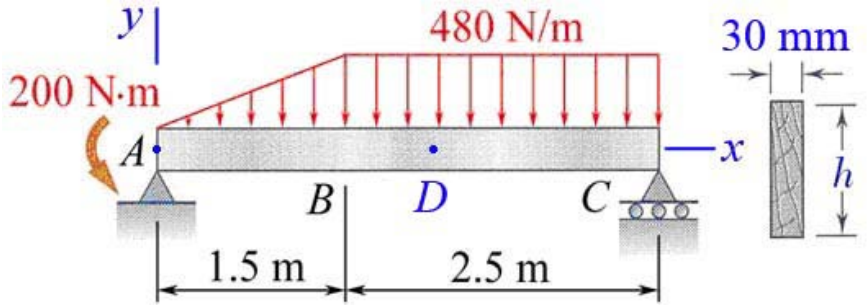
MEEG 3013 Quiz #5.m15.072

1. ③ Define the values of the *singularity function* $\langle x-a\rangle^n$.

2. ⑦ A timber beam is shown. (*a*) Determine the reactions **A** and **C** at supports *A* and *C*. (*b*) Using *singularity functions*, find the location x_D and magnitude M_D of the maximum bending moment in the beam occurring at *D*. (*c*) Knowing that the available stock consists of beams with an allowable stress of 12 MPa and a rectangular cross section of 30-mm width and depth *h* varying from 80 mm to 160 mm in 10-mm increments, determine the value of *h* for most economical cross section.



---

1. $\langle x-a\rangle^n = (x-a)^n$ if $x-a\geq 0$ & $n>0$

$\langle x-a\rangle^n = 1$ if $x-a\geq 0$ & $n=0$ ③

$\langle x-a\rangle^n = 0$ if $x-a<0$ or $n<0$

2. (*a*) FBD & Equilibrium: **A** = 695 N ↑ & **C** = 865 N ↑. ②

(*b*) $q = -200\langle x\rangle^{-2} + 695\langle x\rangle^{-1} - 320\langle x\rangle^{1} + 320\langle x-1.5\rangle^{1}$

$V = -200\langle x\rangle^{-1} + 695\langle x\rangle^{0} - 160\langle x\rangle^{2} + 160\langle x-1.5\rangle^{2}$ ②

$M = -200\langle x\rangle^{0} + 695\langle x\rangle^{1} - \frac{160}{3}\langle x\rangle^{3} + \frac{160}{3}\langle x-1.5\rangle^{3}$

Noting that *M* is maximum when *V* = 0, we get

$x_D = 2.1979$ m $x_D = 2.20$ m ①

$M_{\max} = M_D = 779.4$ N·m $M_D = 779$ N·m ①

(*c*) $h_{\min} = 0.11397$ m. Choose beam with *h* = 120 mm. ①