Math 4326 | **LINEAR ALGEBRA** | Spring 2008

Dr. Duval | **Homework**

Thursday, April 3–REVISED

Follow the separate general guidelines for Parts A,B,C. Be sure to include and label *all four* standard parts (a), (b), (c), (d) of Part A in what you hand in.

## Orthogonal Projections and Minimization Problems

pp. 111–116

**A: Reading questions.** Due by 2pm, Wed., 9 Apr.

1. Find $U^\perp$ for $U = \operatorname{span}((9,1,5))$ in $V = \mathbf{R}^3$. Describe $U^\perp$ geometrically in this case.
2. Verify Theorem 6.29 in the case of question 1 above.
3. Find $P_U v$ for $v = (1,2,3)$ and $U = \operatorname{span}((9,1,5))$ in $V = \mathbf{R}^3$.
4. In the example starting on p. 114, approximating $\sin x$ by a 5th-degree polynomial, explain how $\int_{-\pi}^{\pi} |\sin x - u(x)|^2 \, dx$ is minimized using the inner product 6.39 and Proposition 6.36.

**B: Warmup exercises.** For you to present in class. Due by end of class Thu., 15 Apr.

**Verify** the five properties of $P_U$ listed near the top of p. 113.

**Ch. 6:** Exercises 19, 21.

## Generalized Eigenvectors (part I)

pp. 164–167

**A: Reading questions.** Due by 2pm, Wed., 16 Apr.

1. The text states, in the middle of p. 164, that the operator in 5.19 "does not have enough eigenvectors for 8.2 to hold." Explain carefully what that means in this case.
2. Show how the example at the top of p. 165 matches the equation near the bottom of p. 164, $V = \operatorname{null}(T - \lambda_1 I)^{\dim V} \oplus \cdots \oplus \operatorname{null}(T - \lambda_m I)^{\dim V}$.
3. The text claims, in the margin of p. 165, that "if $(T - \lambda I)^j$ is not injective for some positive integer $j$, then $T - \lambda I$ is not injective ...". Verify this claim.
4. Verify Proposition 8.5 for the linear operator $T \in \mathcal{L}(\mathbf{F}^4)$ given by $T(z_1, z_2, z_3, z_4) = (z_1, z_3, z_4, 0)$.

**B: Warmup exercises.** For you to present in class. Due by end of class Thu., 17 Apr.

**Ch. 8:** 1.