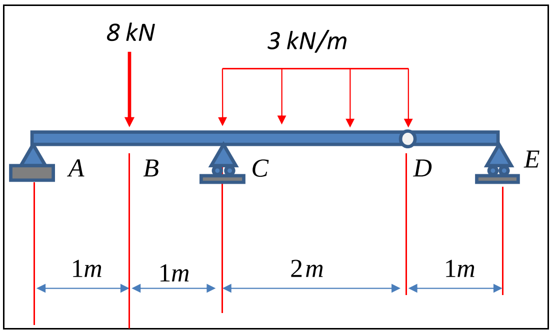
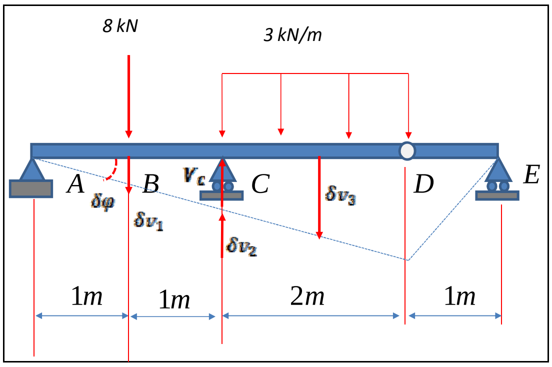
Determine the value of all reactions forces in the next structure by the PTV.



1) Calculation of V_C



$$\sum \delta W_{virt} = \sum F\delta v_i + M\delta\,\varphi_i = 0$$

$8.\delta v_1 - V_C \delta v_2 + 6\delta v_3 = 0$

$\delta v_1 = \delta\varphi$

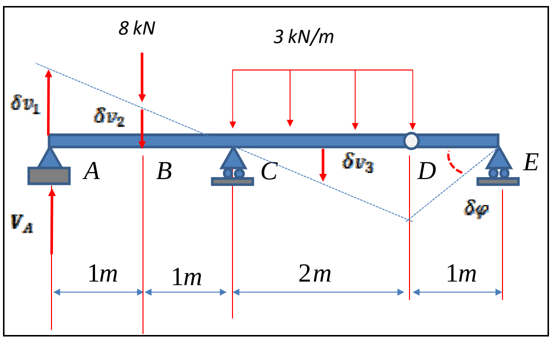
$\delta v_2 = 2.\delta\varphi$

$\delta v_3 = 3.\delta\varphi$

$8.\delta\varphi - V_C.2.\delta\varphi + 6.3.\delta\varphi = 0$

$\boldsymbol{V_C = 13\ kN}$

2) Calculation of V_A



$$\sum \delta W_{virt} = \sum F\delta v_i + M\delta\,\varphi_i = 0$$

$V_A.\delta v_1 - 8.\delta v_2 + 6\delta v_3 = 0$

$\delta v_1 = 2.\delta\varphi$

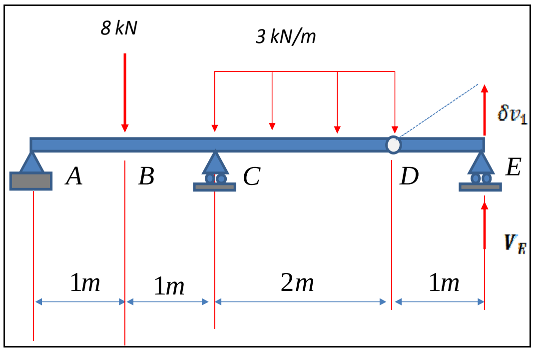
$\delta v_2 = \delta\varphi$

$\delta v_3 = \delta\varphi$

$V_A.2\delta\varphi - 8.\delta\varphi + 6.\delta\varphi = 0$

$\boldsymbol{V_A = 1\ kN}$

3) Calculation of V_E



$$\sum \delta W_{virt} = \sum F\delta v_i + M\delta\,\varphi_i = 0$$

$V_E.\delta v_E = 0$

$\boldsymbol{V_E = 0\ kN}$

Now we are going check these results with the three scalar equations of equilibrium:

$\sum M_D = 0 \rightarrow \boldsymbol{V_e = 0\ \ kN}$

$\sum M_a = 0 \rightarrow 2V_c - 6.3 - 8.1 = 0$

$\boldsymbol{V_c = 13\ kN}$

$\sum F_y = 0 \rightarrow V_a = 8 + 6 - 13 = 1$

$\boldsymbol{V_a = 1\ kN}$

Both results are equal. Reactions forces are well calculated