

## Assignment 14

- The set  $\mathcal{B} = \{1 - t^2, t - t^2, 2 - 2t + t^2\}$  is a basis for  $\mathbb{P}_2$ .
  - What is the coordinate vector of  $6 + 2t - 12t^2$  with respect to  $\mathcal{B}$ ?
  - If  $[p(x)]_{\mathcal{B}} = \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}$  what is  $p(x)$ ?
- Let  $T: \mathbb{P}_2 \rightarrow \mathbb{M}_{2 \times 2}$  be the transformation  $T(p) = \begin{bmatrix} p(0) & p(-1) \\ p(1) & p(2) \end{bmatrix}$ .
  - What is the matrix of  $T$  relative to the standard bases for  $\mathbb{P}_2$  and  $\mathbb{M}_{2 \times 2}$ ?

Let  $S: \mathbb{P}_3 \rightarrow \mathbb{M}_{2 \times 2}$  be the transformation  $S(p) = \begin{bmatrix} p(0) & p(-1) \\ p(1) & p(2) \end{bmatrix}$ . (The only difference between  $S$  and  $T$  is the type of input.)

  - What is the matrix of  $S$  relative to the standard bases for  $\mathbb{P}_3$  and  $\mathbb{M}_{2 \times 2}$ ?
- Let  $T: \mathbb{P}_2 \rightarrow \mathbb{R}^2$  be given by  $T(p(x)) = \begin{bmatrix} \int_{-1}^0 p(x) dx \\ \int_0^1 p(x) dx \end{bmatrix}$ .
  - Compute  $T(x^2), T(x), T(1)$ .
  - What is the matrix of  $T$  with respect to the standard bases of  $\mathbb{P}_2$  and  $\mathbb{R}^2$ ?
- Let  $V$  be the subspace of the vector space of real valued continuous functions of a single real variable generated by  $\cos(x)$  and  $\sin(x)$ . Let  $T: V \rightarrow V$  be defined by  $T(f(x)) = f'(x) + f''(x)$ . What is the matrix of  $T$  relative to the basis  $\{\cos(x), \sin(x)\}$ ?
- Find the change of coordinates matrix from  $\mathcal{B} = \left\{ \begin{bmatrix} -1 \\ 8 \end{bmatrix}, \begin{bmatrix} 1 \\ -5 \end{bmatrix} \right\}$  to  $\mathcal{C} = \left\{ \begin{bmatrix} 1 \\ 4 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix} \right\}$ .
- In  $\mathbb{P}_2$  find the change of coordinates matrix from  $\mathcal{B} = \{1 - 3t^2, 2 + t - 5t^2, 1 + 2t\}$  to the standard basis.