King Fahd University of Petroleum & Minerals

Department of Civil and Environmental Engineering

CE 201 – Statics

Semester: 132
Examination: Final
Date (Day): May 21, 2014 (Wednesday)
Time: 08:00 – 11:00 a.m.

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

Student's Name :
Student's ID :

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

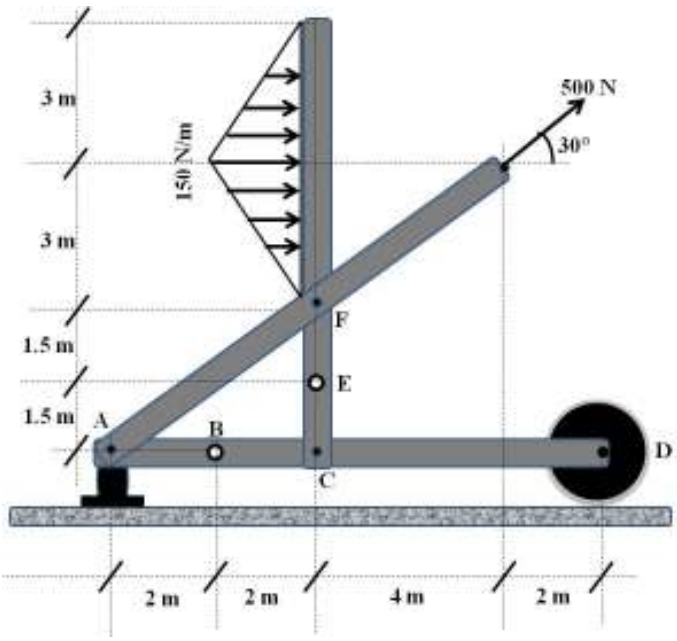
Good Luck

Problem 1 (30 Points)

The 3-member frame shown in the figure is supported by pin at A and roller at D. Determine:

1. The horizontal and vertical components of reactions at pins C and F
2. The internal sheer force, normal force and bending moment at points B and E

Note: Show all solution steps



Problem 2 (20 Points)

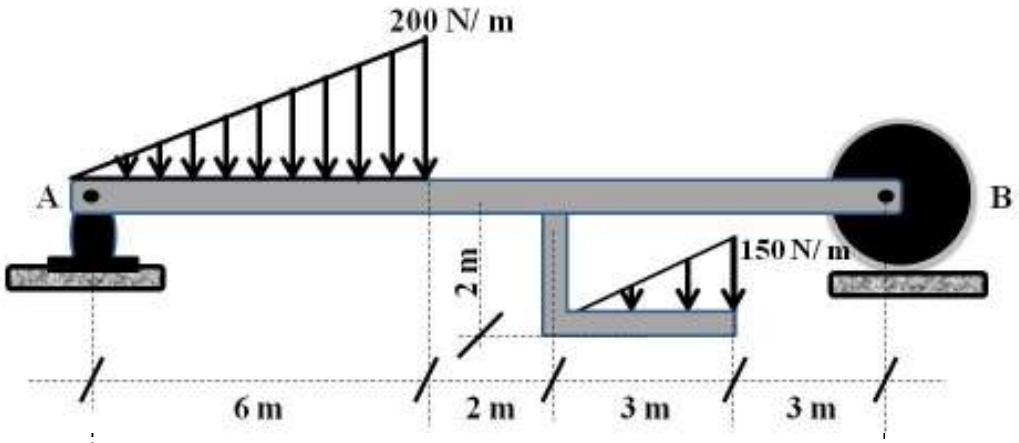
The beam shown in the figure is supported by pin at A and roller at B.

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

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

Develop the equations on **page 5** and draw the diagrams on **this page**.

