

Practice Problems About Coordinates

- (1) Write down an ordered basis \mathcal{B} for $\mathbb{P}_3(t)$, and then write down the matrix $_{\mathcal{B}}[T]_{\mathcal{B}}$ for the transformation $T: \mathbb{P}_3(t) \rightarrow \mathbb{P}_3(t): f(t) \mapsto f(t+1)$.

- (2) Let θ be an angle. Using the standard basis for \mathbb{R}^2 , write down matrices for the following transformations.
 - (a) The counterclockwise rotation of the plane through the angle θ which leaves the origin fixed.

 - (b) The reflection of the plane through the line $y = \tan(\theta) \cdot x$.

- (3) Let $V := \mathbb{P}_3(t)$ and let U_a be the subspace of V consisting of all polynomials in V that have a as a root ($U_a = \{p(t) \in \mathbb{P}_3(t) \mid p(a) = 0\}$). Find a basis for $U_2 \cap U_3$. (Warning: make sure your basis vectors lie in the space.)

- (4) A square matrix M is symmetric if $M^T = M$, and is antisymmetric if $M^T = -M$. Find a basis for the space of 2×2 real symmetric matrices, and then find a basis for the space of 2×2 real antisymmetric matrices.