Mechanics of Materials

Lecture 21 - Statically indeterminate beams

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schedule

- 3 Nov - Statically Indeterminate Beams, HW 9 Due, HW 8 Self-Grade Due
- 5 Nov - Statically Indeterminate Beams
- 10 Nov - Exam 3 Review, HW 10 Due, HW 9 Self-Grade Due
- 12 Nov - Exam 3
- 17 Nov - Stress Concentration
- 19 Nov - Buckling
- 20 Nov - Project 3 Due
- 1 Dec - Bucking, Final Review
- 3 Dec - Final Review, Problem Solving, HW 11 Due

outline

- statically indeterminate beams
- indeterminate beams - superposition
- group problems

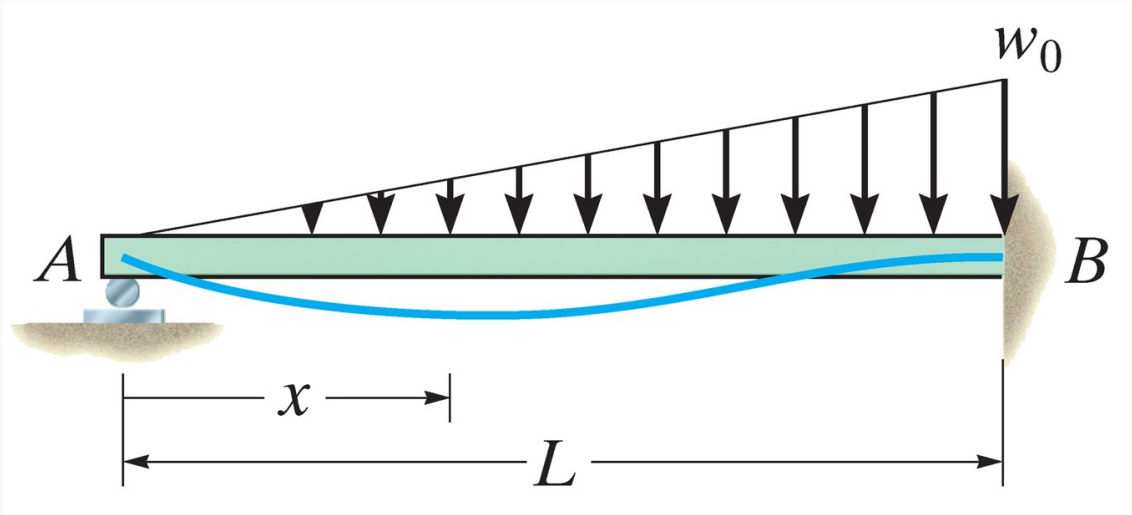
statically indeterminate

- If we have redundant supports, we can have some difficulty finding the displacement
- There are several approaches to solve these problems, we will consider direct integration and superposition

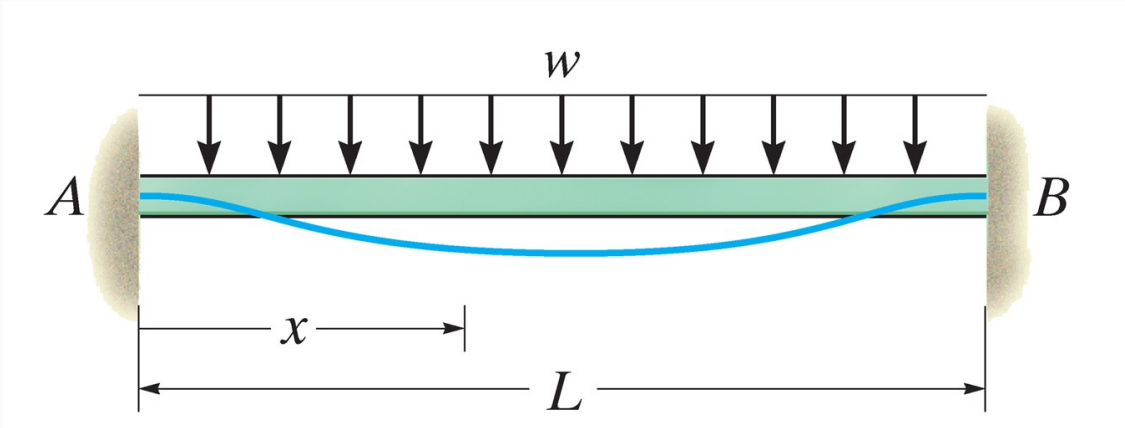
integration

- We can take the extra unknowns and include them in our formulation for $M(x)$
- They will be solved for with the extra boundary conditions applied