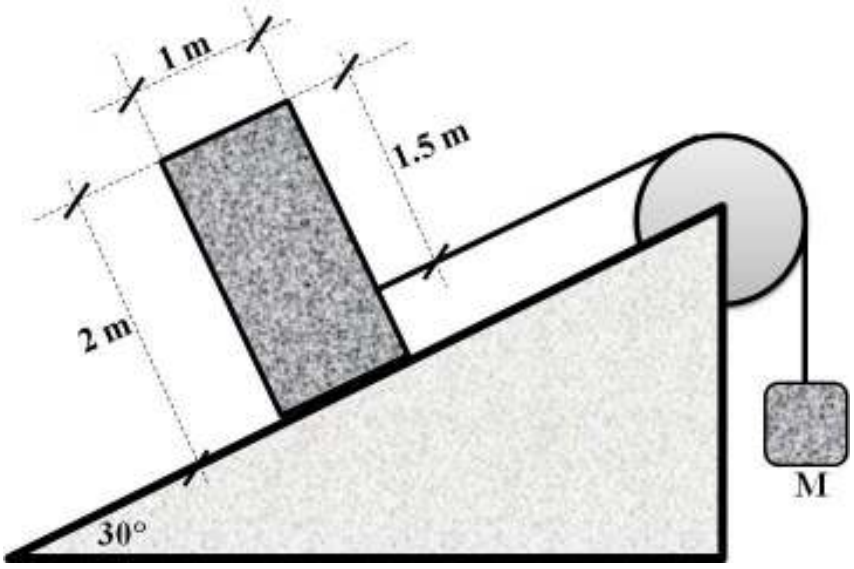
Note: Show all solution steps



Problem 3 (30 Points)

The 200-kg block, shown in the figure, is placed on a 30° inclined surface. The coefficient of friction between the block and the surface is 0.5. A light and inextensible cord is attached to the block, passes around a frictionless pulley and is attached to a second block of mass (M). Determine the minimum and maximum masses (M_{min} and M_{max}) such that the system is in equilibrium.

Note: Show all solution steps

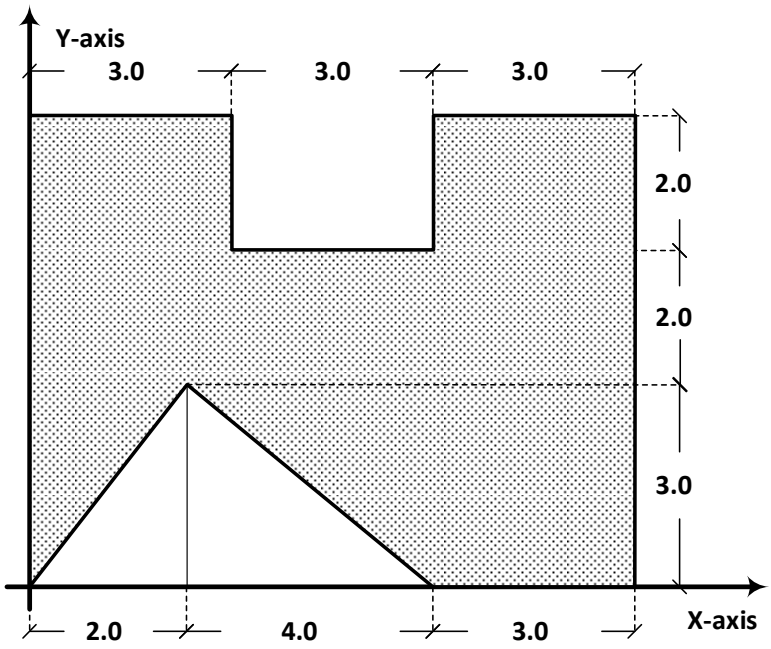


Problem 4 (20 Points)

For the area shown in the figure:

a) Determine the location of the centroid $(\bar{X},\bar{Y})$. **Use the Table below**
b) Determine the moment of inertia about the X-axis (Ix). **Use the Table below**

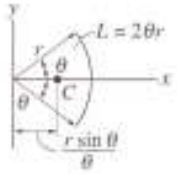
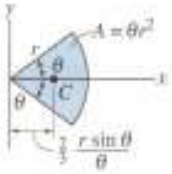
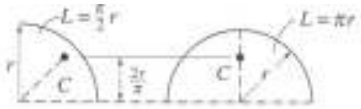
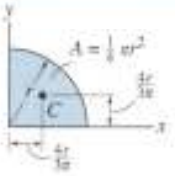
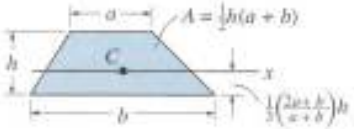
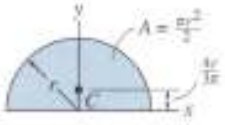
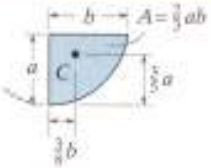
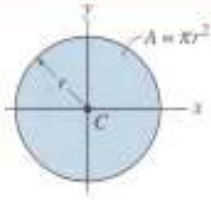
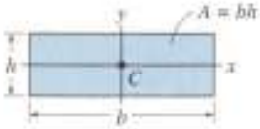
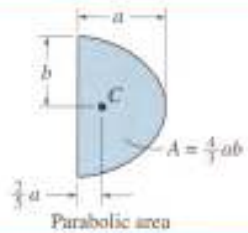
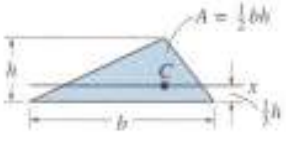
Note: All measurements are in meter (m)



