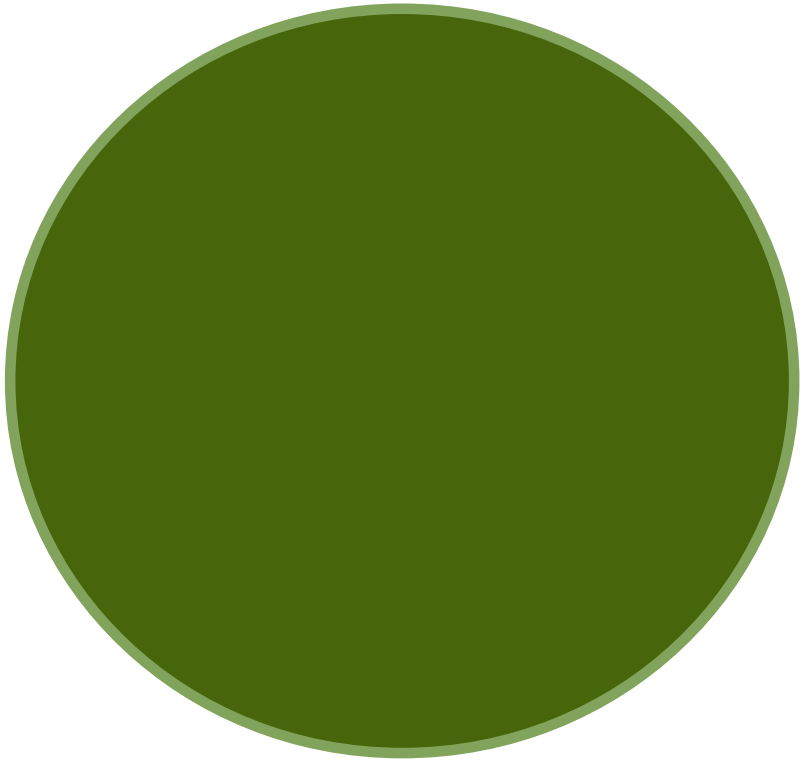
Karin Crumb Kosmala
Kristine Kemmis

Architectural Elements

Building strong shapes

- **What is the strongest geometric shape?**
  - There are several shapes that are used when strength is important.

THE CIRCLE



The arc (think: circle) is the strongest structural shape, and in nature, the sphere is the strongest 3-d shape.

The reason being is that stress is distributed equally along the arc instead of concentrating at any one point.

Storage silos, storage tanks, diving helmets, space helmets, gas tanks, bubbles, planets, etc. use cylinder or sphere shapes -- or both.

THE TRIANGLE

The triangle is the strongest to as it holds it shape and has a base which is very strong a also has a strong support. The triangle is common in all sorts of building supports and trusses.

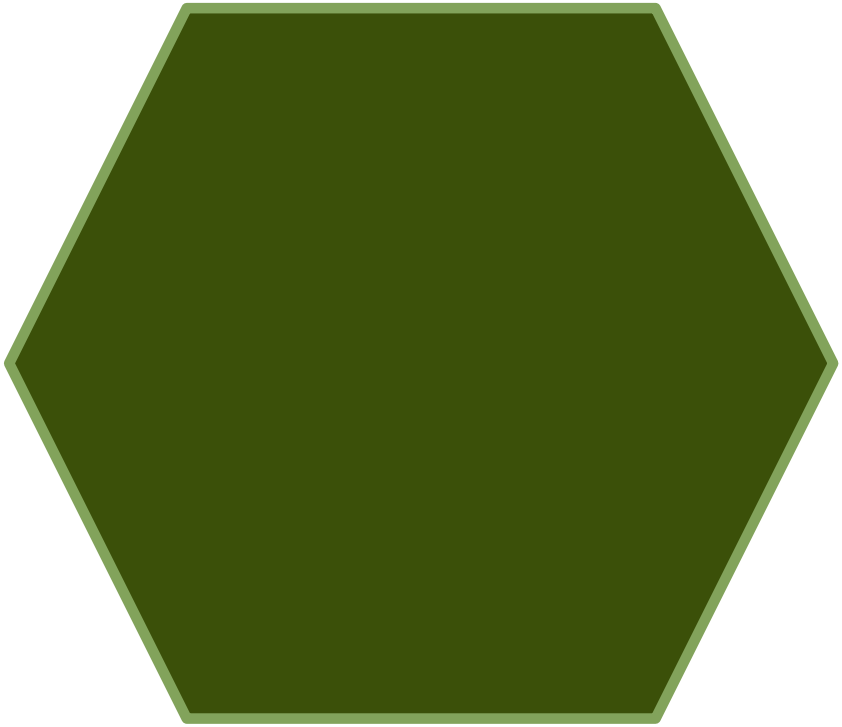
It is strong because the three legs of a triangle define one and only one triangle. If all three sides are made of rigid material, the angles are fixed and cannot get larger or smaller without breaking at the joints, unlike a rectangle, for example, which can turn into a parallelogram and even collapse totally. If you take a rectangle and place one diagonal piece from corner to corner, you can make that strong and stable, too, but doing that makes two triangles!! Think about it! so yes, it is the strongest shape

THE CATENARY CURVE

The overall shape of many bridges is in the shape of a catenary curve.

The catenary curve is the strongest shape for an arch which supports only its own shape. Freely hanging cables naturally form a catenary curve.

