The most famous math textbook in history

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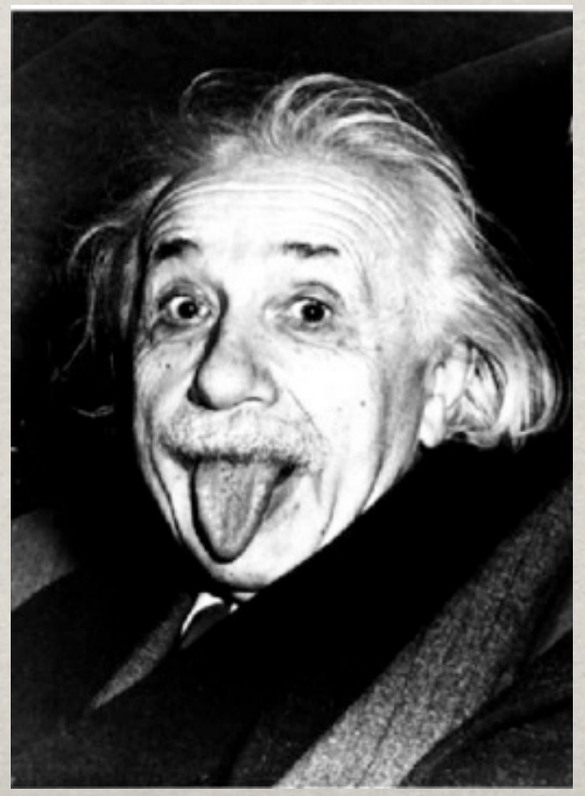
At the age of 12, I experienced a wonder of a totally different nature: in a book dealing with Euclidean geometry, which came into my hands at the beginning of the school year.

I remember that an uncle told me the Pythagorean Theorem before the book came into my hands. After much difficulty, I succeeded in proving this theorem... for anyone who experiences this for the first time, it is marvelous that man is capable of reaching such a degree of certainty, as the Greeks showed us to be possible in geometry.

