Announcements

- TAM 210/211 students – check your grades on Compass
- Written Assignment 6 regrade submission
- 1 written assignment “accident forgiveness”

Upcoming deadlines:
- Friday (3/15) – Today!
  - PL HW 8
  - Written Assignment
Objective

• Relations among external load (distributed force, concentrated force, couple moment) and internal load (shear force and bending moments)
Relationships between $w$, $V$, $M$

Draw the shear and moment diagrams for the beam.
Relations Among Load, Shear and Bending Moments

Wherever there is an external concentrated force, there will be a change (jump) in internal shear force.
Relations Among Load, Shear and Bending Moments

Wherever there is an external couple moment, there will be a change (jump) in internal bending moment.

upward jump = clockwise ext. moment.
Relations Among Load, Shear and Bending Moments

Relationship between load and shear:

\[ \sum F_j = 0: \quad V - (V + \Delta V) + w \Delta x = 0 \]
\[ \Delta V = w \Delta x \]

Dividing by \( \Delta x \) and letting \( \Delta x \to 0 \), we get:

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

\[ \int f(x) \, dx = \Delta V \]
\[ \int -w \, dx = -wx + C \]
Relations Among Load, Shear and Bending Moments

Relationship between shear and bending moment:

\[ \sum M_o = 0: \quad (M + \Delta M) - M - V \Delta x - w \Delta x (k \Delta x) = 0 \]
\[ \Delta M = V \Delta x + w k (\Delta x)^2 \]

Dividing by \( \Delta x \) and letting \( \Delta x \to 0 \), we get:

\[ \frac{dM}{dx} = V \quad \Delta M = \int V \, dx \]
Example

Draw the shear and moment diagrams for the beam.

\[ \sum M_A = [800 \times 1 - 1200 - 6(3) + 48] \text{Nm} = 0 \]

\[ B = \frac{3800}{4} \quad N = 950 \text{ N} \]

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

\[ A_1 = (450 \text{ N})(1 \text{ m}) \]
\[ = 450 \text{ NNm} \]

\[ A_2 = -350 (1) \text{ Nm} \]
\[ = -350 \text{ Nm} \]

\[ A_3 = -350 (1) \text{ Nm} \]
\[ = -350 \text{ Nm} \]

\[ A_4 = -950 (1) \text{ Nm} \]
\[ = -950 \text{ Nm} \]
Example

Draw the shear and bending moment diagram for the beam below.