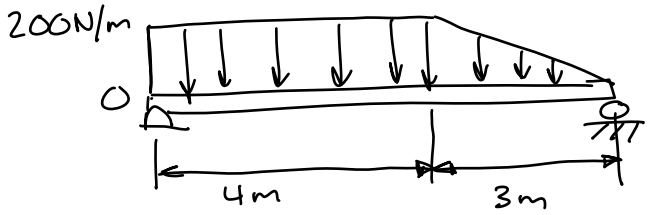
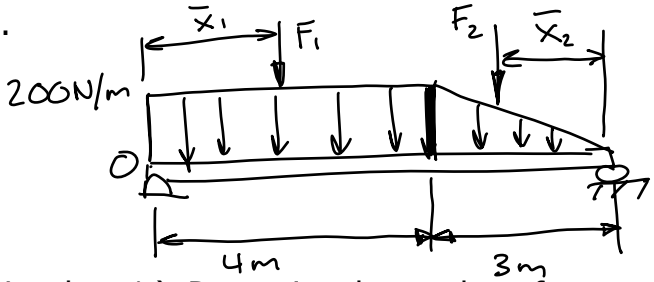
Distributed Loads

Problem Statement: Replace the force system with an equivalent resultant force, and specify its point of application with respect to point O.



1.) Draw the FBD.



Distributed Load: 1.) Determine the resultant force.

$F_1 = (200N/m)(4m) = 800N$

$F_2 = \frac{1}{2}(200N/m)(3m) = 300N$

2.) Determine $\bar{x}$.

$\bar{x}_1 = \frac{1}{2}(4m) = 2m$

$\bar{x}_2 = \frac{2}{3}(3m) = 2m$

2.) Resolve each force into components.

$F_{1x} = 0$ $\quad F_{1y} = -800N$

$F_{2x} = 0$ $\quad F_{2y} = -300N$

3.) Determine the resultant force and its direction.

$F_{Rx} = 0$

$F_{Ry} = -800N - 300N = \underline{-1100N}$

Direction ↓

4.) Determine the moment arms for each component.

$d_{1y} = 2m$

$d_{2y} = 7m - 2m = 5m$

5.) Determine the resultant moment.

$+\circlearrowleft M_{RO} = \Sigma M_O = -(800N)(2m) - (300N)(5m)$

$\boxed{M_{RO} = -3100N \cdot m}$

6.) For a single equivalent force system, determine d.

$$d = \frac{3100N \cdot m}{1100N} = 2.82m$$

7.) Draw the equivalent system.