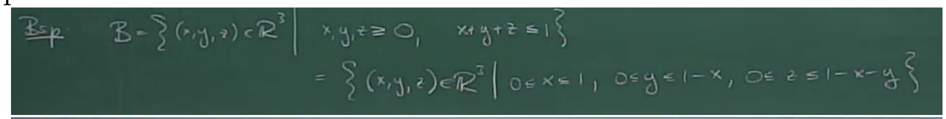
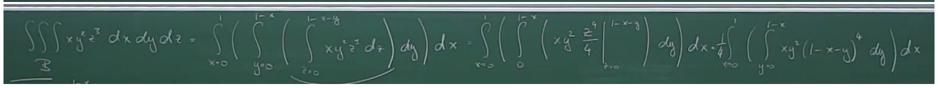
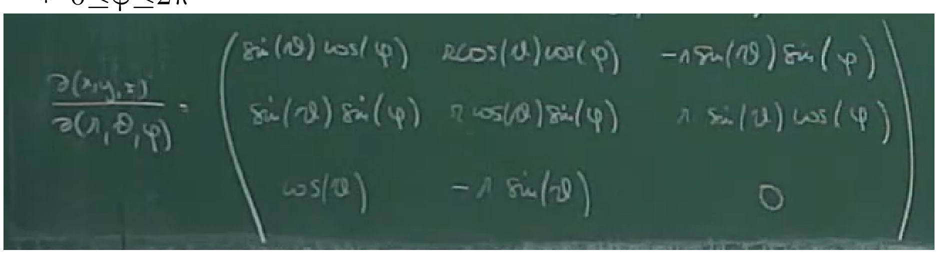
- $R = [a_1, b_1]x[a_2, b_2]x[a_3, b_3]$
- $\int \underset{R}{\int} \int f(x, y, z)dydydz = \int_{x=a_1}^{b_1} (\int_{x=a_2}^{b_2} (\int_{x=a_3}^{b_3} f(x, y, z)dz)dy)dx$
  - andere Reihenfolgen auch möglich

Normalbereich im R^3

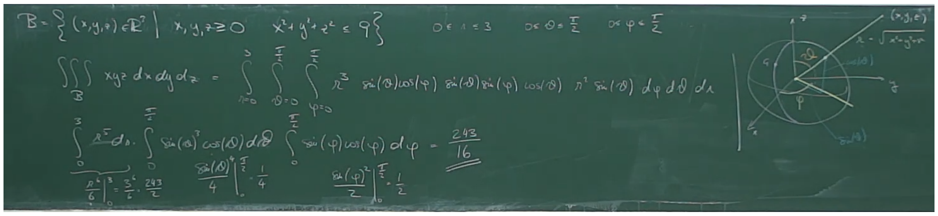
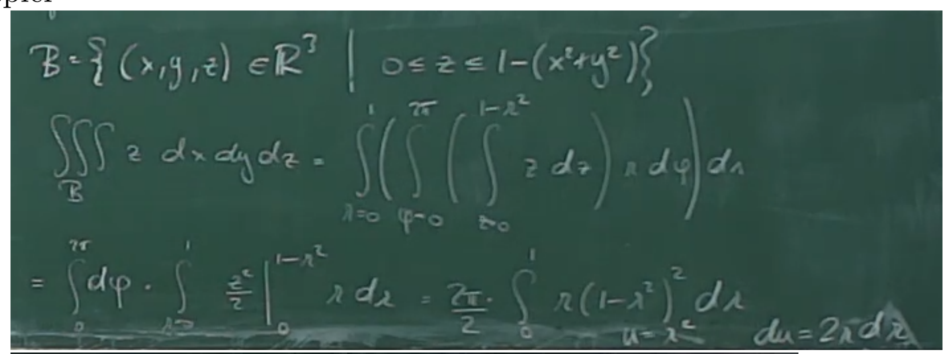
- $N = (x, y, z) \in \mathbb{R}^3 | (x, y) \in M, g(x, y) \leq z \leq h(x, y)$
- $vol(N) = \int_{y=c}^{d} (\int_{x=\psi(y)}^{\varphi(y)} (\int_{z=g(x,y)}^{h(x,y)} dz)dx)dy$
- Beispiel
  - 

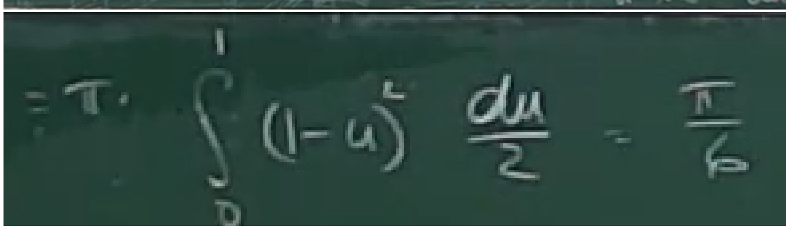
  - 

Substitutionsregel (Transformationsformel)

- $T : B{-}{>}\mathbb{R}^3$
- T differenzierbar und injektiv
- $\int \underset{T(B)}{\int} \int f(x, y, z)dxdydz = \int \underset{B}{\int} \int f * T(u, v, w) * |det \frac{\partial(x,y,z)}{\partial(u,v,w)}|dudvdw$
- Volumensumrechnungsfaktor - JACOBI-Determinante
  - x,y,z beliebig vertauschbar
- Beispiel: dreidimensionale Polarkoordinaten
  - x ==> rsin(ψ)cos(φ)
  - y ==> rsin(ψ)sin(φ)
  - z ==> rcos(ψ)
  - Bedingungen
    * r≥0
    * 0≤ψ≤π
    * 0≤φ≤2π
  - 

  - Beispiel: Polarkoordinaten bei Kugel

* 
- Zylinderkoordinaten
  - x ==> rcos(φ)
  - y ==> rsin(φ)
  - z ==> z
  - Volumenselement
    * $dxdydz = rdrd\varphi dz$
  - Beispiel
    * 

    * 

[[Mehrdimensionale Integralrechnung]]