MATH 232: Engineering Mathematics
Reading Guide for LAS, Section 1.2: Matrix Multiplication

Goals: 1. To be able to view a matrix product $AB$ in terms of combining products of submatrices; most importantly, as linear combinations of the columns of $A$.
2. To be able to write a system of linear algebraic equations in terms of algebraic operations between matrices and vectors.

Read: Section 1.2 of LAS

Terms to know:
- linear combination, (linear) span, matrix blocks, outer product of vectors,
- column space of a matrix, coefficient matrix (for a system of algebraic equations)

Questions you should be able to answer:

1. If you block the matrix $A$ with vertical lines only, is there any need to block $B$ correspondingly to make use of these blocks (in $A$) in multiplying out $BA$? If so, how? If not, is it possible to block $B$ without introducing any new “dividers” that further block $A$?
2. True or False:
   - The rows of an outer product are all parallel.
   - An $m$-by-$n$ matrix can have any number of blocks from 1 up to $mn$.
   - The way to solve a matrix problem $Ax = b$ in practice is to multiply by $A^{-1}$.
3. The system of equations
   \[
   \begin{align*}
   3w + 5x - 6y + z &= 4 \\
   w + x^2 + y - 2z &= 1 \\
   2wx - 3x - y &= 7
   \end{align*}
   \]
   may be written as a matrix problem $A \begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix} = b$.

4. Find at least two other ways, using new linear algebra vocabulary, to say the equivalent of “the matrix equation $Ax = b$ has a solution.”