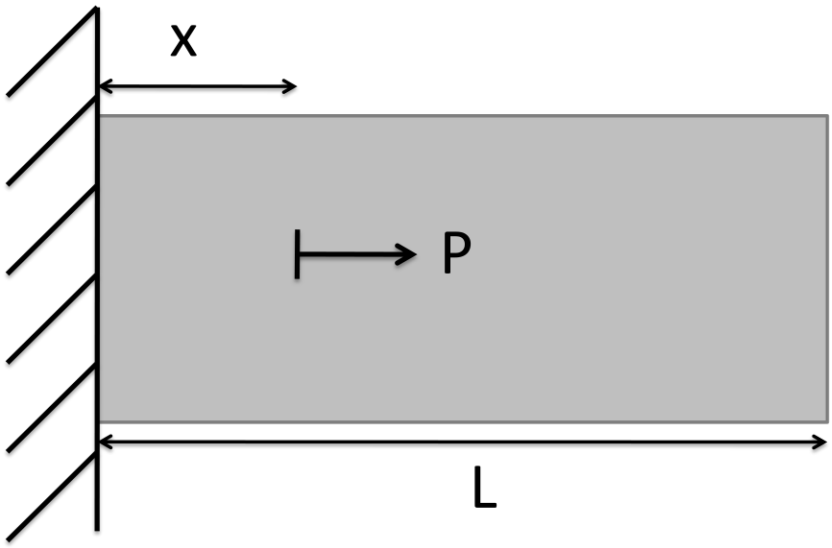
Example Problem:

A uniform beam (L=100in) is clamped at only its left end. A load P=2000lb is applied to the right at a point x=30in from the left clamp. The beam is made of steel (E=30e6 psi) and has a cross-sectional area of 20 in^2.



Segment 1: x1=0in x2=30in

Segment 2: x1 = 30in x2 = 100in

In segment 2, the load is 0lb. Both the stress and displacement in this section is zero.

Segment 1:

$$\sigma_{free} = \frac{P}{A} = \frac{2000\ lb}{20\ in^2} = 100\ psi$$

$$\delta_{free} = \frac{PL}{AE} = \frac{2000\ lb\ 30\ in}{20\ in^2\ 30e6\ psi} = 1.0e\text{-}4\ in$$