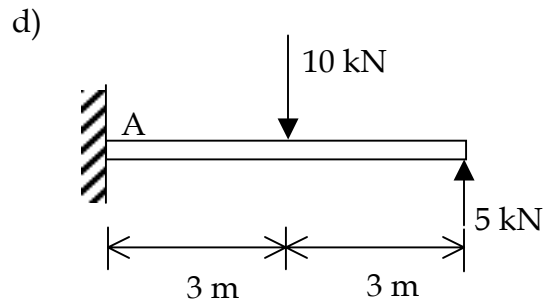
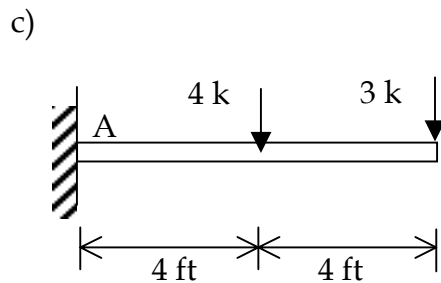
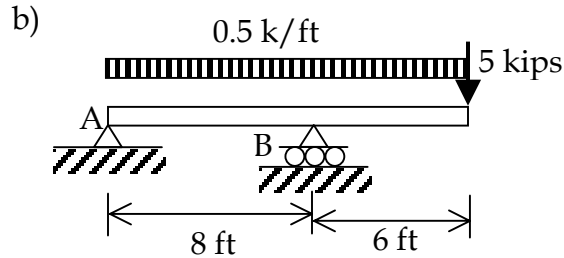
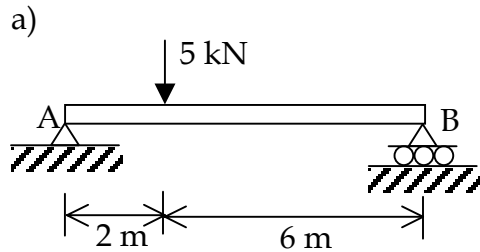


Homework #4: Beam Design

Due: Lecture #11

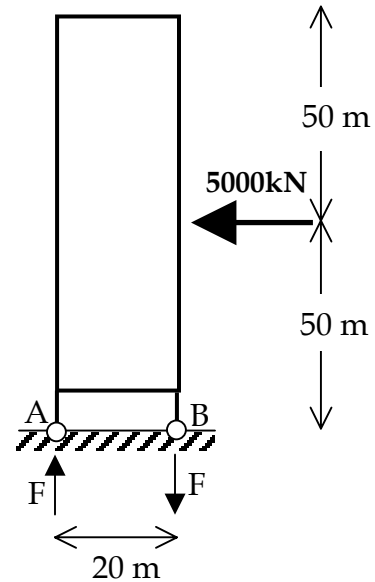
- 1) Draw the shear and moment diagram for each beam under the given loading. Provide all values for the support reactions in each case and label the maximum values of shear and moment.



- 2) The beams in problems 1(b) and 1(c) from above will be built with a rectangular timber glulam beam that is 24" deep and 5" wide. The allowable compression stress in the beam is 1,000 psi (1.0 ksi).

- What is the moment of inertia, I , for this beam if it is supported on the narrow edge?
- Calculate the maximum compression stress in the beam due to the loading in problem 1(b) above. Does the stress exceed the allowable stress in the beam?
- Calculate the maximum compression stress in the beam due to the loading in problem 1(c) above. Does the stress exceed the allowable stress in the beam?
- Sketch a beam profile to carry the loads most efficiently for both cases.

- 3) A tall building must resist lateral loading due to wind. The building shown is 100 meters high, and it must resist a total wind load of 5000 kN, which is assumed to act at mid-height of the building. The building is supported on two rows of columns, one at A and one at B, and these columns must provide a force couple to resist the wind loading. The wind acts to overturn the building, and the force couple at the base provides a stabilizing moment. The columns are spaced 20 meters apart, and each row of columns carries the same magnitude of force, F .



- What is the value of F (in kN) necessary to resist the moment applied due to wind loading?
- Are the columns at A in tension or compression? The columns at B? What would be the effect of spreading the columns further apart at the base?
- This analysis has neglected the weight of the building. If the building weighs 30,000 kN, and this weight is shared between the columns on each side, what is the force in each row of columns due to the combined weight and wind loading?