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

<table>
<thead>
<tr>
<th>Problem</th>
<th>Points</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td></td>
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</tr>
<tr>
<td>Total</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Good Luck
Problem #1 (25 %)

Given the following system of equations:

\[
\begin{align*}
2x_2 + 3x_3 - x_4 &= 2 \\
2x_1 + 4x_2 - 6x_3 + x_4 &= 0 \\
3x_2 + 9x_3 + 2x_4 &= -3 \\
-2x_1 - 4x_2 + x_3 - 3x_4 &= 7
\end{align*}
\]

a) Write the above system of equations in the form \( AX = B \), identifying each of the matrices \( A \), \( X \), and \( B \) (3 points)

b) Compute the determinant of the Matrix \( A \) defined above. (12 points)

c) Find the inverse \( C^{-1} \) of the following matrix \( C \) (10 points)

\[
C = \begin{bmatrix}
1 & 0 & 2 \\
0 & -1 & 2 \\
1 & 0 & 1
\end{bmatrix}
\]

Note: No credit will be given to any numerical result unless **ALL** intermediate work is shown

**SOLUTION #1**
**Problem #2 (25%)**

A 3m pole is supported by a ball-and-socket joint at A and by two cables CD and CE. Knowing that the line of action of the 5-kN force forms an angle $\phi = 30^\circ$ with the vertical xy plane:

a) Draw a complete free body (FBD) diagram. The FBD must be a figure that is separate from the figure given below.

b) Determine the magnitude of the tension in cables CD and CE.

c) Determine the reaction at A. Express the force in the Cartesian vector form.

Note: show all work and calculations

**SOLUTION #2**

a) FBD

b) 

c) 

Problem #3 (25 %)

A beam is subjected to a linearly distributed downward load and rests on two supports BC and DE, which exert uniformly distributed upward loads as shown. Determine the value of $W_{BC}$ and $W_{DE}$ corresponding to equilibrium when $w_A = 600 \text{ N/m}$.

Note: show all work and calculations.

SOLUTION #3

a)

b)

c)
Problem #4 (25%)  

The roof truss shown is supported at A by a smooth pin and at E by a smooth roller.  

a) Determine one zero-force member in the truss structure (2 points)  
b) Determine the reactions at supports A and E (5 points)  
c) Using the method of joints, determine the force in each member of the truss and state whether it is in tension or compression.  

Note: You have to draw all needed FBD you are using in order to receive full credit.