Housekeeping

- Tuesday
  - PL 16
- Thursday
  - ME 17
- Sunday
  - WA 9
- Next Week
  - Q 5 + the usual
  - Oct 28: last day TAM 210 (review?)
  - Weekend Oct 28: TAM 210 office hours
- Week after: TAM 210 FINAL

Shear failure

No office hours from Juarez
Determine the normal force, shear force, and bending moment at C of the beam.
\[ \sum F_x : N_C = 0 \]

\[ \sum F_y : V_C - (\text{dist load from C-B}) = 0 \]

Recall, equiv force for dist load = area under "curve"

\[
\text{"height"} = \frac{1200 \text{ N/m}}{3 \text{ m}} = \frac{W_C}{1.5 \text{ m}}
\]

\[ W_C = 600 \text{ N/m} \]
Equilibrium:

\[
\text{Eq load} = (600 \text{ N/m}) \left( \frac{1}{2} \right) (1.5 \text{ m})
\]

\[
F = 450 \text{ N}
\]

\[\Sigma F_y : \quad V_c - F = 0 \quad \Rightarrow \quad V_c = 450 \text{ N}\]

\[\Sigma M_c : \quad -M_c - (F)(0.5 \text{ m}) = 0
\]

\[M_c = -225 \text{ N}\]
Determine the normal force, shear force, and bending moment acting at point $E$ of the frame.
Slide 4

1. Section the body, ID knowns + unknowns

2. Solve for $R$ → method of joints

$\theta = 45^\circ$

$\Sigma F_y: R \sin \theta - 600 N = 0$

$R = 848.5 N$
3. Solve for internal forces

\[ \Sigma F_x : V_E + R \sin \theta = 0 \]
\[ V_E = -600 \text{N} \]

\[ \Sigma F_y : N_E - R \cos \theta = 0 \]
\[ N_E = 600 \text{N} \]

\[ \Sigma M_C : -M_E - (V_E)(0.5 \text{m}) = 0 \]
\[ M_E = (600 \text{N})(0.5 \text{m}) \]
\[ M_E = 300 \text{N} \cdot \text{m} \]
Internal loadings developed in structural members

Concentrated vs. distributed loads....

V & M will vary depending on where/how load is applied...

Would be nice to see what this looks like

2 kN/m

3 m
Draw the shear and moment diagrams for the simply supported beam.

Pro-tip: When ext loads Δ, Vo, M

1. Determine external loads (incl. reactions)
2. Start from left, section beam
3. FBD of section + solve w/ equations of equil.

Lect 24: Internal Forces - Diagrams
Draw the shear and moment diagrams for the simply supported beam.
External/reaction loads

\[ \Sigma F_x: A_x = 0 \]

\[ \Sigma M_A: (By)(L) - (P)(b) - (w)(a)(\frac{a}{2}) = 0 \]

\[ (By)(L) = \frac{1}{2}aw + Pb \]

\[ By = \frac{1}{L} \left( \frac{1}{2}aw + Pb \right) \]

\[ \Sigma F_y: A_y + By - P = 0 \]

\[ A = P - By \]
From 0 to a (just to end of w)

\[ \Sigma F_x: N = 0 \]
\[ \Sigma F_y: A_y - w(x) - V = 0 \]
\[ V = A_y - w(x) \]
\[ \therefore a + x = 0; \quad V = A_y \]
\[ a + x = a \]
\[ V = A_y - w a \]

\[ \Sigma M(x_1): M - A_y(x) + w(x)(\frac{1}{2}x) = 0 \]
\[ M = -\frac{1}{2}w x^2 + A_y x \] \text{ quadratic!}

@ \( x = 0 \) \quad M = 0

@ \( x = a \) \quad M = -\frac{1}{2}w a^2 + A_y a
From \( a \) to \( b \) (just before \( P \))

\[
\sum F_x: \quad N = 0
\]

\[
\sum F_y: \quad A_y - wa - V = 0
\]

\[ V = A_y - wa \quad \text{constant!} \]

From \( a \) to \( b \) only!

\[
\sum M: \quad M(x)A_y x + (w)(a)(x - \frac{1}{2}a) = 0
\]

\[
M(x) = A_y x - wa(x - \frac{1}{2}a)
\]

\[
M = A_y x - wa x + \frac{1}{2}wa^2
\]

\[
M = (A_y - wa) x + \frac{1}{2}wa^2 \quad \text{at} \quad x = \frac{1}{2}a
\]
From \( \overrightarrow{B} \) to \( \overrightarrow{L} \rightarrow \) just after \( P \)

\[ \Sigma F_x = N = 0 \]

\[ \Sigma F_y: \ A_y - wa - P - V = 0 \]

\[ V(x) = \frac{A_y - wa - P}{constant \ again!} \]

\[ \Sigma M: M + P(x-b) + wa(x - \frac{1}{2}a) - A_y x = 0 \]

linear!

\[ M_{BL} = A_y x - P(x-b) - wa(x - \frac{1}{2}a) \]

\[ M_{BL} = A_y x - P_x + Pb - wa x + \frac{1}{2}wa^2 \]

\[ = (A_y - P - wa)x + (Pb + \frac{1}{2}wa^2) \]