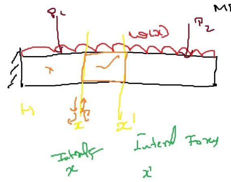
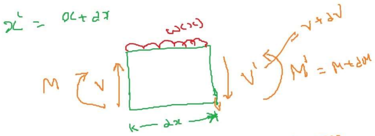
ME1020 — Beams



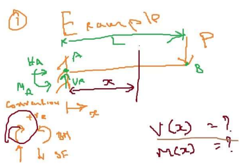
$x' = x + dx$



This notation is considered as +ve SF & +ve BM convention

$$\boxed{\frac{dV}{dx} = -w \qquad \frac{dM}{dx} = V}$$

① Example



SFD & BMD

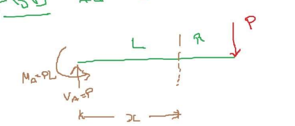
$V(x) = ?$
$M(x) = ?$

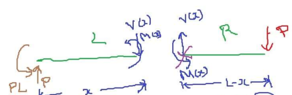
Reaction forces

$\Sigma F_x = 0 \Rightarrow H_A = 0$
$\Sigma F_y = 0 \Rightarrow V_A - P = 0$
$\Sigma M_z = M_A = 0 \quad M_A - PL = 0$

$\Bigg\}$ $H_A = 0$, $V_A = P$, $M_A = PL$

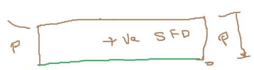
FBD for entire structure



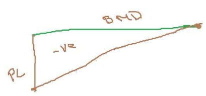


R: FBD

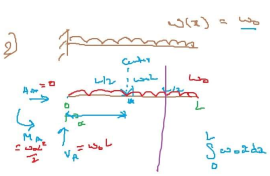
$\Sigma F_y = 0$
$V(x) - P = 0$
$\Sigma M_z^x = 0$
$M(x) - P(L-x) = 0$



$V(x) = P$
$M(x) = P(L-x)$



②



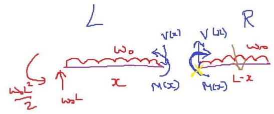
Global equilibrium

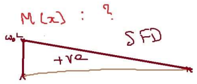
$\Sigma F_x = 0 \Rightarrow H_A = 0$
$\Sigma F_y = 0 \Rightarrow V_A - w_0 L = 0$
$\Sigma M_z = 0 \Rightarrow M_A - w_0 L \cdot \frac{L}{2} = 0$

$\Bigg\} \Rightarrow$ $H_A = 0$, $V_A = w_0 L$, $M_A = \frac{w_0 L^2}{2}$

$V(x) : ?$
$M(x) : ?$

L R





$\Sigma F_y = 0 \quad V(x) - w_0(L-x) = 0$
$\Sigma M_z = 0 \quad M(x) + w_0(L-x)\frac{(L-x)}{2} = 0$

$V(x) = w_0(L-x)$
$M(x) = -w_0\frac{(L-x)^2}{2}$