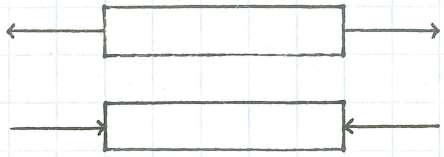
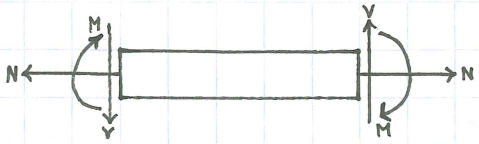
CIV102 - STRUCTURES and MATERIALS

Topic: Bending Moment Diagram/Shear Force Diagram (BMD/SFD)

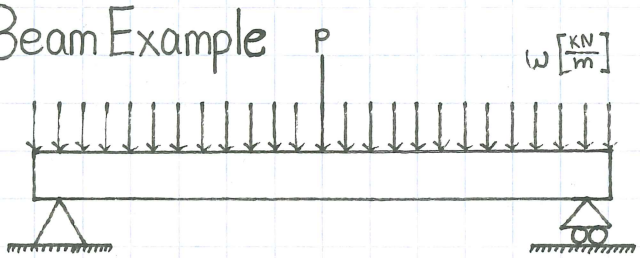
1) Truss Members



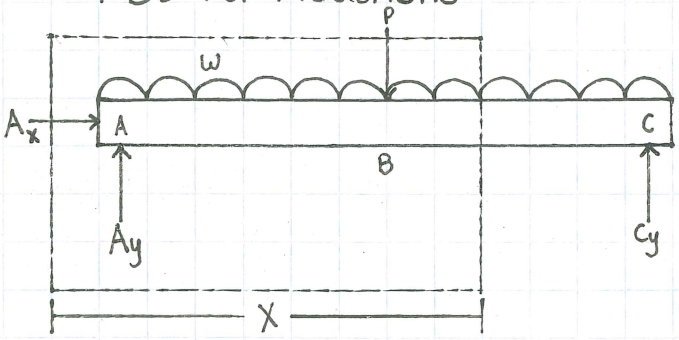
Beam/Column



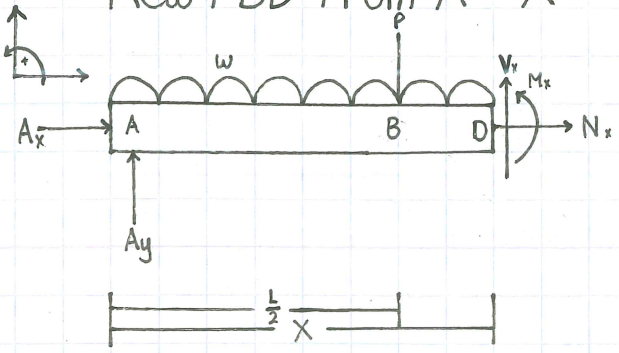
Beam Example

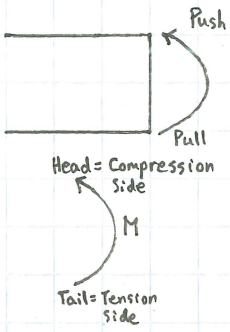


FBD For Reactions



New FBD From A → X





For any $\frac{L}{2} \le X \le L$

$\Sigma F_x = 0$, $A_x = -N_x$ (both = Zero)

$\Sigma F_y = 0$

$0 = A_y - P + V_x - wX$

$V_x = P + wX - A_y$

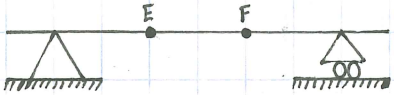
$\Sigma M_0 = 0$

$0 = M_x - A_y \cdot X + wX \cdot \frac{X}{2} + P(X - \frac{L}{2})$

$V_x = P + wX - A_y$

$M_x = -P(X - \frac{L}{2}) - \frac{wX^2}{2} + A_y \cdot X$

$M_x = \int V_x \, dx$ = the change in moment between E and F in a beam equals area under SFD from E to F

