To do ...

- Quiz 5 starts TUES
- HW 18 PL due WED
- HW 19 ME due THURS
- Last TAM 210 class FRI
- WA 10 due SUN

- TAM 210 office hours
  - OCT 30, 31: 5-7 pm 112 Transportation bldg

- TAM 210 FINAL (Nov 1 – Nov 5)
Relations Among Load, Shear and Bending Moments

Consider the beam element:

Shear force:

\[ Z_{F_1} : \quad V(x) - V(x+\Delta x) + w(x) \Delta x = 0 \]

\[ V - V - \Delta V + w(x) \Delta x = 0 \]

\[ \Delta V = w(x) \Delta x \]

The moment:

\[ \sum M_0 : \]

\[ - M(x) + M(x+\Delta x) - V \Delta x \]

\[ - \beta \Delta x \left( w(x) \Delta x \right) = 0 \]

\[ \Delta M = V \Delta x + \beta w(x) \Delta x^2 \]

in the limit that \( \Delta x \to 0 \)
\[
\frac{dv}{dx} = w(x)
\]
\[
\frac{dm}{dx} = v
\]

Slope of shear = Dist load intensity

\[
\Delta v = v_2 - v_1 = \int w(x)dx
\]

Change in shear = Area under loading curve

\[
\Delta M = M_2 - M_1 = \int v(x)dx
\]

Change in moment = Area under shear moment
Wherever there is an external concentrated force, or a concentrated moment, there will be a change (jump) in shear or moment respectively.

\[ \sum F_y: \quad V + F - V - \Delta V = 0 \quad \Rightarrow \quad \Delta V = F \]

\[ \sum M_o: \quad M + \Delta M - M - N_o - \Delta x V = 0 \]

\[ \Delta M = N_o + \Delta x V \quad \therefore \quad \Delta M = N_o \]
Draw the shear and moment diagrams for the beam.

1. DRAW FBD
2. Find Support RwMR

\[ \frac{dv}{dx} = \omega(x) = 0 \]

\[ \Delta v = v_2 - v_1 = -\int \omega(x) dx = 0 \]

\[ \frac{dM}{dx} = V \]

\[ \Delta M = M_2 - M_1 = \int V(x) dx \]
Draw the shear and moment diagrams for the beam.

\[ w = 0 \]
\[ \frac{dV}{dx} = w = 0 \]
\[ 
\Delta V = \int w \, dx = 0 
\]
\[ 
\Delta V = f 
\]

\[ V(x) \]
\[ -3 \]
\[ \text{neg/const.} \]
\[ A_M = A = 2.5k \cdot 15 \]

\[ N(x) \]
\[ 15 \]
\[ -15 \]
Draw the shear and moment diagrams for the beam.

\[
\frac{dv}{dx} = w(x) = \text{neg/const.} \\
\Delta v = \int \text{neg} dx = wa
\]

\[
\frac{dm}{dx} = v = \text{pos/decr.} \\
\Delta m = \int v(x) = \frac{1}{2}wa^2
\]

\[
\frac{dM}{dx} = \text{neg/decr.} \\
\Delta M = \int M(x) = \frac{1}{2}wa^2
\]
$- \frac{\omega a^2}{Z}$
Draw the shear and moment diagrams for the cantilever beam.
Draw the shear and moment diagrams for the overhang beam.
The smooth pin is supported by two leaves A and B and subject to a compressive load caused by bar C. Draw the shear and moment diagrams for the pin.