18.02ρ Problem Set 6

(Due Tuesday, November 1, 11:59:59 PM)

Part I (56 points)

HAND IN ONLY THE UNDERLINED PROBLEMS
(The others are *some* suggested choices for more practice.)
EP = Edwards and Penny; SN = Supplementary Notes (most have solutions)

Double and triple integrals in rectangular coordinates
Reading: EP §§14.1, 14.2, 14.3, 14.6 SN §I
Exercises:
EP §14.1 31
EP §14.2 6, 13, 17, 22, 28
EP §14.3 6, 17, 24, 33 (setup only), 37, 42, 44
EP §14.6 3, 7, 17, 43, 44, 48
SN §3A 1, 3

Change of variables, double integrals in polar coordinates
Reading: EP §§14.4, 14.9, SN §CV
Exercises:
EP §14.4 3, 12, 15, 29, 34, 35
EP §14.9 7, 9, 10, 12, 20
SN §3B 2, 4
SN §3D 2

Triple integrals in spherical and cylindrical coordinates
Reading: EP §14.7
Exercises:
EP §14.7 3, 10, 15, 22, 28, 35, 37, 38, 40, 42

Part II 44 points

Problem 1 (8)
Find the average squared distance between two points in the unit disc (the points are both chosen uniformly and independently). [Hint: You should evaluate a quadruple integral. The law of cosines is your friend.]

Problem 2 (6; 3,3)

a) Find a change of coordinates (s, α) such that $\alpha = 3\theta$ and $dx\,dy = s^5 ds\,d\alpha$.

b) Let $\mathcal{R}$ be the disc of radius 3 centered at the origin. Evaluate the integral

$$\iint_{\mathcal{R}} e^{x^2+y^2}\,dx\,dy$$

using the coordinates (r, θ) and (s, α). Verify that you get the same answer.

Problem 3 (12; 3,3,3,3) EP §14.9 28 and 29.

Problem 4 (12) EP §14.Misc 54. There's a typo in the problem: $r^2 = \frac{uv}{u+v}$ should be $r^4 = \frac{uv}{u+v}$. Also, the final answer may be wrong, so don't worry if you get something else.

Problem 5 (6) EP §14.7 44.