MATH 54 – HINTS TO HOMEWORK 15

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Here are a couple of hints to Homework 15. Enjoy! :)

Section 5.5: Complex eigenvalues

5.5.1, 5.5.3. Just use the same technique you usually use to find eigenvalues and eigenvectors!

5.5.7. First, calculate $r = \sqrt{det(A)}$ (or take the length of the first row of A). Then factor out r from A and recognize the resulting matrix as a rotation matrix, i.e. find ϕ such that the remaining matrix equals to $\begin{bmatrix} \cos(\phi) & -\sin(\phi) \\ \sin(\phi) & \cos(\phi) \end{bmatrix}$

5.5.13, 5.5.15. First, find the eigenvalues of A, and pick one of them. Then the first **ROW** of C consists the real and imaginary parts of the eigenvalue you picked. Then remember that the diagonal entries of C are the same, and the other entries are opposites of each other. Finally, to get P, find an eigenvector corresponding to the eigenvalue you picked, and then the columns of P are the real and imaginary parts of that eigenvector!

Section 6.1: Inner products, lengths, and orthogonality

6.1.7. Divide the vector by its length!

6.1.19.

(a) **T**
(b) **T**
(c) **T** (see pages 279-280)
(d) **F** (Vectors in $Col(A)$ are orthogonal to vectors in $Nul(A^T)$, by Theorem 3)
(e) **T** (this is **1.** at the bottom of page 280)

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6.1.22. $u \cdot u = u_1^2 + u_2^2 + u_3^2 \geq 0$ (as a sum of squares), and this is $= 0$ if and only if all the $u_i = 0$ (and hence $u = \mathbf{0}$), because a sum of squares is 0 if and only if each component is 0.

6.1.24. Use the fact that $\|\mathbf{w}\|^2 = \mathbf{w} \cdot \mathbf{w}$ for any $\mathbf{w}$, and expand the left-hand-side out using a distributive law similar to $(a+b)(c+d) = ac+ad+bc+bd$. Make sure to justify every step!