1.1, Ex. 30. If $k = -2$ there are infinitely many solutions; otherwise there is exactly one solution.

1.3 Ex. 12. $AB$ is undefined, $BA = \begin{bmatrix} 22 & 12 \\ -10 & -6 \\ 44 & 27 \end{bmatrix}$.

1.3 Ex. 14. Both $AB$ and $BA$ are undefined.

1.3 Ex. 38. The product is $\begin{bmatrix} 11 & -1 & 3 \\ 10 & -6 & -3 \\ 2 & 2 & 3 \end{bmatrix}$.

1.3, Ex. 16. For the given matrices, $(A + B)^2 = \begin{bmatrix} -2 & 9 \\ -6 & -5 \end{bmatrix}$, while $A^2 + 2AB + B^2 = \begin{bmatrix} -4 & 8 \\ -6 & -3 \end{bmatrix}$. The correct general formula is $(A + B)^2 = A^2 + AB + BA + B^2$.

A. Computation shows that $(aI_2 + bJ_2) + (cI_2 + dJ_2) = (a + c)I_2 + (b + d)J_2$, which agrees with the formula $(a + bi) + (c + di) = (a + c) + (b + d)i$ for adding complex numbers. Similarly, using the fact that $I_2$ is the identity matrix and computing $J_2^2 = -I_2$, we get $(aI_2 + bJ_2)(cI_2 + dJ_2) = acI_2^2 + adI_2J_2 + bcJ_2I_2 + bdJ_2^2 = (ac - bd)I_2 + (ad + bc)J_2$. This agrees with the formula $(a + bi)(c + di) = (ac - bd) + (ad + bc)i$ for multiplying complex numbers.

B. Solve for each column of $X$ separately by Gaussian elimination to get $X = \begin{bmatrix} 2 & -2 \\ 3 & 0 \\ 1 & 2 \end{bmatrix}$. 
