King Fahd University of Petroleum & Minerals

Department of Civil and Environmental Engineering

CE 201 – Statics

Semester: 131
Examination: Final
Date (Day): January 5, 2014 (Sunday)
Time: 07:00 – 10:00 p.m.

Section	1	2	3	4	5	6	7	9	10
Instructor	Al-Malack	Al-Malack	Chowdhury	Vohra	Hussain	Al-Attas	Al-Amoudi	Al-Osta	Hajyaseen
Time	07:00	08:00	08:00	09:00	10:00	11:00	11:00	10:00	09:00
Tick									

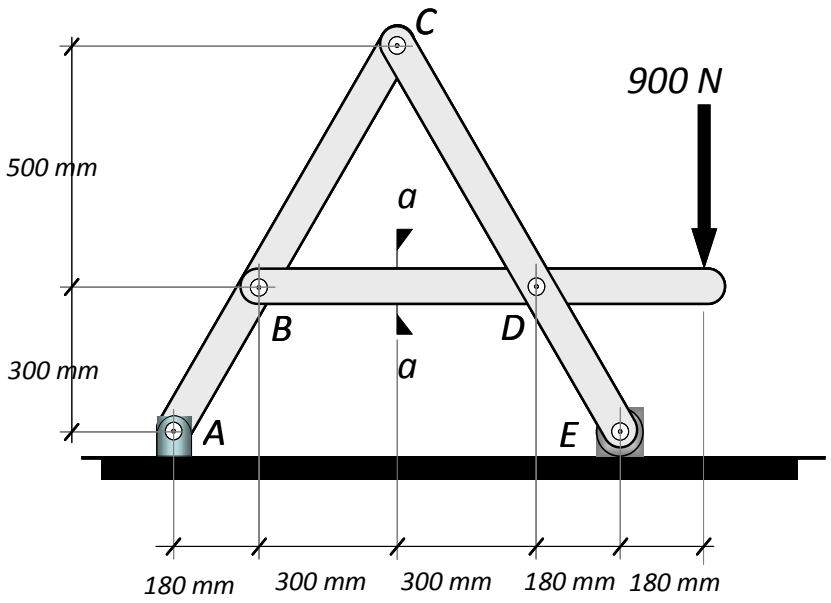
Student's Name :
Student's ID :

Problem	Assigned Grade	Earned Grade
1	25 (Points)	
2	25 (Points)	
3	20 (Points)	
4	15 (Points)	
5	15 (Points)	
Total	100 (Points)	

Good Luck

Problem 1 (25 Points)

The three-member frame is supported by a pin at A and by a roller at B as shown in the figure below. Determine the internal sheer force, normal force and bending moment at section *a*-*a* (**at member BD**).



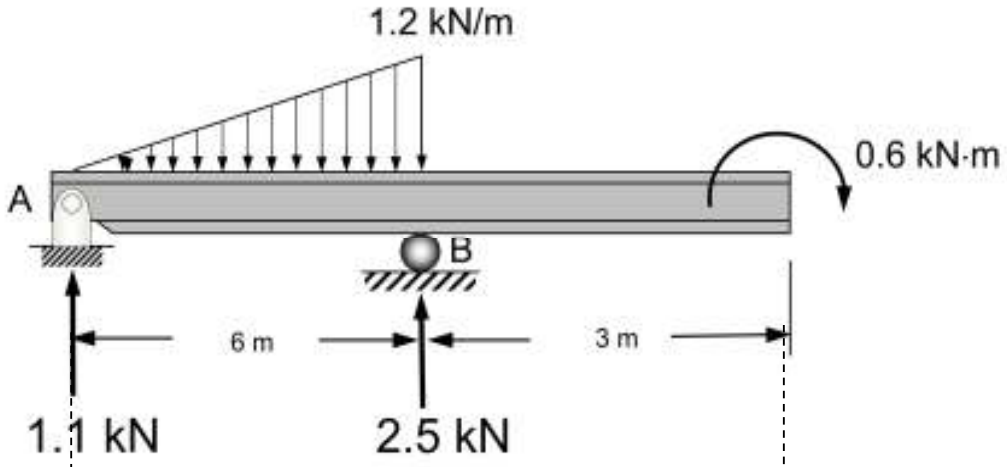
Problem 2 (25 Points)

For the beam shown below:

(15 Points) 1) Determine the equations for the shear force and bending moment.

