Makeup test 2

5:00 – 6:50
Please state clearly all assumptions made in order for full credit to be given.

NAME: ______________________________ Section: ___________

RIN: _______________________________

Wednesday, October 28, 2009

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Problem #1 (25 %)

Consider the following three matrices:

\[
\begin{pmatrix}
2 & 3 \\
4 & 5 \\
\end{pmatrix}
\quad \begin{pmatrix}
2 & 1 & 1 \\
3 & 4 & 5 \\
0 & 1 & 2 \\
\end{pmatrix}
\quad \begin{pmatrix}
3 & 4 & 3 \\
4 & 5 & 4 \\
1 & 2 & 1 \\
\end{pmatrix}
\]

Evaluate the following:

a) \( AB \) (5 points)
b) \( BA \) (5 points)
c) \( CA \) (5 points)

Consider the following vectors:

\( \mathbf{v} = (4\mathbf{i} - \mathbf{j} + 3\mathbf{k}) \) and \( \mathbf{u} = (-2\mathbf{i} + \mathbf{j} - 2\mathbf{k}) \)

d) Evaluate \( (\mathbf{u} - \mathbf{v}) \times \mathbf{u} \) (5 points)
e) Find a unit vector perpendicular to both \( \mathbf{u} \) and \( \mathbf{v} \) (5 points)
Problem #2 (25%)  

A transmission tower is held by three guy wires attached to a pin at A and anchored by bolts at B, C, and D. If the tension in wire AB is 630 lb, and the vertical force exerted by the tower on pin A is P:

a) Identify the particle to be analyzed (3 points)

b) Draw a complete and separate FBD showing the particle and all the forces acting on it. (5 points)

c) Write the equilibrium equations for the FBD (9 points)

 d) Determine the magnitude of the force in each of the three cables (8 points)
Problem #3 (25 %)

a) A force is applied to a square plate, producing a moment about location O. In the following figures, an identical force is applied to the square plate. Indicate (circle) the system(s) that produce the same moment at location O. All forces are applied at the corners of the plate. (5 points)

b) Which of the following pairs of force vectors represents a couple (circle the single correct answer)? (3 points)
   a) 
   b) 
   c) 

c) A force vector is applied at the point (4m, 0m, 4m). Determine the moment of F_A about the follow points. (6 points)
   a) (0m, 0m, 0m)
   b) (0m, 0m, 1m)
   c) (4m, 0m, 6m)

   A force vector is applied at the point (4m, 1m, 3m)

d) Determine the shortest distance from line of action for force F_A to the point (0m, 0m, 0m) (6 points)

e) Determine the moment about a line connecting (0m, 0m, 0m) and (1m, 1m, 0m). (5 points)
Problem #4 (25%)

A 250 N see-saw has a length of 4 meters. At location A, the fulcrum is a smooth pin connection at the center of the see-saw. A 100 N weight is loaded onto the left end and the right end is secured in place by a cable. The see-saw and cable are positioned with the angles shown in the figure. The system is in static equilibrium.

(a) Draw the FBD for the rigid body, labeling all forces. (10 points)
(b) Express in Cartesian vector form all forces, known and unknown, applied to the rigid body. (5 points)
(c) Solve for the reaction force vectors at positions A and B. (10 points)