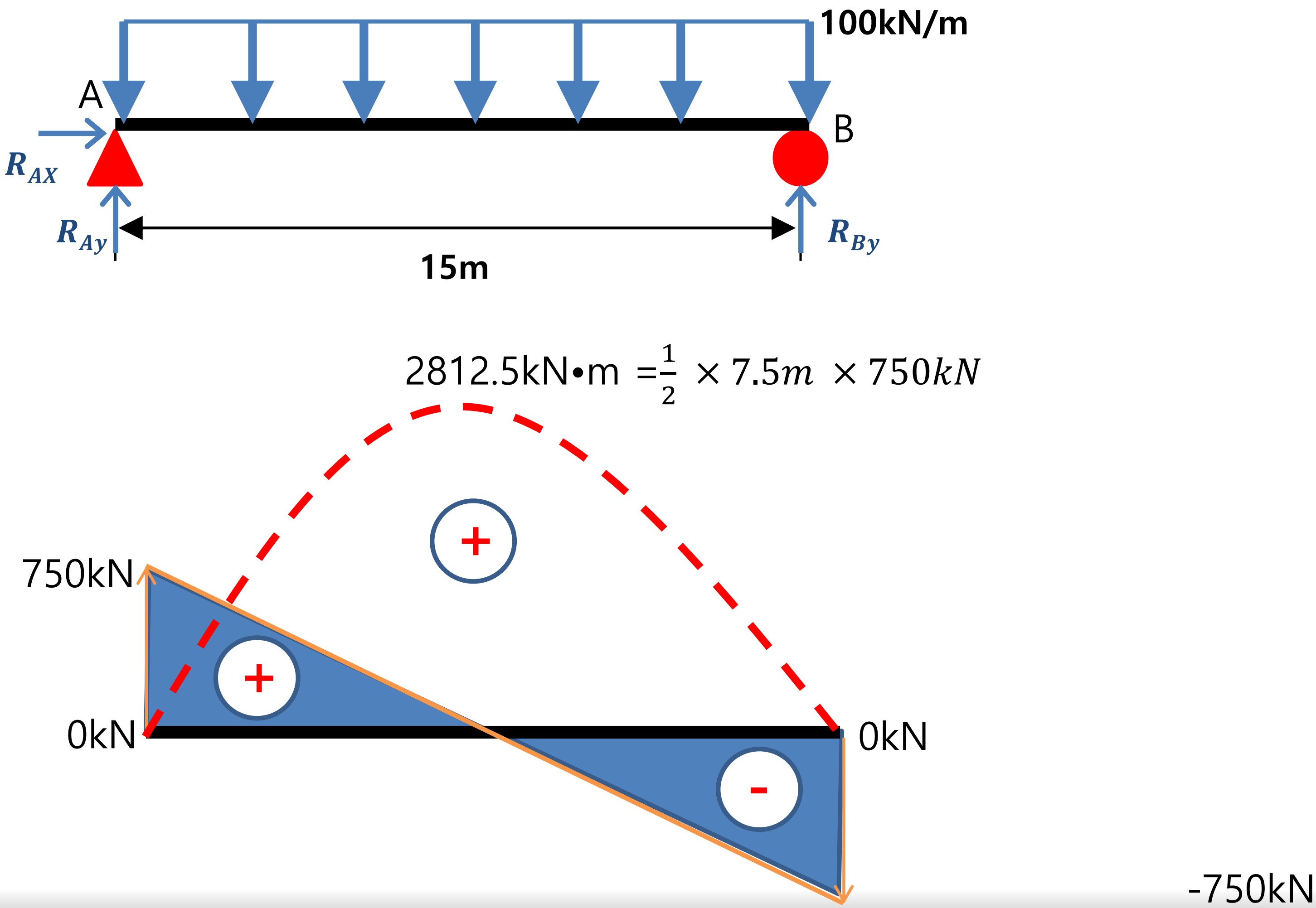
Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 9)



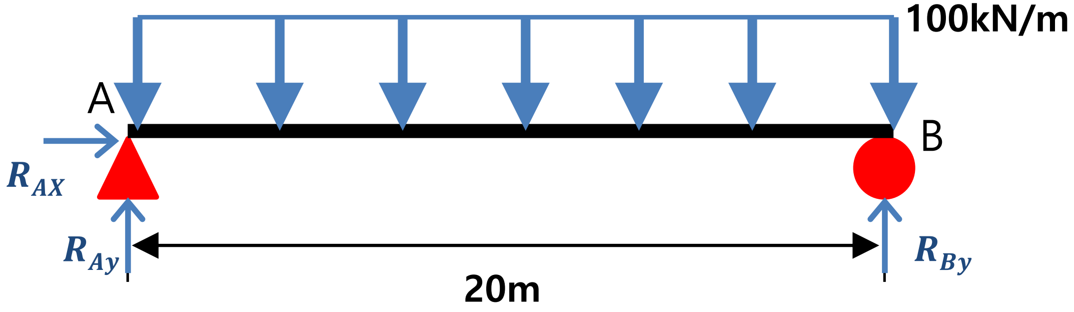
Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

