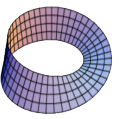
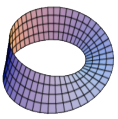


Moment of Inertia – Proofs

1. * Prove that the moment of inertia of a uniform circular disc, of mass m and radius r , about an axis through its centre perpendicular to its plane is $\frac{1}{2}mr^2$.
2. * Prove that the moment of inertia of a uniform square lamina of mass m and side $2l$ about an axis through its centre parallel to one of its sides is $\frac{1}{3}ml^2$.
3. * Prove that the moment of inertia of a uniform rod of mass m and length $2l$ about an axis through its centre perpendicular to the rod is $\frac{1}{3}ml^2$.
4. * Prove that the moment of inertia of a uniform rod [ab] of mass m and length $2l$ about a perpendicular axis through its endpoint a is $\frac{4}{3}ml^2$.
5. * A lamina is rotating with angular velocity ω about an axis perpendicular to its plane. If the moment of inertia of the lamina about the axis is I , prove that the kinetic energy is $\frac{1}{2}I\omega^2$.
6. * Find the moment of inertia of a uniform circular disc, of mass m and radius r , about an axis through its circumference perpendicular to its plane is $\frac{1}{2}mr^2$.
7. * Find the moment of inertia of a uniform square lamina of mass m and side $2l$ about an axis through its vertex parallel to one of its sides is $\frac{1}{3}ml^2$.
8. * Find the moment of inertia of a uniform rod of mass m and length $2l$ about an axis through its endpoint perpendicular to the rod is $\frac{1}{3}ml^2$.
9. * Find the moment of inertia of a uniform rod [ab] of mass m and length $2l$ about a perpendicular axis through its center a is $\frac{4}{3}ml^2$.
10. ** A hoop is made by removing a disc of radius r from the middle of larger disc of radius R . Show that the moment of inertia about an axis perpendicular to the plane of the hoop through its centre is $\frac{1}{2}M(R^2 + r^2)$, where M is the resultant mass.



Source(s):

- <http://www.examinations.ie/>
- <http://www.MathsGrinds.ie/>

Further Information:

- Questions marked with an asterisk * are past Leaving Cert Exam questions.
- Questions marked with a double asterisk ** are taken from Oliver Murphy's Book "Fundamental Applied Maths".

Answers:

1. See 2013A, 2012A, 2010A, 2008A, 2004A, 2001A, 2000A, 1997A, 1996A or 1995A
2. See 2011A or 2007A
3. See 2009A, 2006A, 2005A, 2003A, 2002A or 1999A
4. See 1998A
5. See 1998B
6. $\frac{3}{2}mr^2$.
7. * $\frac{25}{3}ml^2$.
8. * $\frac{4}{3}ml^2$.
9. * $\frac{7}{3}ml^2$.
10. ** N/A