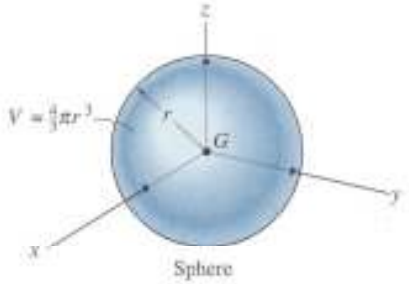
Centroid

Moment of Inertia

Geometric Properties of Line and Area Elements

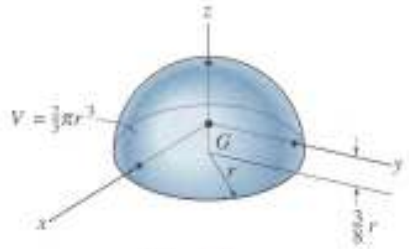
Centroid Location	Centroid Location	Area Moment of Inertia
 Circular arc segment	 Circular sector area	$I_x = \frac{1}{4}r^4(\theta - \frac{1}{2}\sin 2\theta$ $I_y = \frac{1}{4}r^4(\theta + \frac{1}{2}\sin 2\theta$
 Quarter and semicircle arcs	 Quarter circle area	$I_x = \frac{1}{16}\pi r^4$ $I_y = \frac{1}{16}\pi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



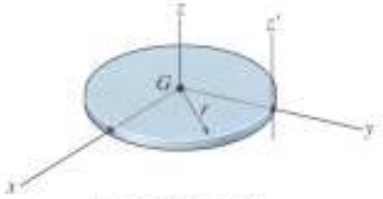
Sphere

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



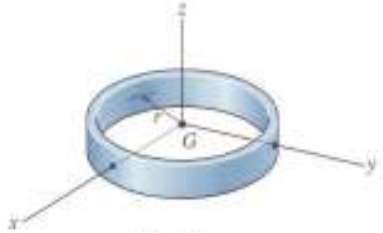
Hemisphere

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



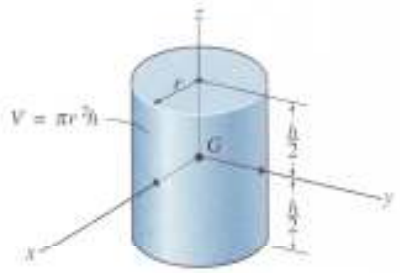
Thin Circular disk

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



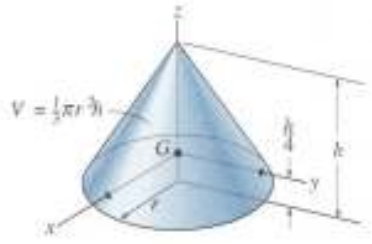
Thin ring

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



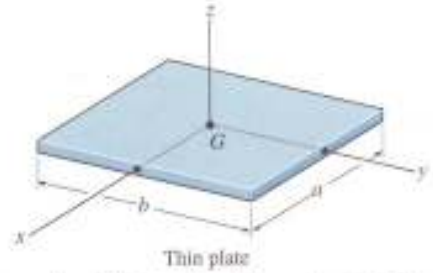
Cylinder

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



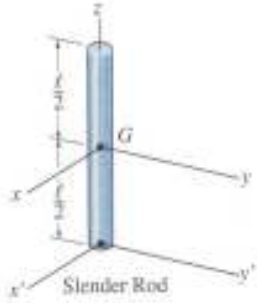
Cone

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



Thin plate

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



Slender Rod

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