Please state clearly all assumptions made in order for full credit to be given.

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<th>Problem</th>
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Problem #1 (25 %)

Three points have the following coordinates A (3, -2, 4), B (1, 4, 1), and C (6, 2, -8).

a) The norm of vector \((\mathbf{AB} - \mathbf{AC} + 3\mathbf{BC})\) (5)
b) The dot product \(\mathbf{AB}\cdot\mathbf{BC}\) (4)
c) Determine the angle between \(\mathbf{AB}\) and \(\mathbf{BC}\), in degrees (5)
d) Express the orthogonal projection of \(\mathbf{AB}\) onto \(\mathbf{BC}\), \(\|\mathbf{proj}_{\mathbf{BC}}\mathbf{AB}\|\) in vector form (6)
e) Express the component of \(\mathbf{AB}\) orthogonal to \(\mathbf{BC}\) (5)

Note: You should show all work to receive full credit
Problem #2 (25%)

Two forces $F_1$ and $F_2$ act on a bracket as shown. $F_2$ makes an angle of $45^\circ$ with the positive x-axis, and an angle of $60^\circ$ with the positive y-axis. This force is below the XY plane.

a) Express each force in Cartesian vector form (6)

b) Determine the resultant of the two forces in Cartesian vector form (4)

c) Determine the magnitude of the resultant in N. (4)

d) Determine the angles between the resultant and the 3-coordinate axes in degrees (6)

e) Determine the angle between the two forces in degrees. (3)

Note: You need to show all work to receive full credit.
Problem #3 (25 %)

If the chandelier has a mass of 50 kg, determine the tension in each of the four wires.

**Note:** You have to draw any required FBD and show all work to receive full credit.
Problem #4 (25%)

Solve the following system of linear equations using the Gauss-Jordan Elimination method:

\[ x_1 + 5x_2 - 2x_3 = -4 \]
\[ 2x_1 - x_2 - 2x_3 = -5 \]
\[ -4x_1 + 4x_2 + 2x_3 = 7 \]

a) Show the augmented matrix \( (5) \)
b) Use elementary row operations to obtain the reduced row echelon form \( (17) \)
c) Write the solution for the three variables \( x_1, x_2, \) and \( x_3 \) \( (3) \)

Note: To receive full credit All intermediate work (e.g., elementary row operations should be shown)

\[ \text{a)} \]

\[ \text{c)} \]