Name: ____________________

1. (5 points) Determine if $\vec{x} = \begin{bmatrix}1\\0\\0\end{bmatrix}$ is in the span of $\vec{v}_1 = \begin{bmatrix}1\\2\\1\end{bmatrix}, \vec{x} = \begin{bmatrix}1\\3\\4\end{bmatrix}, \vec{x} = \begin{bmatrix}1\\4\\8\end{bmatrix}$. If so, write the coordinates of $\vec{x}$ on the answerline. If not, write FALSE on the answerline.

1. ____________

2. (5 points) Find the matrix B of the linear transformation $T(\vec{x}) = \begin{bmatrix}0 & 1\\2 & 3\end{bmatrix}$ with respect to the basis $\mathfrak{B} = (\vec{v}_1 = \begin{bmatrix}1\\2\end{bmatrix}, \vec{v}_2 = \begin{bmatrix}1\\1\end{bmatrix})$.

2. ____________

3. (5 points) Find a basis $W^\perp$ where $W = \left(\begin{bmatrix}1\\2\\3\\4\end{bmatrix}, \begin{bmatrix}5\\6\\7\\8\end{bmatrix}\right)$.

3. ____________

4. (5 points) Find an orthonormal basis of the plane $x_1 + 2x_2 - x_3 = 0$ in $\mathbb{R}^3$

4. ____________

5. (5 points) Find the nullity of $T(f(t)) = \int_{-2}^{2} f(t)$ from P_2 to $\mathbb{R}$.

5. ____________

6. (5 points) (True/False) If T is a linear transformation from P_6 to $\mathbb{R}^{\times 2}$, then the kernel of T must be at least three dimensional.

6. ____________

7. (5 points) Let V be the span of vectors $f_1(x) = 1$ and $f_2(x) = x$. Find the matrix of $T(f) = 3f + 2f'$ from V to V with respect to the basis $\mathfrak{B} = (f_1, f_2)$.

7. ______________

8. (5 points) Find the best fit line $y = mx + b$ to the data points $(0, 1), (1, 1), (2, 3)$ using least squares.

8. ______________

9. (5 points) For which values of t is $\begin{bmatrix} t & 1 & 0 \\ 2 & t & 2 \\ 0 & 1 & t \end{bmatrix}$ invertible?

9. ______________

10. (5 points) Find the determinant of the matrix $B = \begin{bmatrix} 0 & 0 & 2 & 3 & 1 \\ 0 & 0 & 0 & 2 & 2 \\ 0 & 9 & 7 & 9 & 3 \\ 3 & 4 & 5 & 8 & 5 \\ 0 & 0 & 0 & 0 & 5 \end{bmatrix}$.

10. ______________

11. (5 points) Find the determinant of $\begin{bmatrix} 1 & 3 & 2 & 4 \\ 1 & 6 & 4 & 8 \\ 1 & 3 & 0 & 0 \\ 2 & 6 & 4 & 12 \end{bmatrix}$

11. ______________

12. (5 points) Find the orthogonal projection of $\begin{bmatrix} 49 \\ 49 \\ 49 \end{bmatrix}$ onto the subspace spanned by $\begin{bmatrix} 2 \\ 3 \\ 6 \end{bmatrix}$ and $\begin{bmatrix} 3 \\ -6 \\ 2 \end{bmatrix}$

12. ______________