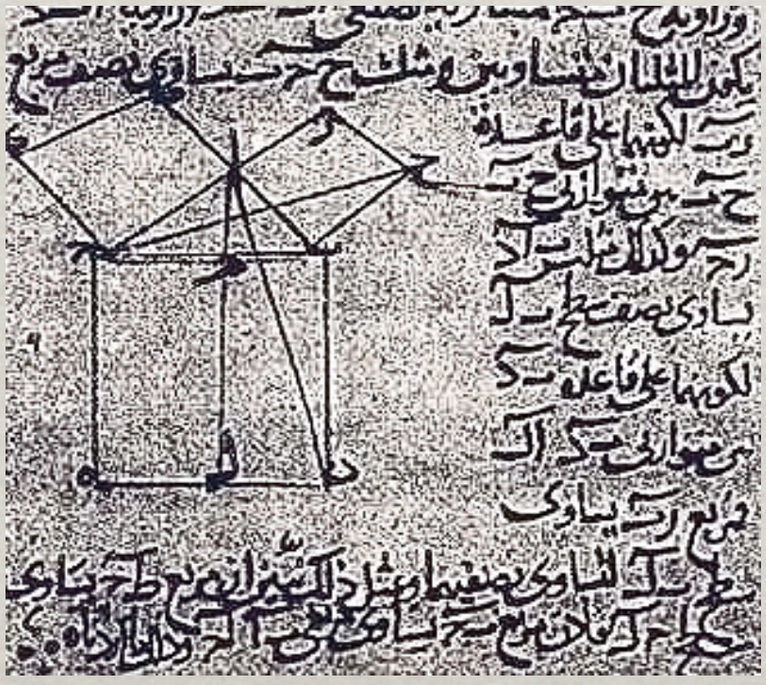
- Albert Einstein

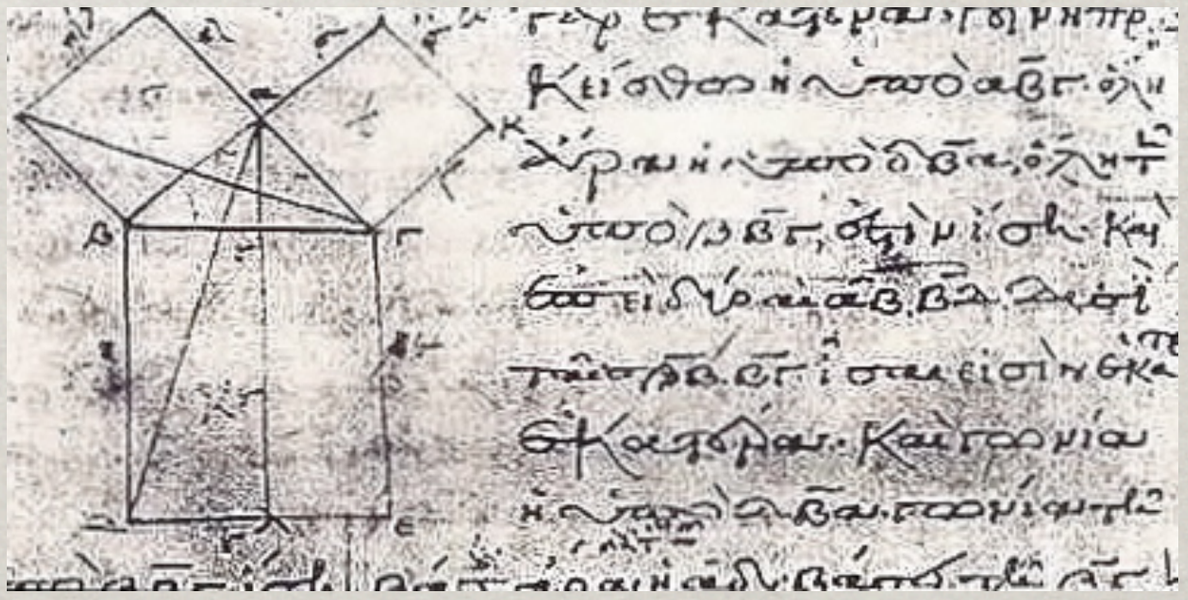


"The Elements" of Euclid

Next to the Bible, it is the most translated, published and studied of all books in the Western hemisphere - **B. van Waerden**

More than 2000 editions in 70 languages and in continuous use since 300 B.C. !



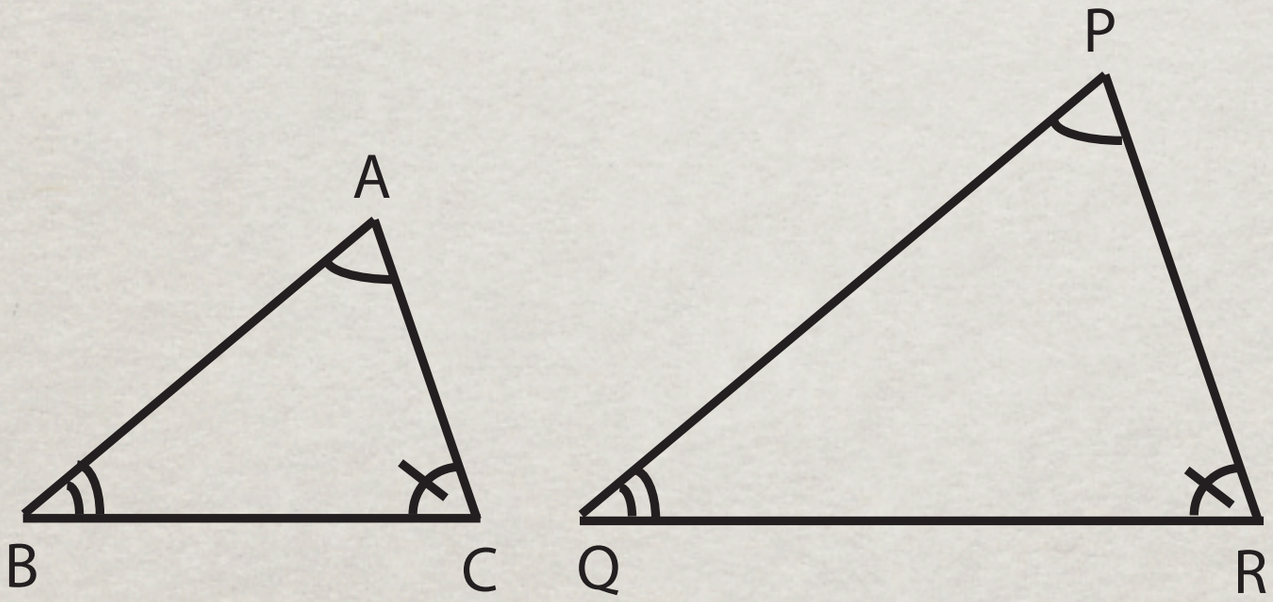


"THE ELEMENTS"

(13 Volumes)

- Volume I : Triangles, Parallel Lines, Area
- Volume II: Geometric proofs of algebraic identities e.g. $a^2 - b^2 = (a - b)(a + b)$
- Volume III: Circles and Tangents
- Volume IV: Polygons, Geometric constructions (using an unmarked ruler and compass)

- Volume V: Ratio and Proportion
- Volume VI: Similar figures



- Volume VII-X: Properties of numbers !
- Volume XI-XIII: Three-dimensional geometry

It is the glory of geometry that from so few principles, it is able to accomplish so much.

