

AK

CARLETON UNIVERSITY

**FINAL
EXAMINATION
APRIL 1996**

DURATION: 3 HOURS

No. of Students: **203**

Department Name & Course Number: **91.111A and B Engineering Mechanics**

Course Instructor(s) **Professors N. Holtz and S.J. Kennedy**

AUTHORIZED MEMORANDA
Calculators, drafting equipment, rulers and pencils.

Students **MUST** count the number of pages in this examination question paper **before** beginning to write, and report any discrepancy immediately to a proctor. This question paper has **11** pages.

This examination question paper **MAY NOT** be taken from the examination room.

Name: _____

Student No: _____

Notes:

1. If a question appears incomplete, make the appropriate assumptions, based on engineering judgement and complete the question.

STATE YOUR ASSUMPTIONS CLEARLY

2. The marking scheme follows:

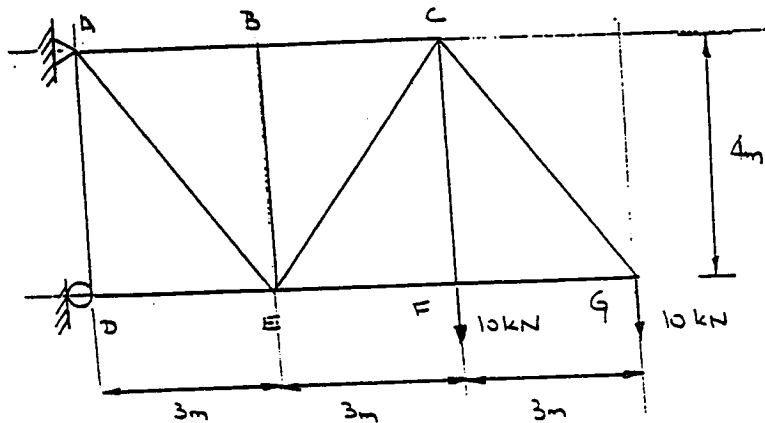
Question No.	Mark
1	110
2	110
3	110
4	110
5	110
6	110
Total	160

Solutions

1.0 Short Answer Problems

(a) *Truss - Method of Joints*

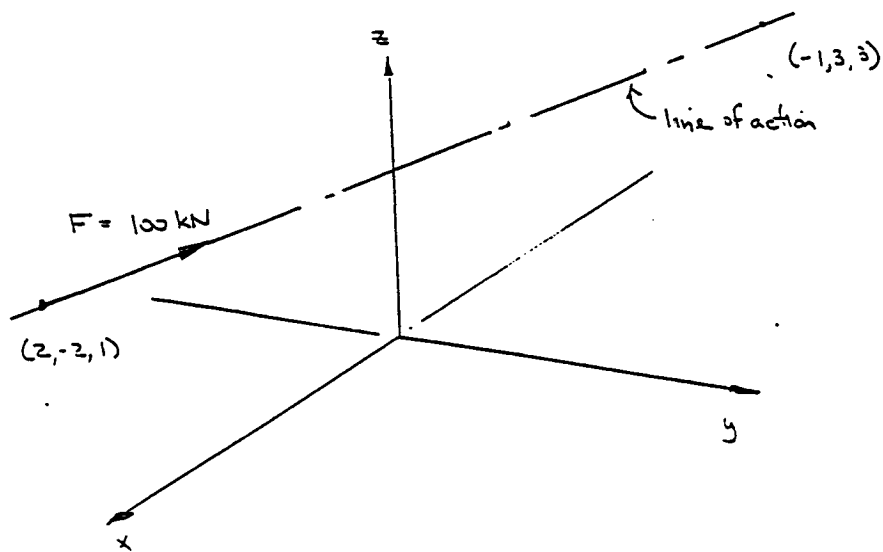
Determine the member forces in CG, EF, CF, FG by method of joints.



