Carleton UNIVERSITY

EXAMINATION

DURATION: 3 HOURS **No. of Students:**

Department name & Course Number:

Civil and Environmental Engineering Department

Mechanics I (ECOR 1101)

Course Instructor: Professor E. Zalok

AUTHORIZED MEMORANDA

(1) Closed book exam
(2) This exam paper contains 8 problems. Answer all questions
(3) Questions carry equal weight
(4) No extra papers or crib sheets will be provided or accepted
(5) A page of formulas is provided
(6) Programmable calculators are not allowed.
(7) Write clearly and neatly

Students MUST count the number of pages in this examination question before beginning to write, and report any discrepancy to a proctor. This question paper has 6 pages.
This examination question paper **MAY NOT** be taken from the examination room.
In addition to this question paper, students require: an additional booklet yes ■ no ☐
a Scantron sheet yes ☐ no ■

Name: ----------

ID:----------

Section: ----------

Problem	Mark
1	
2	
3	
4	
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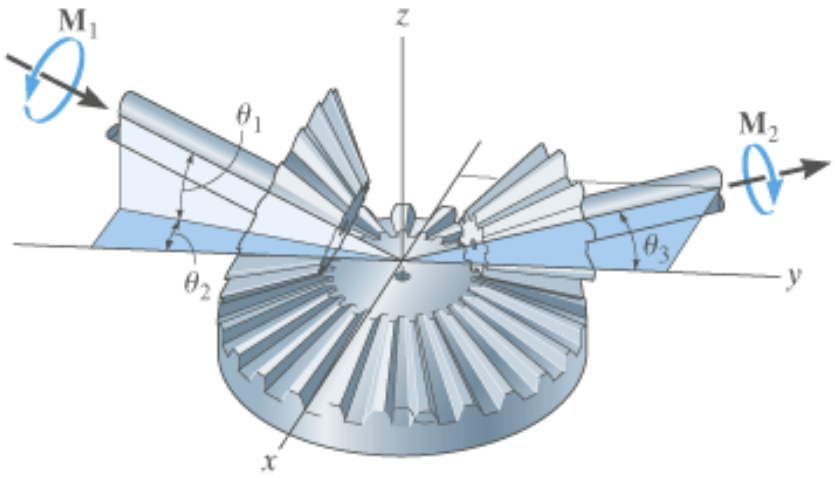
6	
7	
8	
Total	

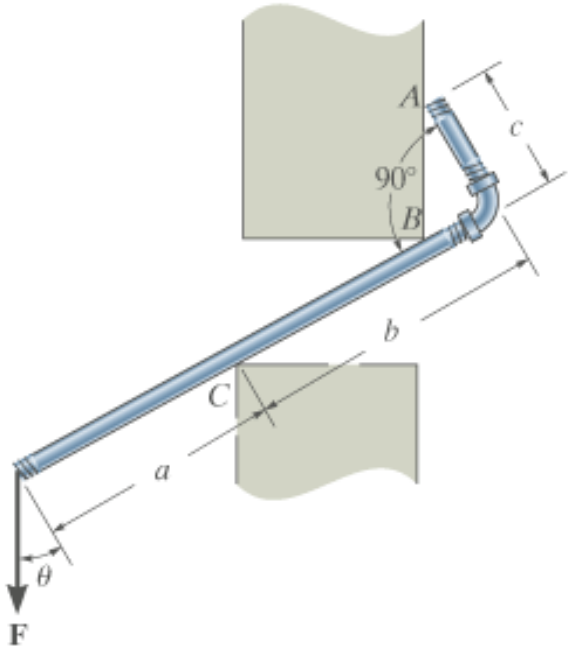
Question 1

The gears are subjected to the couple moments shown. Determine the magnitude and coordinate direction angles of the resultant couple moment.
M_1 = 40 lb.ft, M_2 = 30 lb.ft, θ_1 = 20 deg, θ_2 = 15 deg, θ_3 = 30 deg



