**Part 1: Deformation in Truss Members**

Build the table below in MS Excel to find the elongation in an axially loaded bar. This is the same elongation (or contraction) that each truss member would experience. The equation for deformation in an axially loaded rod is given by:

\[ \delta = \frac{PL}{AE} \]

Where,
- \( \delta \) = axial deformation in inches
- \( P \) = the applied load in pounds
- \( L \) = the length of the rod in inches
- \( A \) = the cross-sectional area of the rod in square inches
- \( E \) = the modulus of elasticity of the material in psi.

<table>
<thead>
<tr>
<th>Modulus of Elasticity, ( E )</th>
<th>30000000 psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, ( L )</td>
<td>30 in</td>
</tr>
</tbody>
</table>

**Deflection in an Axially Loaded Bar:**

<table>
<thead>
<tr>
<th>Load, ( P ) (lbs)</th>
<th>Area, ( A ) (sq. in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.1</td>
</tr>
<tr>
<td>100</td>
<td>Cell formula</td>
</tr>
<tr>
<td>200</td>
<td>Cell formula</td>
</tr>
<tr>
<td>300</td>
<td>Cell formula</td>
</tr>
<tr>
<td>...</td>
<td>Cell formula</td>
</tr>
<tr>
<td>1000</td>
<td>Cell formula</td>
</tr>
</tbody>
</table>

Write ONE CELL FORMULA and COPY it to the other cells to complete the table. It should take you less than 10 minutes to complete this part of the homework.

Print your sheet. Your printout should fit on 1 page wide by 1 page tall. Perform a hand calculation for two of the table values to verify that they are correct. Change the Modulus of Elasticity to 1500000 psi and the length to 60 inches, print out your worksheet again. Be sure to print the gridlines and row and column headers when you print.

**Part 2: Shear and Moment in a Beam**

Create the worksheet shown in the figure below. We will be using the results of this homework to create charts in class, so it is important that you get it done before the next class.

In the worksheet, create cell formulas for the values of \( x \). There should be 20 equally spaced divisions from \( x = 0 \) to \( x = L \). This is done using cell formulas. For example, in cell B19 of the figure below, create a cell formula that divides the span by 20 then adds it to the value of the cell directly above (B18). Copy this formula down the column. Now, as \( L \) changes, the values of \( x \) will also change accordingly. Create cell formulas for shear and moments for each of the \( x \)-values. The formulas for \( V \) and \( M \) are given in the figure below.

Create the worksheet as shown and print it out. You can do a screen capture (Alt + Print Scrn) – paste to copy my beam figure into your document. Crop the resulting figure in your worksheet. The Crop tool is available on the Picture Toolbar. Open the Picture Toolbar with View – Toolbars – Picture.
Print the worksheet with \( w = 2000 \text{ lbs/ft} \) and \( L = 24 \text{ ft} \). Perform a hand calculation to verify your answers for \( x = 4.8 \text{ ft} \). Fix any errors. Be sure to print the gridlines and row and column headers when you print. Your printout should fit on 1 page wide by 1 page tall.

Change \( w \) to 1500 lbs/ft and \( L \) to 20 feet and print again.

Staple your sheets together in the following order:
- Part 1, \( E = 30000000 \text{ psi} \) and \( L = 30'' \)
- Part 1, \( E = 1500000 \text{ psi} \) and \( L = 60'' \)
- Hand verification of part 1.
- Part 2, \( w = 2000 \text{ lbs/ft} \) and \( L = 24 \text{ ft} \)
- Part 2, \( w = 1500 \text{ lbs/ft} \) and \( L = 20 \text{ ft} \)
- Hand verification of \( x = 4.8 \) when \( w = 2000 \text{ lbs/ft} \) and \( L = 24 \text{ ft} \)

### Uniform Load, \( w \)

<table>
<thead>
<tr>
<th>Position, ( x ) (ft)</th>
<th>Shear, ( V ) (pounds)</th>
<th>Moment, ( M ) (ft-lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>24000</td>
<td>0</td>
</tr>
<tr>
<td>1.2</td>
<td>21600</td>
<td>27360</td>
</tr>
<tr>
<td>2.4</td>
<td>19200</td>
<td>51840</td>
</tr>
<tr>
<td>19.2</td>
<td>-14400</td>
<td>92160</td>
</tr>
<tr>
<td>20.4</td>
<td>-16800</td>
<td>73440</td>
</tr>
<tr>
<td>21.6</td>
<td>-19200</td>
<td>51840</td>
</tr>
<tr>
<td>22.8</td>
<td>-21600</td>
<td>27360</td>
</tr>
<tr>
<td>24.0</td>
<td>-24000</td>
<td>0</td>
</tr>
</tbody>
</table>

**Shear:**

\[ V = w(0.5L - x) \]

**Moment:**

\[ M = 0.5wLx - 0.5wx^2 \]

**NOTE:**

Value in cell is 1/20th of the span plus the value in the cell above.