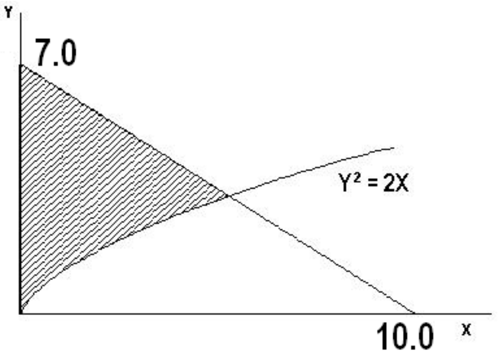
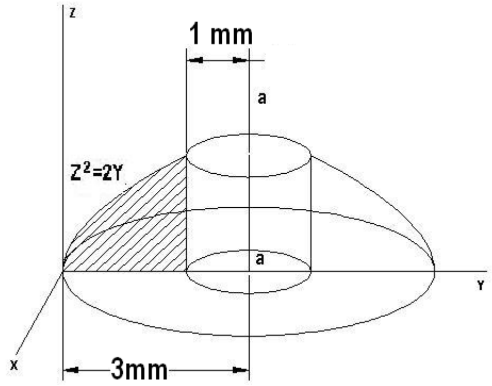
PROPERTIES OF SURFACES (TUTORIAL SHEET 6)

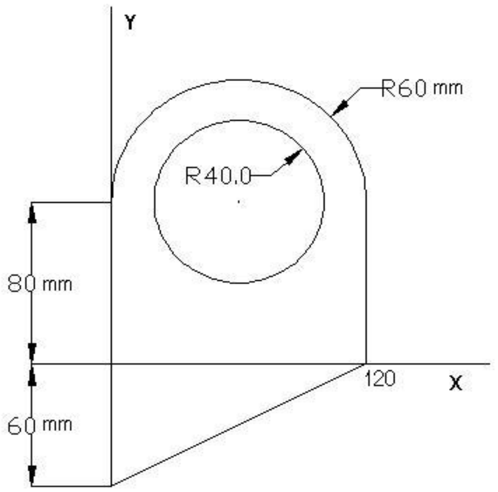
1. What are the coordinates of the centroid of the shaded area? The parabola is given as $Y^2=2X$. X & Y are in mm. (Ans: 1.7 mm, 3.75 mm)

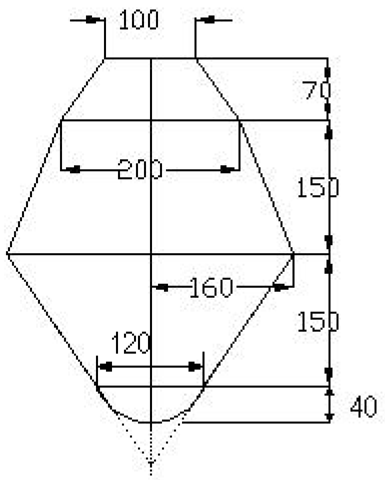




2. Locate the centroid of the volume formed by rotating the shaded area about the a-a axis. (Ans: 0.0m, 3.0m, 0.694m)

3. For the plane area shown, determine
   (a) the first moments about X and Y axes, (b) the location of the centroid.
   (Ans: $506\text{x}10^3\text{mm}^3$, $758\text{x}10^3\ \text{mm}^3$, 54.8mm, 36.6mm)

