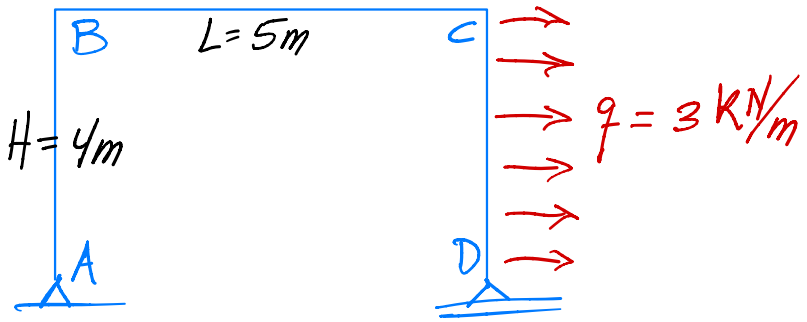
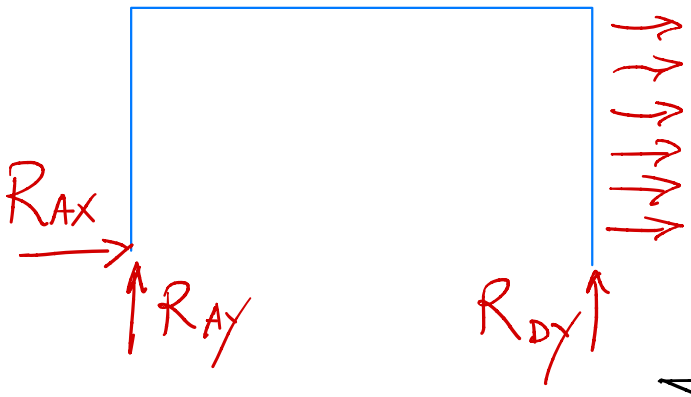
Example: Statically determinate frame

Objective: Determine the bending moment diagram (BMD), followed by the shear force diagram (SFD), and finally the axial force diagram (AFD)



First use equilibrium to determine the reactions:



$$\sum F_x = 3\frac{kN}{m}(4m) + R_{AX} = 0$$

$$\Rightarrow R_{AX} = -12\,kN$$

$$\sum M_A = 3\frac{kN}{m}(4m)(2m) - R_{DY}(5m) = 0$$

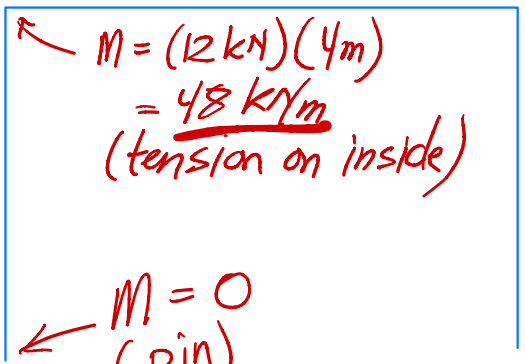
(resultant)

$$\Rightarrow R_{DY} = 4.8\,kN$$

$$\sum F_y = R_{AY} + R_{DY} = 0$$

$$\Rightarrow R_A = -4.8\,kN$$

Then determine the bending moment at "key" locations:



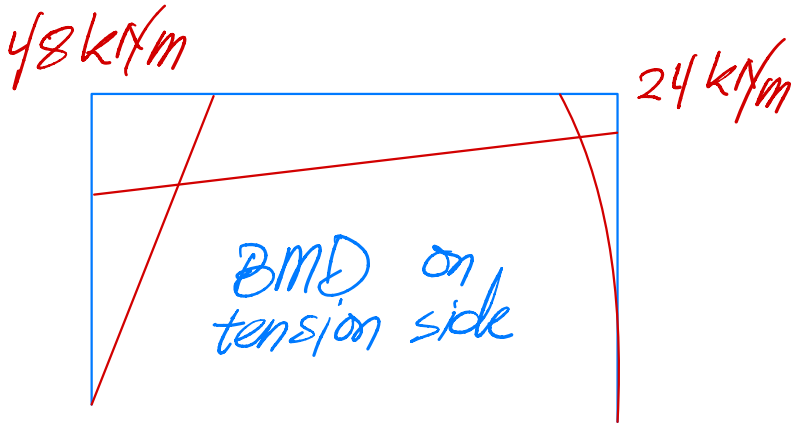
$M = (12\,kN)(4m) = 48\,kN\cdot m$ (tension on inside)

$M = \frac{"qL^2"}{2} = \frac{(3)(4)^2}{2} = 24\,kN\cdot m$ (tension on inside)

