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

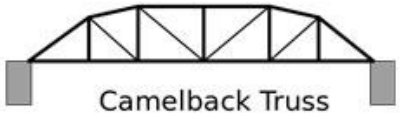
Examples: bridges, transmission towers

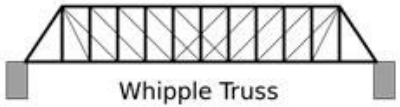
Which is which?

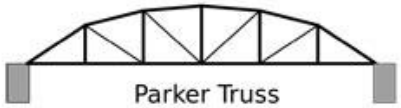
Many more truss designs

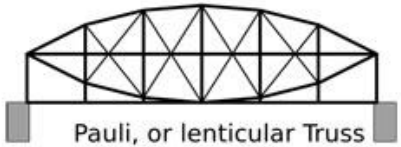
←pitched (common) truss

← Howe truss









Engineering Terminology

Load

Applied weight or force on a structure

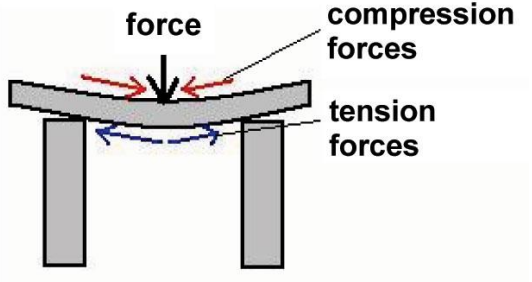
Example: vehicles and wind on a bridge

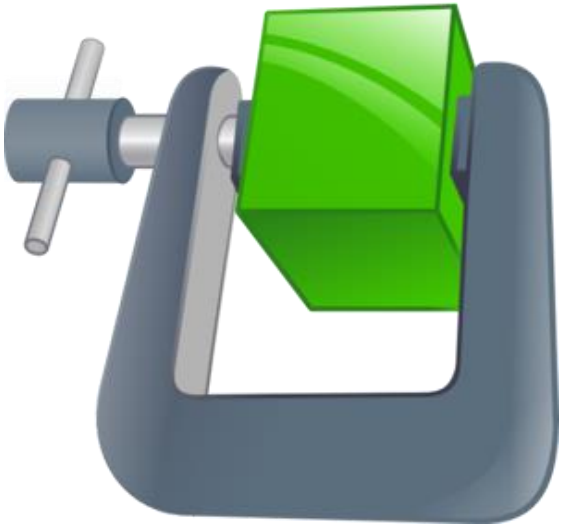
Structural Member

A physical piece of a larger structure

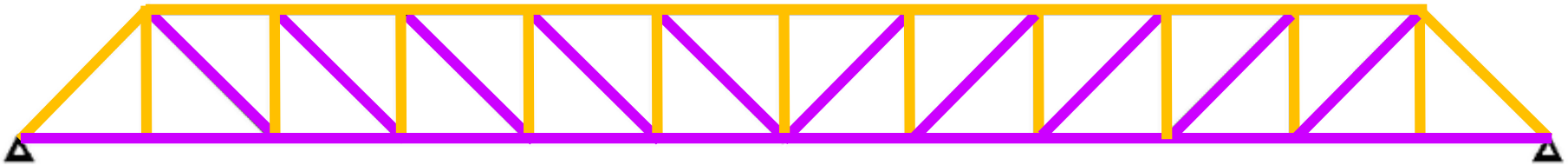
Example: a steel beam

Compression and Tension





Truss in Compression and Tension

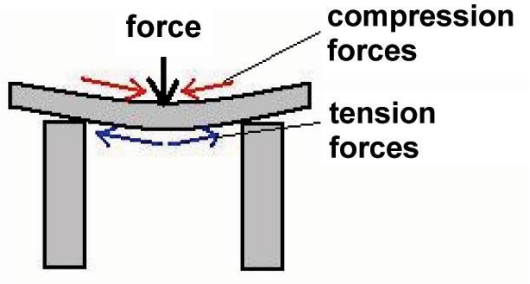


Pratt truss

- 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**.

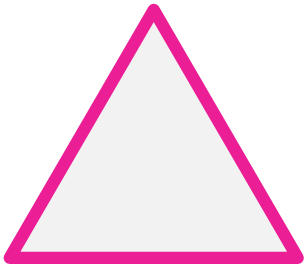
We will measure some of the angles in our truss—both before and after a load is applied—in order to **calculate the amount of deflection**.

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.

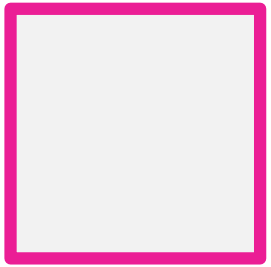
Your Engineering Design Challenge

You are going to make a space truss!

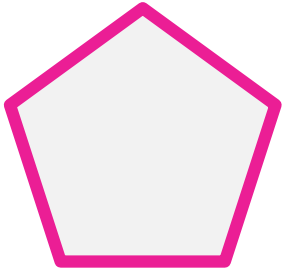
Choose from these regular polygons:



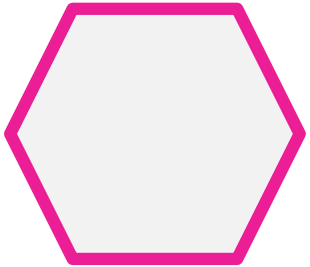
Triangle



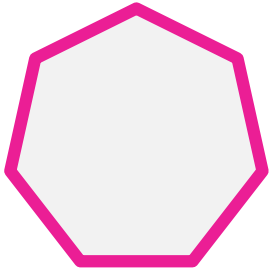
Quadrilateral



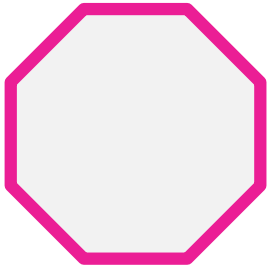
Pentagon



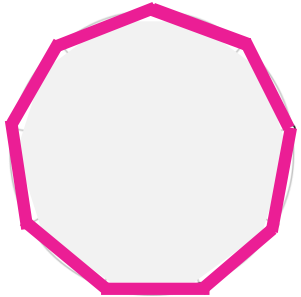
Hexagon



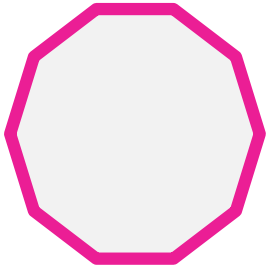
Heptagon



Octagon



Nonagon



Decagon

Example Trusses

Data Collection

Polygon	Sum of Interior Angles	Measure of Angle 1	Measure Angle 2	Deflection of Angle 1**	Deflection of Angle 2**
Triangle	180	60	65	60-(57)=3	65-(50)=15
Pentagon	540	113	103	113-(100)=13	103-(100)=3
Square	360	90	90	90-(75)=15	90-(70)=20

Sum of interior angles = (n-2)*180

n=number of sides in your polygon

Tagging and Measuring

Your Target Angles