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.

\[
\sum M_C = 0:
\]
\[-5A_y + 3(160) - 1(20) = 0 \quad \therefore \quad A_y = 92 \quad A = 92 \text{ kN} \uparrow \quad \text{①}
\]

\[
\sum F_y = 0:
\]
\[92 + C_y - 160 - 20 = 0 \quad \therefore \quad C_y = 88 \text{ kN} \quad C = 88 \text{ kN} \uparrow \quad \text{①}
\]

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

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

\[
M = 92 < x > ^{1} - 20 < x > ^{2} + 20 < x - 4 > ^{2} + 88 < x - 5 > ^{1} \quad \text{②}
\]

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