Introduction to Trusses
What is a truss?
A truss is a structural unit made from straight bars that form triangles or other stable, rigid shapes.

The simplest form of a truss is one single triangle.
For roof construction

Support for elevated train tracks

A church ceiling
Tell me an example of a truss you have seen.
What makes up a truss?
A truss is a series of straight bars that form triangles or other stable, rigid shapes.

A truss is composed of:

- structural members
- joints or nodes
- angles
- polygons

Due to their geometry and rigidity, trusses can distribute a single point of weight over a wider area.
What is the difference between a planar truss and a space truss?
planar (simple) truss
Members and nodes in the 2D plane
*Examples:* bicycle frame, roofing, rafters

space truss
Members and nodes in the 3D plane
*Examples:* bridges, transmission towers
Many more truss designs

- pitched (common) truss
- Howe truss
Load
Applied weight or force on a structure
Example: vehicles and wind on a bridge

Structural Member
A physical piece of a larger structure
Example: a steel beam
Compression and Tension
Truss in Compression and Tension

- **Pratt truss**

- Uses vertical members in compression and horizontal members in tension

- Most efficient under vertical-loading compression
Have you ever walked across a simple footbridge made of boards or a rope bridge and noticed how the bridge changes shape (bends) as you walk across its center?
Deformation

This bending of the bridge is called *deformation*.

**Deformation** refers to something that changes shape when pressure is applied.

As we design and test trusses today, we will apply weight (in the form of books) to our trusses and observe how the angles deflect when subjected to a load.

We will measure some of the angles in our truss—both before and after a load is applied—in order to *calculate the amount of deflection*.

Engineers consider many factors in bridge design, including the *maximum load it can support* and *how much deformation* the bridge materials can withstand before breaking.
Your Engineering Design Challenge

You are going to make a space truss!
Choose from these regular polygons:

- Triangle
- Quadrilateral
- Pentagon
- Hexagon
- Heptagon
- Octagon
- Nonagon
- Decagon
Example Trusses
## Data Collection

<table>
<thead>
<tr>
<th>Polygon</th>
<th>Sum of Interior Angles</th>
<th>Measure of Angle 1</th>
<th>Measure of Angle 2</th>
<th>Deflection of Angle 1**</th>
<th>Deflection of Angle 2**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle</td>
<td>180</td>
<td>60</td>
<td>65</td>
<td>60-(57)=3</td>
<td>65-(50)=15</td>
</tr>
<tr>
<td>Pentagon</td>
<td>540</td>
<td>113</td>
<td>103</td>
<td>113-(100)=13</td>
<td>103-(100)=3</td>
</tr>
<tr>
<td>Square</td>
<td>360</td>
<td>90</td>
<td>90</td>
<td>90-(75)=15</td>
<td>90-(70)=20</td>
</tr>
</tbody>
</table>
Sum of interior angles = \((n-2)\times180\)
n=number of sides in your polygon
Tagging and Measuring
Your Target Angles