

NAME

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Write your final **solutions** on this sheet. INCLUDE ALL **NECESSARY** COMMENTS, CALCULATIONS and EXPLANATIONS.

1. Find all complex numbers which are equal to (one of) their own roots of order 7.

2. $\mathbf{R} = \{v_1, v_2, v_3\}$ is a basis for \mathbf{R}^3 .

(a) Is $S = \{v_1+v_2, v_2+v_3, v_3+v_1\}$ a basis for \mathbf{R}^3 ?

(b) If the answer to (a) is YES: what is the matrix of F in S , where $F(x, y, z) = (x, y, z)$

3. $F: \mathbf{R}_n[x] \rightarrow \mathbf{R}_n[x]$, $F(f) = f'$. Prove that F is a linear mapping. Find $\ker(F)$ and $\text{im}(F)$.

4. Find a diagonal matrix D similar to the matrix $A = \begin{bmatrix} 0 & -3 & -1 & 1 \\ 2 & 5 & 1 & -1 \\ -2 & -3 & 1 & 1 \\ 2 & 3 & 1 & 1 \end{bmatrix}$.

5. Find the inverse matrix for $A = \begin{bmatrix} -1 & -1 & -1 & -1 \\ 1 & 3 & 2 & 2 \\ 2 & 4 & 2 & 3 \\ 1 & 3 & 4 & 1 \end{bmatrix}$. Verify your answer by matrix multiplication.