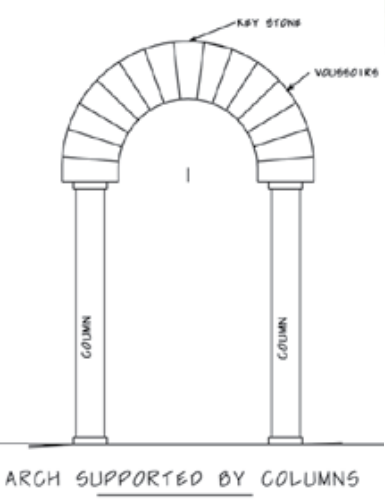
THE HEXAGON



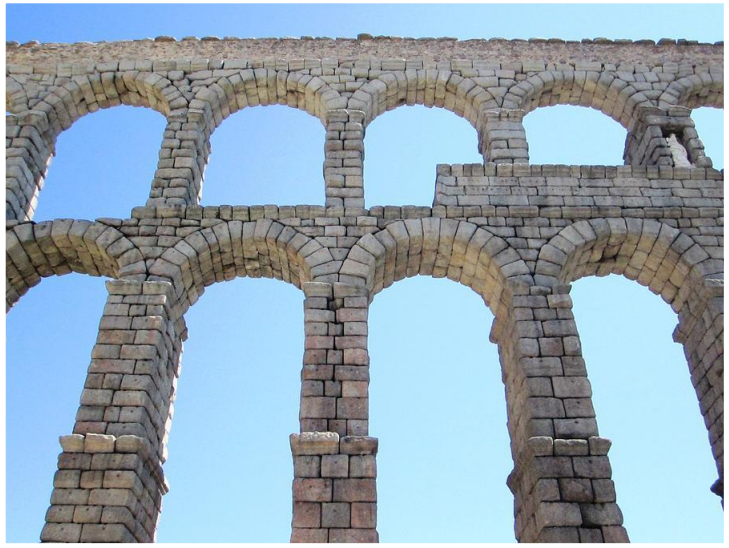
The hexagon is the strongest shape known. Not many people know this but if you want something to hold a lot of weight pick a hexagon. Hexagonal patterns are prevalent in nature due to their efficiency. In a hexagonal grid each line is as short as it can possibly be if a large area is to be filled with the fewest number of hexagons. This means that honeycombs require less wax to construct and gain lots of strength under compression. It's also one of the only shapes which tessellates perfectly (think tiles, if you tiled a wall with hexagons then there wouldn't be any gaps.

Structural Elements

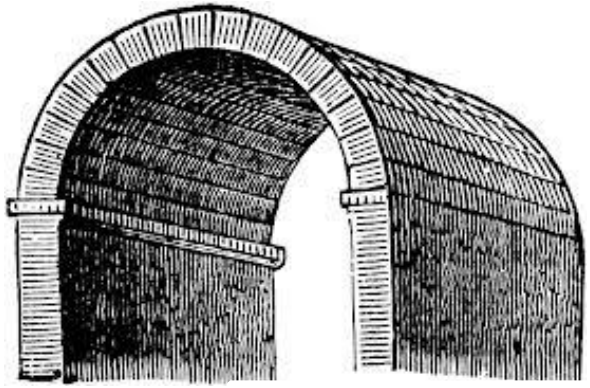
Arch – a curving structure used to span openings in a wall: wedge shaped pieces that lean against each other in compression.

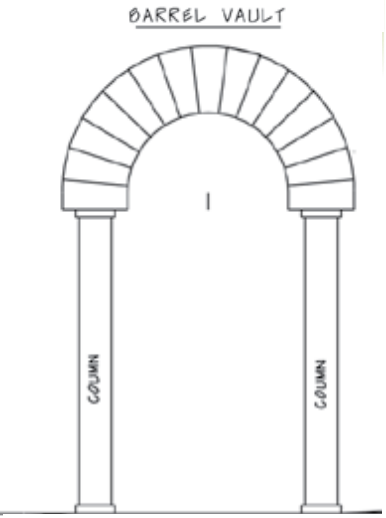


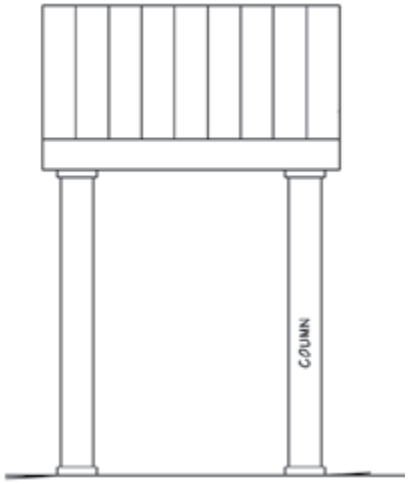
ARCH SUPPORTED BY COLUMNS



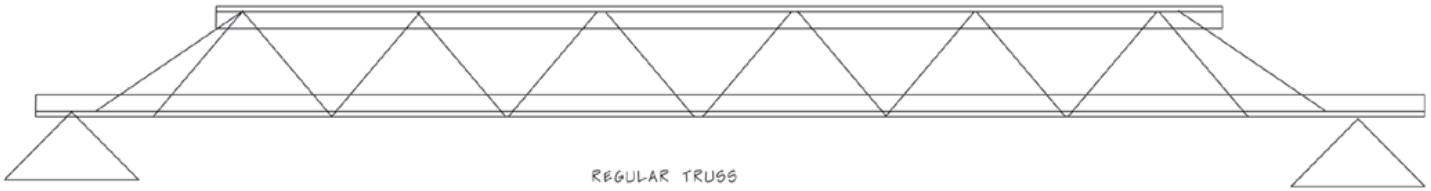
Barrel Vault – a continuous surface of semicircular or pointed sections; basically a series of arches set side-by-side forming a half cylinder.



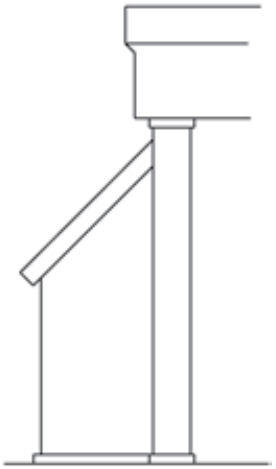




Truss – a system of support members that are held rigid by utilizing a series of triangles.

