1. Answer the questions about $A \in \mathbb{R}^{3 \times 3}$ below. *[10 points]*

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}.$$

(a) Write a basis for $C(A)$. *[2 points]*

(b) Write a basis for $C(A^{\mathrm{T}})$. *[2 points]*

(c) Write a basis for $N(A)$. *[2 points]*

(d) Write a basis for $N(A^{\mathrm{T}})$. *[2 points]*

(e) Fill in the blanks *[0.5 points each]*

    i. The dimension of $C(A)$ is _____

    ii. The dimension of $N(A^{\mathrm{T}})$ is _____

    iii. $N(A)^{\perp} \;=\; \left\{\mathbf{y} \in \mathbb{R}^3 \;\middle|\; \mathbf{y} \perp N(A)\right\} \;=\;$ _____.

    iv. $N\left(A^{\mathrm{T}}\right)^{\perp} \;=\; \left\{\mathbf{y} \in \mathbb{R}^3 \;\middle|\; \mathbf{y} \perp N\left(A^{\mathrm{T}}\right)\right\} \;=\;$ _____.