Reading assignment
Ulaby, 3-1, 3-2, 3-3, Inside back cover
Connor and Salon, I-1 → I-14

Software
Maple (check your solutions)

Problem 1 - Dot and cross products
Given $\mathbf{A} = r^3 \mathbf{a}_r + 4 \sin \theta \mathbf{a}_\phi$ and $\mathbf{B} = 3 \mathbf{a}_r + 2 \mathbf{a}_\theta + 12 \sin \theta / r^3 \mathbf{a}_\phi$
Find $\mathbf{A} \cdot \mathbf{B}$ and $\mathbf{A} \times \mathbf{B}$

Problem 2 - Area integrals
For each of the following surfaces, sketch the surface, and find its area.
a. $r = 3, 0 \leq \varphi \leq \pi/3, -2 \leq z \leq 2$.  
b. $0 \leq r \leq 5, \theta = \pi/3, 0 \leq \varphi \leq 2\pi$.  
c. Identify $d\mathbf{s}$ for each of the surfaces.

Problem 3 - Volume integrals
a. Sketch each of the following volumes and then calculate its value by integrating over the appropriate differential volume element.
   1) $2 \leq x \leq 5, 0 \leq y \leq 3, -2 \leq z \leq 3$.  
   2) $1 \leq r \leq 3, 0 \leq \varphi \leq \pi/3, -2 \leq z \leq 2$.  
b. Integrate the function $(a^e r^a / r)$ over the volume of a sphere of radius $a$.

Problem 4 - Useful areas and volumes
a. What is the surface area of a sphere of radius $r$?
b. What is the surface area of the side of a cylinder with radius $r$ and length $l$?
c. What is the volume of a sphere of radius $r$?
d. What is the volume of a cylinder of radius $r$ and length $l$?