King Fahd University of Petroleum & Minerals

Department of Civil and Environmental Engineering

CE 201 – Statics

Semester: 122
Examination: Final
Date (Day): May 22, 2013 (Wednesday)
Time: 07:00 – 10:00 p.m.

Section	1	2	3	4	6	7	8	9
Instructor	Al-Malack	Al-Malack	Schowdhury	Al-Attas	Al-Shayea	Hussein	Arifuzzaman	Al-Attas
Time	07:00	08:00	09:00	09:00	10:00	11:00	13:10	10:00
Tick								

Student's Name :
Student's ID :

Problem	Assigned Grade	Earned Grade
1	20 (Points)	
2	25 (Points)	
3	25 (Points)	
4	30 (Points)	
Total	100 (Points)	

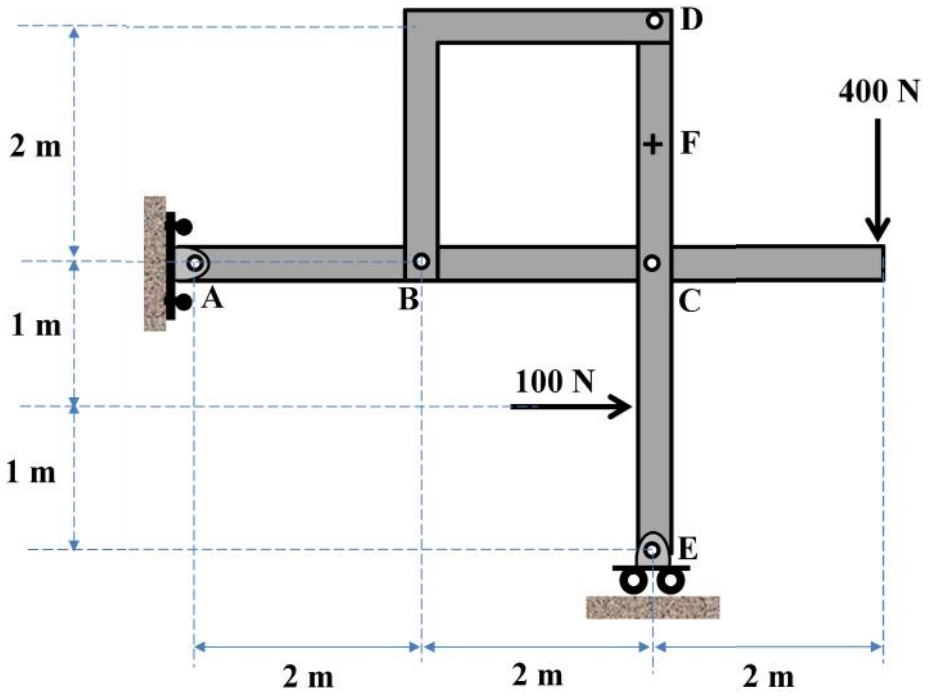
Good Luck

Problem 1 (20 Points)

For the three-member frame, show below, that is supported by pin at A and roller at E:

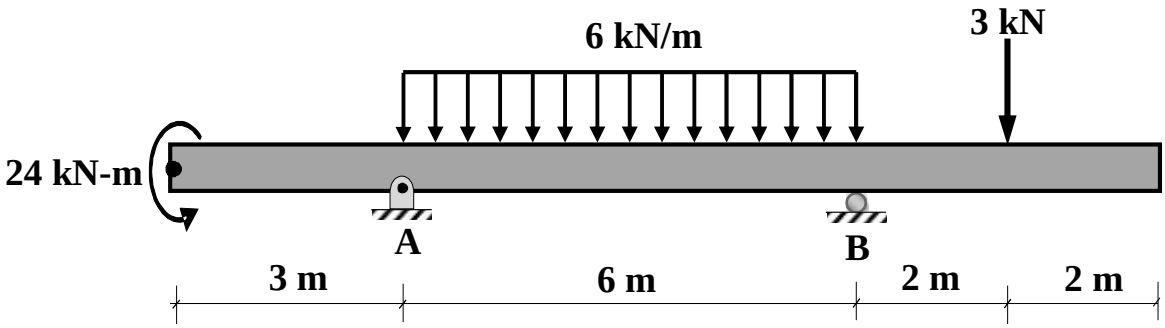
(15 Points) 1): Determine reactions on member ABC at A, B and C.

