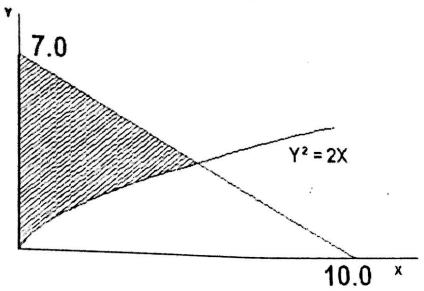
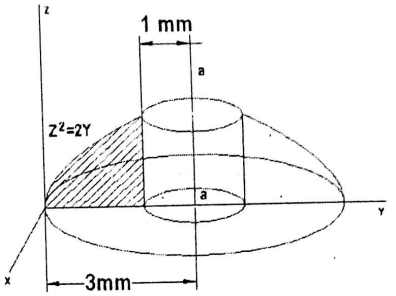
PROPERTIES OF SURFACES (TUTORIAL SHEET 6)

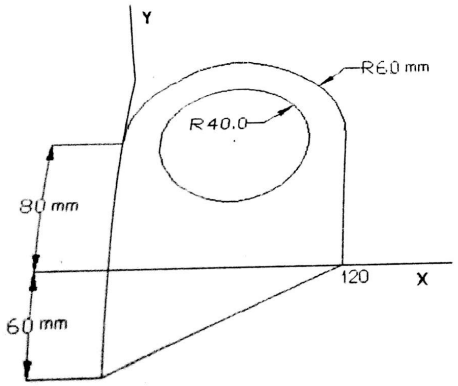
1. What are the coordinates of the centroid of the shaded area? The parabola is given as $Y^2=2X$. X & Y are in mm. (Ans: 1.7 mm, 3.75 mm)

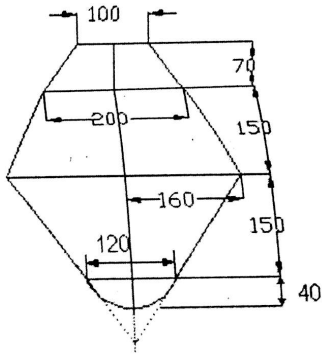




2. Locate the centroid of the volume formed by rotating the shaded area about the a-a axis. (Ans: 0.0m, 3.0m, 0.694m)

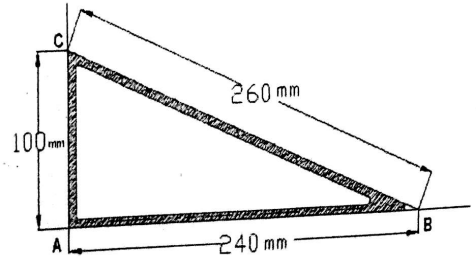
3. For the plane area shown, determine
   (a) the first moments about X and Y axes, (b) the location of the centroid.
   (Ans:$506\times10^3 mm^3$, 758×10^3 mm^3, 54.8mm, 36.6mm)





