Solutions to Test 2

1. B - the matrix is upper triangular with diag. entries 0, 1, 2 and 3

2. C - you only need to check that the columns of the proposed P's are eigenvectors for 3, 2 and -1 - the eigenvalues of A.

3. B - If A is 3×3 then the char. poly is $\lambda^3 + a_2\lambda^2 + a_1\lambda + a_0$ and $a_2 = -tr(A)$, $a_0 = (-1)^3 \det(A)$

4. D - you multiply each vector by A and check.

5. C - the matrix which is similar will have the same char. poly which in this case is $(\lambda+1)(\lambda-1)(\lambda+2)(\lambda-2)$

6. D - the answer is a prob. vector which is also an eigenvector for $\lambda = 1$.

7. A

8. A - $i(2-i) = 1+2i$

9. B $\quad \dfrac{1+2i}{1-3i} \cdot \dfrac{1+3i}{1+3i} = \dfrac{-5+5i}{10} = -\dfrac{1}{2} + \dfrac{i}{2}$

10. C - $2^5\left(\cos\left(\frac{2\pi}{5}\cdot 5\right) + i\sin\left(\frac{2\pi}{5}\cdot 5\right)\right) = 32$

11. A

12. D − $\|u+v\|^2 = \|u\|^2 + \|v\|^2 - 2\|u\|\|v\| u\cdot v$
so $u \cdot v = 0$.

13. E $n = (1,-1,2)$ A point P on the plane is
$P = (0,0,1)$ so if $Q = (1,2,3)$
$u = \overrightarrow{PQ} = (1,2,2)$
and $\|\text{proj}_n u\| = \dfrac{|u\cdot n|}{\|n\|} = \dfrac{3}{\sqrt{6}}$

14. B − area $= \begin{vmatrix} 2 & 3 \\ 1 & 2 \end{vmatrix} = 4-3=1$

15. A