(5 Points) 2): Determine the internal sheer force, normal force and bending moment at point F which is located mid-way between points C and D.



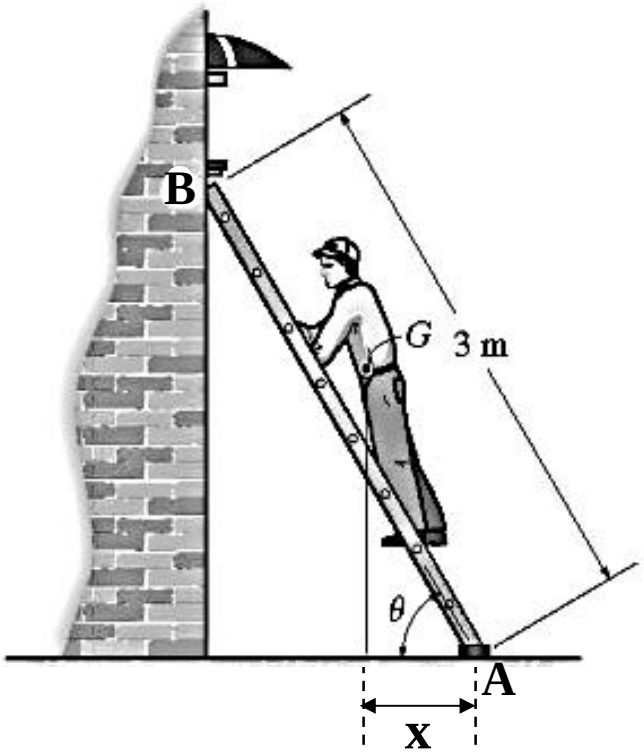
Problem 2 (25 Points)

Develop the equations and draw the Shear Force and Bending Moment diagrams for the following loading system. Vertical reactions at supports are: R_{AY} = 21 kN and R_{BY} =18 kN in the upward direction.



Problem 3 (25 Points)

In the figure shown below, the man climbs up the ladder with inclination θ = 60°. The ladder has a weight of 100 N and the man has a weight of 900 N. The coefficient of static friction (μ_s) between the wall and the ladder is 0.2 and μ_s between the floor and the ladder is 0.4. Determine the maximum distance (X) that the man can climb before the ladder slips.
(Show detailed analysis to support your answers)

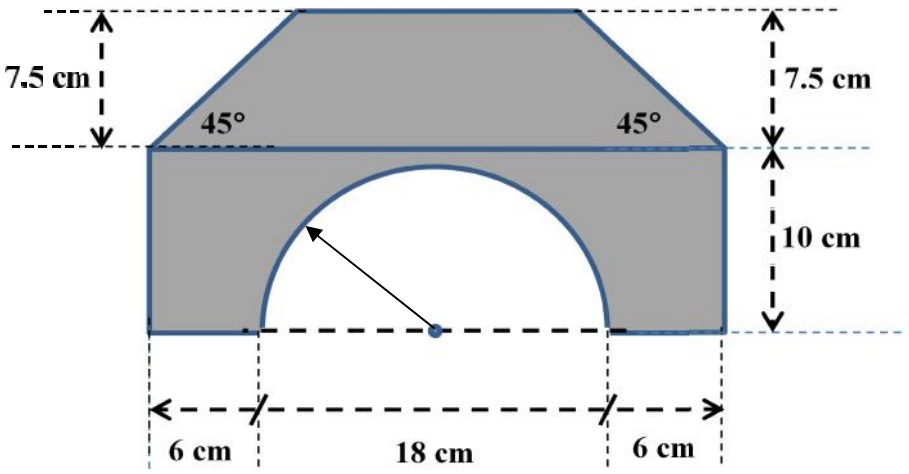


Problem 4 (30 Points)

