

9:00 - 11:00  
32-155

MIT ID# (last four digits) \_\_\_\_\_

**Unified Quiz FTM1**  
September 26, 2007

**M - PORTION**

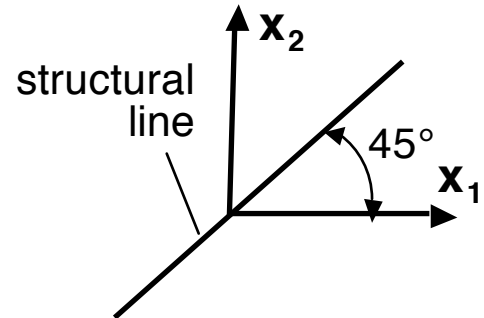
**EXAM SCORING:**

#1M (50%)	
#2M (50%)	
FINAL SCORE	

**PROBLEM #1M (50%)**

A set of four forces acts in the  $x_1$ - $x_2$  plane at points along a structural line through the origin at a  $45^\circ$  angle to the axis system. This configuration is illustrated in the accompanying figure. The force vectors and the  $(x_1, x_2)$  points at which they act are as follows:

$\underline{F}_1 = (2 \text{ N}) \underline{i}_1 + (5 \text{ N}) \underline{i}_2$	acts at (1 m, 1 m)
$\underline{F}_2 = (5 \text{ N}) \underline{i}_1$	acts at (-3 m, -3 m)
$\underline{F}_3 = (-3 \text{ N}) \underline{i}_1 + (2 \text{ N}) \underline{i}_2$	acts at (-1 m, -1 m)
$\underline{F}_4 = (-10 \text{ N}) \underline{i}_2$	acts at (5 m, 5 m)



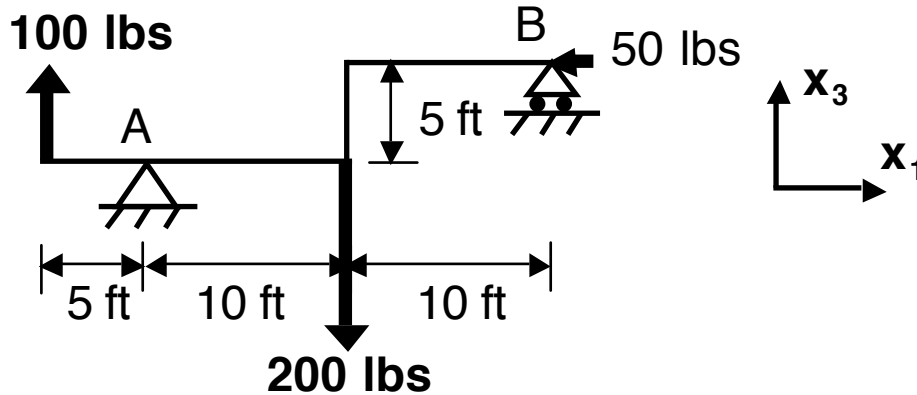
- (a) Determine the force system acting at the origin that is equipollent to this force system.

**PROBLEM #1M (continued)**

- (b) Can this system be put in equilibrium by applying one force at any point along the structural line? If so, what is that force and what is the location? If not, explain why not and how many forces are needed and how these forces and their location can be determined. Clearly explain your reasoning.

**PROBLEM #2M (50%)**

The 25-foot structure is supported along two height levels. At one side, there is a pin that the structure hangs beyond by 5 feet, while at the other end, a roller supports the structure at a level 5 feet above the pin. Loads are applied at three points: a 50-pound horizontal load at the roller support, a 200 pound vertical load at the midpoint between the supports, and a 100-pound vertical load at the far tip of the structure beyond the pin. 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.