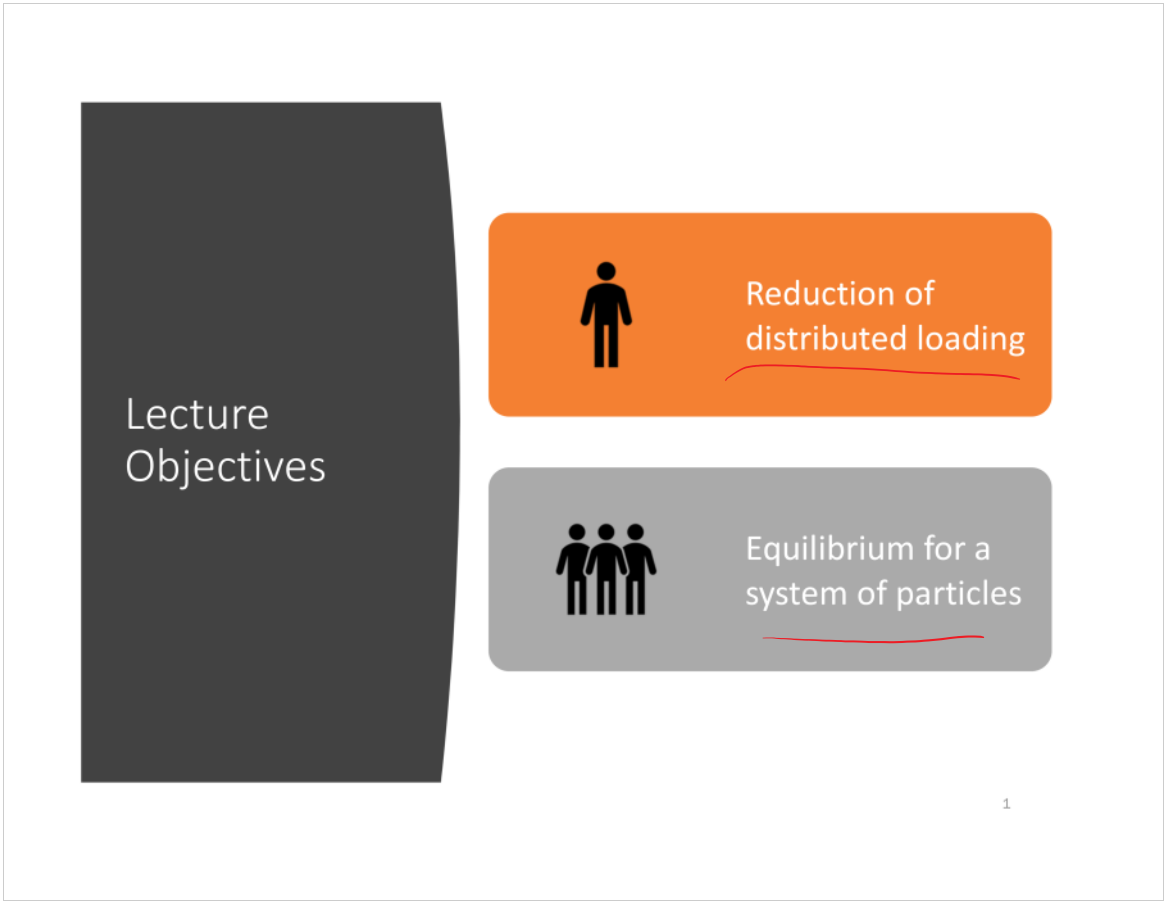
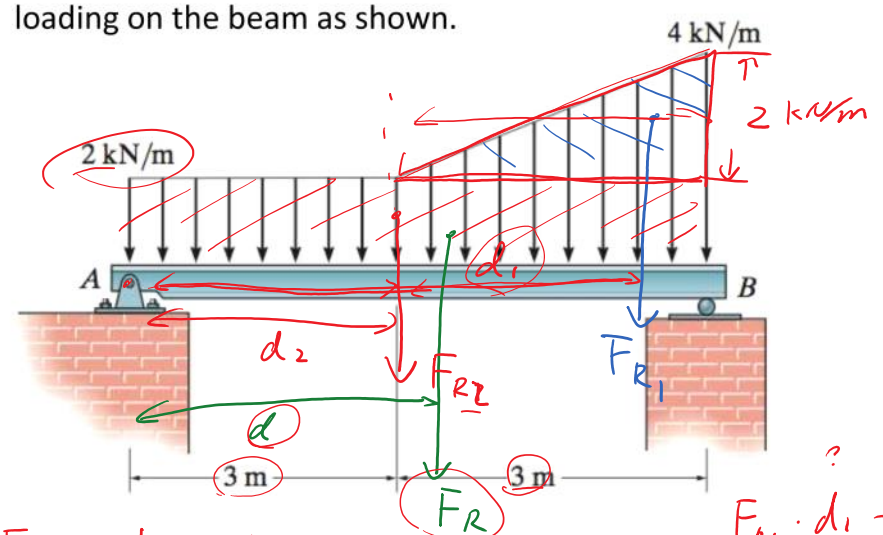
Lec11

Wednesday, October 14, 2020 7:53 AM



Example – composite method

Find the equivalent force and its location from point *A* for the loading on the beam as shown.



