Kafrelsheikh University
Faculty of Engineering
Dept. of Mech. Engineering
Year: First Year
Subject: Mechanics 2

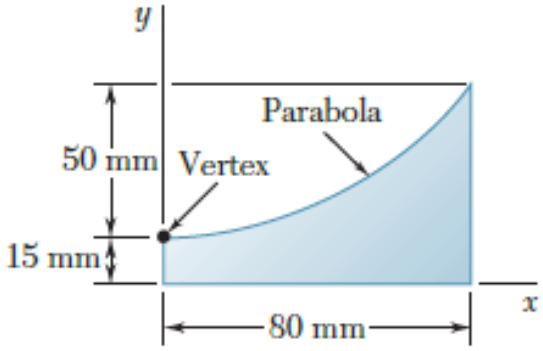
2nd Semester
Final Examination تخلفات
Date: May 2021
Model Mechanics 2
Full Mark: 100

General rules:

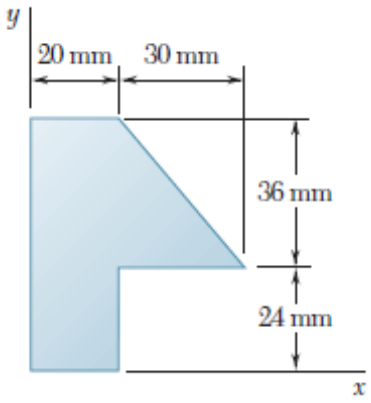
Answer should be very clear and readable; you will get zero for any unreadable answer.

Question #1 (20 Marks):

1. Determine by direct integration the *x*- and *y*-coordinates of the centroid of the shaded area.

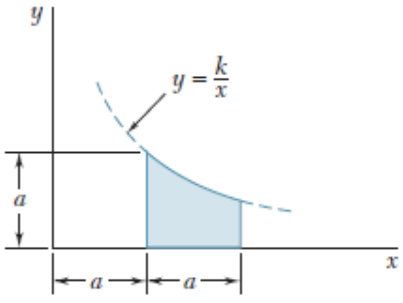


2. Using Pappus theorem, calculate the volume V of the solid generated by revolving the shaded area about *x*-axis. If this body were constructed of steel, what would be its mass m? The density of steel is $\rho = 7.85 \times 10^3$ kg/m^3.

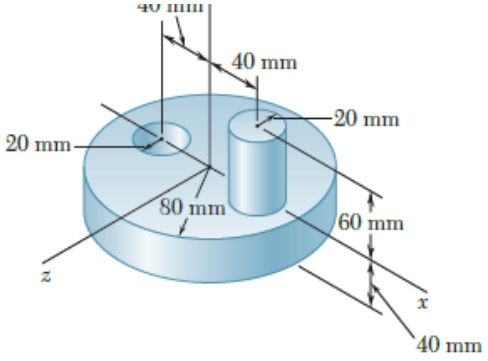


Question #2 (20 Marks):

a) Determine by direct integration the moment of inertia of the shaded area with respect to the *x*- and *y*- axes.

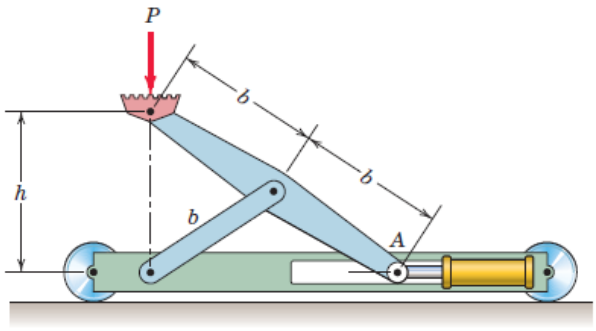


b) Determine the mass moment of inertia and the radius of gyration of the steel machine element shown with respect to (a) the x axis, (b) the y axis, (c) the z axis. (The density of steel is 7850 kg/m^3.).



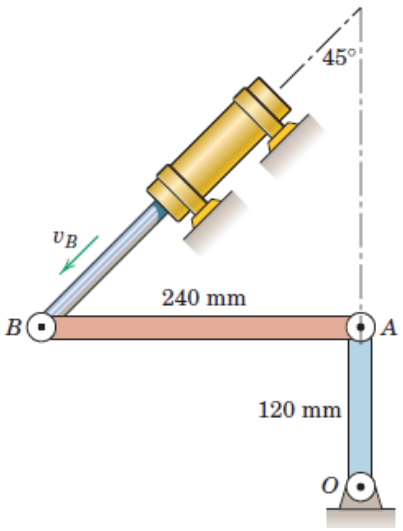
Question #3 (20 Marks):

The portable car hoist is operated by the hydraulic cylinder which controls the horizontal movement of end A of the link in the horizontal slot. Using the method of virtual work, determine the compression C in the piston rod of the cylinder to support the load P at a height h.



Question #4 (20 Marks):

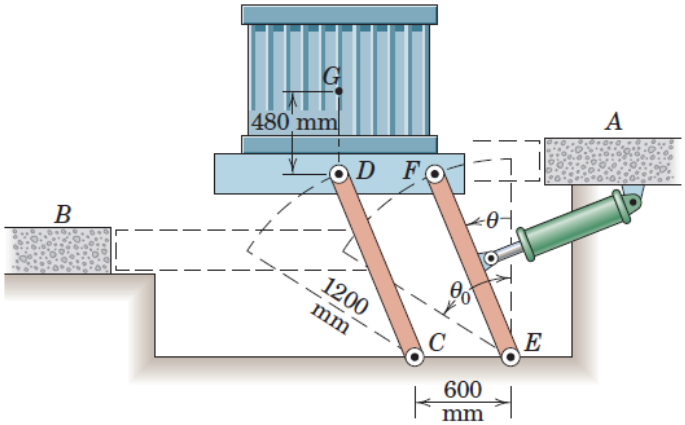
The hydraulic cylinder imparts motion to point B which causes link OA to rotate. For the instant shown where OA is vertical and AB is horizontal, the velocity of pin B v_B is 6 m/s and is increasing at the rate of 24 m/s^2. For this position determine the angular velocity and angular acceleration of OA.



Question # 4

Question #5 (20 Marks):

The parallelogram linkage is used to transfer crates from platform A to platform B and is hydraulically operated. The oil pressure in the cylinder is programmed to provide a smooth transition of motion from $\theta = 0$ to $\theta = \theta_o = \pi/3$ rad given by $\theta = \frac{\pi}{6}\left(1 - cos\ \frac{\pi t}{2}\right)$ where t is in seconds. Determine the force at D on the pin (a) just after the start of the motion with θ and t essentially zero and (b) when $t = 1$ s. The crate and platform have a combined mass of 200 kg with mass center at G. The mass of each link is small and may be neglected.



Question # 5