A beam *AD* is shown. (*a*) Determine the reactions **A** and **C** at supports *A* and *C*. (*b*) Using *singularity functions*, write the equations defining the loading function *q*, the shear *V*, and bending moment *M* for the entire beam. (*c*) Using the equation defining *M*, compute the moment *M* at $x = 4.5$ m.
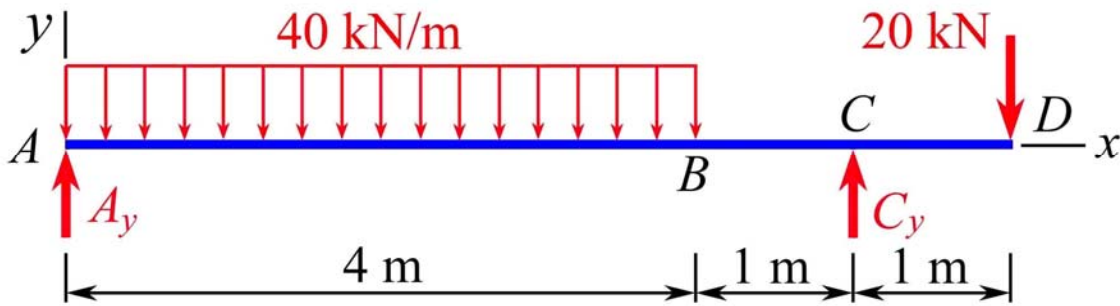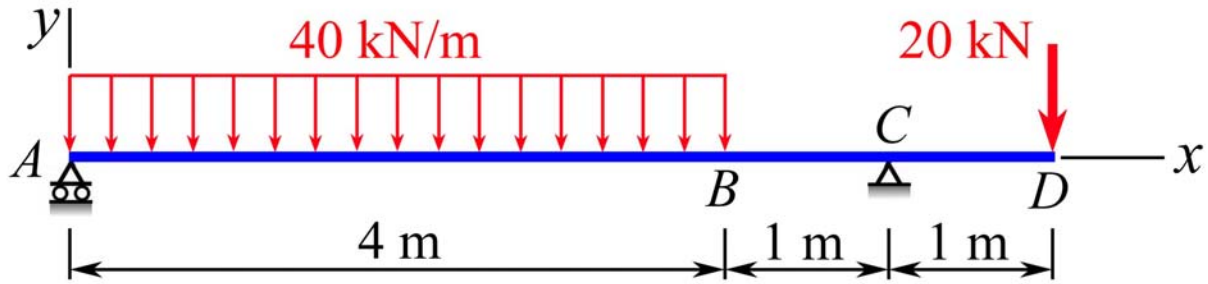
$+\circlearrowleft \Sigma M_C = 0:$

$-5A_y + 3(160) - 1(20) = 0 \qquad \therefore \quad A_y = 92 \qquad \boxed{\mathbf{A} = 92 \text{ kN} \uparrow} \quad ①$

$+\uparrow \Sigma F_y = 0:$

$92 + C_y - 160 - 20 = 0 \qquad \therefore \quad C_y = 88 \text{ kN} \qquad \boxed{\mathbf{C} = 88 \text{ kN} \uparrow} \quad ①$

$\boxed{q = 92 <x>^{-1} - 40 <x>^{0} + 40 <x-4>^{0} + 88 <x-5>^{-1}} \quad ②$

$\boxed{V = 92 <x>^{0} - 40 <x>^{1} + 40 <x-4>^{1} + 88 <x-5>^{0}} \quad ②$

$\boxed{M = 92 <x>^{1} - 20 <x>^{2} + 20 <x-4>^{2} + 88 <x-5>^{1}} \quad ②$

At $x = 4.5$ m, $\boxed{M = 14 \text{ kN·m}}$. ②