ES202 - Assignment

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PLACHOLDER

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1 Introduction

These are my solutions to the assignment given in the course ES202.

1.1 AI Policy of This Paper

Large-Language-Model's (LLM) are only used in the formatting of this file. At no point, LLM's are used to solve the questions in the assignment, unlike other students taking the course who like to ask the help of LLMs even during the examinations. The reason this is written in LaTeX rather than by hand, is only because I have no time to do it by hand, and wanted to improve my LaTeX skills. The git commit history can be found in the GitHub repository jayshozie/es202-assignment, also as a proof of the fact that this entire document was written by hand.

2 Question 1

Problem An airplane is monitored at coordinates $(5, 7, 4)$ relative to the airport (South, East, Up). Find the directional angles of the plane.

Solution: Let the position vector of the plane be $\vec{r}$. We define the axes such that $x =$ South, $y =$ East, and $z =$ Up.

$$\begin{aligned}
\vec{r} &= 5\hat{i} + 7\hat{j} + 4\hat{k} \\
\|\vec{r}\| &= \sqrt{5^2 + 7^2 + 4^2} \\
&= \sqrt{25 + 49 + 16} \\
&= \sqrt{90} \\
&\approx 9.4868
\end{aligned}$$

The directional angles α, β, γ are given by the direction cosines:

$$\begin{array}{lll}
\alpha = \cos^{-1}\left(\dfrac{r_x}{\|\vec{r}\|}\right) & \beta = \cos^{-1}\left(\dfrac{r_y}{\|\vec{r}\|}\right) & \gamma = \cos^{-1}\left(\dfrac{r_z}{\|\vec{r}\|}\right) \\
= \cos^{-1}\left(\dfrac{5}{\sqrt{90}}\right) & = \cos^{-1}\left(\dfrac{7}{\sqrt{90}}\right) & = \cos^{-1}\left(\dfrac{4}{\sqrt{90}}\right) \\
\approx 58.19^\circ & \approx 42.45^\circ & \approx 64.06^\circ
\end{array}$$

2.1 Question 2

Problem Prove that

$$\left\|\vec{a}.\vec{b}\right\| \leq \|\vec{a}\|.\left\|\vec{b}\right\|$$