- Isaac Newton

EUCLID'S AXIOMS

1. Any two points can be joined by a straight line.

2. Any straight line segment can be extended indefinitely.

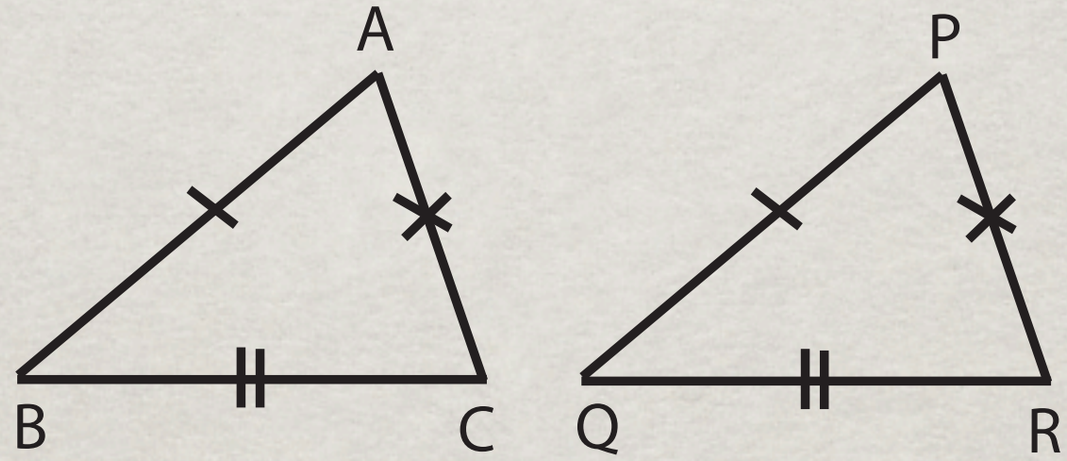
3. Given any straight line segment, a circle can be drawn having the segment as radius and one endpoint as centre.

4. All right angles are equal to one another.

5. Through any point in space, there is exactly one straight line parallel to a given straight line.

"Format" of a Euclidean Theorem

Euclid I.8: If two triangles have the three sides of one severally equal to the three sides of the other, the triangles are equiangular.

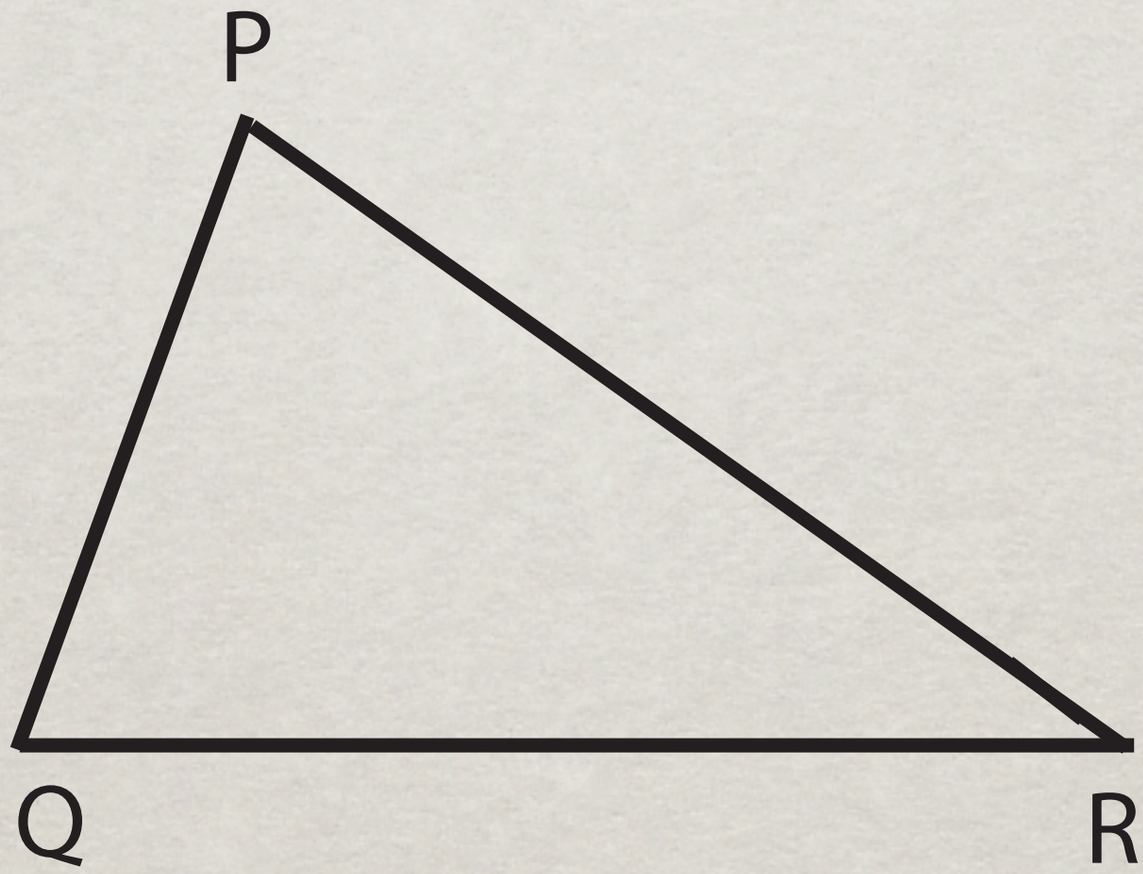


- Hypothesis: What we are required to <u>assume</u>
- Conclusion: What we are required to <u>prove</u>