$F_{R_1} = \frac{1}{2}\, 2\ \text{kN/m} \cdot 3\ \text{m} = 3\ \text{kN}$

$F_{R_2} = 2\ \text{kN/m} \cdot 6\ \text{m} = 12\ \text{kN}$

$F_R = F_{R_1} + F_{R_2} = 15\ \text{kN}$

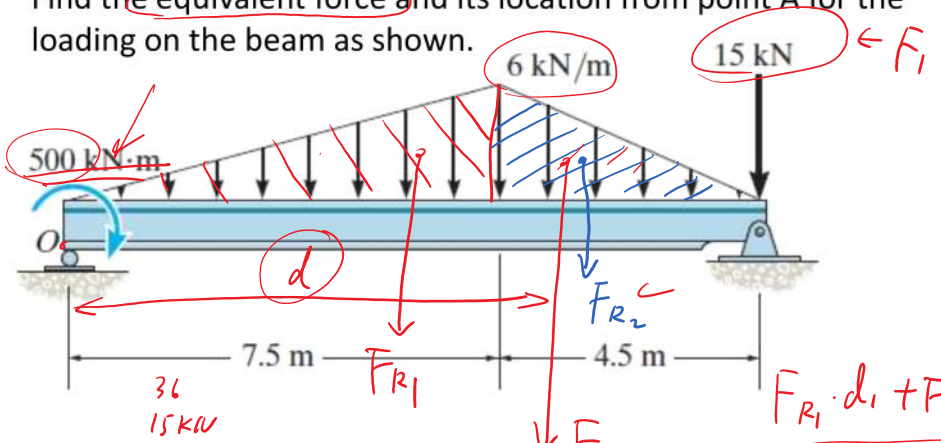
$F_{R_1} \cdot d_1 + F_{R_2} d_2 = F_R \cdot d$

$d_2 = 3\ \text{m}$

$d_1 = 3 + \frac{2}{3} \cdot 3 = 5\ \text{m}$

Example

Find the equivalent force and its location from point A for the loading on the beam as shown.



$F_R = F_1 + F_{R_1} + F_{R_2} = 51\ \text{kN}$

$F_{R_1} = \frac{1}{2} \times 7.5 \times 6 = 22.5\ \text{kN}$

$F_{R_2} = \frac{1}{2} 4.5 \cdot 6 = 13.5\ \text{kN}$

$F_{R_1} \cdot d_1 + F_{R_2} \cdot d_2 + F_1 \cdot L + M = F_R \cdot d$

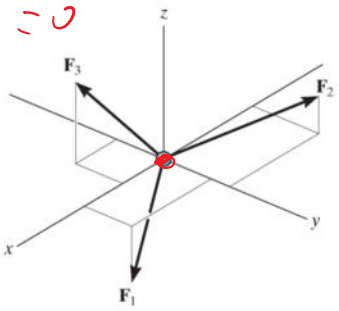
$d_1 = \frac{2}{3} 7.5 = 5\ \text{m}$

$d_2 = 7.5 + \frac{1}{3} 4.5 = 9\ \text{m}$

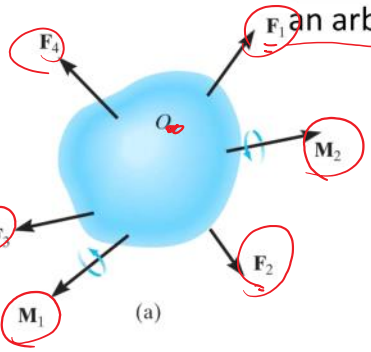
$L = 7.5 + 4.5 = 12\ \text{m}$

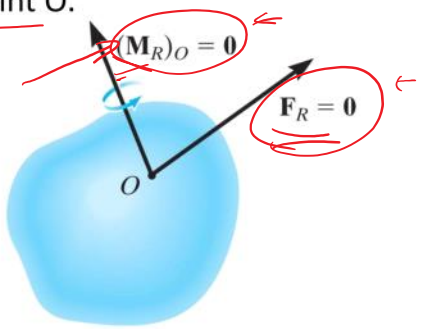
$d = 17.92\ \text{m}$

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.