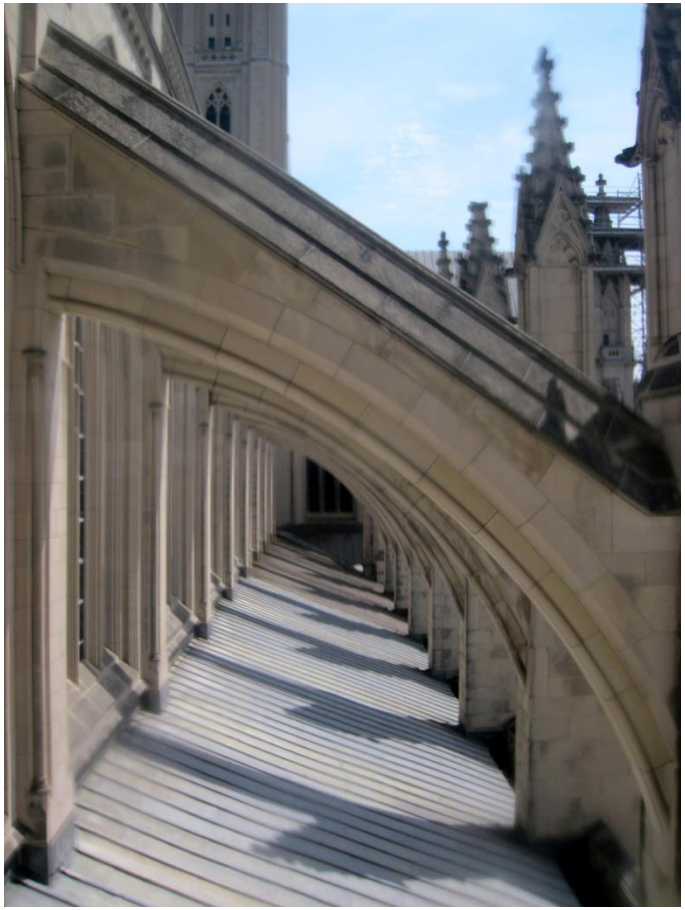


Buttress – a small, support wall at a right angle to another wall to counteract the outward thrust of a heavy roof or wall.

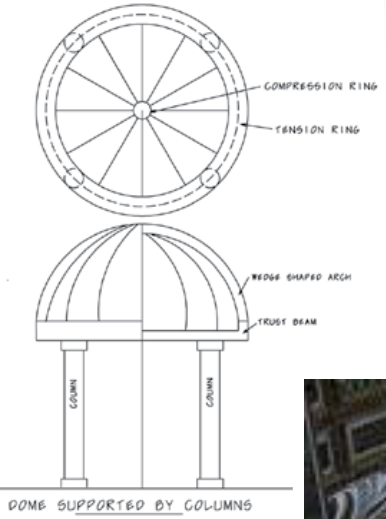


BUTTRESS

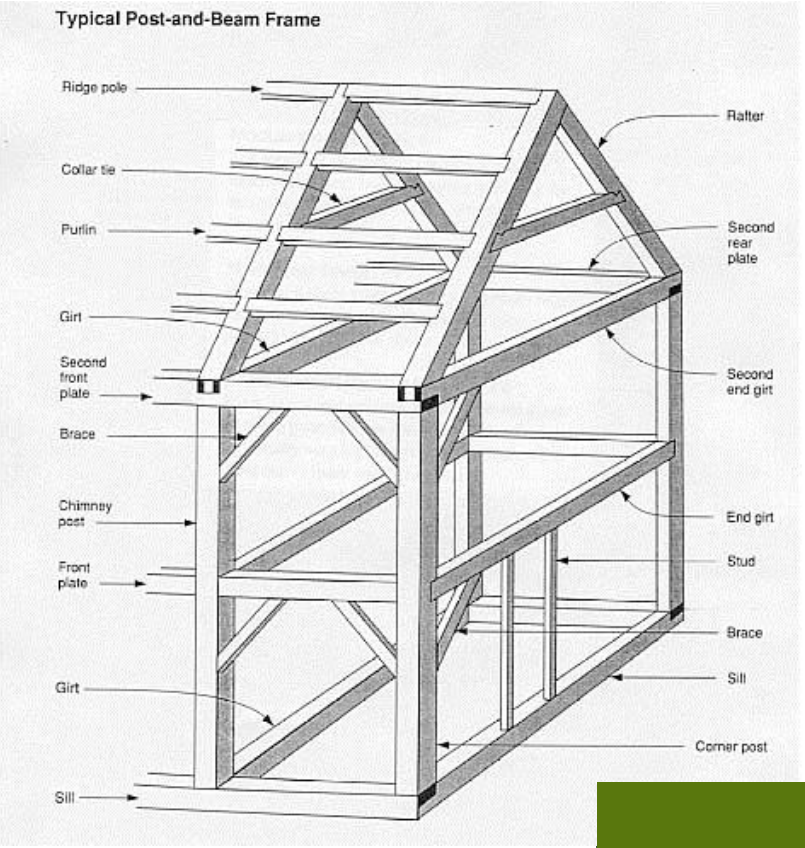
Flying Buttress – a buttress
with a non-structural section removed to give it the appearance of lightness.



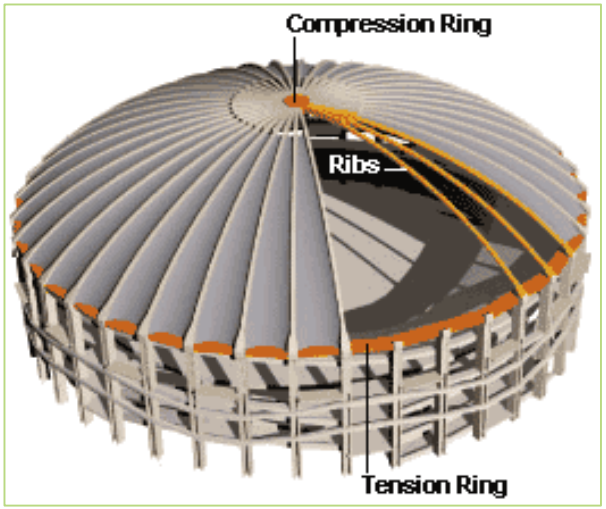
Dome – a three dimensional form based on a circle, the top of a dome is in compression while the bottom of a dome is in tension.