CG = _____

(b) *Direction Angles*

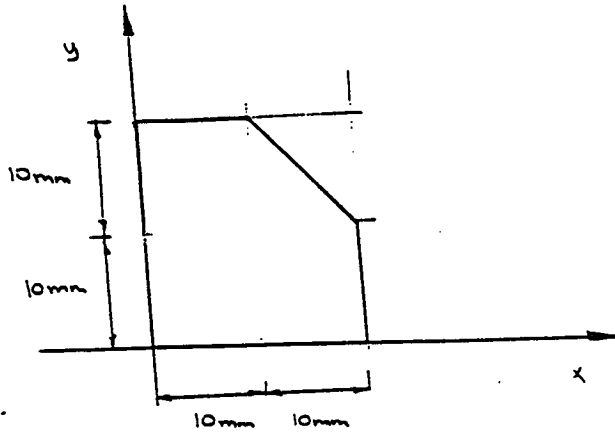
Calculate the direction angles for the vector shown.



$\theta_x = \underline{\hspace{2cm}}$

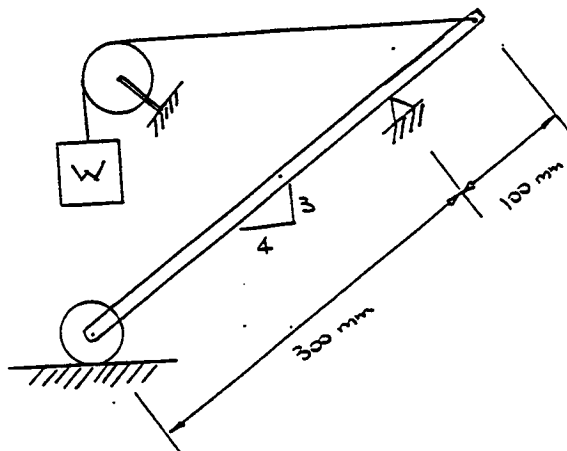
(c) Centroid

Calculate and locate the centroid of the area shown.



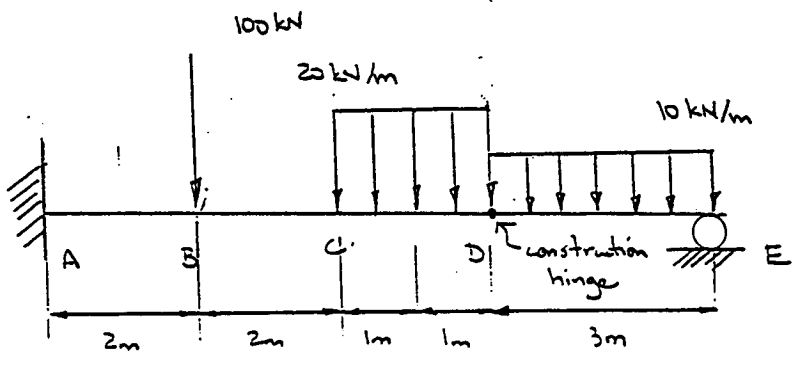
(d) *Free Body Diagram*

Draw the FBD's required to solve for the reactions. DO NOT WRITE THE EQUATIONS OF STATICS. DO NOT SOLVE FOR THE REACTIONS.



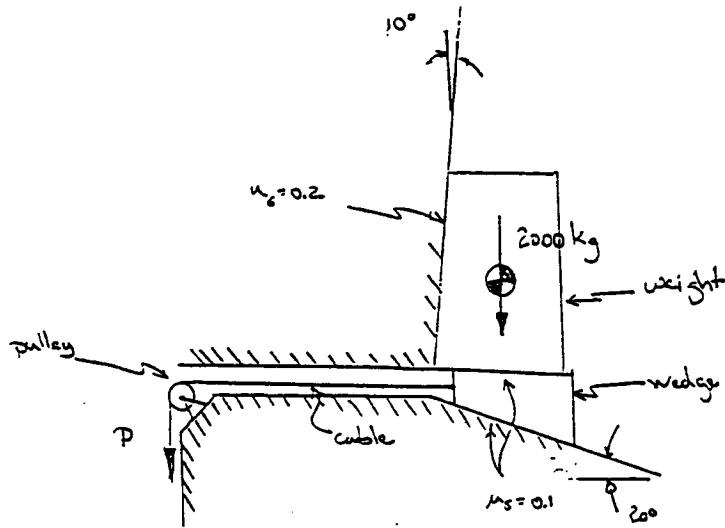
2.0 Internal Force Diagrams

Draw the free body diagram; shear force and bending moment diagrams.