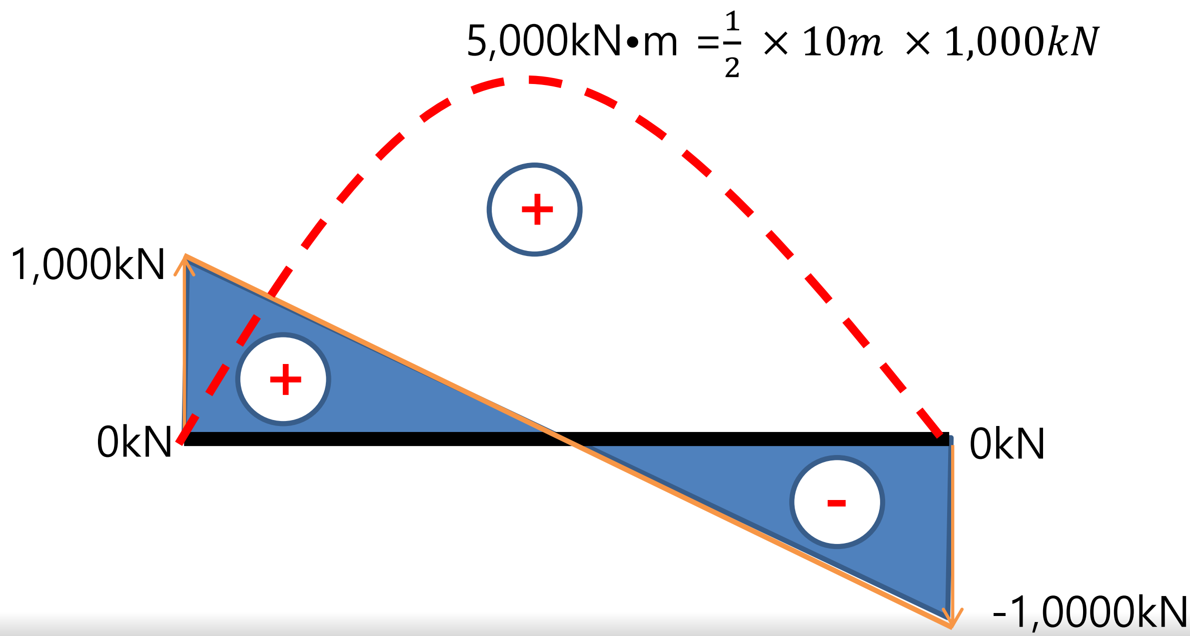
- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 10)



Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

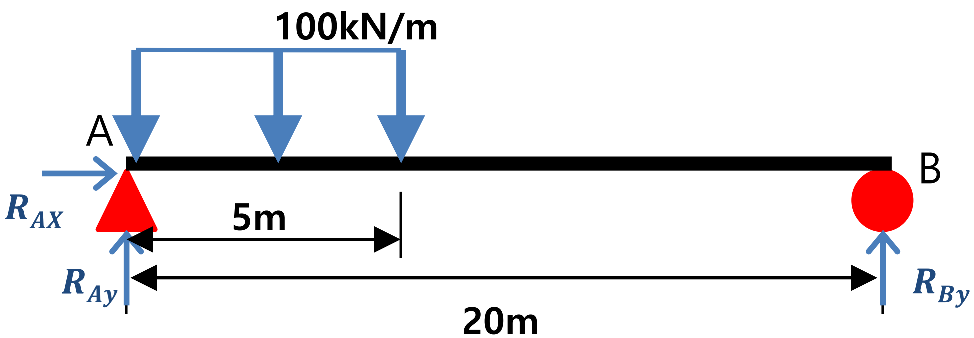
- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 11)

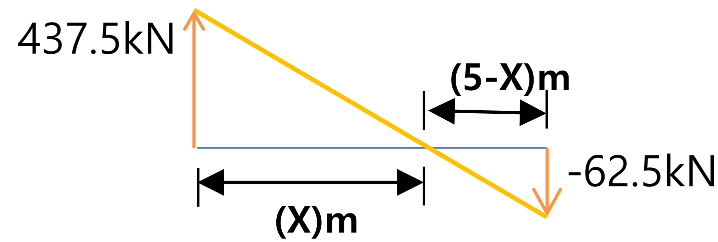




Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 12)