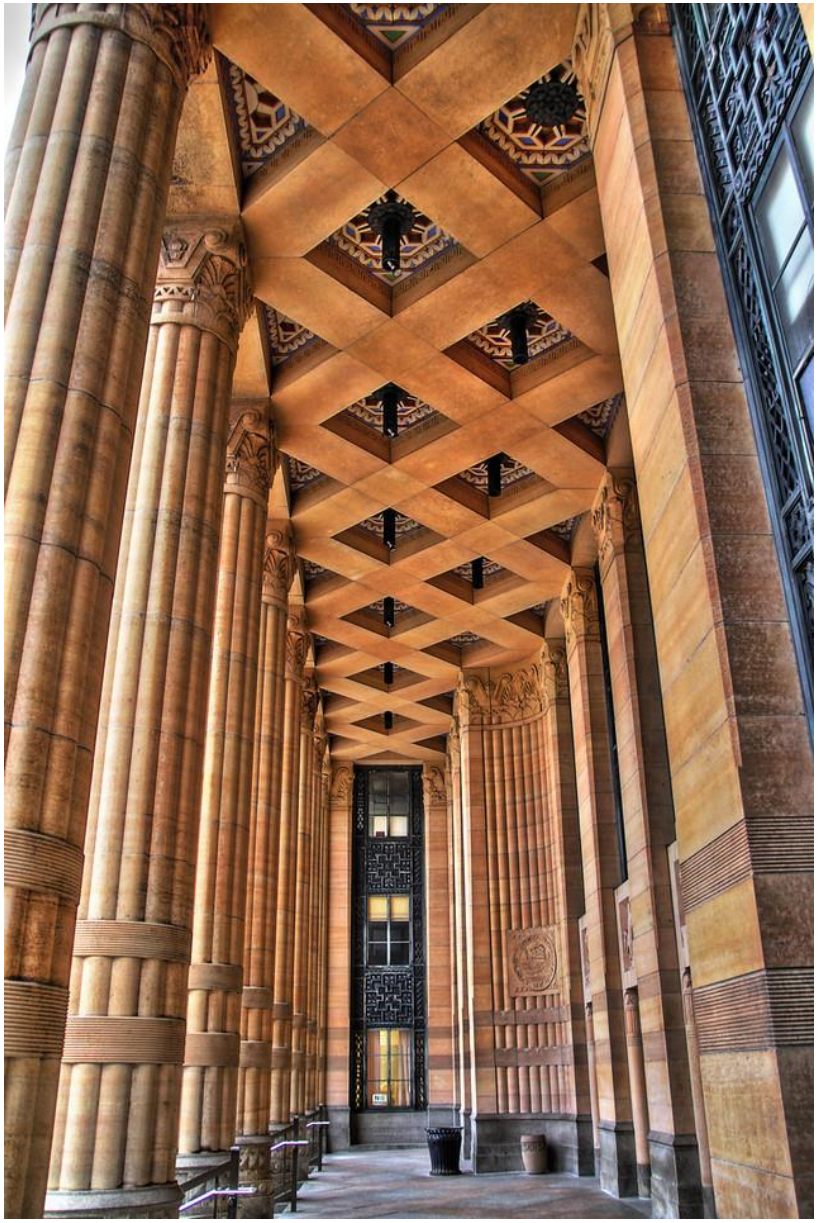
Post and Beam – One of the earliest methods--of building, it includes any structure built of vertical posts that hold up beams laid horizontally across them.

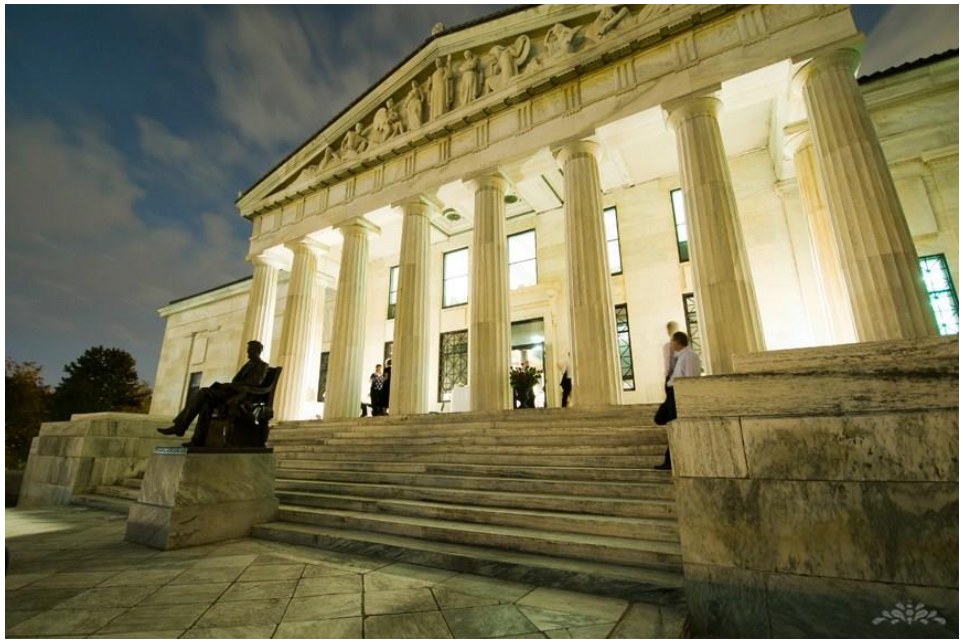


Tension Ring – a ring holding its shape because its members are in tension, pushing away from each other.



Column – an upright (vertical) support member.





