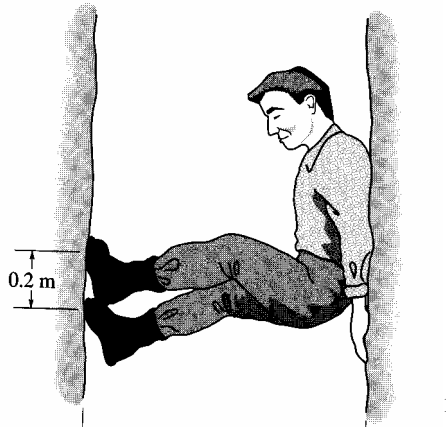


## Homework VIII

Due April 20, 2009

### Design Project 2



The man in the image likes to climb up the vertical crevice near his house. The cliff walls are a total of 300 feet high, and as he's getting older, the climb is harder for him to make. The problem here is to create a device that the man can use to take a break from climbing and rest on. He will have to be able to transport this device up and down the cliff wall every time he wants to climb.

Additional Problem data:

- The cliff walls are vertical, with a distance of 4 feet,  $\pm 2$  inches apart (the width varies slightly at different points).
- Although completely unphysical, to simplify this problem and focus on stress analysis we can assume a friction coefficient equal to 1, if necessary for your design.
- You are not creating a permanent post: he'll carry the device with him, and use it whenever he feels too tired.
- We can assume the man is a fully trained machinist; just send him your design and parts list, and he'll order and build everything on his own.

## 530.215 MECHANICS-BASED DESIGN

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The grading and requirements are going to be slightly more involved than in the first design project. Here are the changes:

- You will need to provide stress analysis at 3 critical points in the design. If your design is so simple that there are only 2 obvious critical points, then just pick a third, non-critical point for completeness.
- Also, concerning the stress analysis: You will need to apply the failure theories this time (von Mises/max distortion energy, Tresca/max shear stress, etc). It will not be acceptable to just compare the highest stress value to the material yield strength.
- Weight and cost will matter! Make sure to pick both a cost and weight that is justifiable in your design constraints. If a part doesn't list it's weight online, estimate the weight roughly. If it's too heavy, he won't be able to carry it with him. He's also buying it with his own money, so don't wipe out his retirement savings.
- The safety factor must also be above a certain minimum value that you must justify. Hint: try to be at least at a value of two. He'll fall if the device breaks...