Converse: Interchange hypothesis and conclusion

EUCLID I.32

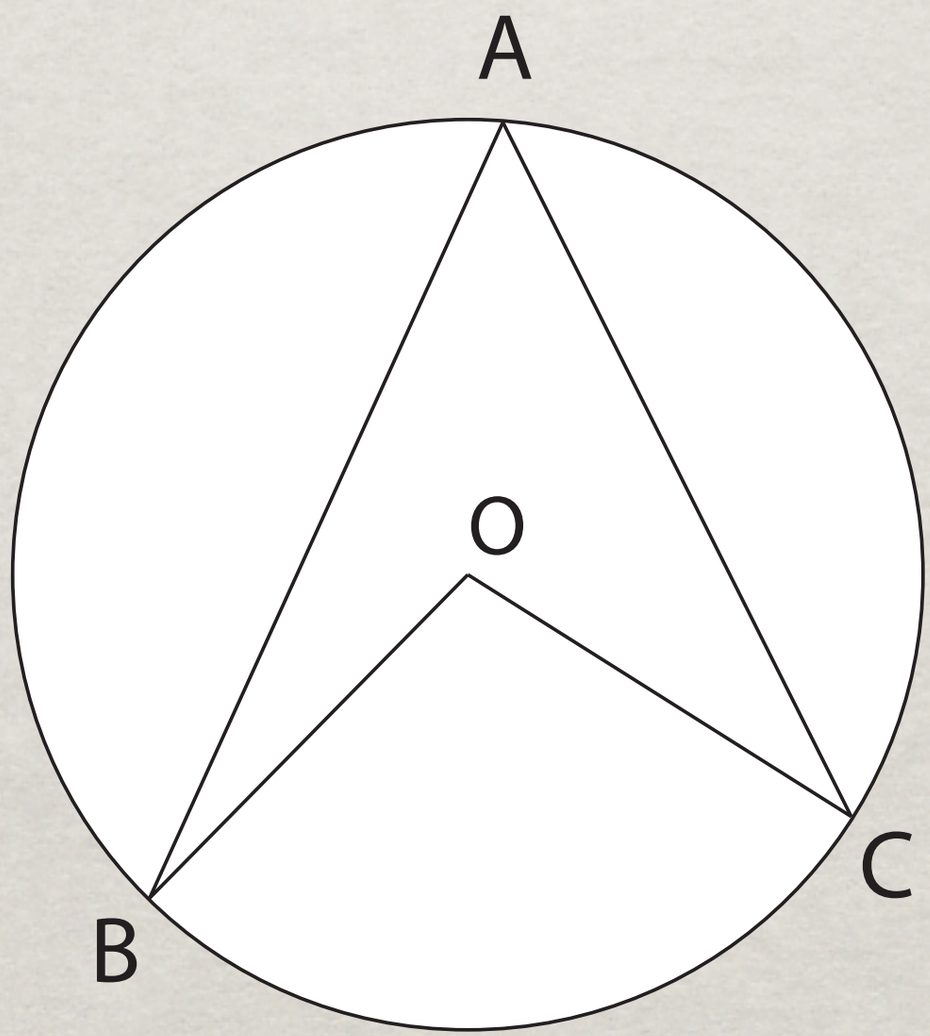
The three angles of a triangle are together
equal to two right angles



Prove $\angle P + \angle Q + \angle R = 180$

EUCLID III.20

The angle at the centre of a circle is double
of the angle at the circumference standing on the same arc.