Building Elements- building character

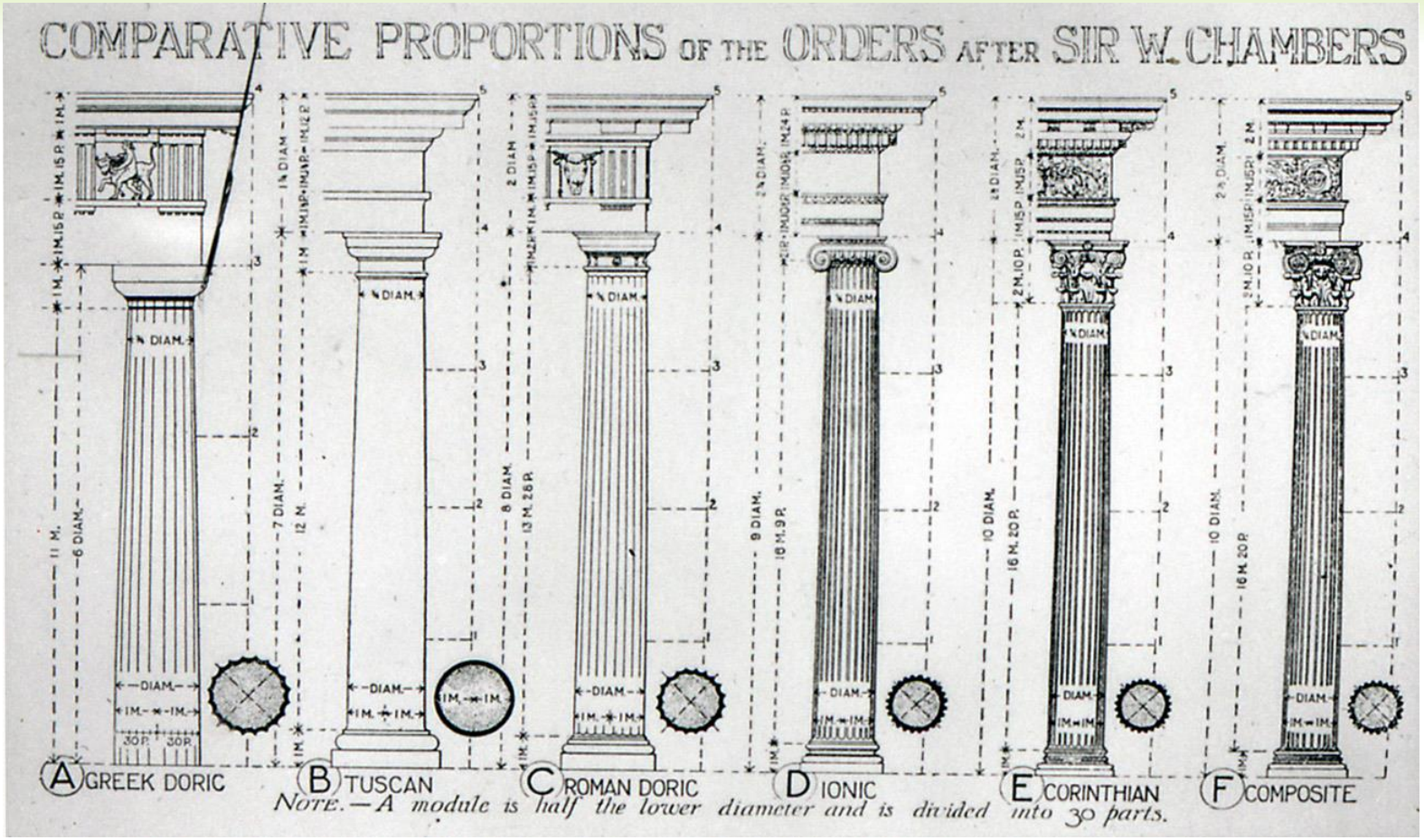
CLASSICAL ORDER

The Elements of Classical Architecture
All classical architecture of the Greco-Roman tradition is composed, or written, in one language of forms. These elements of classical architecture include specific Moldings and assemblages of moldings called an **Order**.

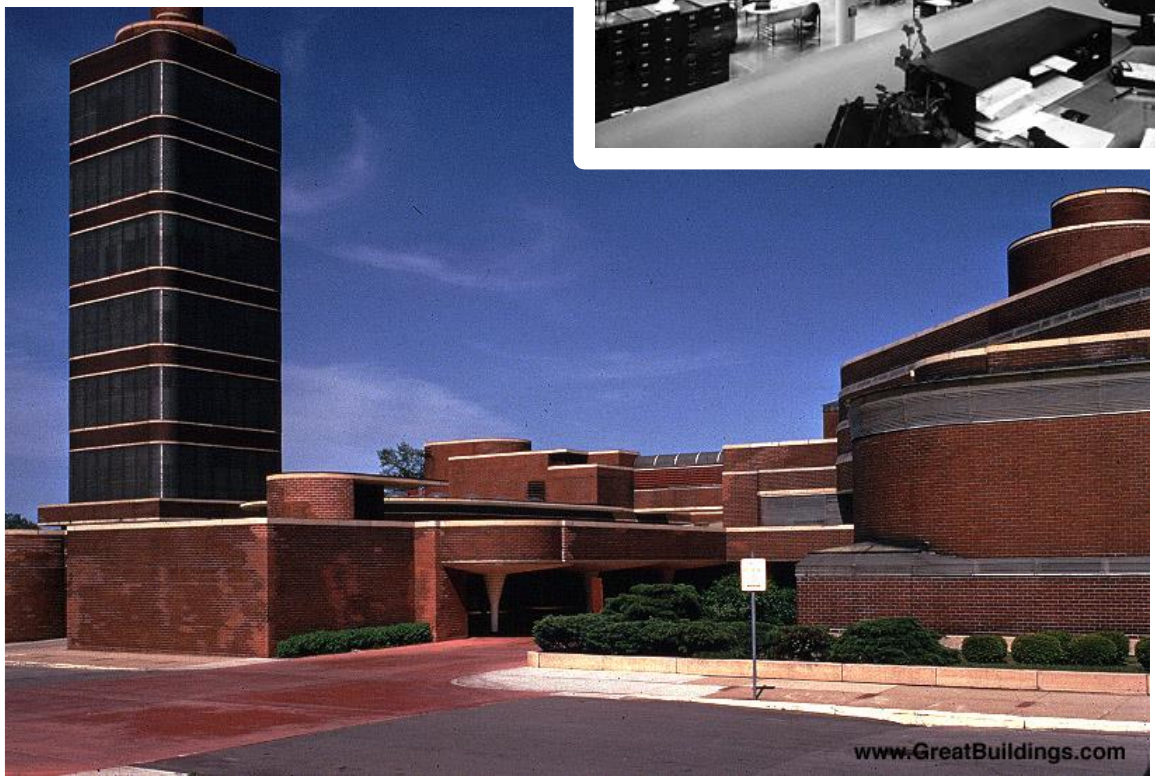
* An Order is an accepted way of assembling a column (supporting element) with an entablature (spanning element) while imparting a certain character. In short, an Order orders a design. Orders are never applied after the building is designed, as they are generative.