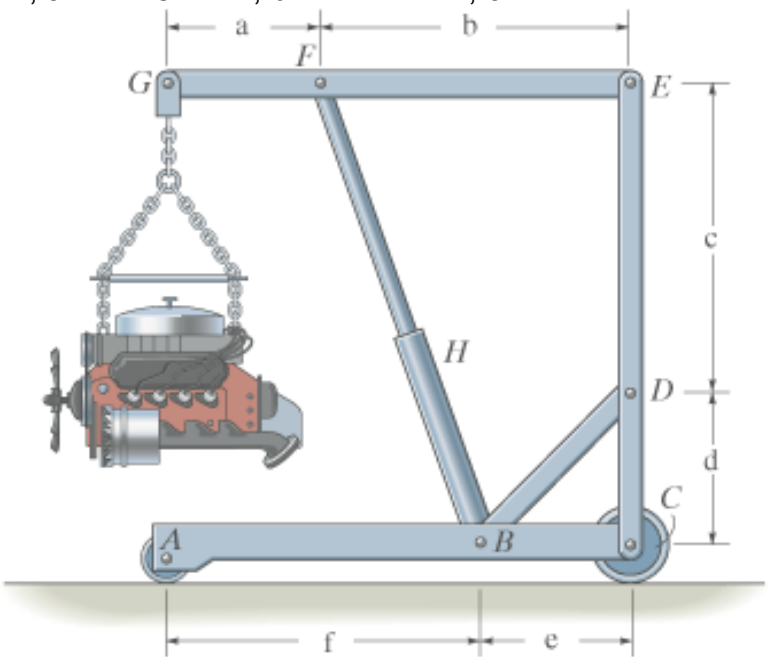
Question 2

The smooth pipe rests against the wall at the points of contact *A, B,* and *C*. Determine the reactions at these points needed to support the vertical force **F**. Neglect the pipe's thickness in the calculation.
F = 45 lb, θ = 30 deg, *a* = 16 in, *b* = 20 in, *c* = 8 in



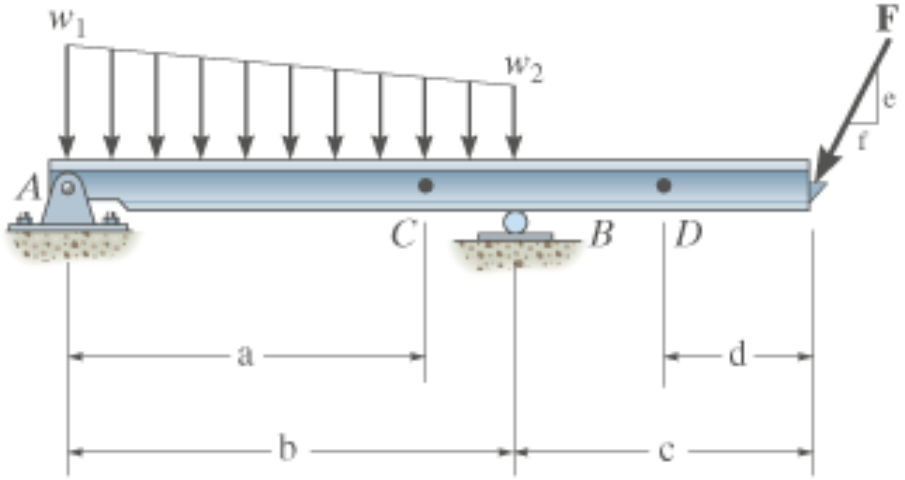
Question 3

The hoist supports the engine of mass *M*. Determine the force in member *DB* and in the hydraulic cylinder *H* of member *FB*.
M = 125kg, d = 1m, a = 1m e = 1m, b = 2m f = 2m, c = 2m



Question 4

Determine the internal normal force, shear force, and moment at points *C* and *D* of the beam.
w_1=60 lb/ft, w_2 = 40 lb/ft, a = 12ft, b = 15ft, c= 10ft, d = 5ft, F = 690 lb, e = 12, f = 5