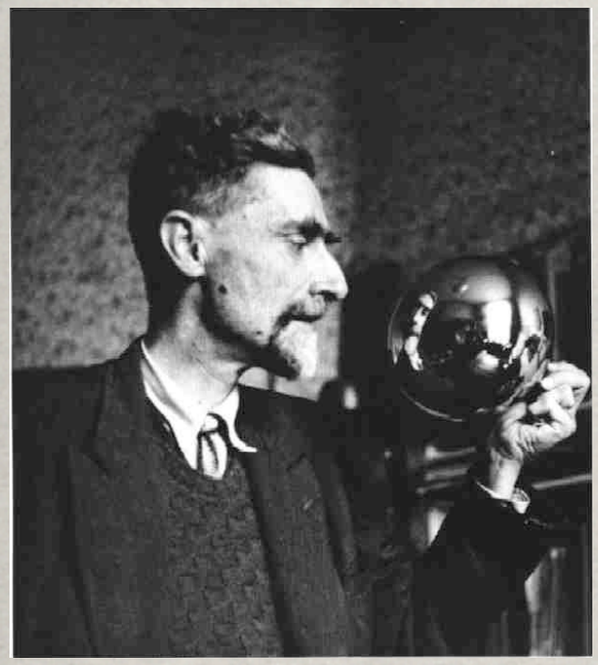


Prove $\angle BOC = 2\ \angle BAC$

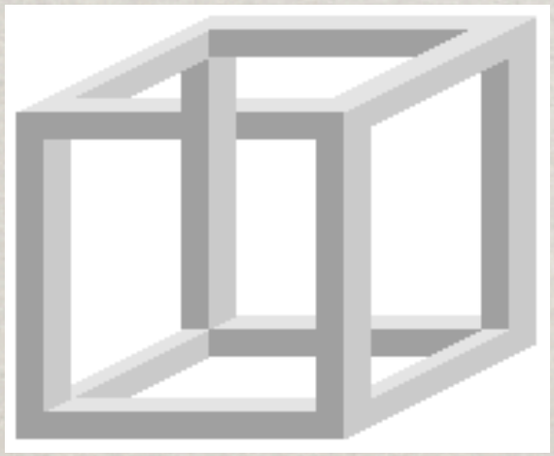
ART OF M.C.ESCHER

I never got a pass mark in math...

Just imagine - mathematicians use my prints to illustrate their books. I guess they are unaware of the fact that I am ignorant of the whole thing !



M.C.Escher



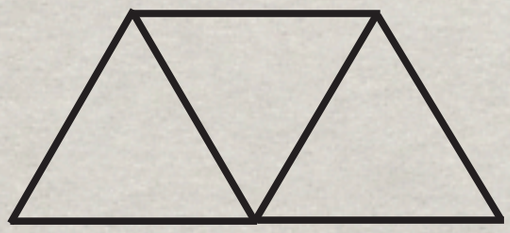
TILING PROBLEM

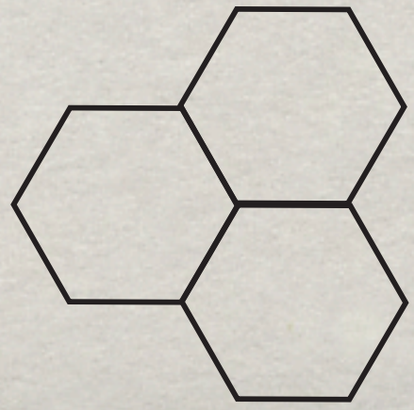
Show that the only regular figures which may be fitted to form a plane surface are:

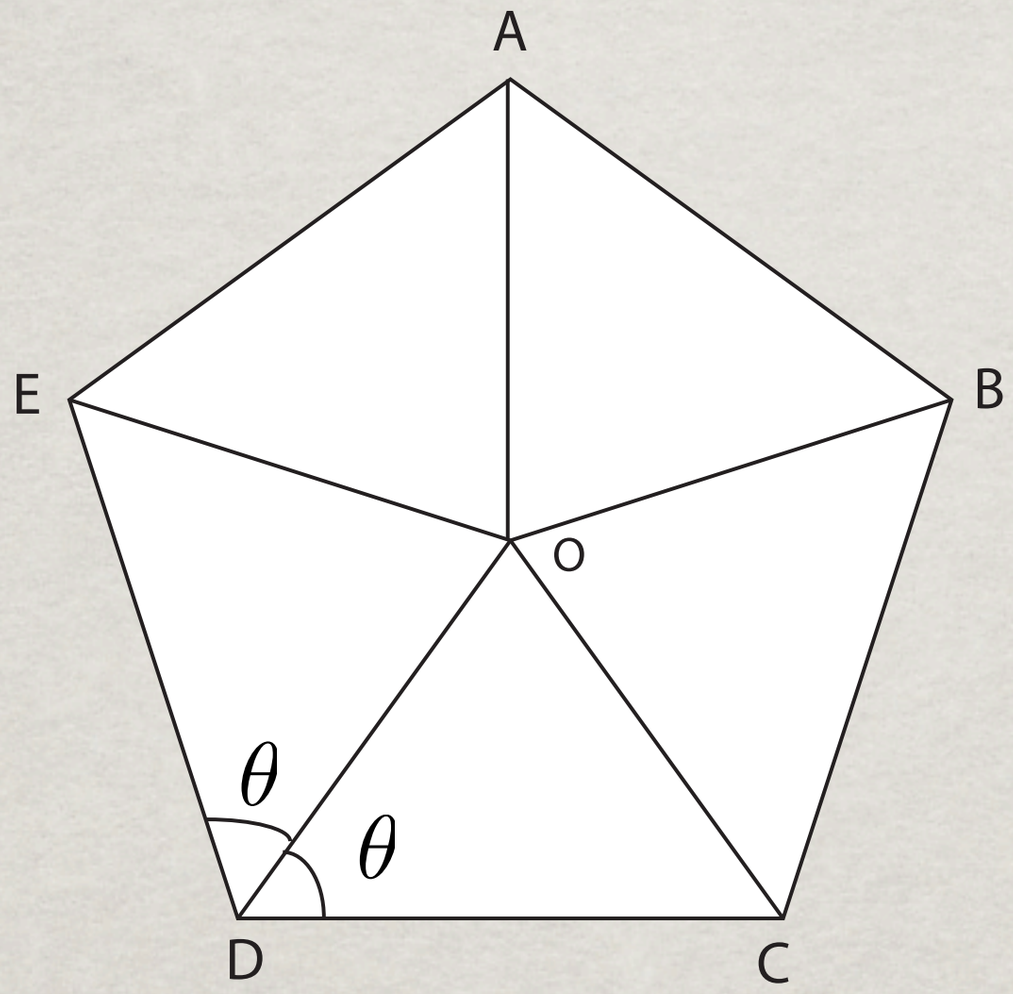
(i) Equilateral triangles

(ii) Squares

(iii) Regular hexagon

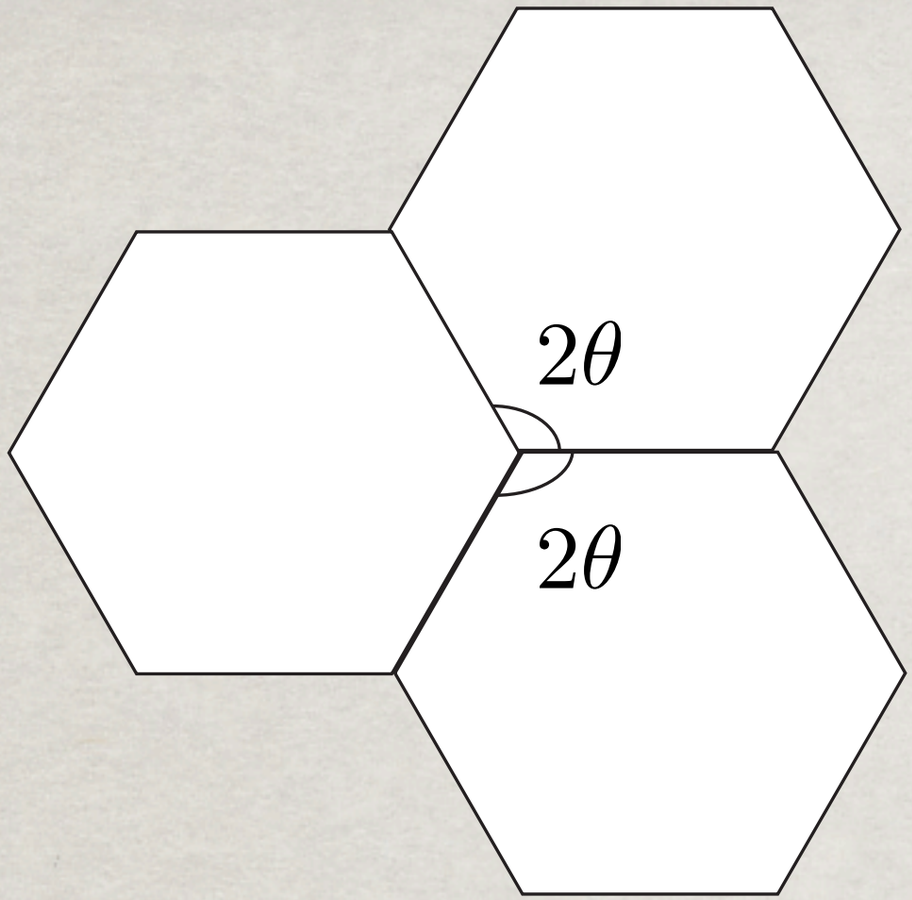






In the above regular polygon with n sides,

$$n \cdot 2\theta + 360 = n \cdot 180 \qquad \ldots(i)$$



Let $k+2$ regular polygons meet at a point,

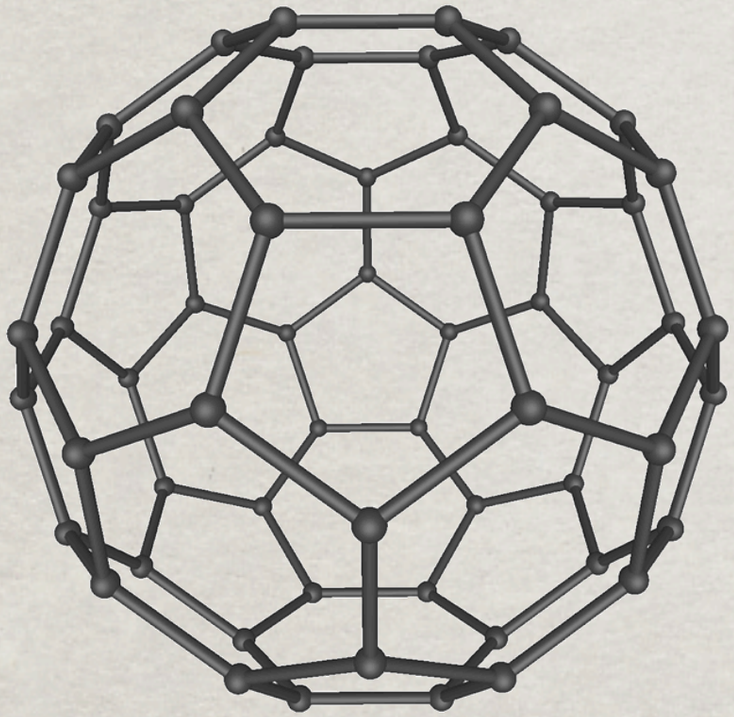
$$(k+2)\cdot 2\theta = 360 \qquad \ldots(ii)$$

