1. Introduction

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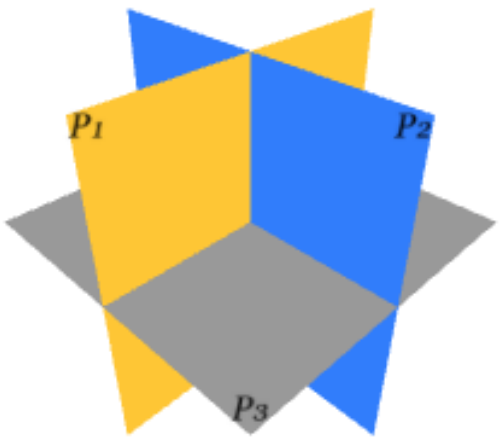
Introduction

For this unit, we will focus on a particular family of multivariate functions: the **linear** functions. You will see the nice properties of linear functions and study examples such as:

1. The equations of planes.



Clickable 3D image showing three planes.

2. Image rotation.

Click image to toggle animation.

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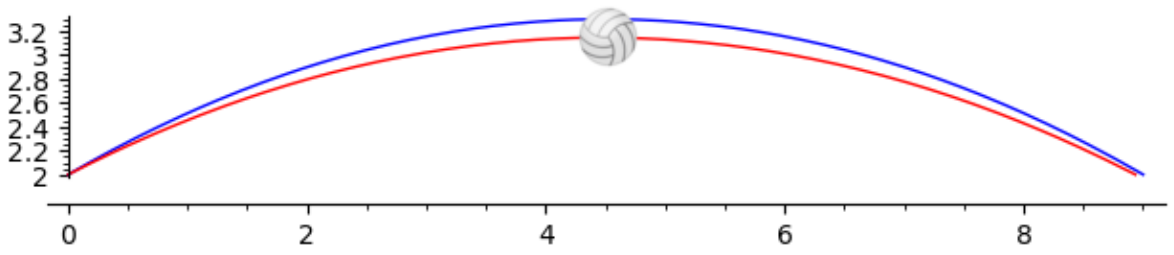
3. Serving a volleyball.



You have already encountered linear functions of several variables. For example, 3D planes are given by $z = ax + by + c$. You have also seen linear functions that result from doing linear approximation (these are the "tangent plane" approximations). In this section, we will be looking more closely at linear functions through the lens of **matrices**.

In this first lecture, we will show you an example of matrices arising "in the wild". We hope you will come to see matrices and linear functions all over science and engineering!

The final topic of this unit is **linearization**, the process by which any function can be replaced, for small inputs, by a linear one. In this sense, the study of linear functions will help us to better understa

Objectives

By the end of this lecture and recitation, you will be able to:

1. Given a vector v, find the coordinates of the vector obtained by **rotating** v by an angle θ.

2. **Multiply** a matrix by a vector (2×2 and 3×3).

3. Recognize and **re-write equations** that can be written as a matrix times a vector.

4. **Multiply** a matrix by a matrix (2×2 and 3×3).

5. Make use of the interpretation of matrix multiplication as **composition**.

6. Apply matrices to **computer graphics**.

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