example 12.17



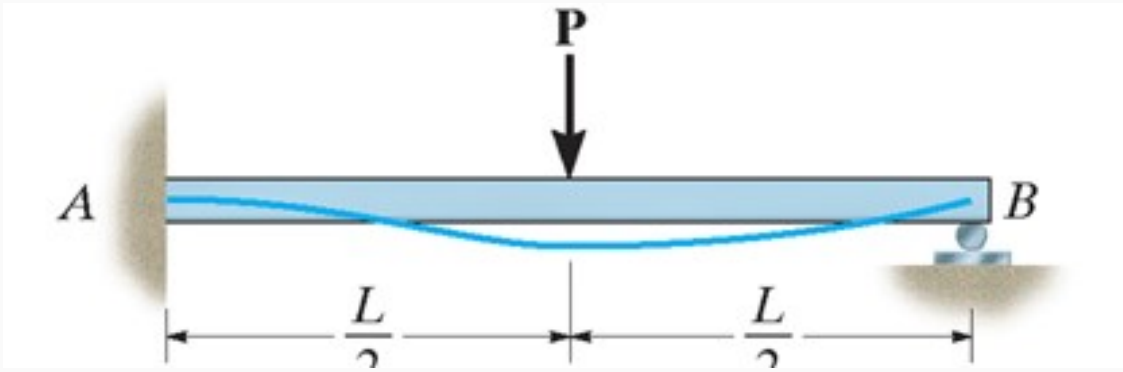
example 12.18



superposition

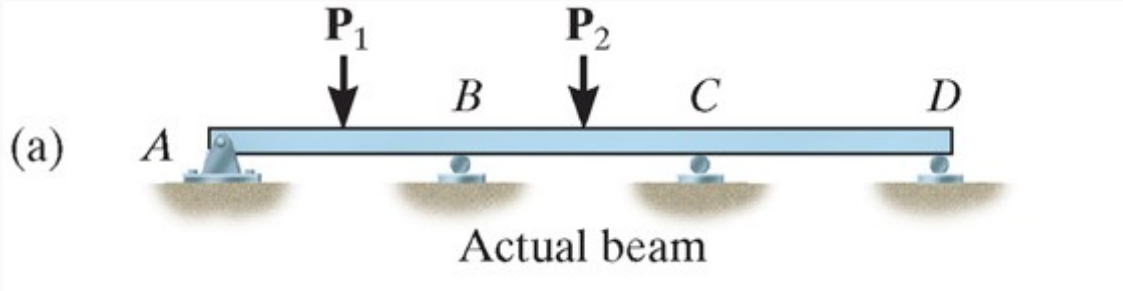
- To use superposition for finding deflection of statically indeterminate beams, we must first identify redundant reactions
- We initially remove these, then superpose them back such that the deflection at that point is 0
- The choice of which reaction(s) is redundant is arbitrary, we can choose whatever we are most comfortable with
- We use Appendix C to find deflection and slope

superposition



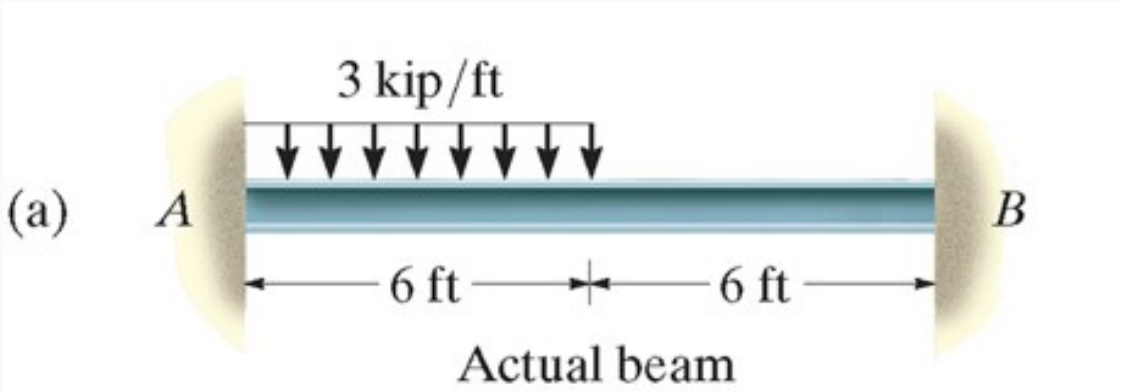
We can consider any reaction to be redundant.

