To do ...

- Quiz 2 this week *(ends on Sat)*
- WA 4 due *Sun*
- HW 8 PL due *Tues*
- HW 9 ME due *Thurs*
What is the equivalent system?
Replace the force system acting on the post by a resultant force and resultant moment about point A, and specify where its line of action intersects the post AB measured from point A.
Reduction of a simple distributed load
Reduction of a simple distributed load

In structural analysis, we often are presented with a distributed load \( w(x) \) (force/unit length) and we need to find the equivalent loading \( F \).

Example of such forces are winds, fluids, or the weight of items on the body’s surface.
Triangular loading

\[ w(x) \]

\[ w(L) = w_0 \]
Rectangular loading \[ w(x) = w_0 \]
Determine the magnitude and location of the equivalent resultant of this load.
The diagram illustrates a side view of a head and neck, with the following annotations:

- **A** is a point labeled with $12$ lb/ft,
- **B** is a point labeled with $18$ lb/ft,
- **w** is the weight per unit length given by $w = 12(1 + 2x^2)$ lb/ft,
- The horizontal distance from **A** to **B** is marked as $0.5$ ft.

The diagram on the right side shows a wall with a variable pressure distribution $p = (4z^{1/2})$ kPa. The wall is supported at two points and has a height of $4$ m. The pressure at the bottom of the wall is $8$ kPa. The height from the bottom of the wall to a point labeled $h$ is $z.$
Chapter 5: Equilibrium of rigid bodies
Main goals and learning objectives

- Develop the equations of equilibrium for a rigid body
- Introduce the concept of the free-body diagram for a rigid body
- Solve rigid body equilibrium problems using the equations of equilibrium
Equilibrium of a Rigid Body

In contrast to the forces on a particle, the forces on a rigid-body are not usually concurrent and may cause rotation of the body.

We can reduce the force and couple moment system acting on a body to an equivalent resultant force and a resultant couple moment at an arbitrary point O.
Equilibrium of a Rigid Body

Static equilibrium:
Maintained by reaction forces and moments

Assumption of rigid body
Process of solving rigid body equilibrium problems

1. Create idealized model (modeling and assumptions)

2. Draw free body diagram showing ALL the external (applied loads and supports)

3. Apply equations of equilibrium
Equilibrium in two-dimensional bodies

Support reactions

- Roller
- Smooth pin or hinge
- Fixed support
The uniform truck ramp has weight 400 lb and is pinned to the body of the truck at each side and held in the position shown by the two side cables. Determine the reaction forces at the pins and the tension in the cables.
The operator applies a vertical force to the pedal so that the spring is stretched 1.5 in. and the force in the short link at B is 20 lb. Determine the vertical force applied to the pedal.