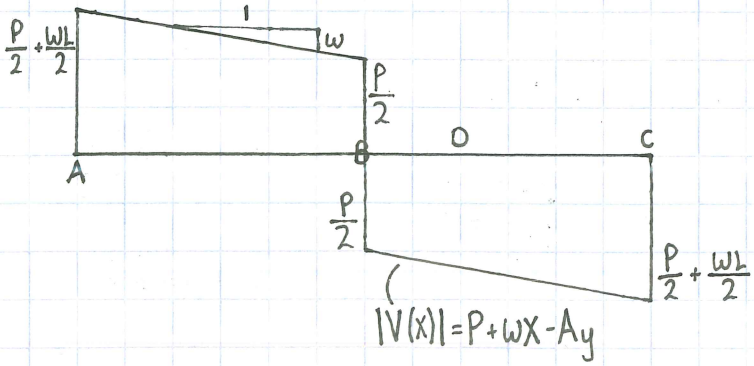


$V_x = \frac{dM}{dx}$ = Shear Force = Slope of BMD

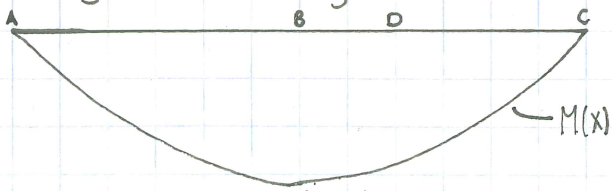
$w = \frac{dV}{dx}$ = Uniform Load = Slope of SFD

Draw

Shear Force Diagram



Bending Moment Diagram



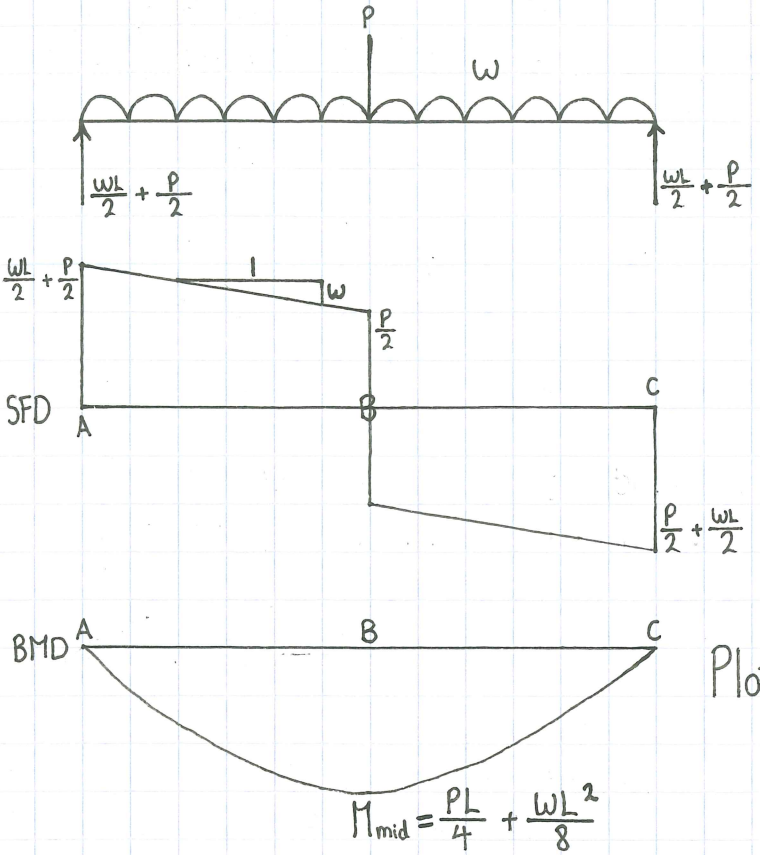
$M(X) = -P(X - \frac{L}{2}) - \frac{wX^2}{2} + A_y - X$

Max at Middle = Area of SFD from A to B = $\frac{P}{2}\frac{L}{2} + \frac{WL}{2}\frac{L}{2}\frac{1}{2}$

How to generate BMD, SFD without algebra

- Get reaction forces

For SFD - Accumulate Up + Down Forces



Plot on tension side