University of California, Davis
Society of Manufacturing Engineers at UC Davis

ENG 35*	Statics	Unofficial

Preliminary Practice

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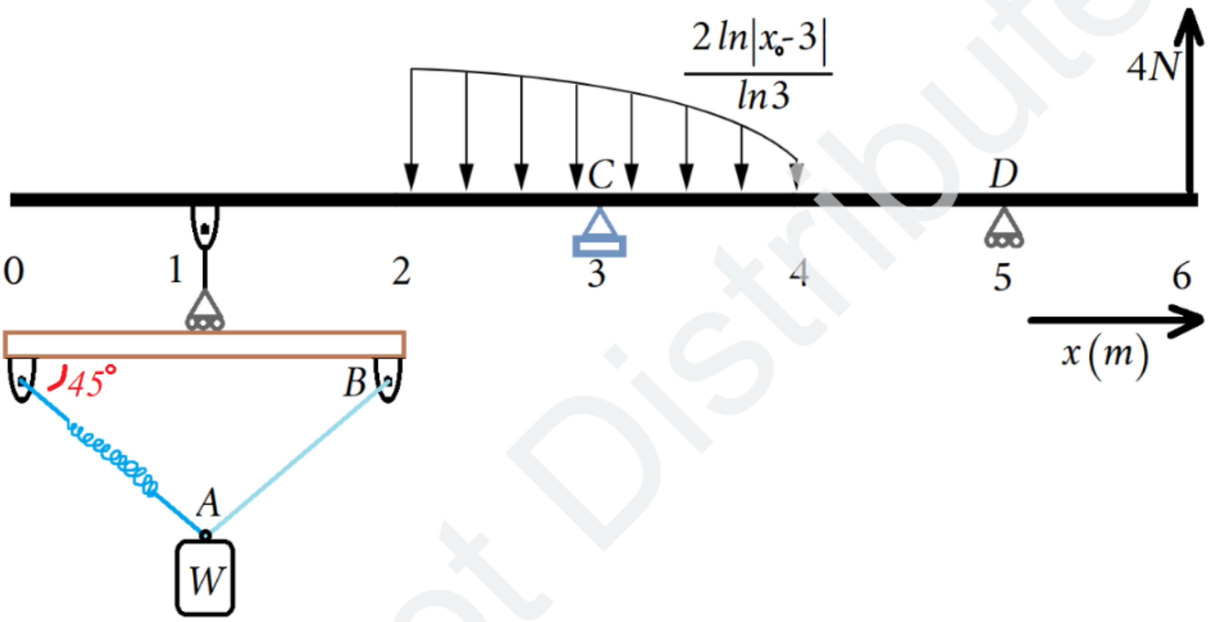
Question 1) Springs, Distributed Loads, Shear and Moment Diagrams	
Question 2) Friction and Hydrostatics	
Question 3) Internal Force (Forthcoming)	

Question 1) Springs, Distributed Loads, Shear and Moment Diagrams

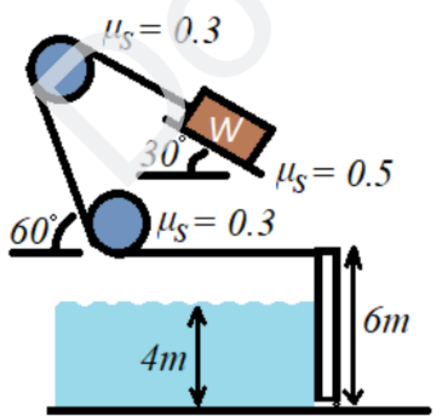
For the beam shown below, there is a support that attaches to a weightless plank attached to a spring and a string *AB*, both attached to a weight of W = 6N. The spring is 1 m long if unstretched and has a spring constant of k = 1N/m. The string's length is specifically engineered so the weight is centered at x = 1 m. Note that the pinned supports on the weightless plank are not necessarily located at x = 0 m or x = 2 m, but they are equidistant from the middle of the plank where the roller support resides.

The distributed load's function can be modeled as $2 \ln|x_0 - 3| / \ln 3$ [N], where x_0 would equal to x - 2 (since the distributed load starts at x = 2 m). So, x_0 is between 0 m and 2 m.



a) How long is string *AB*?
b) Draw the complete shear and moment diagrams. Please label your graphs.

Question 2) Friction and Hydrostatics

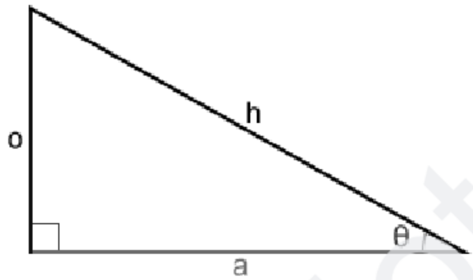


An aquarium has water filled up to 4 m contained by a bar that is 6 m tall. The bar is held to a string that goes through two cylindrical supports with a static friction of 0.3. The string is ultimately connected to a weight of W on a 30 degree inclined surface with a static friction of 0.5. The string is parallel with that surface. Your job is to determine the range of W in kN so that the block does not slide down or up nor will the water break through the bar and leak out of the aquarium, releasing all the fish.

Question 3) Internal Force (Work in Progress - Not in Version 1)

Useful References and Equations

- $\sum F_N = 0$ at the N-axis
- $M_A = \sum(d_A)F_A$, where d_A is the displacement from point A to the point of the force F_A's exertion
- $g = 9.806\ m/s^2$
- Hydrostatic pressure of water $p = \rho g h$, where, for water, mass density $\rho = 1000\ kg/m^2$
- $x_{AVG} = (1/W) \int_A^B x\, w\, dx$, where W is the total weight of the distributed load that spans between $A \leq x \leq B$ and w is the function of the distributed load
- $\int \ln(y)\, dy = y \ln(y) - y + C$, where C is a constant number
- $\int y \ln(y)\, dy = 0.5y^2 \ln(y) - 0.25y^2 + C$, where C is a constant number
- N is equivalent to $kg*m/s^2$



$\sin\theta = o/h$

$\cos\theta = a/h$

$\tan\theta = o/a$

Pinned support:  can have a reaction at any direction but not moments

Roller support:  can only have a reaction pointing perpendicular to the support