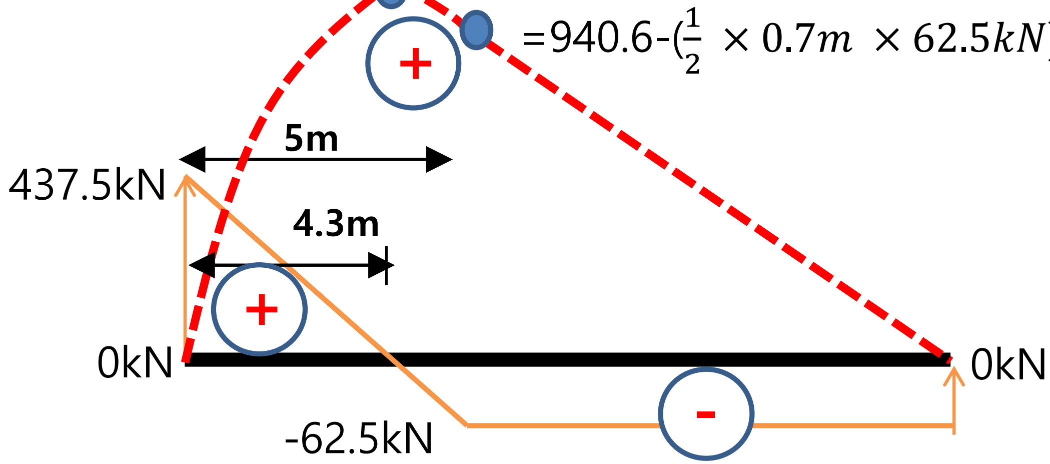
$$\frac{X}{437.5} = \frac{5-X}{62.5}$$

437.5(5-X) = 62.5 X

500X=2187.5, X=4.3m

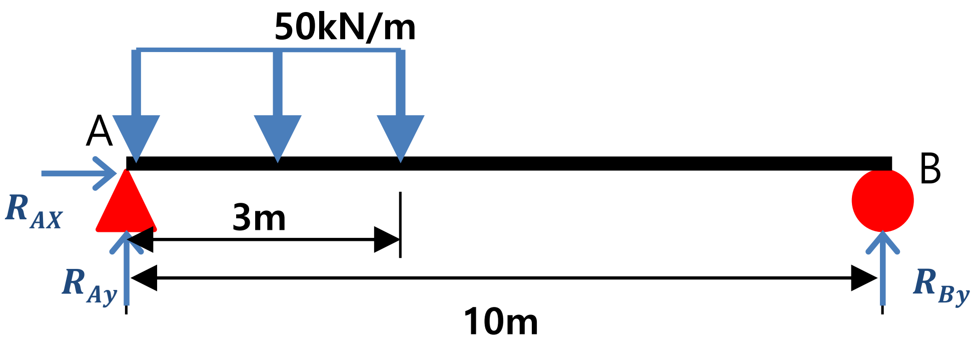
940.6kN•m $= \frac{1}{2} \times 4.3m \times 437.5kN$

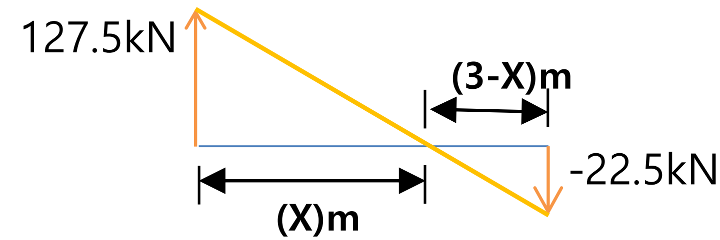
918.7kN•m $= 940.6 - (\frac{1}{2} \times 0.7m \times 62.5kN)$



Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 13)