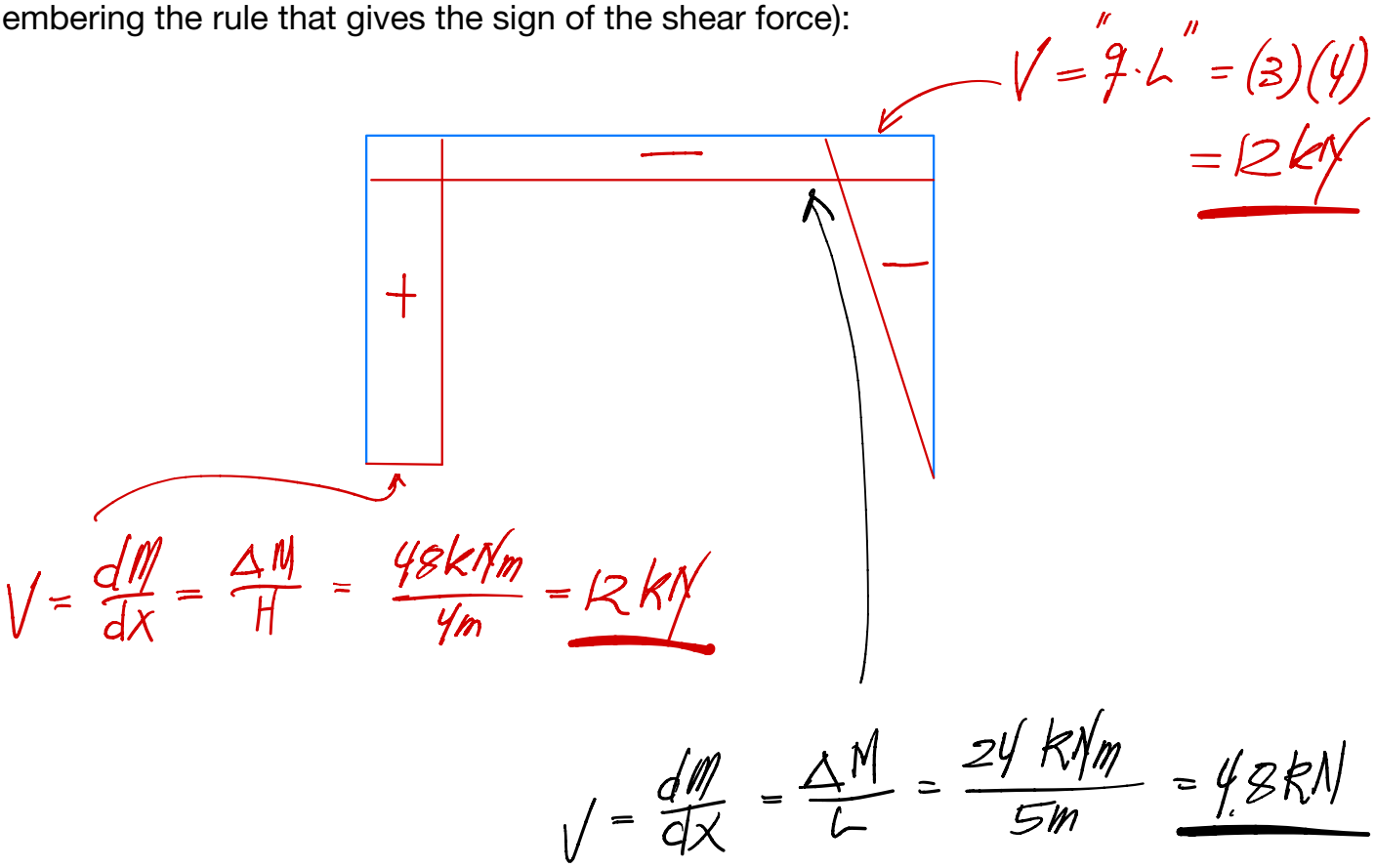
$M = 0$ (pin)

$M = 0$ (roller)

