

Unified Quiz FM2

October 15, 2008

M - PORTION

- Put your name on each page of the exam.
- Read all questions carefully.
- Do all work on that question on the page(s) provided. Use back of the page(s) if necessary.
- Show all your work, especially intermediate results. Partial credit cannot be given without intermediate results.
- Show the logical path of your work. Explain clearly your reasoning and what you are doing. *In some cases, the reasoning is worth as much (or more) than the final answers.*
- Please be neat. It will be easier to identify correct or partially correct responses when the response is neat.
- Be sure to show the appropriate units throughout. Answers are not correct without the units.
- Report significant digits only.
- Box your final answers.
- **Calculators are allowed.**
- **Print-outs of Handout "HO-M-4" along with 2 sides of pages of handwritten material are allowed.**

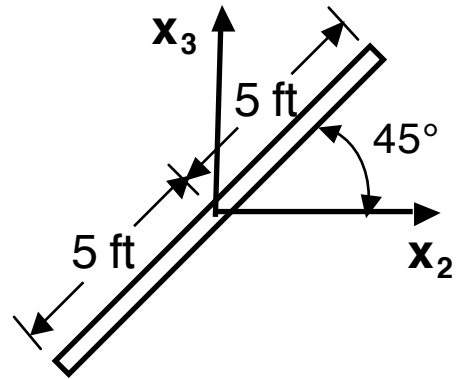
EXAM SCORING

| | |
|-------------|--|
| #1M (1/3) | |
| #2M (1/3) | |
| #3M (1/3) | |
| FINAL SCORE | |

PROBLEM #1M (1/3)

A set of four forces acts in the x_2 - x_3 plane on a 10-foot long bar that passes through and is centered on the origin, and that makes a 45° angle with the axis system as shown. The force vectors and the distance along the bar from the origin at which they act are as follows:

| | |
|---|------------------|
| $\underline{F}_A = (3 \text{ lbs}) \underline{i}_2 + (6 \text{ lbs}) \underline{i}_3$ | acts at + 4 feet |
| $\underline{F}_B = (-2 \text{ lbs}) \underline{i}_2 + (-2 \text{ lbs}) \underline{i}_3$ | acts at 0 feet |
| $\underline{F}_C = (4 \text{ lbs}) \underline{i}_2 + (-1 \text{ lbs}) \underline{i}_3$ | acts at - 1 feet |
| $\underline{F}_D = (6 \text{ lbs}) \underline{i}_2$ | acts at - 3 feet |



- (a) Determine the force system acting at the origin that is equipollent to this force system.

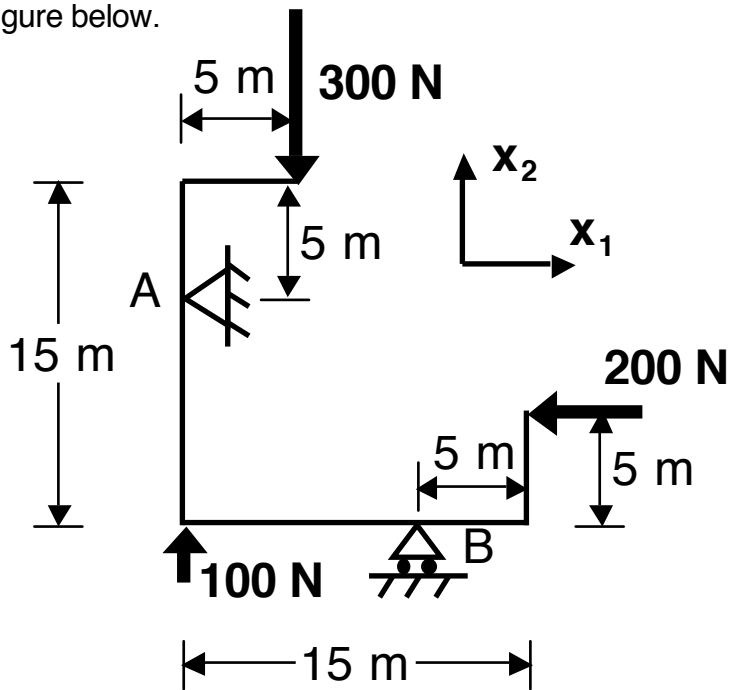
PROBLEM #1M (continued)

- (b) Can this system be put in equilibrium by applying one force at any point along the bar? If so, what is that force and what is the location? If not, clearly explain why not.