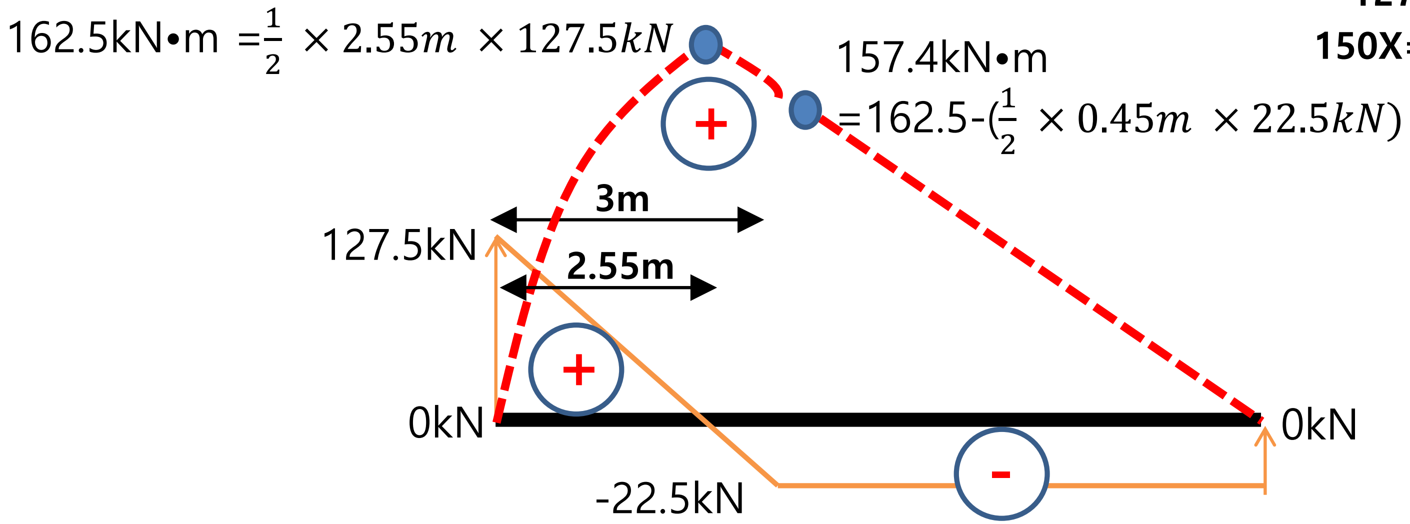




$$\frac{X}{127.5} = \frac{3-X}{22.5}$$

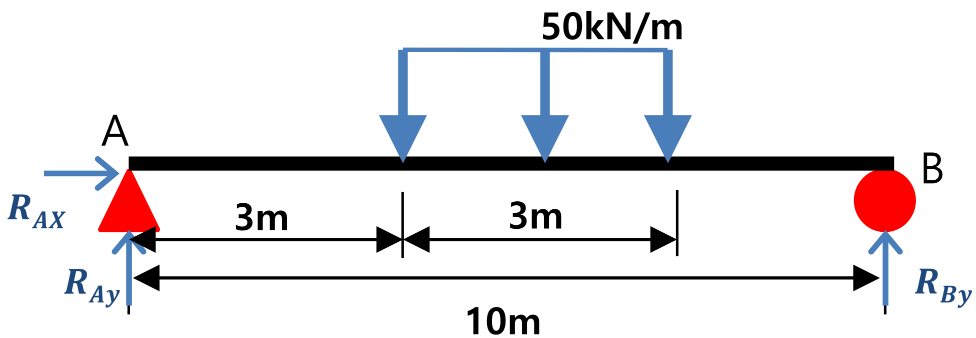
127.5(3-X) = 22.5 X

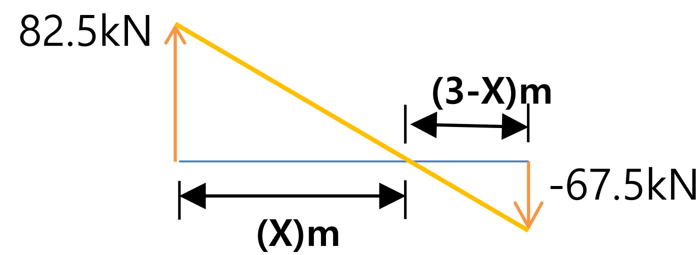
150X=382.5, X=2.55m



Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 14)

