Using Free Body Diagrams

I. Choose a specific object or group of objects. Write a sentence telling me what the object is. Draw an outline sketch of **just** your chosen object, without any other items near it. Do not re-orient this sketch.

II. Draw and **name** all forces **that act on your object**, at the place and direction where they actually act. Each force must have a unique symbolic name: \( W_D \), or \( N_B \), etc.

III. Draw a coordinate system specifying all directions, including rotation.

IV. If some of your forces are oriented diagonally with respect to your coordinate system, start over again at step II, using a new outline. **You should not erase your earlier version!** In the new version, instead of each “diagonal” force, draw two separate forces, each of which is a component of the “diagonal” force. All the same forces should be on this diagram as were on the original, except that a few will now be there in component form.

V. **Write Newton’s 2nd law** for each possible component direction (including rotation!), **symbolically**. If a force was drawn in the same direction as a coordinate axis, it is positive when you include it in \( \Sigma F \), otherwise it is negative. Moments are positive when they are in the same direction as the coordinate axis (in the example below, \( +z \) is counter clockwise). Also, write any geometric constraints as equations.

VI. Do algebra until you have solved for the item you wanted to know, then box your answer.

\[
\begin{align*}
\Sigma F_x &= 0 \\
- N_{1x} - N_{2x} + T &= 0 \quad [1] \\
\Sigma F_y &= 0 \\
- W + N_{1y} + N_{2y} &= 0 \quad [2] \\
\Sigma M_{Az} &= 0 \\
+(\frac{1}{2}D)W + (0)T + (0)(N_{2y}) &- (L - H)(N_{2x}) - (L)(N_{1x}) - (D)(N_{1y}) = 0 \quad [3]
\end{align*}
\]

Geometry:
\( N_{1y}/N_{1x} = N_{2y}/N_{2x} \)