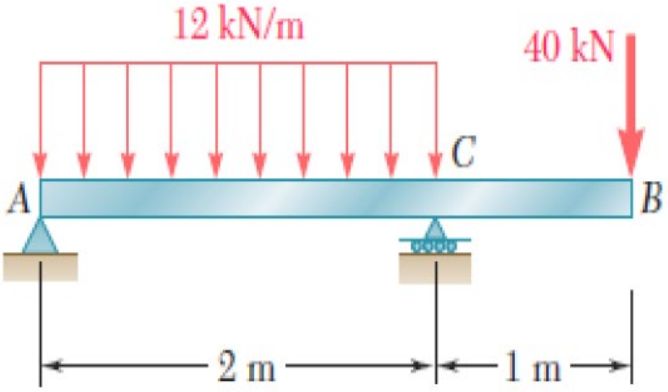
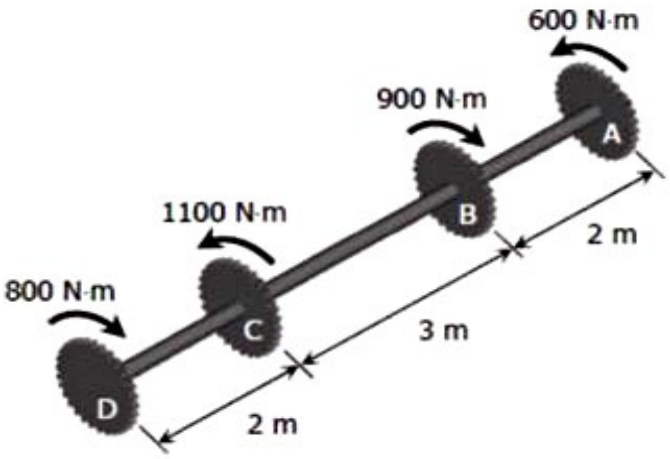
Strength of Materials

Q.1/ Overhanging beam shown in figure below, with (**0.08**) m wide, if the bending stress is not to exceed (**$20*10^6$**) Pa, determine the <u>minimum height</u> of the beam.

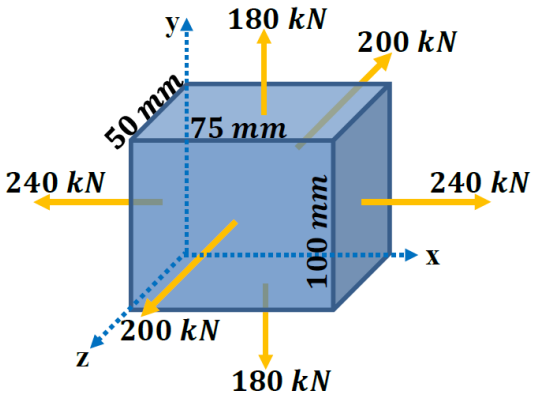


Q.2/ An aluminum shaft with a constant diameter of 50 mm is loaded by torques applied to gears attached to it as shown in figure below. Using G = 28 GPa, determine the relative angle of twist of gear D relative to gear A.

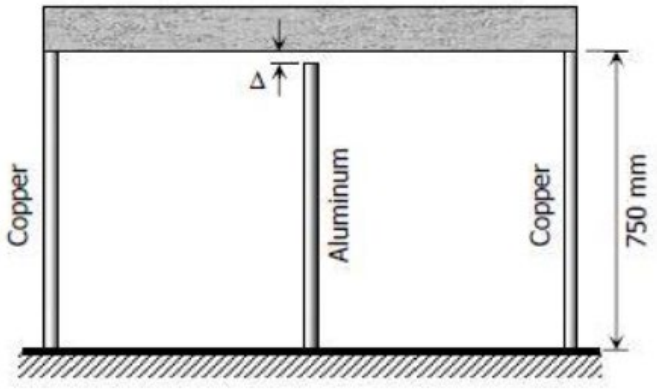


Q.3/ A 50-mm diameter bar is used as a simply supported beam 3 m long. Determine the largest uniformly distributed load that can be applied over the right two-thirds of the beam if the flexural stress is limited to 50 MPa.

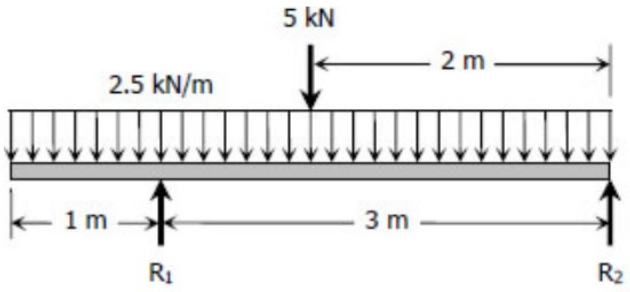
Q.4/ Find a single force in x-direction that gives the same change in the direction parallel to x, for shown figure below. Take $v=1/3$ and $E=70$ GPa.