For the shaded area shown below:

(20 Points) 1): Find the coordinates of the centroid (x and y). **(Use the below table)**

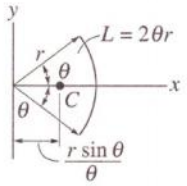
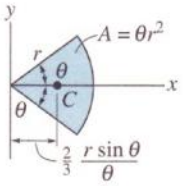
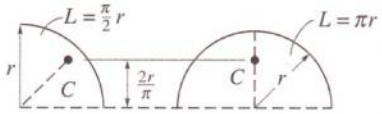
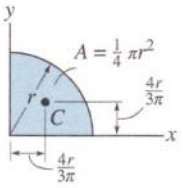
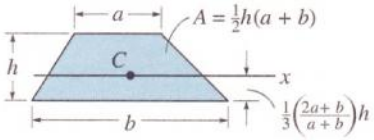
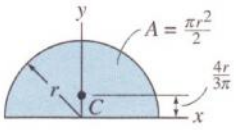
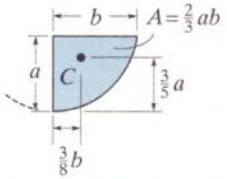
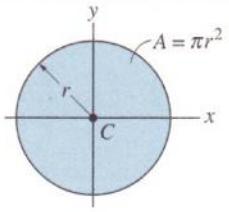
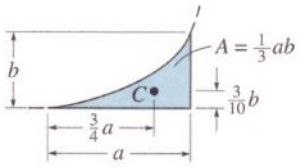
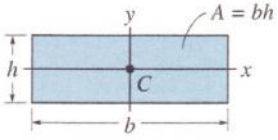
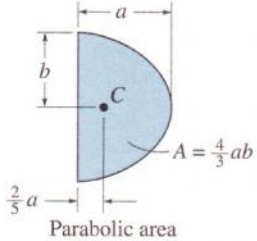
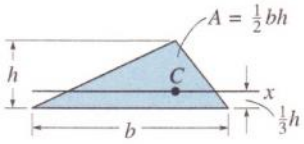
(10 Points) 2): Find the moment of inertia about the x-axis. **(Use the below table)**



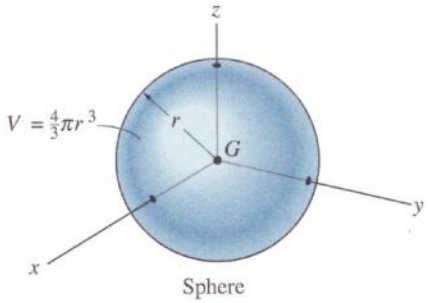
Centroid

Moment of Inertia

Geometric Properties of Line and Area Elements

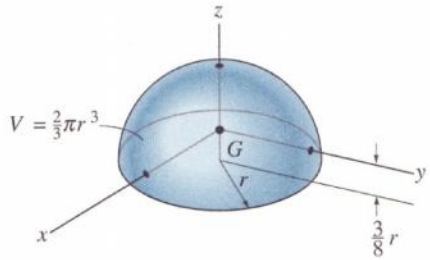
Centroid Location	Centroid Location	Area Moment of Inertia
 Circular arc segment	 Circular sector area	$I_x = \frac{1}{4}r^4(\theta - \frac{1}{2}\sin 2\theta$ $I_x = \frac{1}{4}r^4(\theta + \frac{1}{2}\sin 2\theta$
 Quarter and semicircle arcs	 Quarter circle area	$I_x = \frac{1}{16}\pi r^4$ $I_y = \frac{1}{16}\pi r^4$
 Trapezoidal area	 Semicircular area	$I_x = \frac{1}{8}\pi r^4$ $I_y = \frac{1}{8}\pi r^4$
 Semiparabolic area	 Circular area	$I_x = \frac{1}{4}\pi r^4$ $I_y = \frac{1}{4}\pi r^4$
 Exparabolic area	 Rectangular area	$I_x = \frac{1}{12}bh^3$ $I_y = \frac{1}{12}hb^3$
 Parabolic area	 Triangular area	$I_x = \frac{1}{36}bh^3$