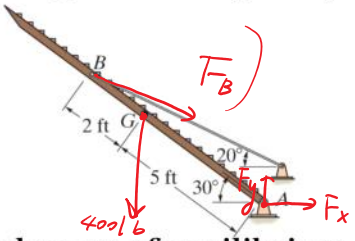




Process of solving rigid body equilibrium problems

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.

1. Create idealized model (modeling and assumptions)



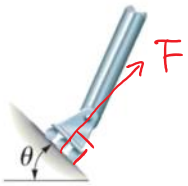
2. Draw free body diagram showing ALL the external (applied loads and supports)

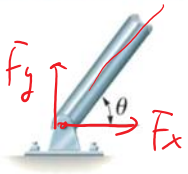
3. Apply eqns of equilibrium

Equilibrium in two-dimensional bodies

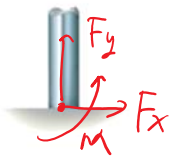
Support reactions

one unknow





two unknows



three unknows

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i-Clicker Time

Support reactions

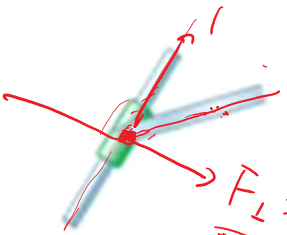
How many unknowns are associated with a pin-connect smooth collar?

A) 1 force

B) 2 force

C) 1 force and 1 moment

D) 2 forces and 1 moment



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i-Clicker Time

Support reactions

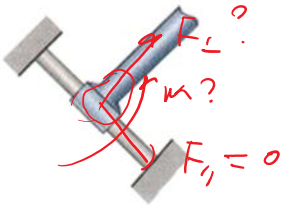
How many unknowns are associated with a fixed-connected smooth collar?

A) 1 force

B) 2 force

C) 1 force and 1 moment

D) 2 forces and 1 moment



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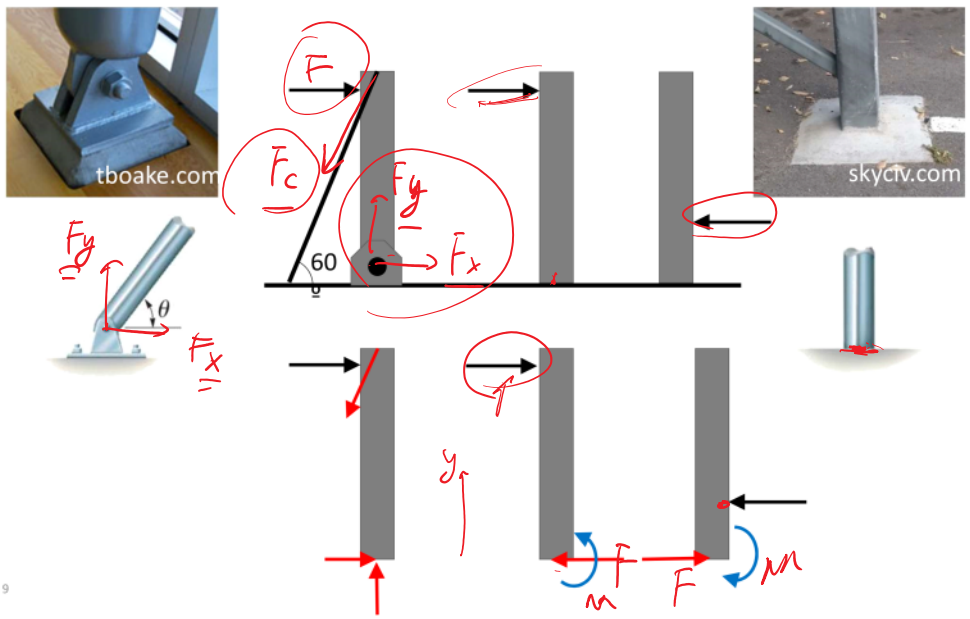
Equilibrium in two-dimensional bodies

Active Forces vs. Support reaction components



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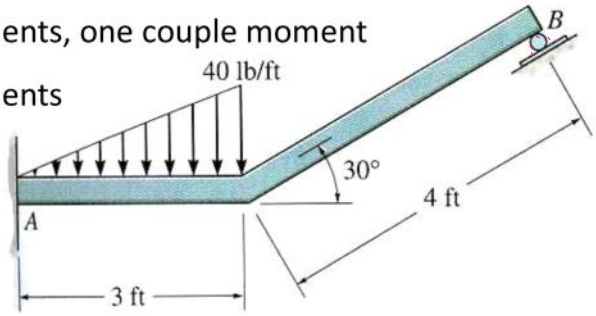
i-Clicker Time

How many reaction support force components and couple moments are there in this problem?

A) Two force components, two couple moments

B) One force component, two couple moments

C) Three force components, one couple moment

D) Three force components