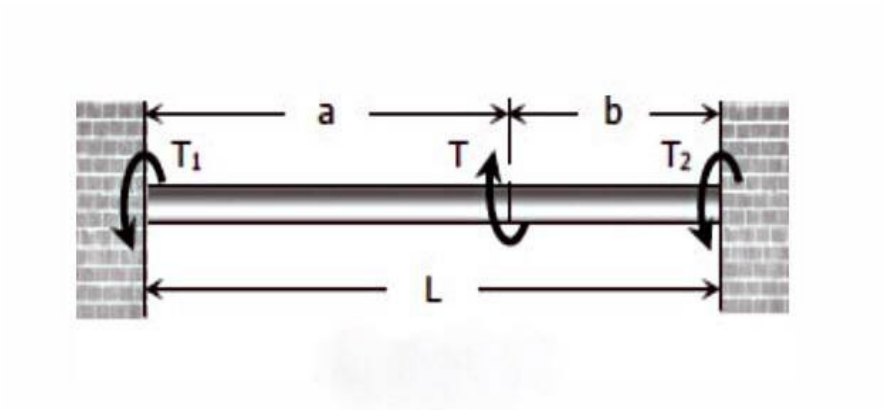
Q.5/ As shown in figure below, there is a gap between the Aluminum bar and the rigid slab that is supported by two Copper bars. At (**10**°C), (**Δ= 0.18)** mm. Neglecting the mass of the slab, calculate the stress developed in each rod when the temperature in the assembly is increased to (**95)** °C. For each copper bar, (**A=500)** mm^2, (**E=120)** GPa, and (**α=16.8)** μm/(m·°C). For the aluminum bar, (**A=400)** mm^2, (**E=70)** GPa, and (**α=23.1)** μm/(m·°C). **(10 Marks)**



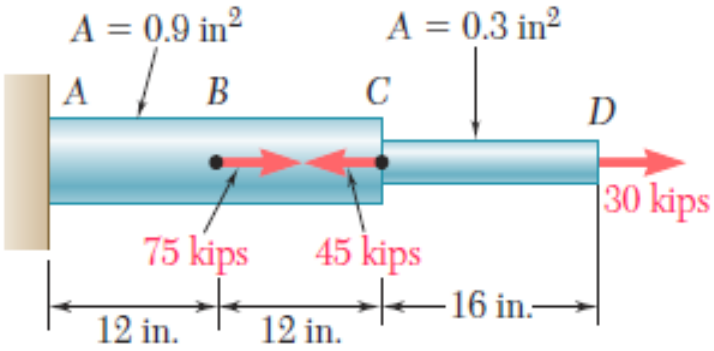
Q.6/ Overhanging beam shown in figure below, with (**0.08**) m wide, if the bending stress is not to exceed (**20*10^6**) Pa, determine the <u>minimum height</u> of the beam.



Q.7/ A torque T is applied, as shown in figure below, to a solid shaft with built-in ends. Prove that the resisting torques at the walls are $T_1 = Tb/L$ and $T_2 = Ta/L$?

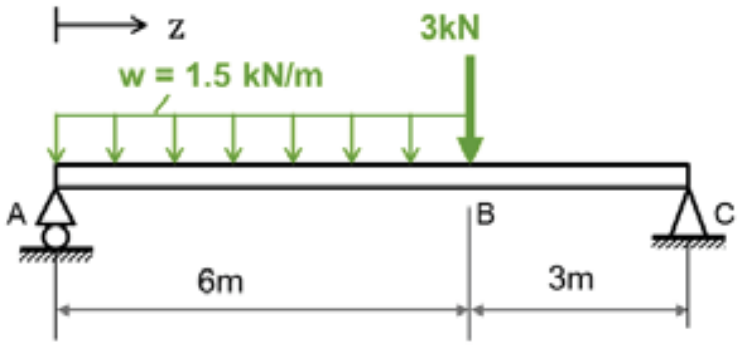


Q.8/ Determine the deformation of the steel rod shown in figure below under the given loads. E=29 x10^6 psi.

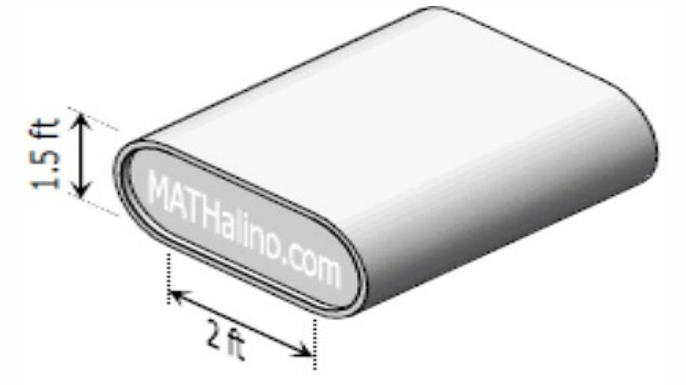


Q.9/ The simply supported beam in figure below has a rectangular cross section 100 mm wide and 200 mm high.

1. Compute the maximum bending stress in the beam.
2. Compute the bending stress at a point 3 m form support (A) that is 25 mm below the top of the beam.



Q.10/ Derive an expression to find the longitudinal and hoop stresses for the vessel shown in figure below. After then, find them if the internal pressure of 125 psi.



Practical Part

Q.1/ In compression test, discuses the shape of samples before and after the test?

Q.2/ In a Brinell hardness test, a 1500 kg load is pressed into a specimen using a 10 mm diameter hardened steel ball. The resulting indentation has a diameter of 3.2 mm. Determine the Brinell hardness number for the metal?

Q.3/ Enumerate the factors affect the result of impact test?

Q.4/ What are the aims of tensile test, illustrate the stress strain curve?

Q.5/ Explain in details the shear modulus (G)?

Q.6/ Explain with drawing the derivative of the following law:

$$W = m \times g \times R (\cos \beta - \cos \alpha)$$