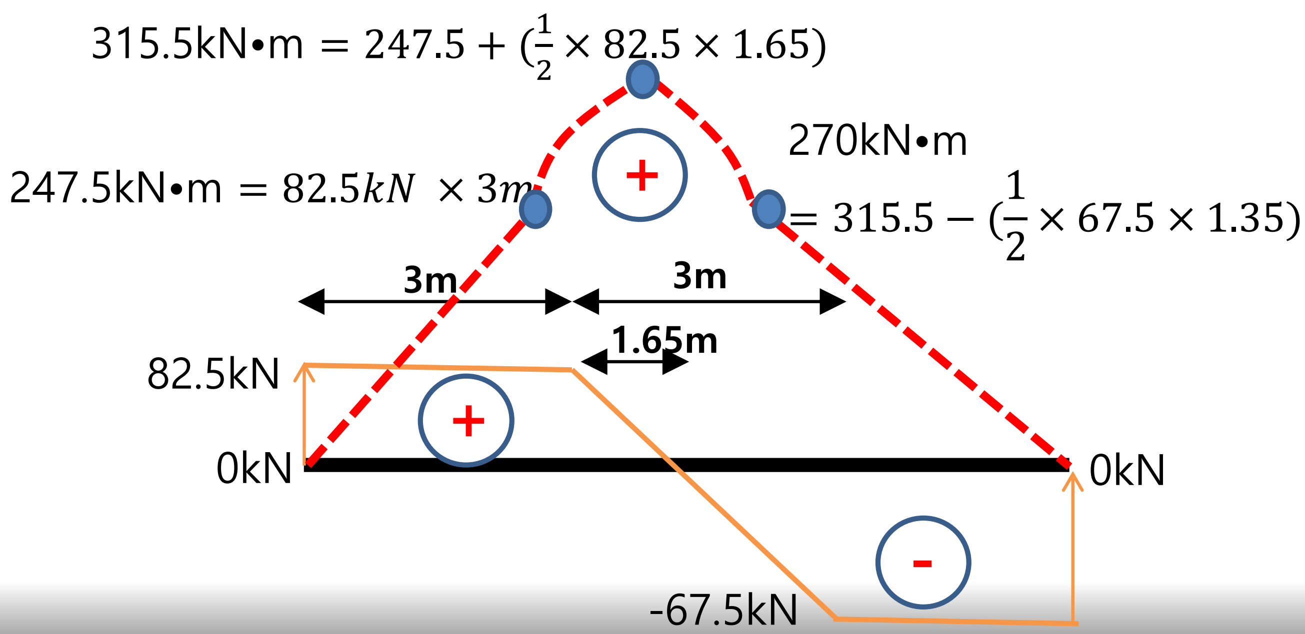




$$\frac{X}{82.5} = \frac{3-X}{67.5}$$

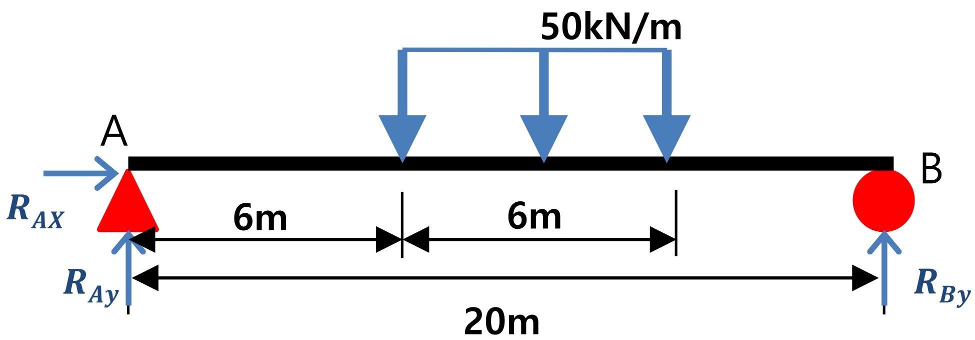
82.5(3-X) = 67.5 X

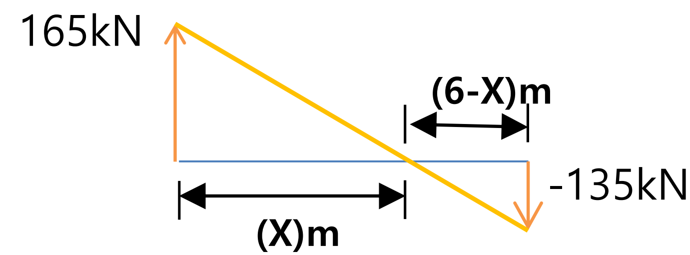
150X=247.5, X=1.65m



Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 15)



