Some easy problems

1. Consider the cylinder with radius 2 and height 4. We use the cylindrical coordinate \((\rho, \theta, z)\) to parametrize it.
   a). Find the ranges for \(\rho, \theta, z\)
   b). Find the volume element.
   c). Evaluate the integral \(\int_V z^2 dV\) where \(V\) is the volume inside the cylinder.

2. Consider the surface \(S\) of the cube \(0 \leq x, y, z \leq 1\).
   a). Calculate \(\int_S (x^2 + 1) dS\)
   b). Let \(d\vec{S}\) be the area element where we use the outer normal vector for the direction.

Then calculate \(\int_S \vec{r} \cdot d\vec{S}\)

1.5

Do #1 again and compare the solutions here with your solutions to #1 in 1.6. Convince yourself that the two methods to finding the surface elements and volume elements are actually the same.

Do #2 #4 again.

1.6

Do #1, #2 #3 carefully and understand all of them.
Spend some time thinking about #4.
For #2, find the corresponding formula in Math222 (the polar coordinate) and see how we arrived at this same formula there.