Honors Calculus 252-2

Winter 2002

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Problem Set 2

to be handed in Friday January 18, 2002, in class

1. (a) Compute the mass M of a disc of unit radius lying in the $x-y$ plane and centered at the origin with density (in polar coordinates) $\rho(r,\theta)=r$.

   (b) Use the Law of Cosines to compute the square of the distance between a point $(x_0,y_0)=(d,0)$ and a point with polar coordinates (r,θ).

   (c) Compute the moment of inertia $I(d,0)$ of the disk with respect to a vertical axis of rotation through $(d,0)$.

   (d) Show that

$$I(d,0)=I(0,0)+Md^2. \tag{1}$$

   For which d is the moment of inertia minimal? Eq.(1) is an example of the *parallel axis theorem.*

2. For the region $\mathcal{R}$ defined by $x^2+y^2\leq a^2,\ x\geq 0,\ y\geq 0$, evaluate the following integrals:

   (a)

$$\int\int_{\mathcal{R}} xy\ dA \tag{2}$$

   (b)

$$\int\int_{\mathcal{R}} \frac{1}{\sqrt{x^2+y^2}}\ dA \tag{3}$$

3. 7.2.8, 7.2.11, 7.2.14, 7.2.25, 7.2.29

4. 7.3.4,iv, 7.3.5,iv, 7.3.12