Over time the canon has come to include five Orders: Tuscan, Doric, Ionic, Corinthian, and Composite. The Orders presented here represent the canon of the Roman tradition.

THE 5 CLASSICAL ORDERS



NATURAL ELEMENTS




THE


NATURAL
ARCHITECTURE
ALESSANDRO ROCCA

Building Systems & Body Systems

- How might our bodies compare to buildings?
- Do we have elements that are similar to structural elements of buildings??
  - Facade = Face
  - Door = Mouth
  - Windows = Eyes & Ears
  - Exterior Walls = Skin
  - Structural Framework = Skeleton
  - Electrical System = Nervous System
  - Plumbing System = Digestive & Excretory System
  - Ventilation = Respiratory System

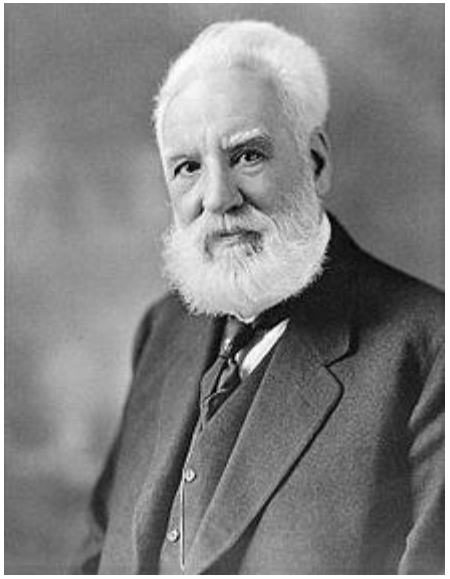
Building Systems & Body Systems

Human Body	Building	My Building Parts
Skin & Hair	Outside Building Walls and Roof	
Skeleton	Structural Framework	
Digestive System	Plumbing	
Nervous System	Electricity	
Respiratory System	Heat and Air Conditioning	

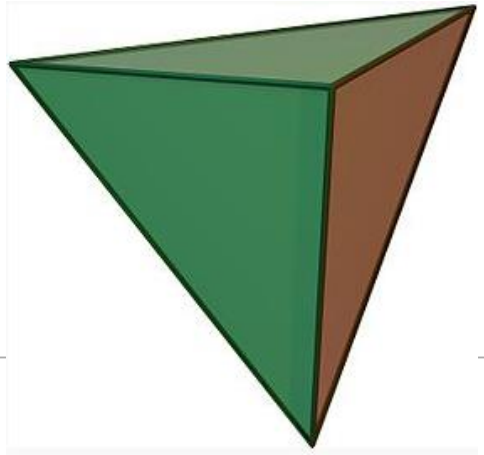
KNOWLEDGE → WORK

Alexander graham bell

- Who was Alexander Graham Bell?
- What was he known for?
- What does he have to do with Architecture?



TETRAHEDRONS



Tetrahedron

From Wikipedia, the free encyclopedia

Not to be confused with tetrahedroid.

For the academic journal, see Tetrahedron (journal).

In geometry, a **tetrahedron** (plural: **tetrahedra** or **tetrahedrons**) is a polyhedron composed of four triangular faces, three of which meet at each corner or vertex. It has six edges and four vertices. The tetrahedron is the simplest of all the ordinary convex polyhedra and the only one that has fewer than 5 faces.[1]

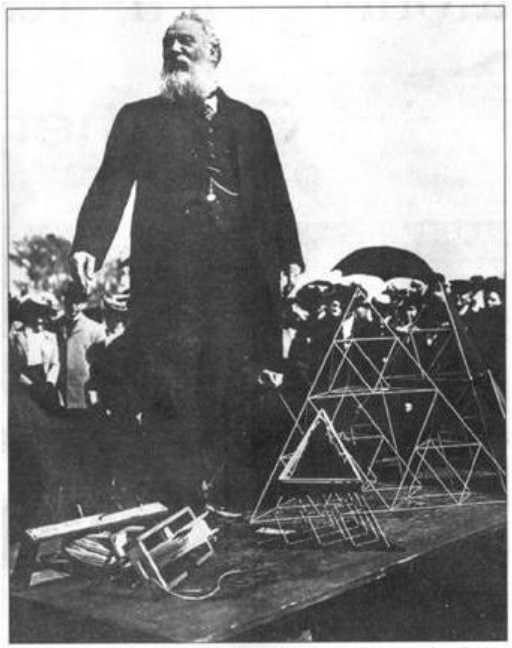
The tetrahedron is the three-dimensional case of the more general concept of a Euclidean simplex.

The tetrahedron is one kind of pyramid, which is a polyhedron with a flat polygon base and triangular faces connecting the base to a common point. In the case of a tetrahedron the base is a triangle (any of the four faces can be considered the base), so a tetrahedron is also known as a "triangular pyramid".

Like all convex polyhedra, a tetrahedron can be folded from a single sheet of paper. It has two such nets.[1]

For any tetrahedron there exists a sphere (called the circumsphere) on which all four vertices lie, and another sphere (the insphere) tangent to the tetrahedron's faces.

