18.02 HOMEWORK #7, DUE THURSDAY OCTOBER 25TH

Part A (10 points)

(10/18) Read: 14.4; Notes I.2; centroid, page 968-970, moments of inertia, pages 973-975.
3B/1<u>ac</u>d, 2b<u>d</u>, 3<u>ac</u>,
3C/<u>1</u>, 2<u>a</u>, <u>4</u>,
14.4/<u>4</u>, <u>17</u>, 25,
14.5/11.
(10/19) Review
(10/23) 2nd midterm

Part B (13 points)

1. (Thursday 4 points) Show that the average distance of a point in a disk of radius a to its centre is $\frac{2a}{3}$.

2. (Thursday 4 points) If L is a line in the plane, then the moment of inertia about L is given by

$$I_L = \iint_R d^2 \delta \, \mathrm{d}A,$$

where $d = d(x,y)$ is the distance from the point (x,y) to the line L. Let $(\bar{x}, \bar{y})$ be the centre of mass, let I be the usual moment of inertia about the y-axis,

$$I = \iint_R x^2 \delta \, \mathrm{d}A,$$

and let $\bar{I}$ be the moment of inertia about the vertical line $x = \bar{x}$. Show that

$$I = \bar{I} + M\bar{x}^2,$$

where M is the total mass.

3. (Thursday, 5 points) Find the average area of a triangle inscribed in the unit circle. Assume that each vertex is equally like to be at any point of the circle and that the location of one vertex does not affect the location of the other vertices. (*Hint: put one vertex at* $(1,0)$ *and use the polar angles of the other two vertices as variables*).

Part C: 0 points