Let

$$A = \begin{bmatrix} 4 & 3 & 5 \\ 2 & 1 & -1 \\ 3 & 1 & -3 \\ 0 & 0 & 0 \\ 1 & 0 & -2 \end{bmatrix}.$$

(a) (10 points) Compute the dimensions of $\mathbf{R}(A)$, $\mathbf{N}(A)$, $\mathbf{C}(A)$, and $\mathbf{N}(A^\top)$.

(b) (5 points) The third row of A is the sum of its second and fifth rows. Give a basis for $\mathbf{N}(A^\top)$.

(c) (5 points) True or false? If $\{\mathbf{v}_1, \mathbf{v}_2, \mathbf{v}_3\}$ is a basis for $\mathbb{R}^3$, then $\{A\mathbf{v}_1, A\mathbf{v}_2, A\mathbf{v}_3\}$ is a basis for $\mathbf{C}(A)$. Briefly justify your answer.