The University of Manitoba
The Department of Civil Engineering

Course: Applied Mechanics 1A, 23.135 — Date: December 11, 1993, 1:30–3:30 p.m.
Paper No.: 316 — Time: 2 hours

Examiner: Professors D. Polyzois, A. Shah, L. Domaschuk, E. Wilms, K. McLachlan

1) A force F with a magnitude of 1500 N is applied in the direction shown in Fig. 1. Determine;

a) The moment of this force about the co-ordinate axes x, y, and z;

b) The moment about line OC.

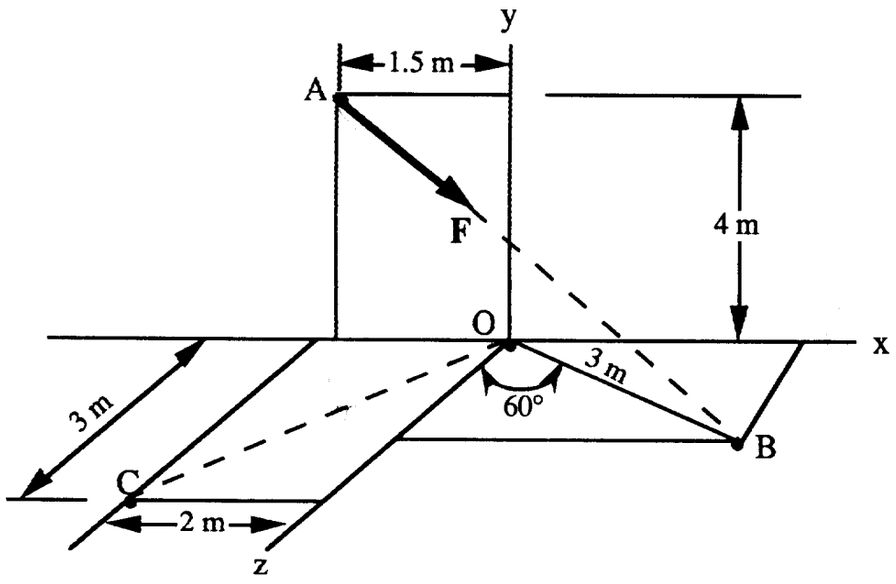

Figure 1

ANSWER:

(a) $\vec{M}_o = (1520.28, 570.11, -2633.26)$ N m

(b) $M_{oc} = -3034.30$ N·m

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2) Compute the reactions at supports A, C, and D in the planar structure shown in Fig. 2. Supports A and C are pins and B and D are rollers.

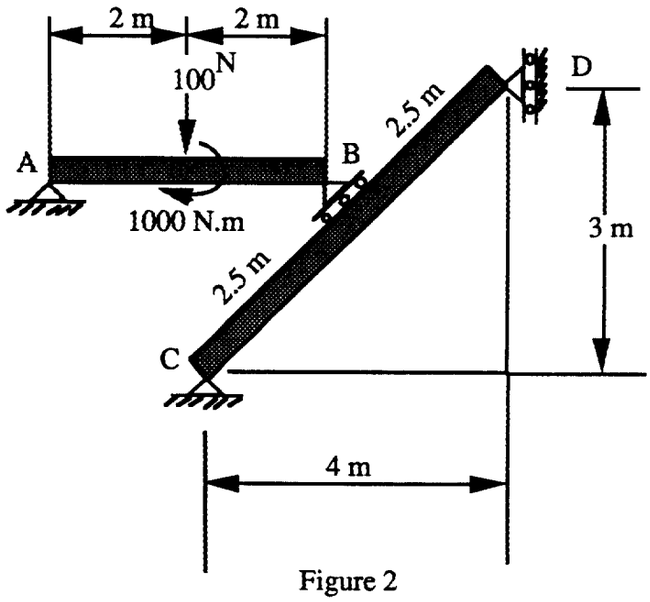
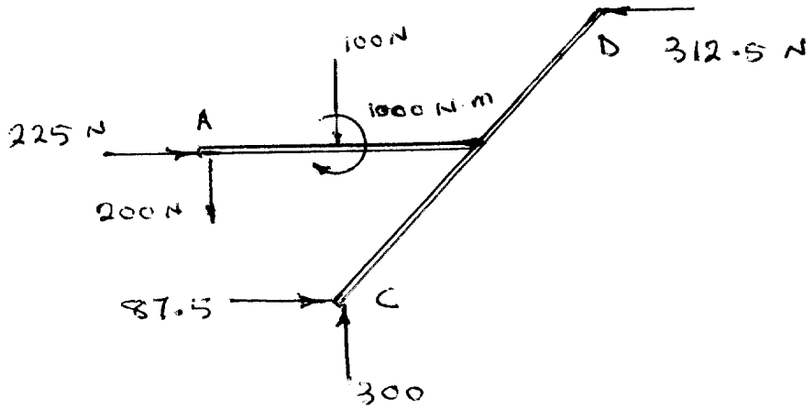


Figure 2

ANSWER



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3) Determine the reactions at pins A and B in the planar frame shown below. Assume the pulley is frictionless and has a radius of 0.25 m. Supports A and B are pins.