Question 5

Locate the centroid of the shaded area. a = 4 m, b = 4 m

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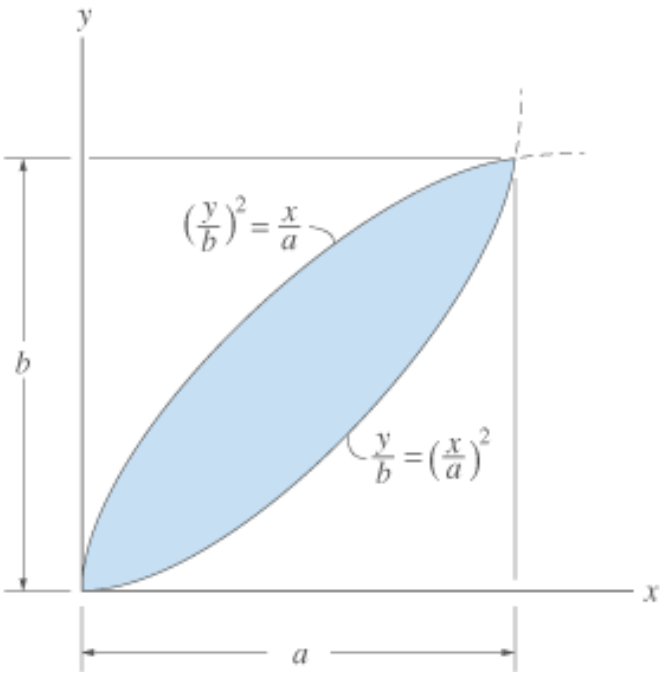
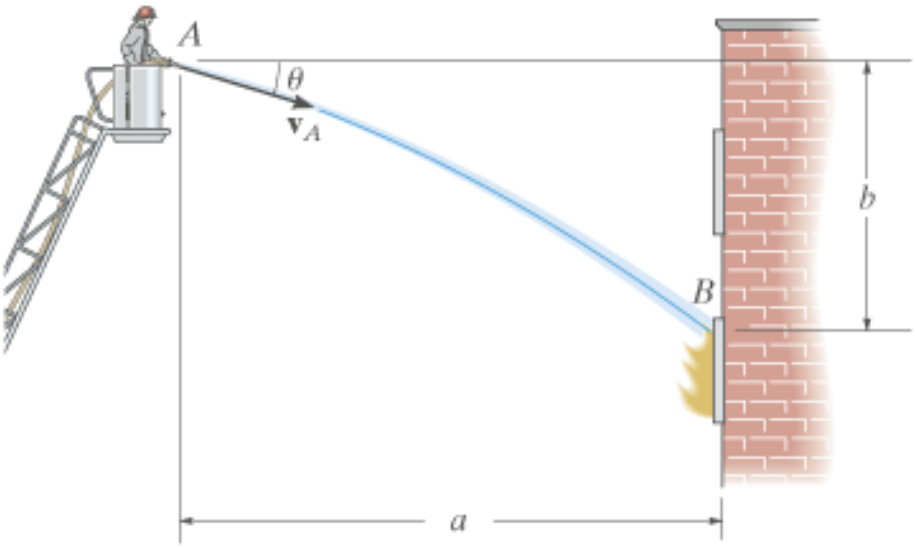


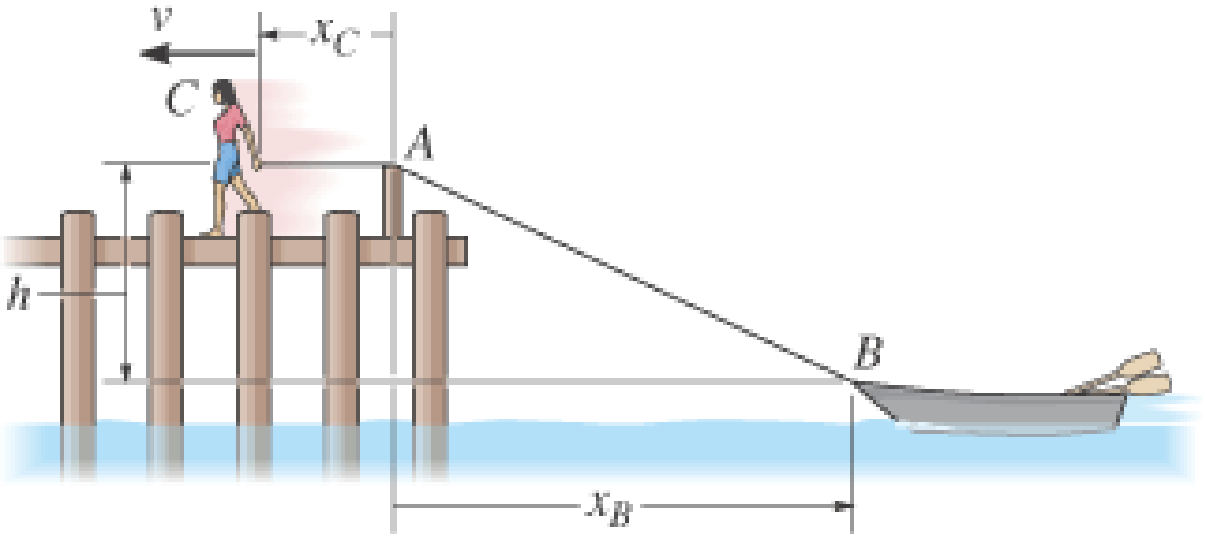
Question 6

The fireman standing on the ladder directs the flow of water from his hose to the fire at B. Determine the velocity of the water at A if it is observed that the hose is held at angle θ. (θ = 20 deg, a = 60 ft, b = 30 ft)



Question 7

The girl at *C* stands near the edge of the pier and pulls in the rope *horizontally* at constant speed 6 ft/s. Determine how fast the boat approaches the pier at the instant the rope length *AB* is 50 ft. (*h* = 8 ft)



Question 8

The girl has a mass of 50 kg. She is seated on the horse of the merry-go-round which undergoes constant rotational motion $\dot{\theta}$ = 1.5 rad/s. If the path of the horse is defined by *r* = *4m*, *z* = *b* 0.5 sin(θ), determine the maximum and minimum force F_z the horse exerts on her during the motion.