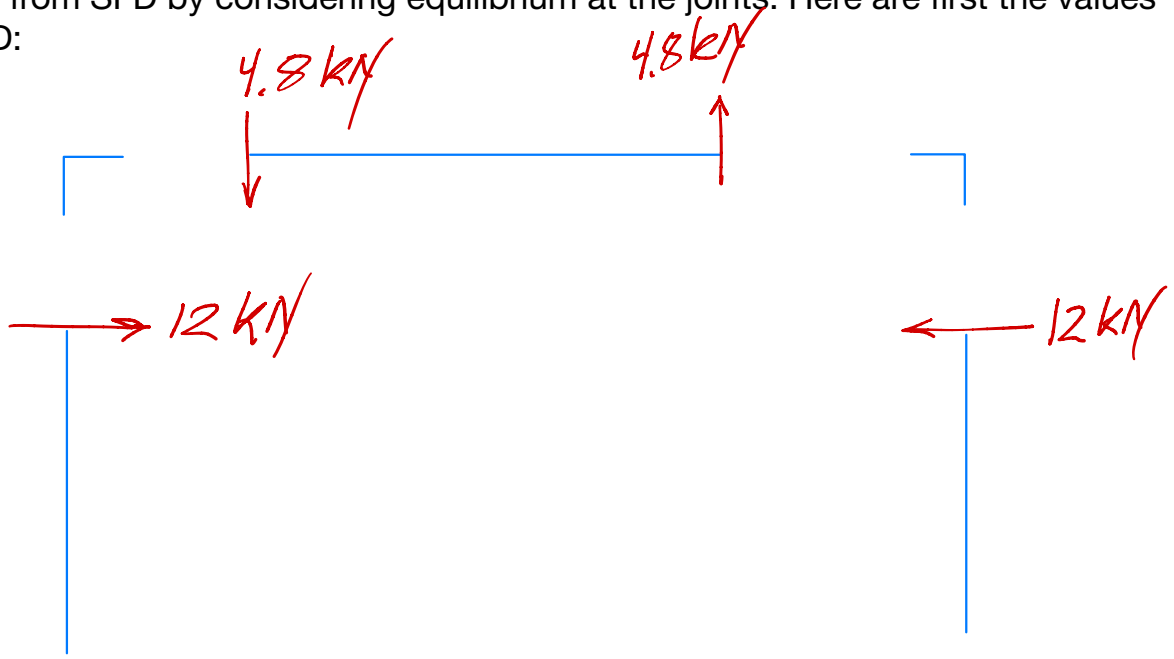
Draw the BMD in between those locations:



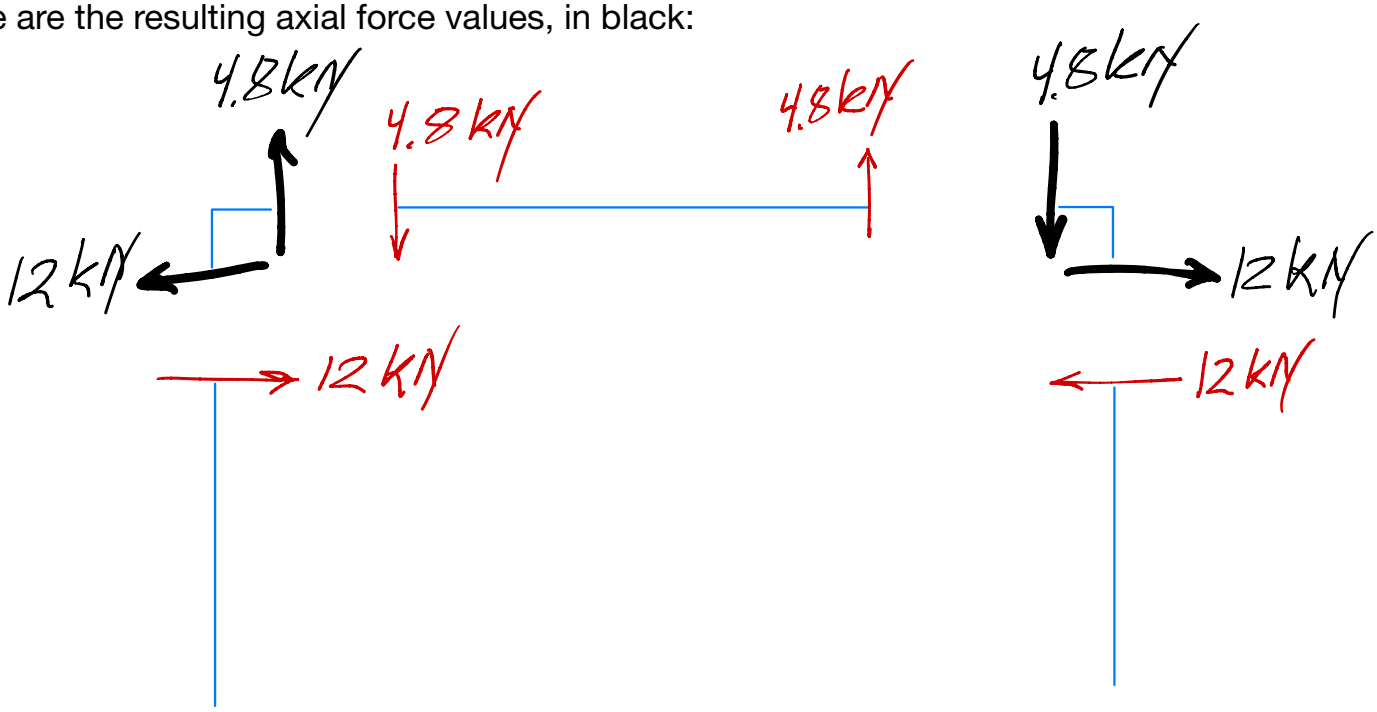
Draw the SFD from the BMD, using V=dM/dx plus cantilever reference case from the formula sheet (remembering the rule that gives the sign of the shear force):



The AFD is obtained from SFD by considering equilibrium at the joints. Here are first the values directly from the SFD:



Next, here are the resulting axial force values, in black:



Finally, the axial force diagram (AFD):