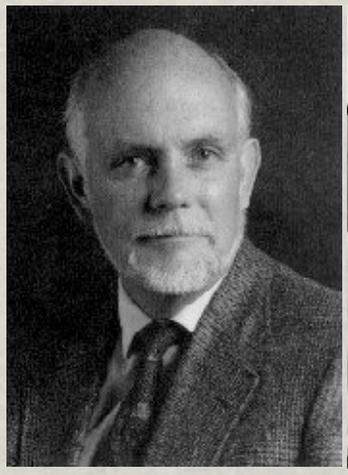
Solving (i) and (ii), we get $k = \dfrac{4}{n-2}$

$$\therefore n = 3, 4, 6$$

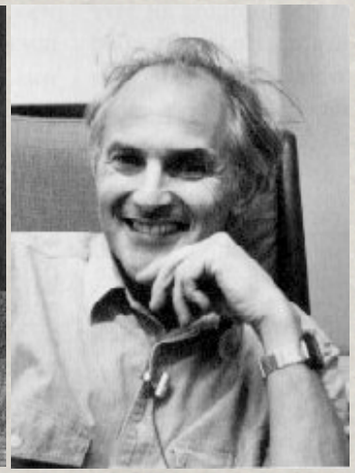
GEOMETRY IN CHEMISTRY

C_{60} (Buckyball)