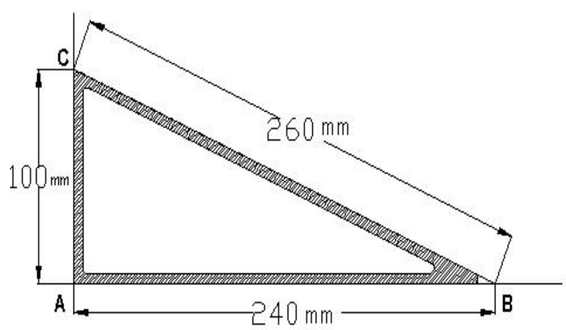




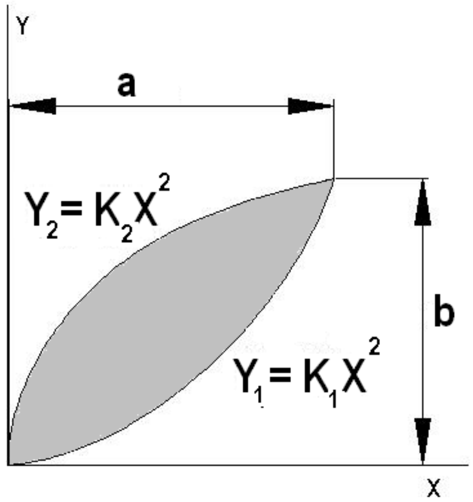
All dimensions are in mm

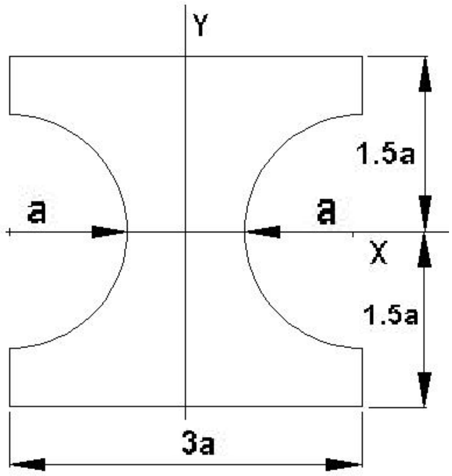
4. Find the surface area & earth entry capsule for an unmanned mars sampling mission. Approximate the rounded nose with a pointed nose as shown with dashed lines
   (Ans: 0.862m^2, 0.0633m^3)

5. Determine the center of gravity of the triangular figure formed by bending a thin homogenous wire. (Ans: 100mm, 30mm)



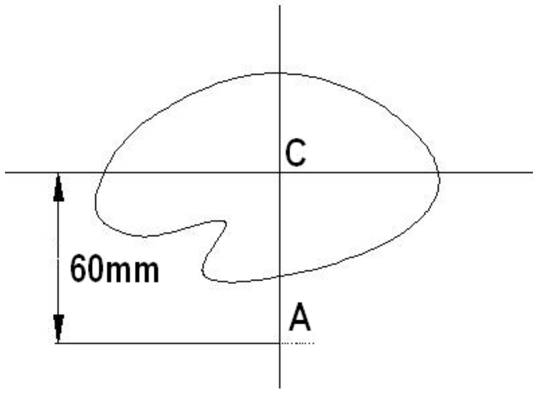
6. Determine the moment of inertia and radius of gyration of the shaded area with respect to X & Y axes. (Ans: 3/35 ab^3, 3/35 a^3b, b√ (9/35), a√ (9/35))





7. Determine the moment of inertia of the shaded area shown with respect to the X & Y axes when a=20mm. (Ans: $95.4 \times 10^4 mm^3$, $46.3 \times 10^4 mm^3$)

8. The shaded area is equal to 5000 mm^2, determine the centroidal moment of inertia I_x & I_y knowing that I_y=$2I_x$ and the polar moment of inertia of the area about point A is $J_A = 22.5 \times 10^6$ mm^4.
(Ans 1.5×10^6 mm, 3.0×10^6 mm)



9. Determine moment of inertia I_x ,I_y ,I_{xy} of the areas shown with respect to the centroidal X and Y axes. Also determine the orientation of the principal axes through the centroid and the principal moment of inertia.

Ans: (a) 3.2×10^6 mm^4, 7.2×10^6 mm^4, 2.4×10^6 mm^4, θ=25.1°,8.32×10^6 mm^4, 2.1×10^6 mm^4,
(b) 0.61×10^6 mm^4,1.9×10^6 mm^4,-0.8×10^6 mm^4, θ=-25.7°,$2.28 \times 10^6 mm^4$, 0.23×10^6 mm^4,

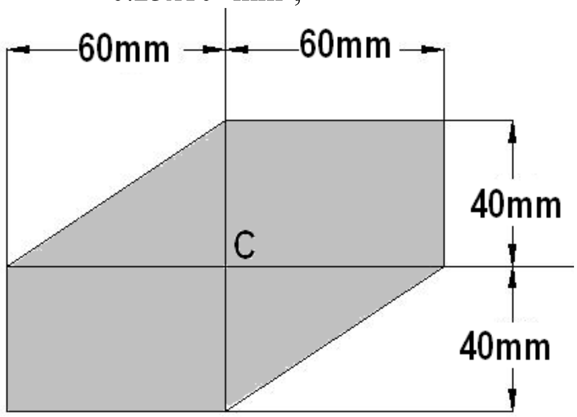


FIG: a