Due Date: Thursday, September 8 at 5PM EDT

Carefully read and provide solutions to the problems below, showing all work required to justify any conclusions you make. You are encouraged to collaborate with your classmates, but all solutions turned in should be your own work. If you do collaborate, please record the names of those other students on your submitted work. Finally, your work should be submitted as a PDF on Canvas before the listed due date.

Textbook problems: Section 12.1 #8, 14, 16, 30, 38; Section 12.2 #26; Section 12.3 #4, 10, 16, 18, 32, 42; Section 12.4 #2, 14, 20, 32; Section 12.5 #2, 8, 24, 32

Optional textbook problems: the odd numbered problems from Sections 12.1 - 12.5

Problem 1. Find the volume that lies inside both of the following spheres:

$$x^2 + y^2 + z^2 + 4x - 6y + 2z + 6 = 0 \quad \text{and} \quad (x+2)^2 + (y-3)^2 + (z+1)^2 = 4.$$

Problem 2. Two vectors $\vec{v}$ and $\vec{w}$ are **parallel** if they have the same or opposite direction. That is, $\vec{v}$ and $\vec{w}$ are parallel if $\vec{v} = c\vec{w}$ for a nonzero number c, which can be $c > 0$ (same direction) or $c < 0$ (opposite direction). If $\vec{v}$ and $\vec{w}$ are parallel vectors, what is $\vec{v} \cdot \vec{w}$? What are the possible angles between $\vec{v}$ and $\vec{w}$?