Center of Gravity and Mass Moment of Inertia of Homogeneous Solids



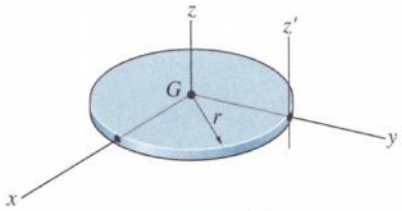
Sphere

$I_{xx} = I_{yy} = I_{zz} = \frac{2}{5} mr^2$



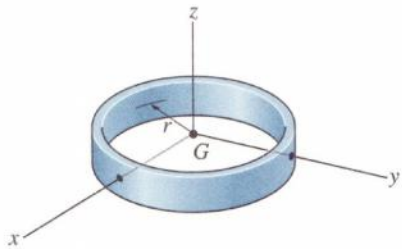
Hemisphere

$I_{xx} = I_{yy} = 0.259mr^2 \quad I_{zz} = \frac{2}{5} mr^2$



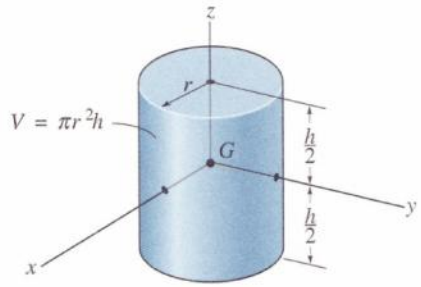
Thin Circular disk

$I_{xx} = I_{yy} = \frac{1}{4} mr^2 \quad I_{zz} = \frac{1}{2} mr^2 \quad I_{z'z'} = \frac{3}{2} mr^2$



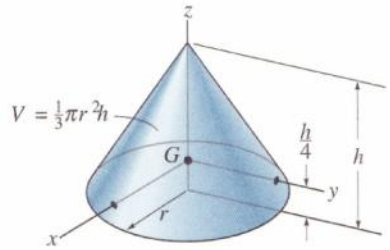
Thin ring

$I_{xx} = I_{yy} = \frac{1}{2} mr^2 \quad I_{zz} = mr^2$



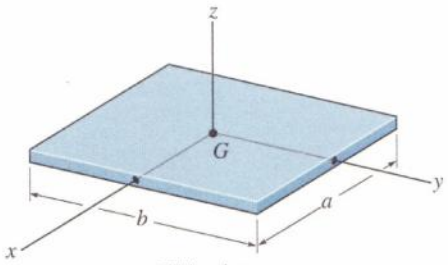
Cylinder

$I_{xx} = I_{yy} = \frac{1}{12} m(3r^2 + h^2) \quad I_{zz} = \frac{1}{2} mr^2$



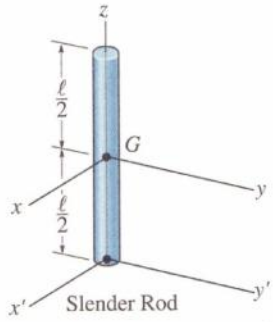
Cone

$I_{xx} = I_{yy} = \frac{3}{80} m(4r^2 + h^2) \quad I_{zz} = \frac{3}{10} mr^2$



Thin plate

$I_{xx} = \frac{1}{12} mb^2 \quad I_{yy} = \frac{1}{12} ma^2 \quad I_{zz} = \frac{1}{12} m(a^2 + b^2)$



$I_{xx} = I_{yy} = \frac{1}{12} m\ell^2 \quad I_{x'x'} = I_{y'y'} = \frac{1}{3} m\ell^2 \quad I_{z'z'} = 0$