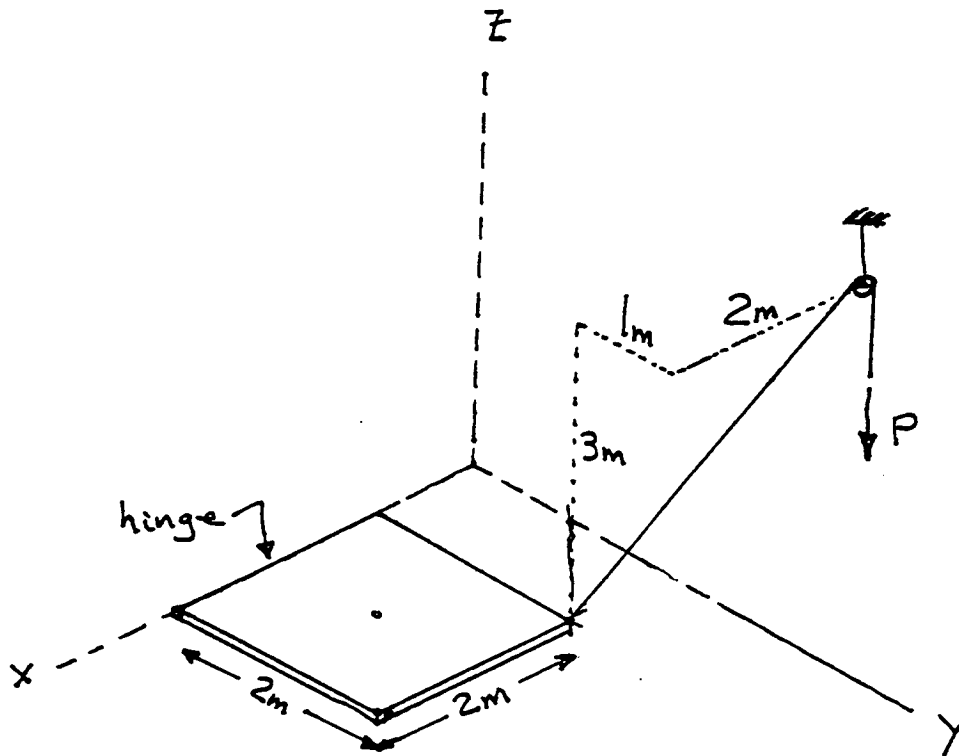


3.0 Friction

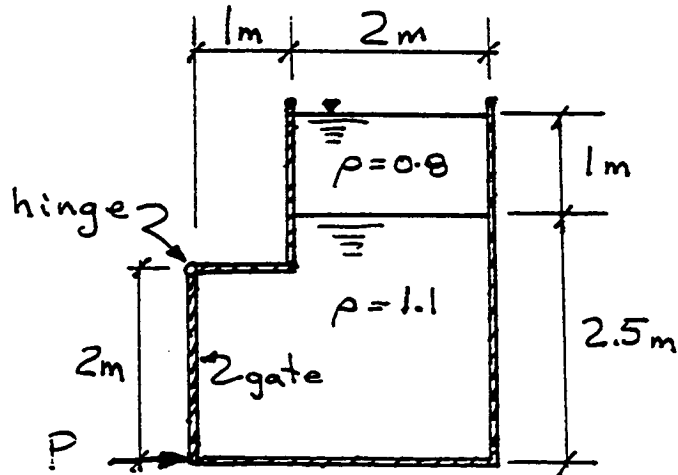
- (a) Determine the force P necessary to lift the weight.
- (b) Determine the force P required to keep the wedge from sliding down the ramp.



- 4.0 The door has a mass of 100 kg, and is hinged along the x-axis. Determine the force, P , required to lift the door using the rope.



- 5.0 A rectangular gate 2m high and 1.5m wide is hinged along its top edge. The tank contains two different liquids of different densities. Determine the force, P , required to hold the gate shut against the fluid pressures.



- 6.0 A person has a mass of 50 kg and stands on a uniform plank of 20 kg. Determine the force she exerts on the plank if she pulls with just enough force to lift the plank at B. Determine also the force she must exert downwards on the rope.