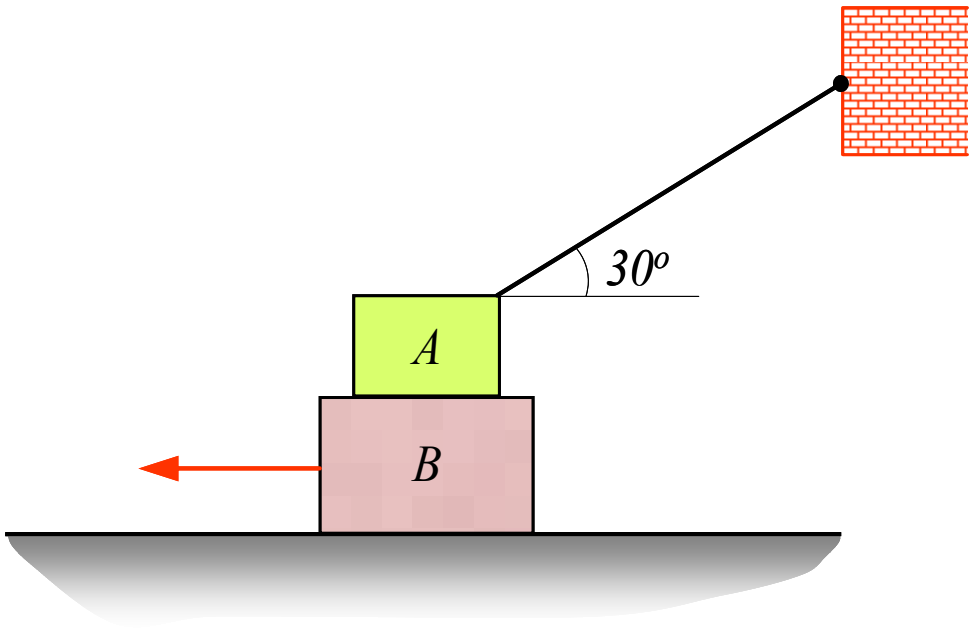
(10 Points) 2) Draw the shear force and bending moment diagrams.

The reactions at the supports A and B are given (R_A = 1.1 kN and R_B = 2.5 kN). Develop the equations on **page 5** and draw the diagrams on **this page**.



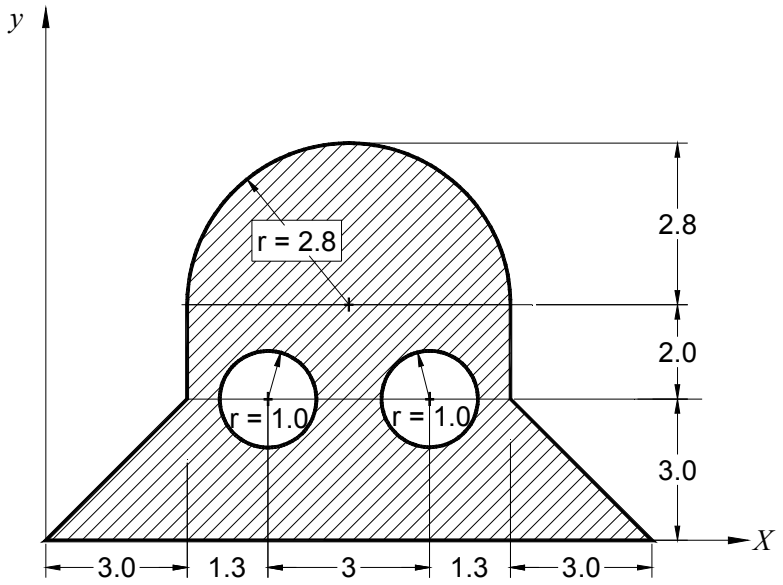
Problem 3 (20 Points)

Two blocks A and B of weights 1 kN and 2 kN, respectively, are in equilibrium position as shown in the figure below. If the coefficient of friction between the two blocks as well as the block B and the floor is 0.3, find the force P required to cause impending motion in the two box assembly.



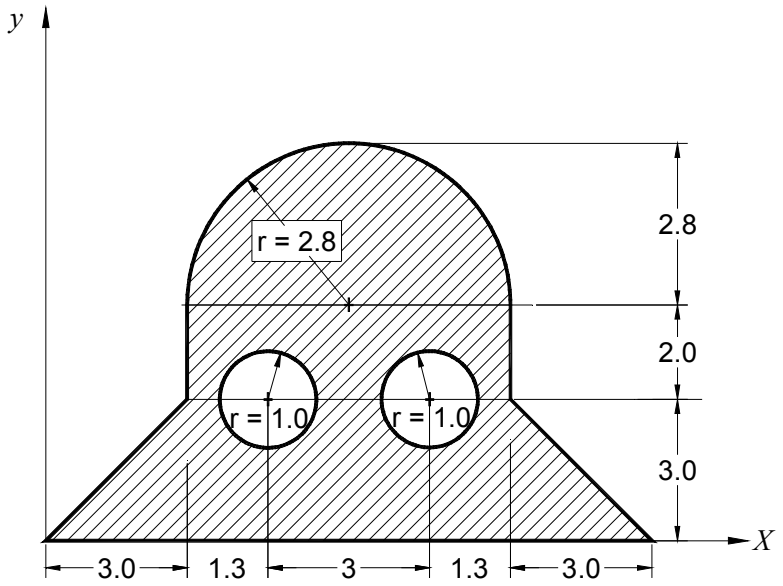
Problem 4 (15 Points)

Determine the location of the centroid $(\bar{X},\bar{Y})$ of the given cross-sectional area. (All dimensions are in meters). **Use the Table below for the solution**.

