

$(2, 2.2, 4) \subset [2]$

Define

$$T: M_{2 \times 2}(\mathbb{R}) \rightarrow P_2(\mathbb{R}) \text{ by } T \begin{pmatrix} a & b \\ c & d \end{pmatrix} \\ = (a+b) + (2d)x + bx^2$$

Let

$$\beta = \left\{ \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix} \right\}$$

$$\text{and } \gamma = \{1, x, x^2\}$$

Compute $[T]_{\beta}^{\gamma}$

$$T \begin{pmatrix} a & b \\ c & d \end{pmatrix} = (a+b) + (2d)x + bx^2$$

$$T \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} = 1$$

$$T \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix} = 1 + x^2$$

$$T \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix} = 0$$

$$T \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix} = 2x$$

$$[T]_{\beta}^{\gamma} = \begin{pmatrix} 1 & 1+x^2 \\ 0 & 2x \end{pmatrix}$$