

1. Problem 1.2-10 (Gere, Mechanics of Materials)
2. Problem 1.2-12 (Gere, Mechanics of Materials)
3. Problem 1.3-7 (Gere, Mechanics of Materials) – place the values for load and elongation into an Excel spreadsheet. Have columns for computing stress and strain. Plot stress vs. strain in Excel. Obtain the desired quantities from the graph.
4. Problem 1.5-5 (Gere, Mechanics of Materials)
5. Problem 1.6-2 (Gere, Mechanics of Materials)
6. Problem 1.6-4 (Gere, Mechanics of Materials)
7. Problem 1.6-9 (Gere, Mechanics of Materials)
8. The bicycle rack (<http://www.andrew.cmu.edu/~lkara/images/bikerack.html>) is supported by four rubber pads that rest against the vehicle, and a pair of straps which are hooked around the back edge of the trunk. The rubber pads are attached to the ends of tubular members by pins which enable the pads to pivot. Pivoting of the pads is necessary for the rack to be attached to various vehicles. Also to accommodate various vehicles, the members that support the bicycles can be set at different inclinations. To adjust the inclination, the user loosens the bolts (one on each side) with the knobs, extracts the bolt, shifts the support members to align with another hole, and replaces and retightens the bolt. For the problem below the inclination is fixed at that shown in the diagrams.

One can also attach side straps to the side edges of the trunk. Side straps can resist side-to-side forces, which can occur during a sudden turn, for example. The side straps are unattached in the side view image.

Problem

Two 15 kg bikes are placed on the bike rack which is secured to the car. Say that the bikes are placed so that the left and right halves of the rack carry the weight equally. Assume that the side straps are not used. Relevant dimensions can be extracted from the diagram superposed on the grid (<http://www.andrew.cmu.edu/course/24-261/images/bikerack.html>).

You are to determine the forces exerted by the car on the rubber pads and the tension in the straps. To do this, you can treat the problem as two-dimensional. Consider the bike rack as one single body and draw a two-dimensional free body diagram of the rack. Set up the equations of equilibrium and solve for the forces discussed above.

Hints:

- ?? Think carefully about the interaction between the swiveling pads and the car surface.
- ?? Simplify the algebra by taking moments about a point through which two unknown forces have no moments.