2008 **8.** **(a)** 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 $\frac{1}{2}mr^2$.

Let M = mass per unit area

mass of element $= M\{2\pi x\, dx\}$

moment of inertia of the element $= M\{2\pi x\, dx\}x^2$ — 5

moment of inertia of the disc $= M\,2\pi \int_0^r x^3\, dx$ — 5

$= M\,2\pi \left[\frac{x^4}{4}\right]_0^r$ — 5

$= \frac{1}{2} M \pi r^4$

$= \frac{1}{2} m r^2$ — 5

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