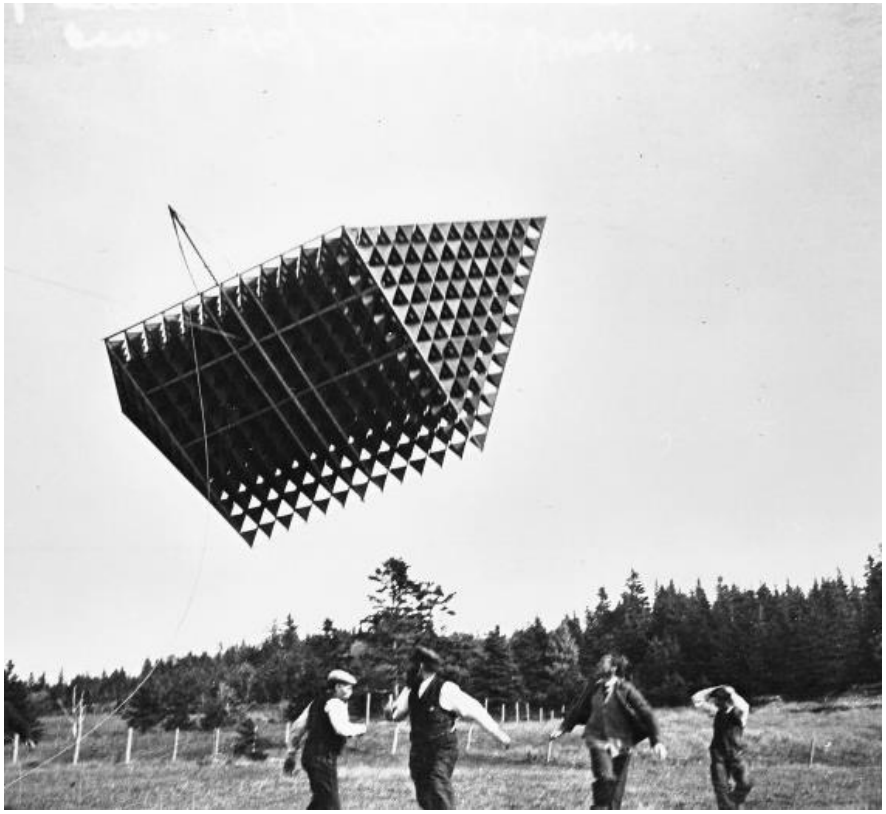
THE TETRAHEDRAL KITE

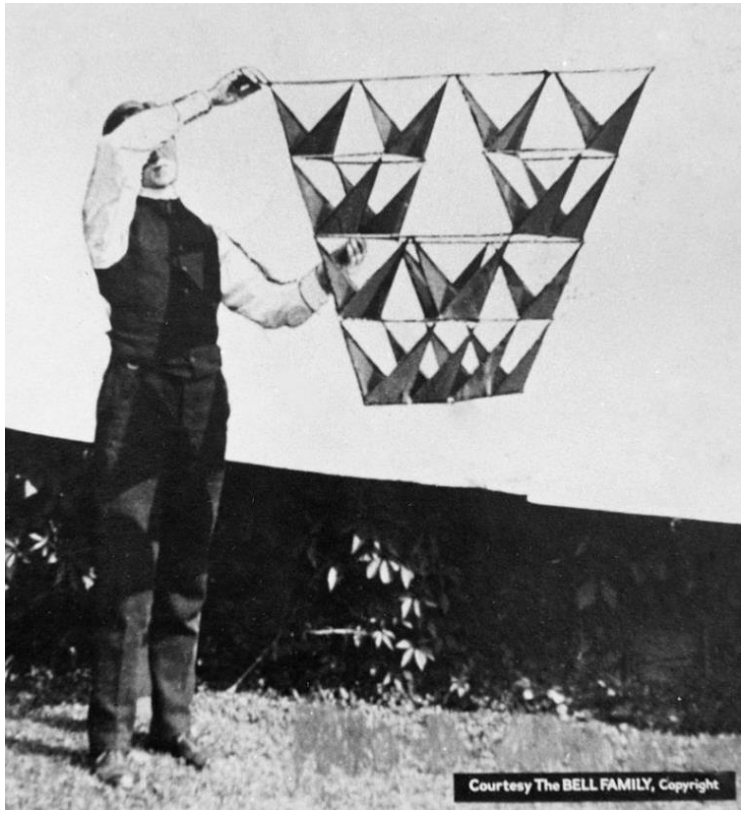


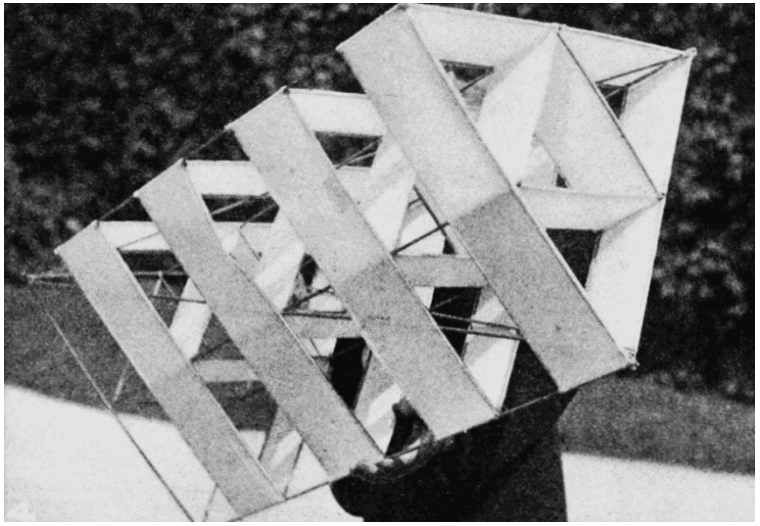
Alexander Graham Bell speaks during the first public demonstration of tetrahedral kites in the spring of 1904 in Baddeck, N.S.
Parks Canada, Alexander Graham Bell National Historic Site/ Canadian Press

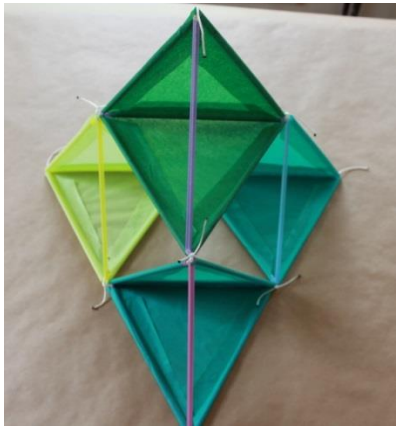
- Invented by Alexander Graham Bell.
- Is a multicelled rigid box kite composed of tetrahedrally shaped cells to create a kind of tetrahedral truss.
- The cells are usually arranged in such a way that the entire kite is also a regular tetrahedron.
- Bell found the tetrahedron to have a very good strength to weight ratio. Put more simply this means that an object is structurally very strong but at the same time very lightweight.
- Think Architecture--Metal girders and beams in most modern buildings are made of hollow steel beams. What were they made of years ago?