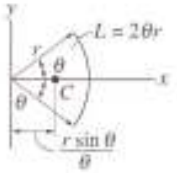
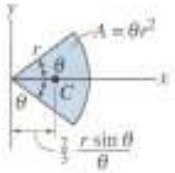
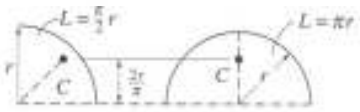
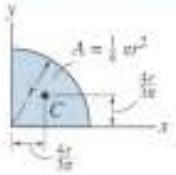
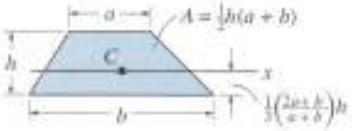
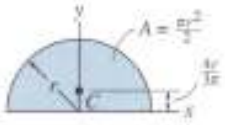
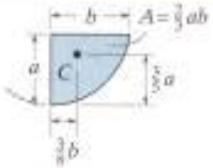
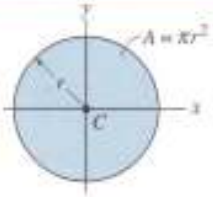
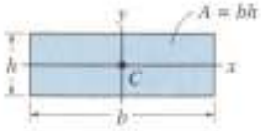
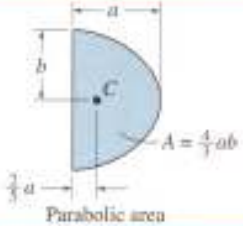
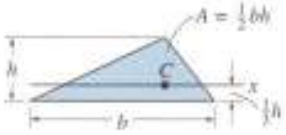


Problem 5 (15 Points)

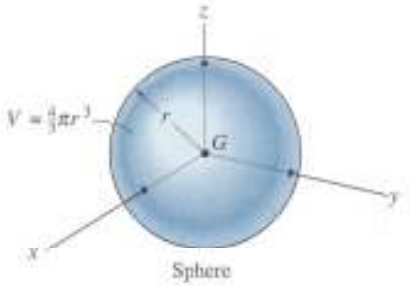
Determine the moment of inertia of the area shown below about the x axis (I_x).
Use the Table below for the solution.



Geometric Properties of Line and Area Elements

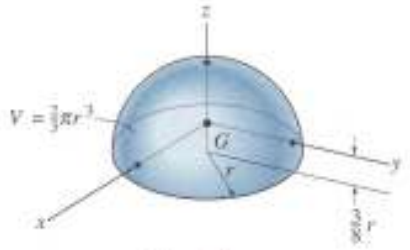
Centroid Location	Centroid Location	Area Moment of Inertia
 Circular arc segment	 Circular sector area	$I_x = \frac{1}{4}r^4(\theta - \frac{1}{2}\sin 2\theta)$ $I_y = \frac{1}{4}r^4(\theta + \frac{1}{2}\sin 2\theta)$
 Quarter and semicircle arcs	 Quarter circle area	$I_x = I_y = \frac{1}{16}\pi r^4$ $I_y = \frac{1}{16}\pi r^4$
 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



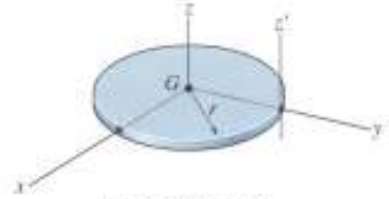
Sphere

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



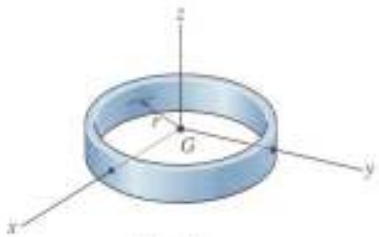
Hemisphere

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



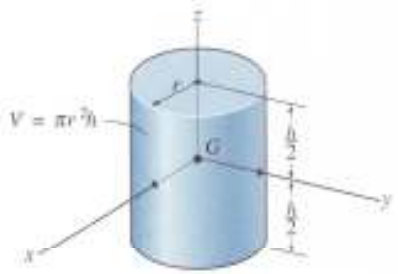
Thin Circular disk

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



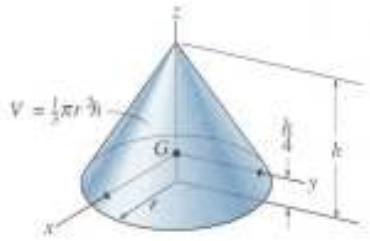
Thin ring

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



Cylinder

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

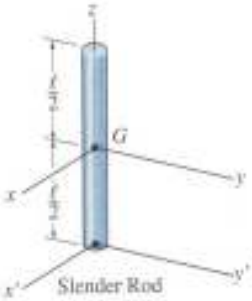


Cone

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

Thin plate

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



Slender Rod

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