

Homework 1

1.1 (10 points) Prove the results in Example 1.B and 1.C (Please first calculate the matrix C using the definition of \mathbf{e}'_i (this is the polar coordinate system) and the definition of \mathbf{e}_i (this is the cartesian system). Then calculate F_{ij} and v' and a').

1.2 (10 points) An airplane flies from city A – spherical coordinates: (ϕ_A, θ_A) – to city B – (ϕ_B, θ_B) –. The pilot keeps a constant γ angle between the direction of the plane and the direction indicated on the magnetic compass. Calculate γ ! (We assume that the magnetic and geological poles are identical, plus the earth is a perfect sphere.)

2.3 (10 points) Find the work done by the vector field

$$\mathbf{F}(x, y, z) = (x, 3xy, -(x + z)) \tag{1}$$

on a particle moving along the line segment that goes from $(1,4,2)$ to $(0,5,1)$