18.02   Problem Set 9
(Due Tuesday, May 3, 11:59:59 PM)

Part I  (80 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)

Divergence Theorem
Reading: EP §15.6 SN §V10
Exercises:
EP §15.6 4, 5, 7, 9, 10, 12, 16, 17, 21, 23, 27
SN §6C 4, 5, 7, 11

Part II  (20 points)

Directions: Try each problem alone for 20 minutes. If you collaborate later, you must write up solutions independently.

Problem 1  (20) Consider a torus of inner radius 3, outer radius 5 whose plane of symmetry is the $xy$-plane and whose center lies at the origin. Let $S_1$ be the part this torus above the $xy$-plane and let $S_2$ be the portion of the $xy$-plane lying inside this torus. Let $F(x, y, z) = (x + \sin(yz), x^2(2yz - 1) + z^2, x^2 + y^2 + z^2 - z)$. Compute $\int_{S_1} F \cdot ndS$ by computing $\int_{S_2} F \cdot ndS$ and then using the divergence theorem. [Hint: what type of symmetry does the torus have?]