(7) No It is not closed under scalar multiplication.

$\begin{bmatrix}1\\1\\1\end{bmatrix}$ is in the set but $\begin{bmatrix}2\\2\\2\end{bmatrix}$ is not in the set.

(8) Yes W is equal to the null space of $\left[\begin{array}{c}a^T\\ \hline b^T\end{array}\right]$.

The null space of a matrix is always a vector space.

(9) $\left[\begin{array}{ccc|ccc}1&4&2&1&0&0\\0&2&1&0&1&0\\3&5&3&0&0&1\end{array}\right]$ $\left[\begin{array}{ccc|ccc}1&4&2&1&0&0\\0&1&\frac{1}{2}&0&\frac{1}{2}&0\\0&-7&-3&-3&0&1\end{array}\right]$ $\left[\begin{array}{ccc|ccc}1&0&0&1&-2&0\\0&1&\frac{1}{2}&0&\frac{1}{2}&0\\0&0&+\frac{1}{2}&-3&\frac{7}{2}&1\end{array}\right]$

$R3 \mapsto R3-3R1$
$R2 \mapsto \frac{1}{2}R2$

$R1 \mapsto R1-4R2$
$R3 \mapsto R3+7R2$

$R2 \mapsto R2-R3$ $\left[\begin{array}{ccc|ccc}1&0&0&1&-2&0\\0&1&0&3&-3&-1\\0&0&\frac{1}{2}&-3&\frac{7}{2}&1\end{array}\right]$ $R3 \mapsto 2R3$ $\left[\begin{array}{ccc|ccc}1&0&0&1&-2&0\\0&1&0&3&-3&-1\\0&0&1&-6&7&2\end{array}\right]$

$$A^{-1} = \begin{bmatrix}1&-2&0\\3&-3&-1\\-6&7&2\end{bmatrix}$$

(10) Suppose $c_1v_1+c_2v_2+c_3v_3=0$. Then $v_1^T(c_1v_1+c_2v_2+c_3v_3)=0$

Thus $c_1v_1^Tv_1+0+0=0$. But $v_1^Tv_1$ is a non-zero number so $c_1=0$.

Repeat this process $v_2^T(c_1v_1+c_2v_2+c_3v_3)=0 \Rightarrow c_2=0$

$v_3^T(c_1v_1+c_2v_2+c_3v_3)=0 \Rightarrow c_3=0$.

The only numbers $c_1, c_2, c_3$ with $c_1v_1+c_2v_2+c_3v_3=0$ are $c_1=c_2=c_3=0$. We have proven that $v_1, v_2, v_3$ are linearly independent.