Math 461 Matlab HW 3.

When you generate a random $m \times n$ matrix , it would have rank as big as possible, which means the minimum of m and n. Try this by using $rank(rand(4,7))$, $rank(rand(8,4))$ etc.
You can generate $m \times n$ matrices with smaller rank by the following method. Assume you would like to get an 4×7 matrix of rank 2. Then use $A = rand(4,2) * rand(2,7)$. Try it and check that indeed rank equals 2.

Problem1. a) Generate random 6×8, 7×5, 10×10 matrices (do not print them !) and check that their ranks are as expected.
b) Generate a random 6×8 matrix of rank 3 . Check that its rank is 3.
Ask matlab for a basis for its nullspace. The matlab command $null(A)$ produces a matrix whose columns form a basis for the nullspace of A.
Use Matlab commands and the theory to check that you indeed got a basis for the nullspace of A.
First use matrix multiplication to check whether vectors you got are in the nullspace . Then check that they are linearly independent. Then refer to a theorem from the textbook which implies that these vectors span the nullspace.

Problem 2. Solve the following linear systems with complex coefficients by using two methods $rref([A\ b])$ and $x = A \backslash b$ and explain your answers.

$$\begin{array}{rcrcrcr} (1+i)x_1 & + & (2-i)x_2 & + & 3ix_3 & = & 7-5i \\ 2x_1 & + & & & (1-i)x_3 & = & 4i \\ x_1 & + & 4ix_2 & + & (1+3i)x_3 & = & -5+7i \end{array}$$

and

$$\begin{array}{rcrcrcr} (1+i)x_1 & + & (-3i)x_2 & + & x_3 & = & 5-4i \\ (3-i)x_1 & - & (6+i)x_2 & + & 3x_3 & = & 1+2i \end{array}$$