

Reading Questions 5

page 61-62 Orthogonal Projections

1. The orthogonal projection of a vector onto a line L is a vector that is parallel to L .
2. The transformation $\text{proj}_L(\vec{x})$ is the orthogonal projection of the vector \vec{x} onto the line L .
3. Suppose the vector \vec{u} is a unit vector. What is the value of $\|\vec{u}\|^3$?

Section 2.2 Linear Transformations in Geometry (Part 1)

Scalings and Orthogonal Projections

P 1. Find the matrix corresponding to the transformation $T(\vec{x}) = 2023\vec{x}$. How does this transformation transform the vector \vec{x} ?

P 2. Write down the formula and matrix for the orthogonal projection of \vec{x} passing through the line $(0, 0)$ and (u_1, u_2) where $u_1^2 + u_2^2 = 1$.

P 3. Let L be the line in \mathbb{R}^2 that consists of all scalar multiples of the vector $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$. Find the orthogonal projection of the vector $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$ onto L .

Reflections and Rotations

P 4. Write down the matrix for the reflection transformation that reflects vectors over the line L containing the unit vector $\begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$.

P 5. Find the matrix for the linear transformation that reflects vectors in \mathbb{R}^2 over the line $y = -2x$.

P 6. Find the matrix for the linear transformation that rotates vectors in \mathbb{R}^2 by 60° .