[14] 1.) $det \begin{bmatrix} 4 & 8 & 3 & 4 \\ 5 & 0 & 10 & 4 \\ 2 & 4 & 3 & 1 \\ 3 & 0 & 2 & 1 \end{bmatrix} = $ _____

[6] 2a.) The orthogonal projection of the vector $(3, 5)$ onto the vector $(1, 2)$ is _____

[6] 2b.) The orthogonal component of the vector $(3, 5)$ orthogonal to $(1, 2)$ is _____

[12] 3.) Solve each of the following system of linear equations by using Gauss-Jordan elimination.

3a.)
$$x_2 + 4x_3 = 1$$
$$3x_1 + 2x_2 = 0$$
$$6x_1 + 5x_2 + 4x_3 = 1$$

3b.)
$$x_2 + 4x_3 = 1$$
$$3x_1 + 2x_2 = 0$$
$$6x_1 + 5x_2 + 4x_3 = 0$$

Answer 3a.) _____   3b.) _____

[2] 3c.) If A = coefficient matrix in 1a, does A^{-1} exist? _____

[2] 3d.) If A = coefficient matrix in 1a, $det\ A =$_____

[1] 3d.) The answer to 1a is a hyperplane that lives in R^m where $m =$ _____.

[1] 3e.) The dimension of the hyperplane in 1a is _____.

[5] 3f.) An equation of the hyperplane in 1a in point-parallel vector form is

[3] 3g.) Using different numbers, an equivalent equation of the hyperplane in 1a in point-parallel vector form is

[20] 4.) Find and use an LU factorization to solve:

$$\begin{bmatrix} 4 & 8 \\ 3 & 7 \end{bmatrix} \mathbf{x} = \begin{bmatrix} 4 \\ 0 \end{bmatrix}$$

Answer: $L =$ _____ $U =$ _____ $\mathbf{x} =$ _____

5.) Circle T for True or F for False.

[3] a.) Suppose a homogeneous system of 3 linear equations with 2 unknowns has exactly one solution, then any system with the same coefficients will also have exactly one solution.   T   F

[3] b.) Suppose a homogeneous system of 3 linear equations with 3 unknowns has exactly one solution, then any system with the same coefficients will also have exactly one solution.   T   F

[10] 6.) Suppose $\begin{bmatrix} 1 & 5 & 2 \\ 0 & 1 & 0 \\ 1 & 0 & 3 \end{bmatrix} \begin{bmatrix} 3 & -15 & -2 \\ 0 & 1 & 0 \\ -1 & 5 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}.$

Solve the following system of equations using the method of inverses:
$$\begin{aligned} 3x_1 - 15x_2 - 2x_3 &= 10 \\ x_2 &= 0 \\ -x_1 + 5x_2 + x_3 &= 2 \end{aligned}$$

Answer 6.) _____

[5] 7a.) Given the line $x_1 = 3 + 5t, x_2 = 1 + t, x_3 = 4 + 2t$, then

a point on the line is _____

and a vector describing the direction of the line is _____.

[5] 7b.) A vector perpendicular to (1, 4, 0) and (5, 2, 1) is _____.

[5] 7c.) Find an equation for the plane in point-parallel form that contains the line $x_1 = 3 + 5t, x_2 = 1 + t, x_3 = 4 + 2t$ and is parallel to the line of intersection of the planes $x_1 + 4x_2 + 1 = 0$ and $5x_1 + 2x_2 + x_3 = 0$ (Hint: use the point in 7a and the vectors in 7a and 7b.

Answer 7c.) _____.