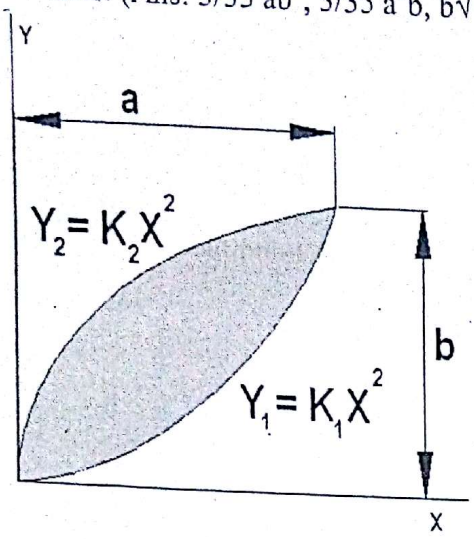
All dimensions are in mm

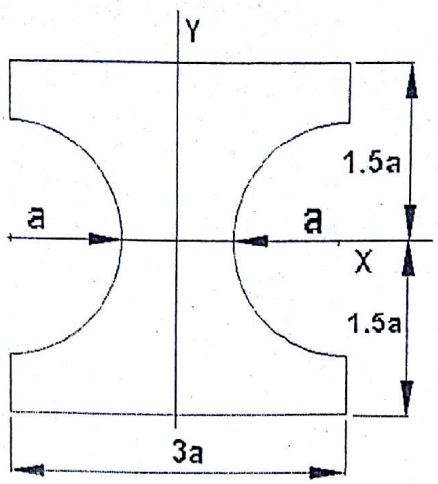
4. Find the surface area & earth entry capsule for an unmanned mars sampling mission. Approximate the rounded nose with a pointed nose as shown with dashed lines
   (Ans: $0.862m^2$, $0.0633m^3$)



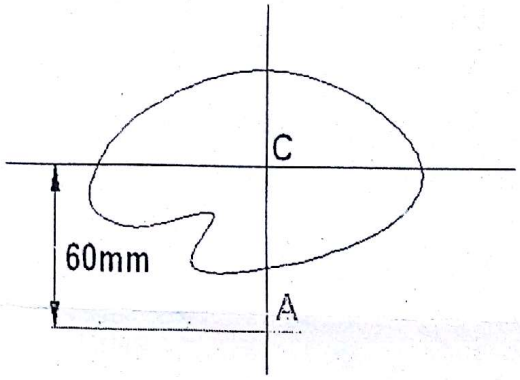
5. Determine the center of gravity of the triangular figure formed by bending a thin homogenous wire. (Ans: 100mm, 30mm)

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, $b\sqrt{(9/35)}$, $a\sqrt{(9/35)}$)





7. Determine the moment of inertia of the shaded area shown with respect to the X & Y axes when a=20mm. (Ans: $95.4x10^4 mm^3$, $46.3x10^4 mm^3$)



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 $1.5x10^6$ mm, $3.0x10^6$ 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) $3.2x10^6 mm^4$, $7.2x10^6 mm^4$, $2.4x10^6 mm^4$, θ=25.1°,$8.32x10^6 mm^4$, $2.1x10^6 mm^4$,
(b) $0.61x10^6 mm^4$,$1.9x10^6 mm^4$,$-0.8x10^6 mm^4$, θ=-25.7°,$2.28x10^6 mm^4$, $0.23x10^6 mm^4$,

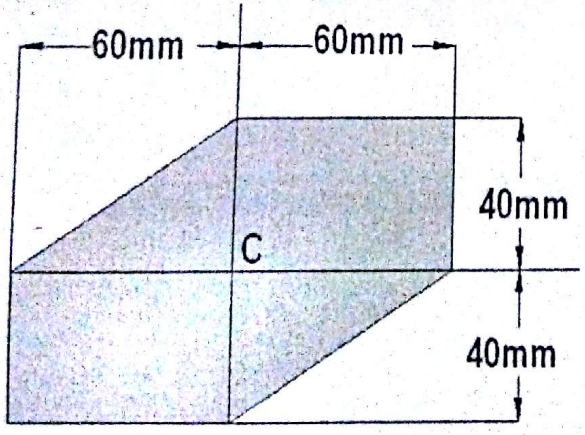


FIG: a

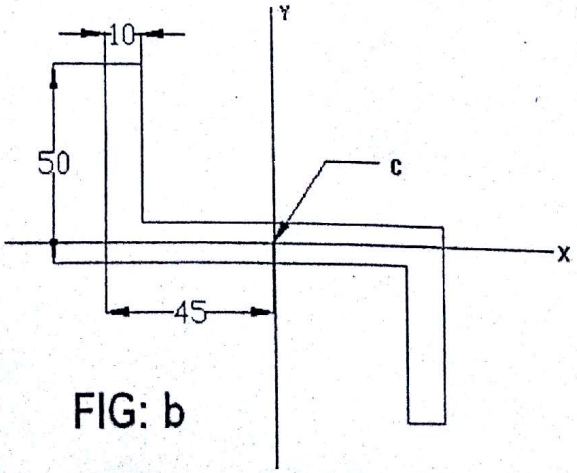


FIG: b