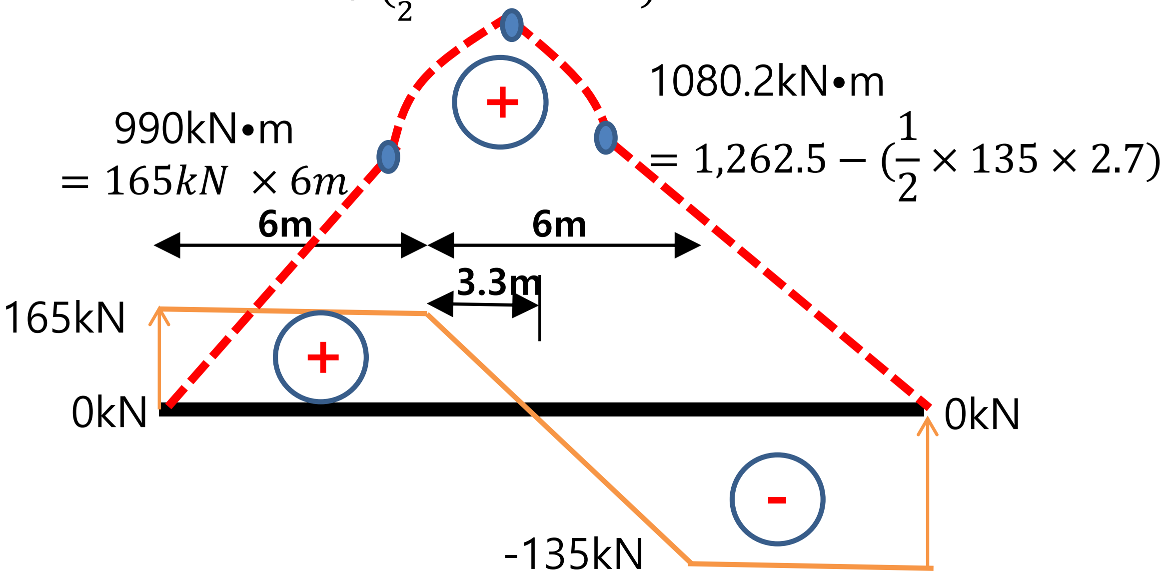


$$\frac{X}{165} = \frac{6-X}{135}$$

165(6-X) = 135 X

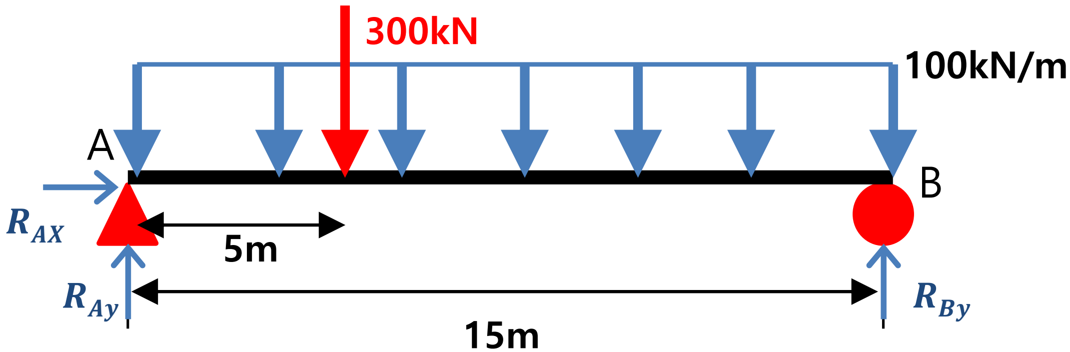
300X=990, X=3.3m

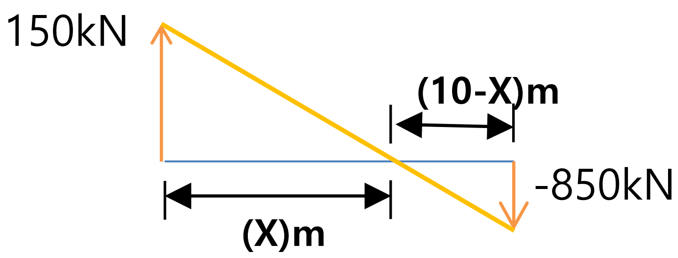
1,262.2kN•m $= 990 + (\frac{1}{2} \times 165 \times 3.3)$



Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 16)