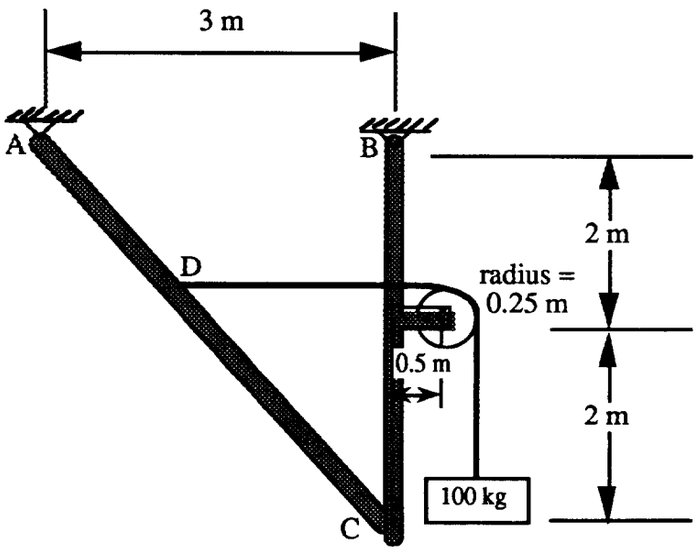

Figure 3

ANSWER: $A_y = 245.25\ N \downarrow$; $A_x = 367.875\ N \leftarrow$

$B_y = 1126.25\ N \uparrow$; $B_x = 367.875\ N \rightarrow$

Continued...

4) Block A, having a mass of 6 kg, is connected by links AC and BC as shown in Fig. 4. If the coefficient of static friction between the block A and surface is μ_s = 0.2, determine the largest vertical force **P** that may be applied to pin C without causing the block A to slip. Neglect the weight of the links.

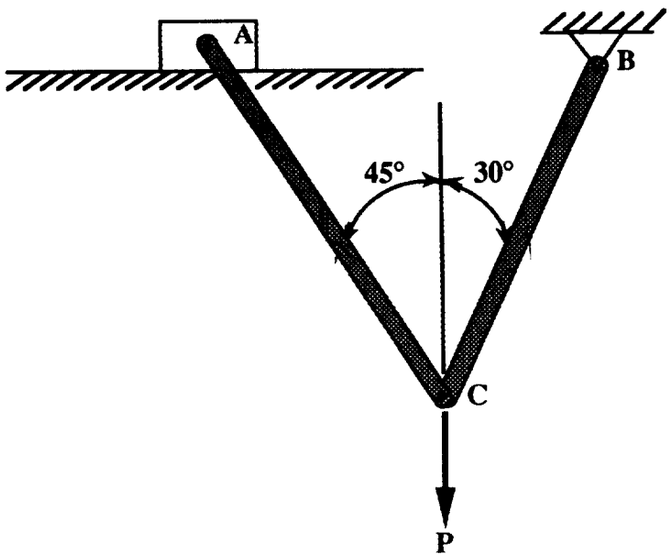

Figure 4

ANSWER:

P = 40.20 N

5) Determine the force in each member of the truss in Fig. 5 and state if the members are in tension or compression.

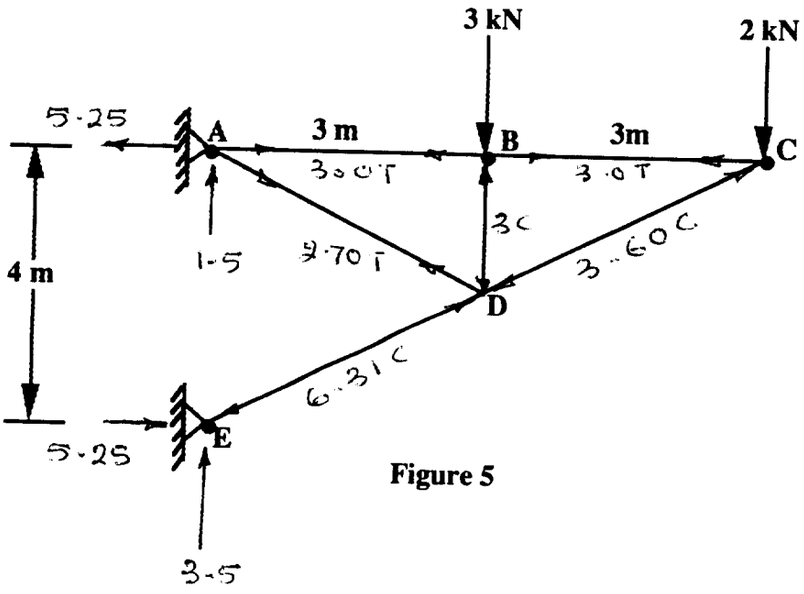

Figure 5

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