Math 4305, Exam 2: 3.2-5.4 (practice) Name/Section: _____

1. (25 points) (3.7.6) Find the rank of the matrix

$$\begin{pmatrix} 1 & 1 & 3 \\ 2 & 1 & 4 \end{pmatrix}.$$

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2. (25 points) (4.3.20) Let $\mathcal{P}$ be the collection of quadratic (and lower order) polynomials in t. Let $\mathcal{B}$ denote the basis $\{1, t, t^2\}$ for $\mathcal{P}$. Find the matrix corresponding to the linear transformation $T : \mathcal{P} \to \mathcal{P}$ given by $T(f) = f'$ with respect to the basis $\mathcal{B}$.

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3. (25 points) (5.3.40) Find the orthogonal projection of $\mathbb{R}^4$ onto

$$W = \text{span}\left\{ \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ 9 \\ -5 \\ 3 \end{pmatrix} \right\}.$$

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4. (25 points) (5.4.23) Find the least-squares approximation for

$$\begin{pmatrix} 1 & 1 \\ 2 & 8 \\ 1 & 5 \end{pmatrix} \mathbf{x} = \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}.$$