

1. A flat contour is defined in the polar coordinate system by

$$r(\phi) = a \sin(3\phi).$$

Plot this contour. What is the minimal range of ϕ to make this contour closed? Calculate the length of the minimal closed contour. Calculate the area of the closed contour. Calculate the moments of inertia I_{xx} , I_{yy} , and I_{zz} considering separately the cases when (a) the mass is uniformly distributed over the area of the contour (solid contour) and (b) the mass is concentrated on the contour (hollow contour).

2. Calculate the surface area of the ellipsoid of revolution

$$\frac{x^2 + y^2}{a^2} + \frac{z^2}{c^2} = 1$$

and plot this ellipsoid.

3. Calculate the flux of the electric field created by a point charge Q through an infinite plane situated at the distance a from the charge.