higher order indeterminacy



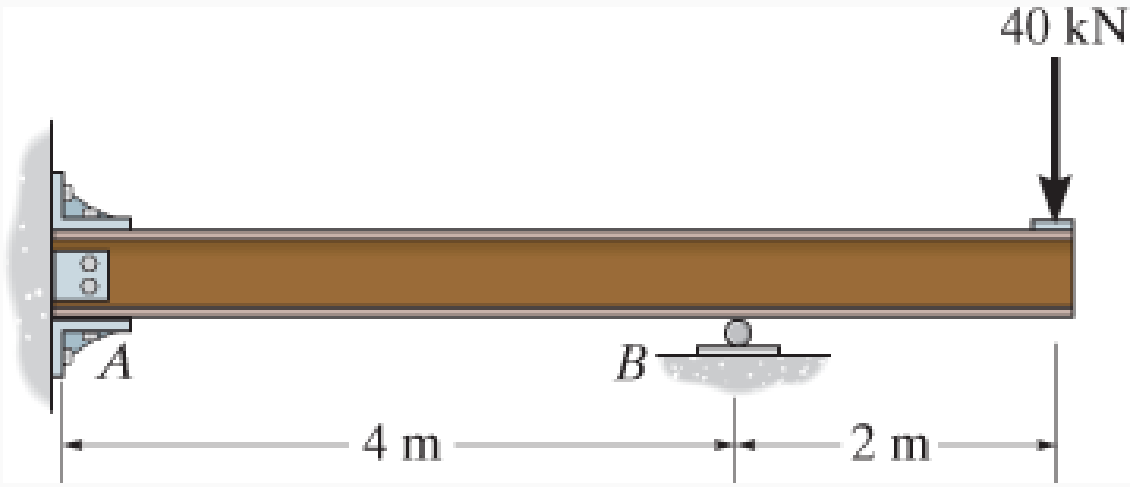
We need to treat each reaction separately to match Appendix C.

example 12.22



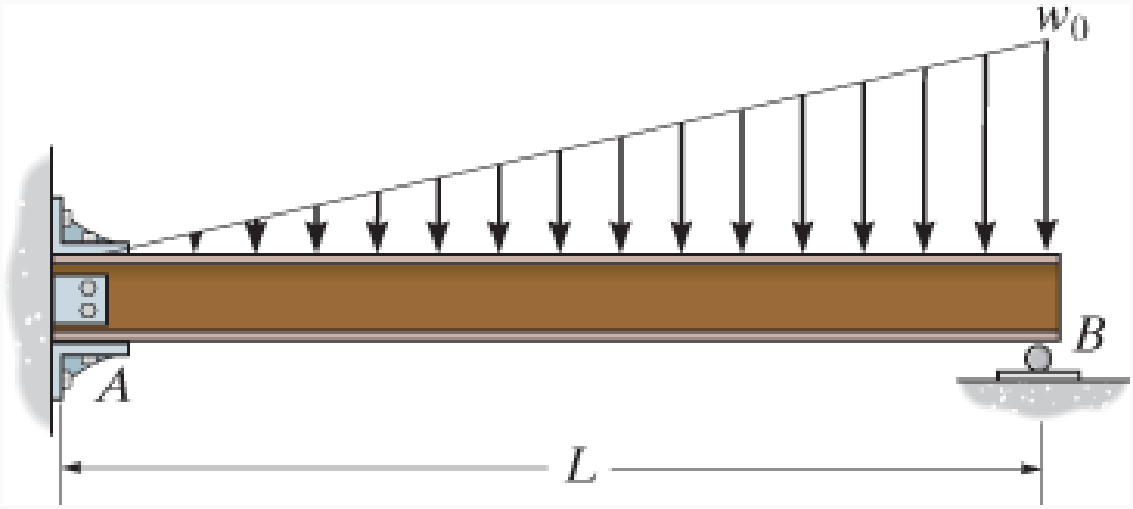
Determine the moment at B.

group one



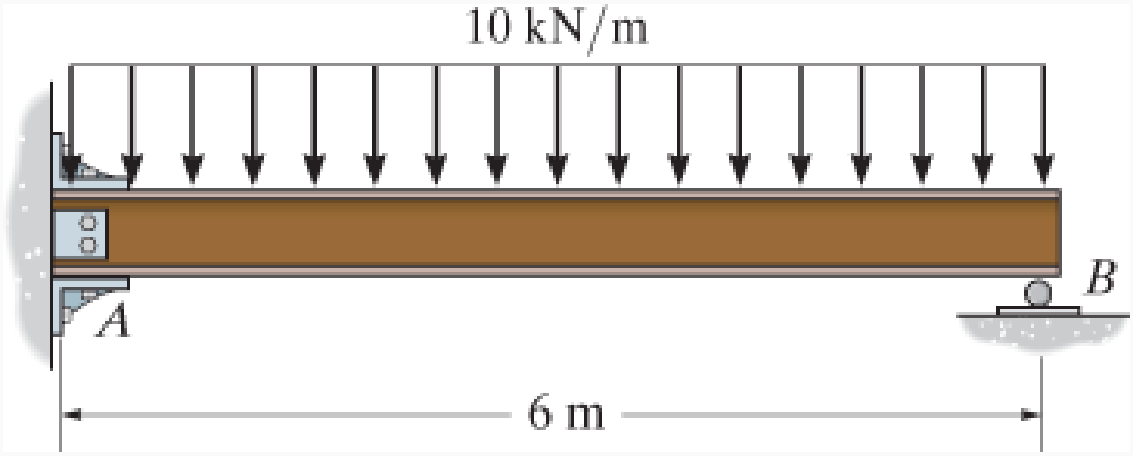
Determine the reactions at A and B (EI is constant).

group two



Determine the reactions at A and B (EI is constant).

group three



Determine the reactions at A and B. The support at B settles 2 mm. $E = 200$ GPa, $I = 65.0$(10-6)m 4.