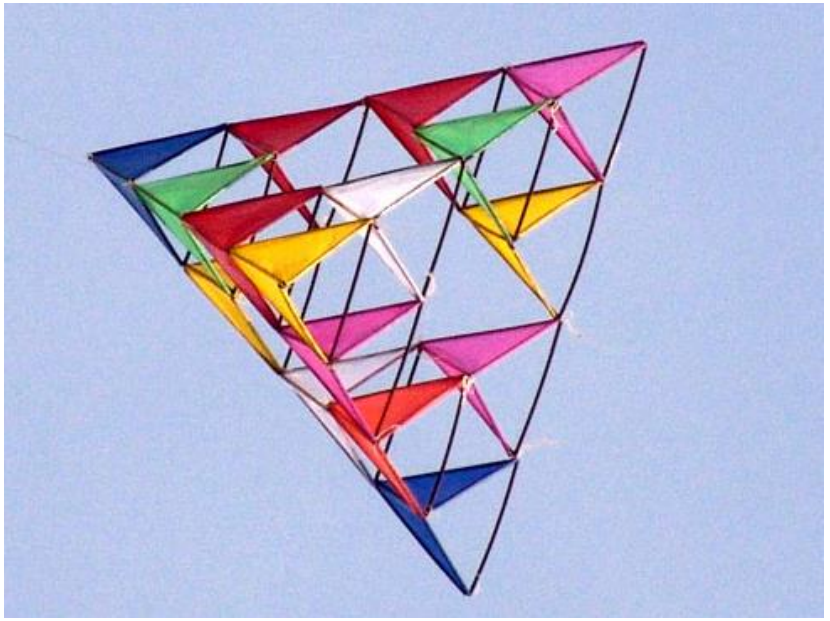
From an initial one cell model, Bell advanced to a 3,393 cell "Cygnet" model in 1907. This 40-foot long, 200 lb kite was towed by a steamer offshore near Baddeck, Nova Scotia on December 6, 1907 and carried a man 168 feet above the water.



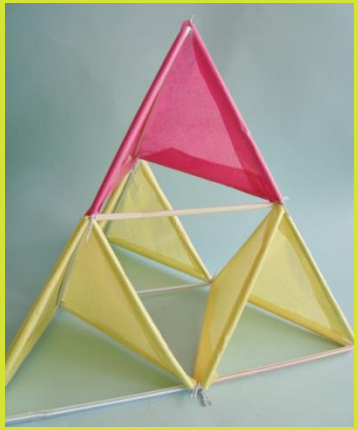








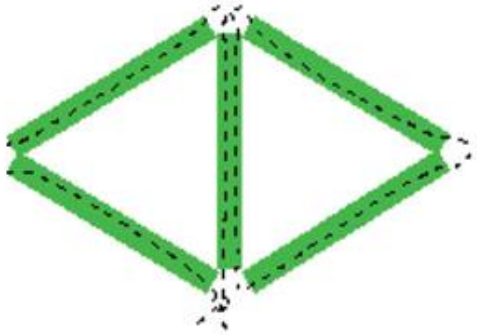
Build Your Own Exercise



- Each table will make (2) four cell kites.
- Within your table group divide yourselves into (2) groups of 4 people. Each person will be responsible for making 1 of the cells for the four cell kite.
- Instructions and supplies will be at your table.
- Creativity is always welcome! ☺
- A & E Committee members will be available to assist if needed.

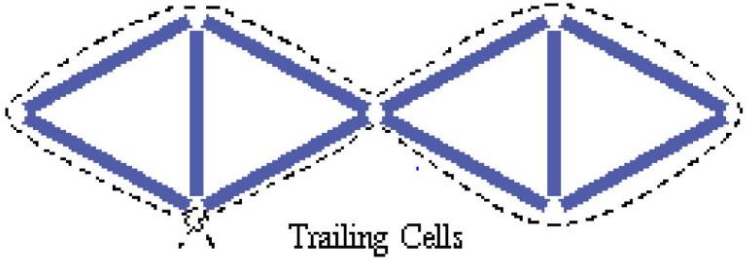
STEP DIAGRAMS

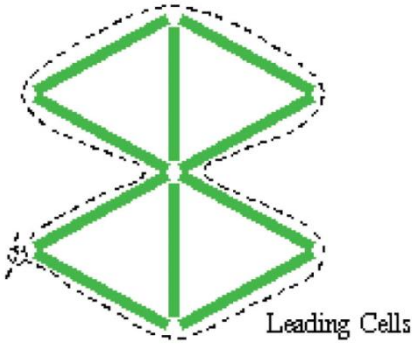
STEP 1



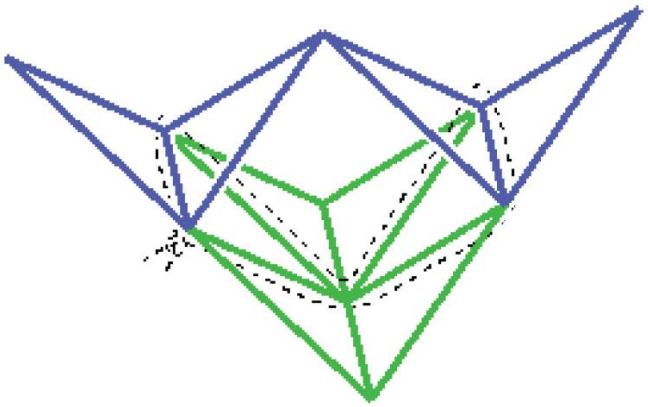
X 4

STEP 3





STEP 4



STEP 7