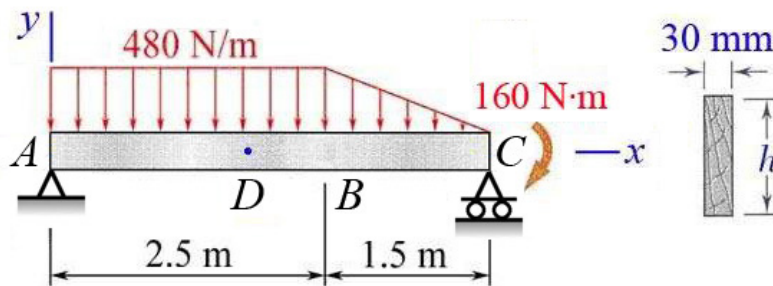


MEEG 3013 Quiz #5.m20.091

- ④ Define the values of (a) $\langle x - a \rangle^n$, (b) $\int_{-\infty}^x \langle x - a \rangle^n dx$.
- ⑥ A timber beam is shown. (a) Determine the reactions **A** and **C** at *A* and *C*. (b) Using *singularity functions*, find the location x_D and magnitude M_D of the maximum bending moment at *D*. (c) Knowing that the available stock consists of beams with an allowable stress of 14 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.



- $\langle x - a \rangle^n = (x - a)^n$ if $x - a \geq 0$ & $n > 0$
 $\langle x - a \rangle^n = 1$ if $x - a \geq 0$ & $n \leq 0$
 $\langle x - a \rangle^n = 0$ if $x - a < 0$ or $n < 0$ ④
 $\int_{-\infty}^x \langle x - a \rangle^n dx = \frac{1}{n+1} \langle x - a \rangle^{n+1}$ if $n > 0$
 $\int_{-\infty}^x \langle x - a \rangle^n dx = \langle x - a \rangle^{n+1}$ if $n \leq 0$
- (a) **FBD** & Equilibrium: **A = 875 N ↑** & **C = 685 N ↑**. ①

(b) $q = 875 \langle x \rangle^{-1} - 480 \langle x \rangle^0 + 320 \langle x - 2.5 \rangle^1$
 $V = 875 \langle x \rangle^0 - 480 \langle x \rangle^1 + 160 \langle x - 2.5 \rangle^2$ ②
 $M = 875 \langle x \rangle^1 - 240 \langle x \rangle^2 + \frac{160}{3} \langle x - 2.5 \rangle^3$
 Noting that M is maximum when $V = 0$, we get
 $x_D = 1.822916 \text{ m}$ **$x_D = 1.823 \text{ m}$** ①
 $M_{\max} = M_D = 797.526 \text{ N}\cdot\text{m}$ **$M_D = 798 \text{ N}\cdot\text{m}$** ①

(c) $h_{\min} = 0.10674 \text{ m}$. Choose beam with **$h = 110 \text{ mm}$** . ①