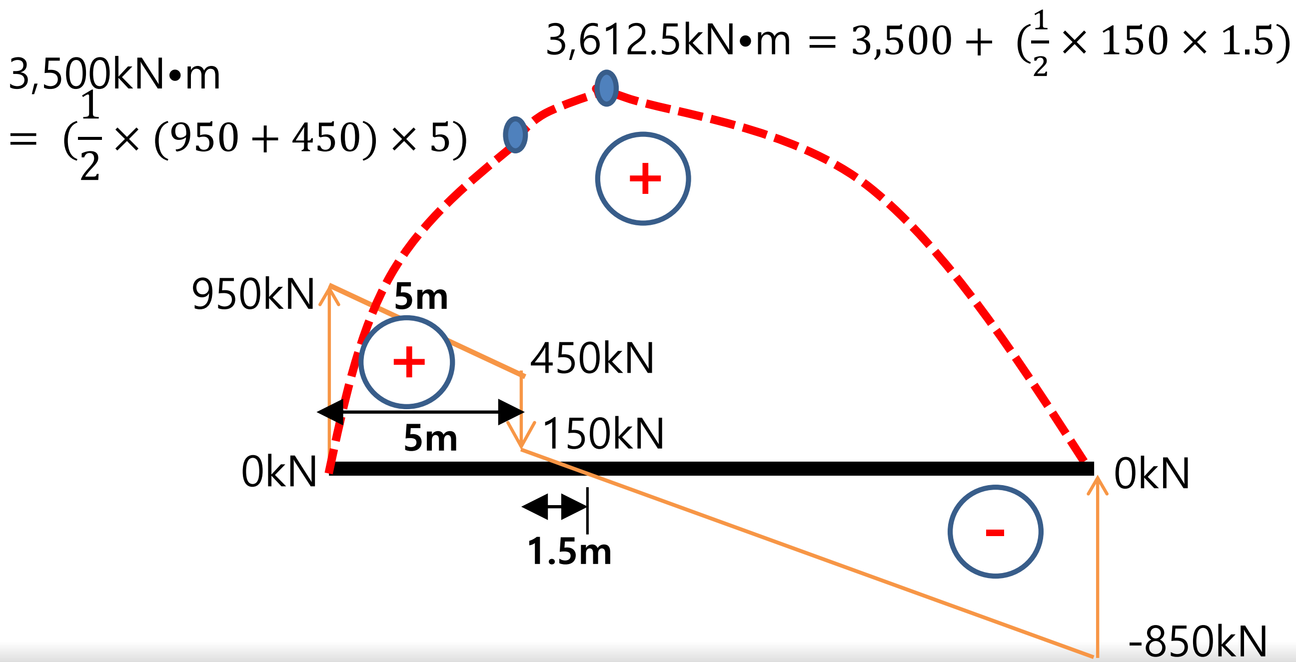




$$\frac{X}{150} = \frac{10-X}{850}$$

150(10-X) = 850 X

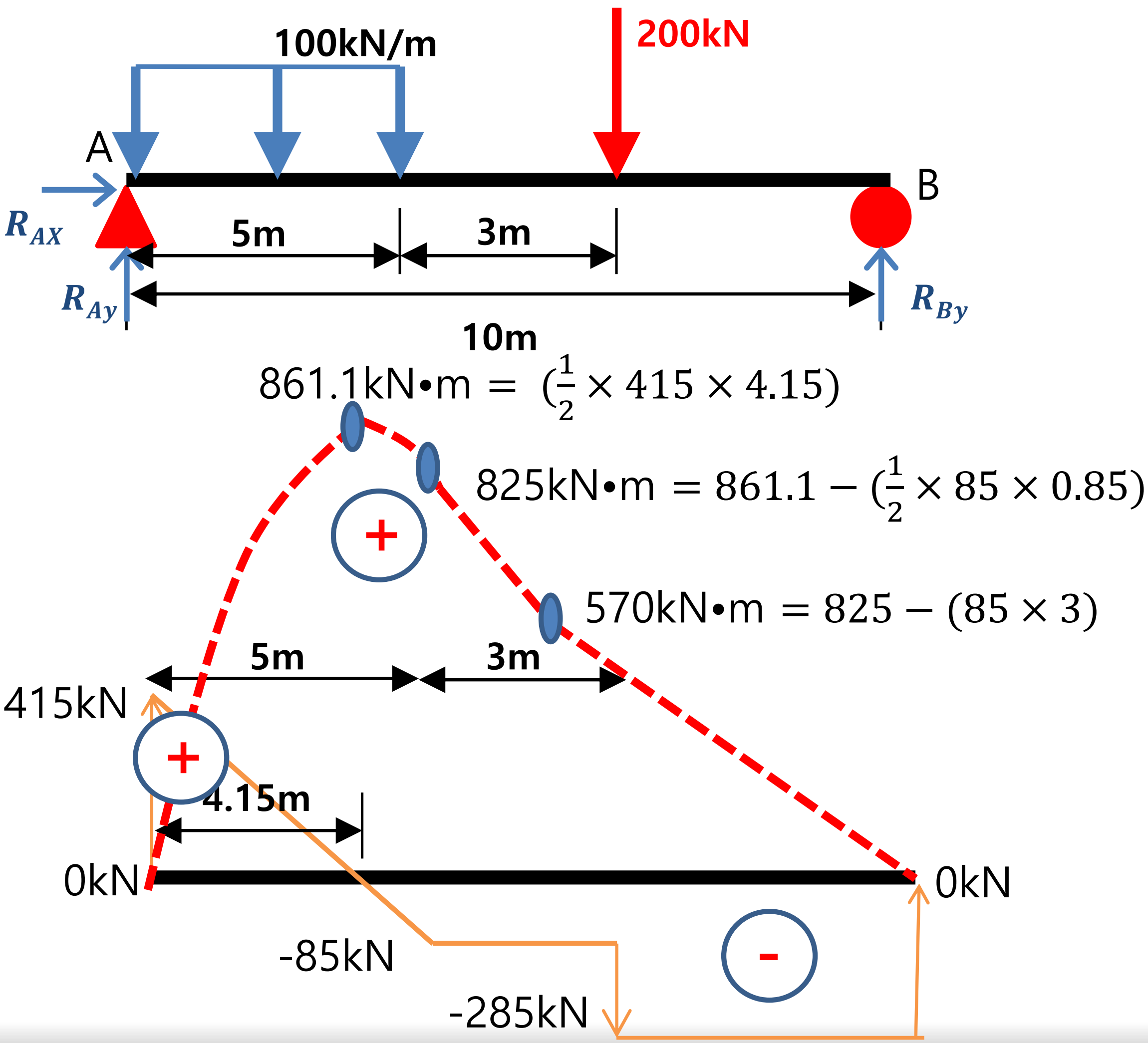
1,000X=1,500, X=1.5m

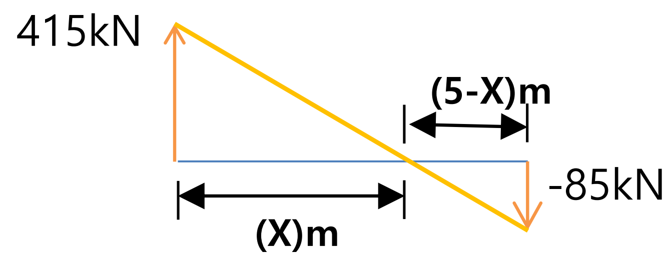


Ⅰ. 보의 휨응력과 전단응력

Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 17)





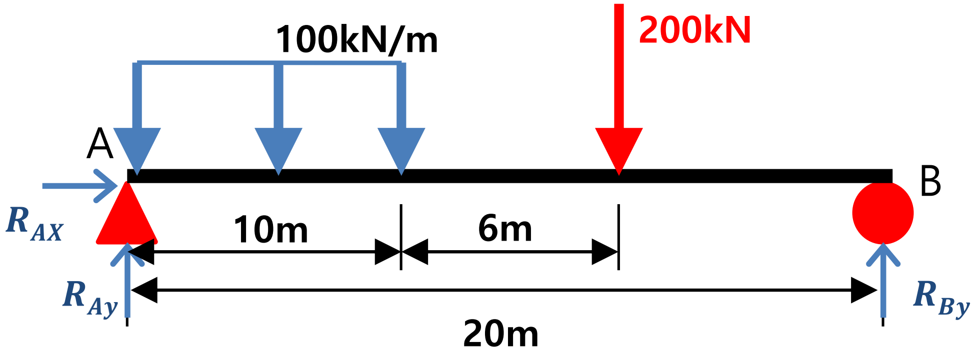
$$\frac{X}{415} = \frac{5-X}{85}$$

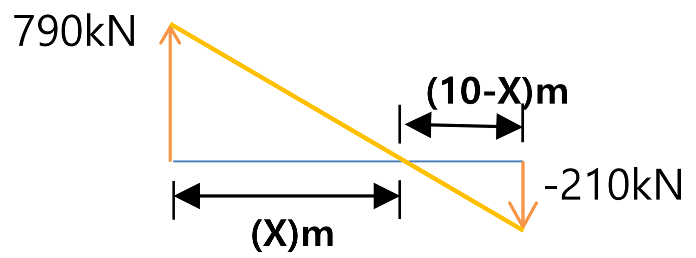
415(5-X) = 85 X

500X=2,075, X=4.15m

Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 18)