PROBLEM #1M (continued)

PROBLEM #2M (1/3)

A structural configuration has overall dimensions of 15 meters by 15 meters. The structure is supported at two different heights with a pin at the far left 10 meters above the bottom of the structure where a roller support is located. Loads are applied at three points: a 300-Newton vertical load at the upper tip, a 200-Newton horizontal load at the right tip, and a 100-Newton vertical load at the lower left corner of the structure. This overall configuration is shown in the figure below.



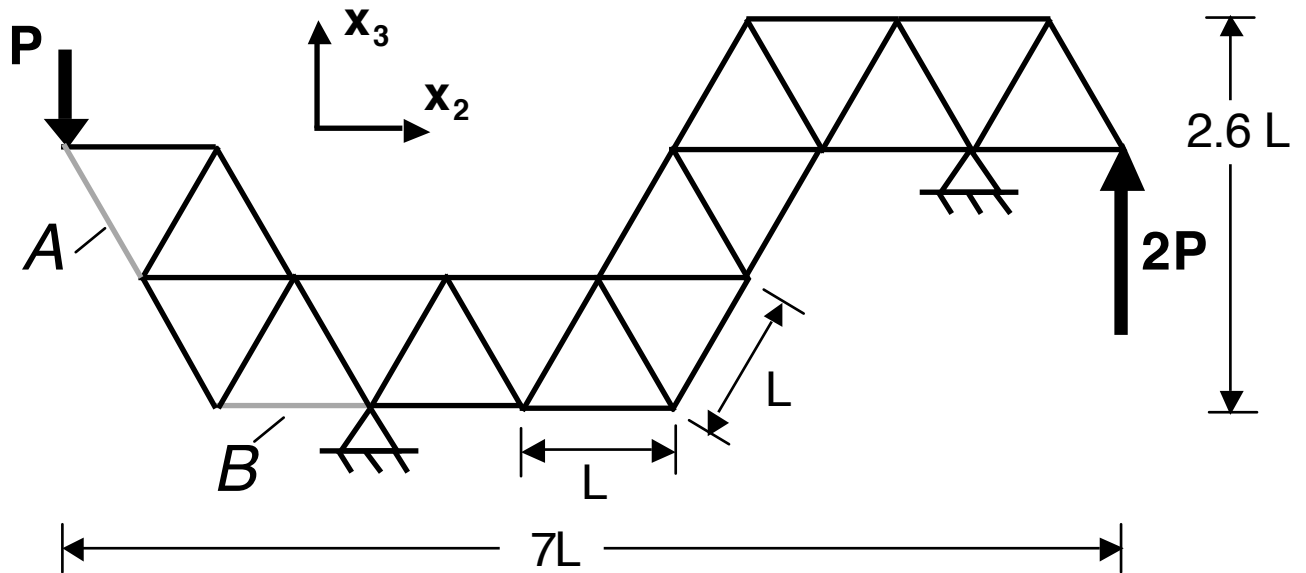
- (a) Determine the reaction forces at the two support points A and B **or** indicate all information available to determine the reaction forces and the additional information that is needed to fully determine these forces.

PROBLEM #2M (continued)

- (b) How are these answers affected by the material from which the structure is made?
Explain clearly.

PROBLEM #3M (1/3)

The following truss has various triangular bays made of bars all of length L . The truss is loaded by two tip loads, P and $2P$, has overall dimensions of $7L$ in the x_2 -direction and $2.6L$ in the x_3 -direction, and is pinned at two points, as shown in the figure below.



- (a) What is the “class/category” of this structural configuration (Dynamic, Statically Determinate, Statically Indeterminate)? Clearly explain your reasoning.

PROBLEM #3M (continued)

- (b) Determine the load in the diagonal bar of the truss labeled "A" (highlighted in the figure) **or** indicate the additional information needed in order to determine this load.

PROBLEM #3M (continued)

- (c) Determine the load in the diagonal bar of the truss labeled "B" (highlighted in the figure) **or** indicate the additional information needed in order to determine this load.