MATH 220

12 May 2025

RECALL: <u>basis</u> is a linearly independent spanning set

<u>dimension</u> is the number of elements in a basis

Standard basis for $\mathbb{R}^4$: $\underbrace{\left\{ \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} \right\}}_{\text{set of vectors}}$ $\dim(\mathbb{R}^4) = 4$

Standard basis for $\mathbb{R}^{2\times 2}$: $\left\{ \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix} \right\}$ $\dim(\mathbb{R}^{2\times 2}) = 4$

Standard basis for $\mathbb{P}^3$: $\{1, x, x^2, x^3\}$ $\dim(\mathbb{P}^3) = 4$

polynomials, degree ≤ 3

$a + bx + cx^2 + dx^3$

Standard basis for $\mathbb{P}$: $\{\underbrace{1, x, x^2, x^3, x^4, x^5, x^6, \ldots}_{\text{infinitely many terms!}}\}$ $\dim(\mathbb{P}) = \infty$

polynomials of <u>any</u> degree

$a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \ldots$

$\mathbb{P}$ is an <u>infinite-dimensional vector space</u>!