Write legibly and show all work. No partial credit can be given for an unjustified, incorrect answer. Put your name in the top right corner.

1. Let \( A = \begin{bmatrix} 0 & 0 & -2 & 6 \\ 1 & 2 & 1 & -4 \\ 1 & 2 & -2 & 5 \end{bmatrix} \). Then \( \text{rref}(A) = \begin{bmatrix} 1 & 2 & 0 & -1 \\ 0 & 0 & 1 & -3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \).

   (a) (Three points) Find a basis for the kernel of the transformation \( \vec{x} \mapsto A\vec{x} \).

   (b) (Three points) Find a basis for the image of the transformation \( \vec{x} \mapsto A\vec{x} \).
2. Let $W \subset P_3$ be the subspace consisting of those polynomials that satisfy $p(1) = 0$. One basis for $W$ is

$$B = \{x - 1, x^2 - x, x^3 - x^2\}.$$ 

Let $f(x) = x^3 - 3x^2 - x + 3$.

(a) (One point) Show that $f(x)$ is in $W$.

(b) (Three points) Find the $B$-coordinate vector for $f(x)$. 