$$\frac{X}{790} = \frac{10-X}{210}$$

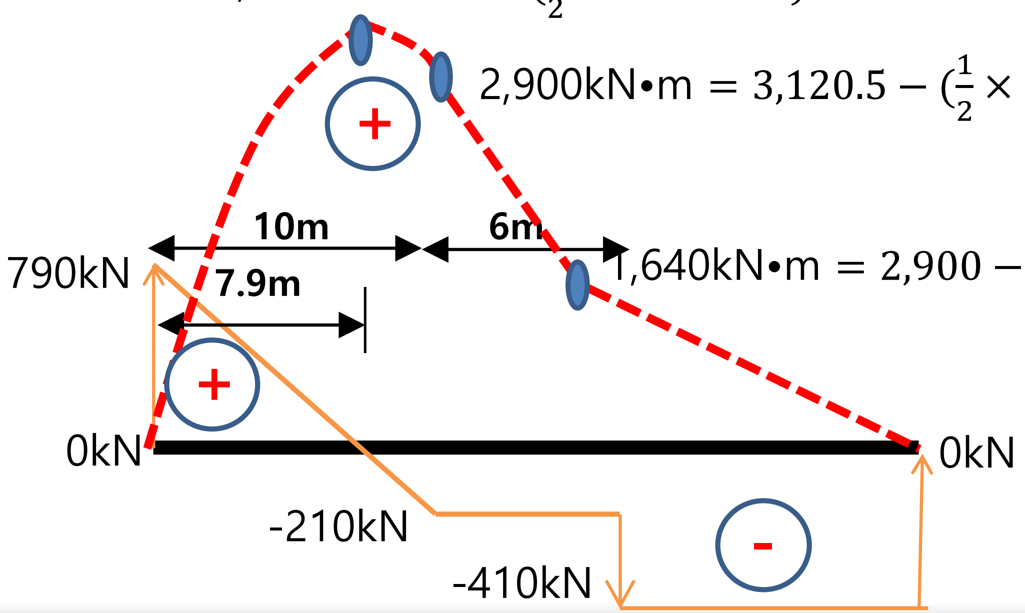
790(10-X) = 210 X

1,000X=7,900, X=7.9m

3,120.5kN•m $= (\frac{1}{2} \times 790 \times 7.9)$

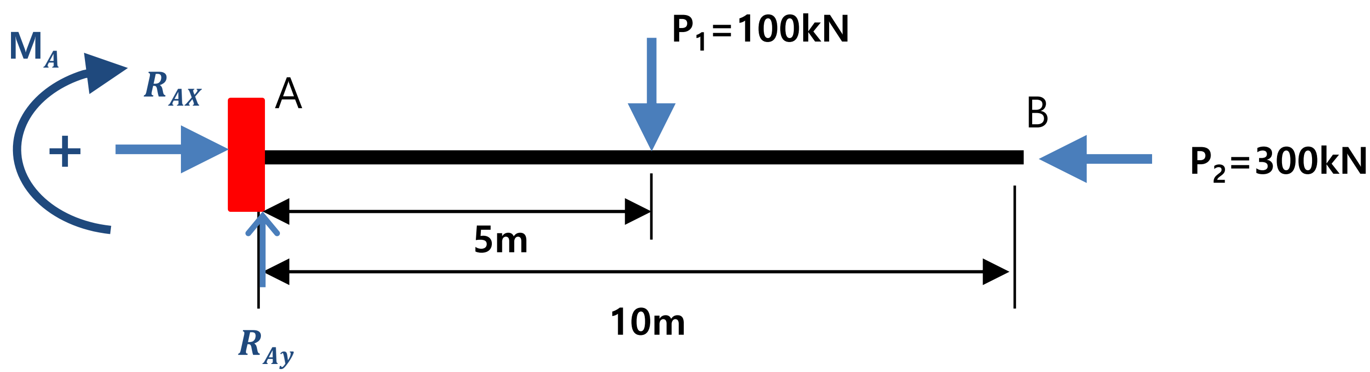
2,900kN•m $= 3{,}120.5 - (\frac{1}{2} \times 210 \times 2.1)$

1,640kN•m $= 2{,}900 - (210 \times 6)$



Ⅰ.3 휨모멘트도 (Bending Moment Diagram : B. M. D)

- 구조물 부재 각 단면의 휨모멘트를 나타내는 선도 (예제 22)



M_A + ↻ = 0, M_A + (100kN X 5m) = 0, M_A = -500kN•m