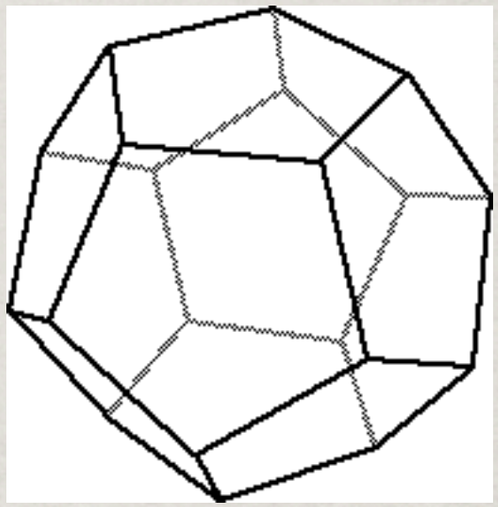


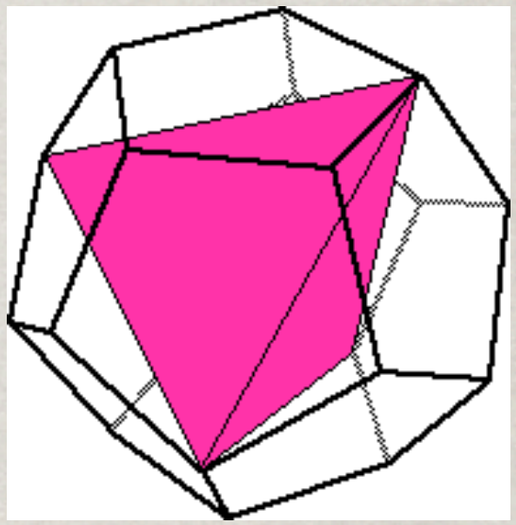
Kroto

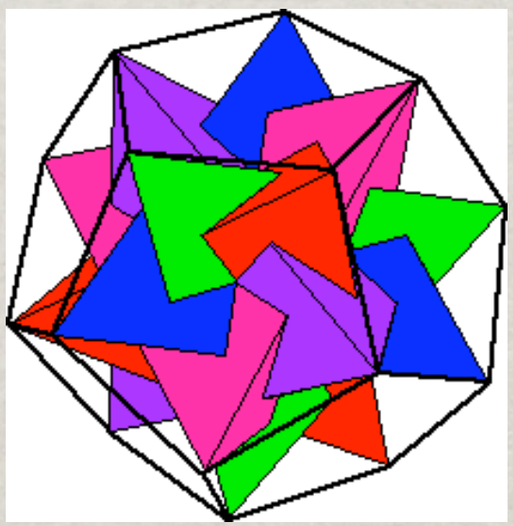


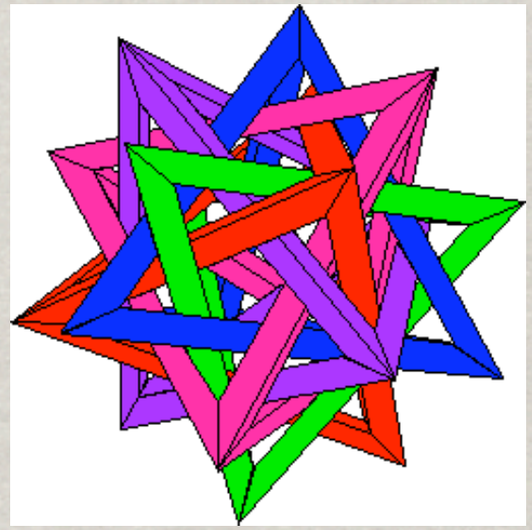
Smalley

Dodecahedron





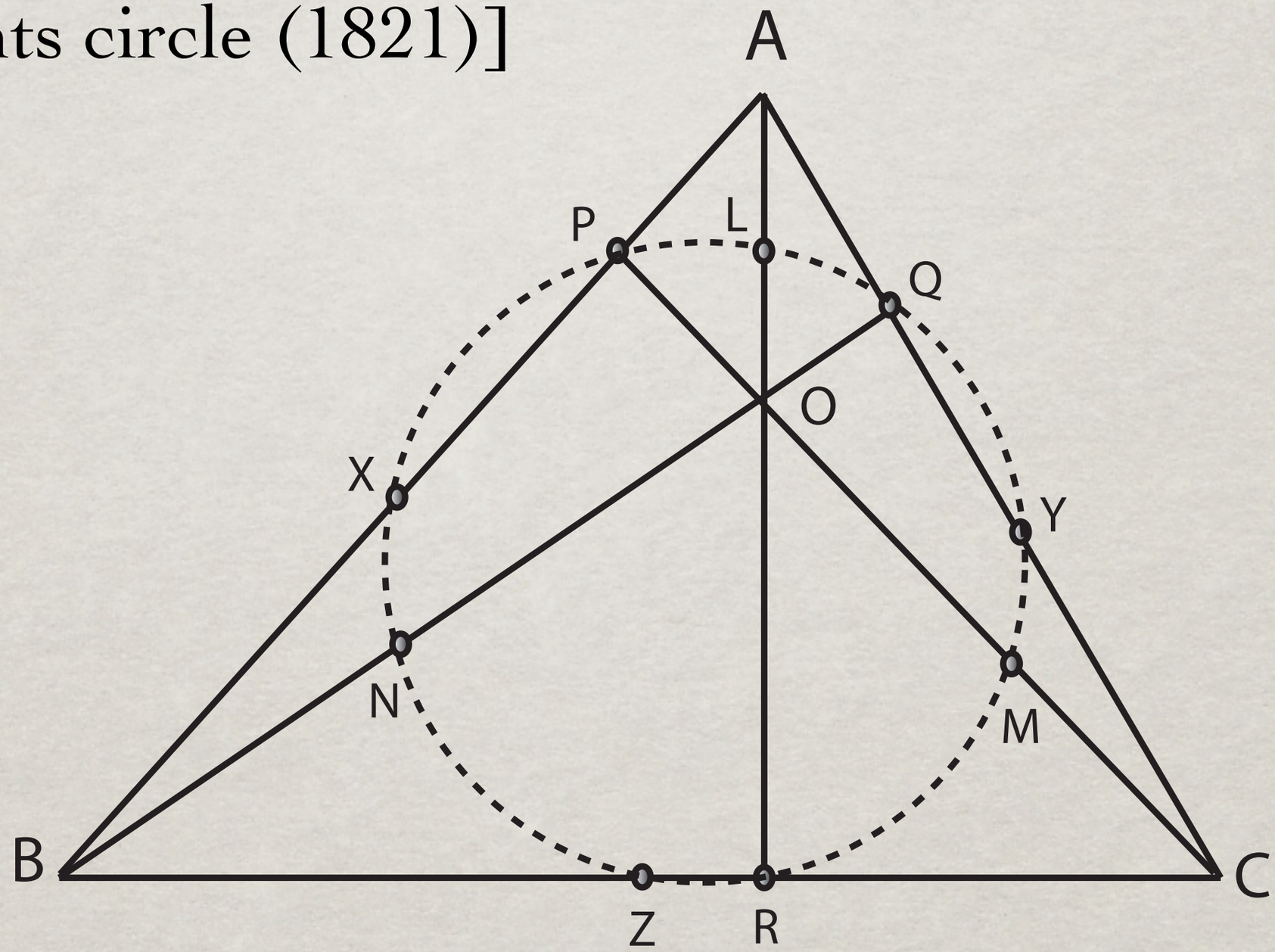




http://kahuna.merrimack.edu/~thull/fit.html

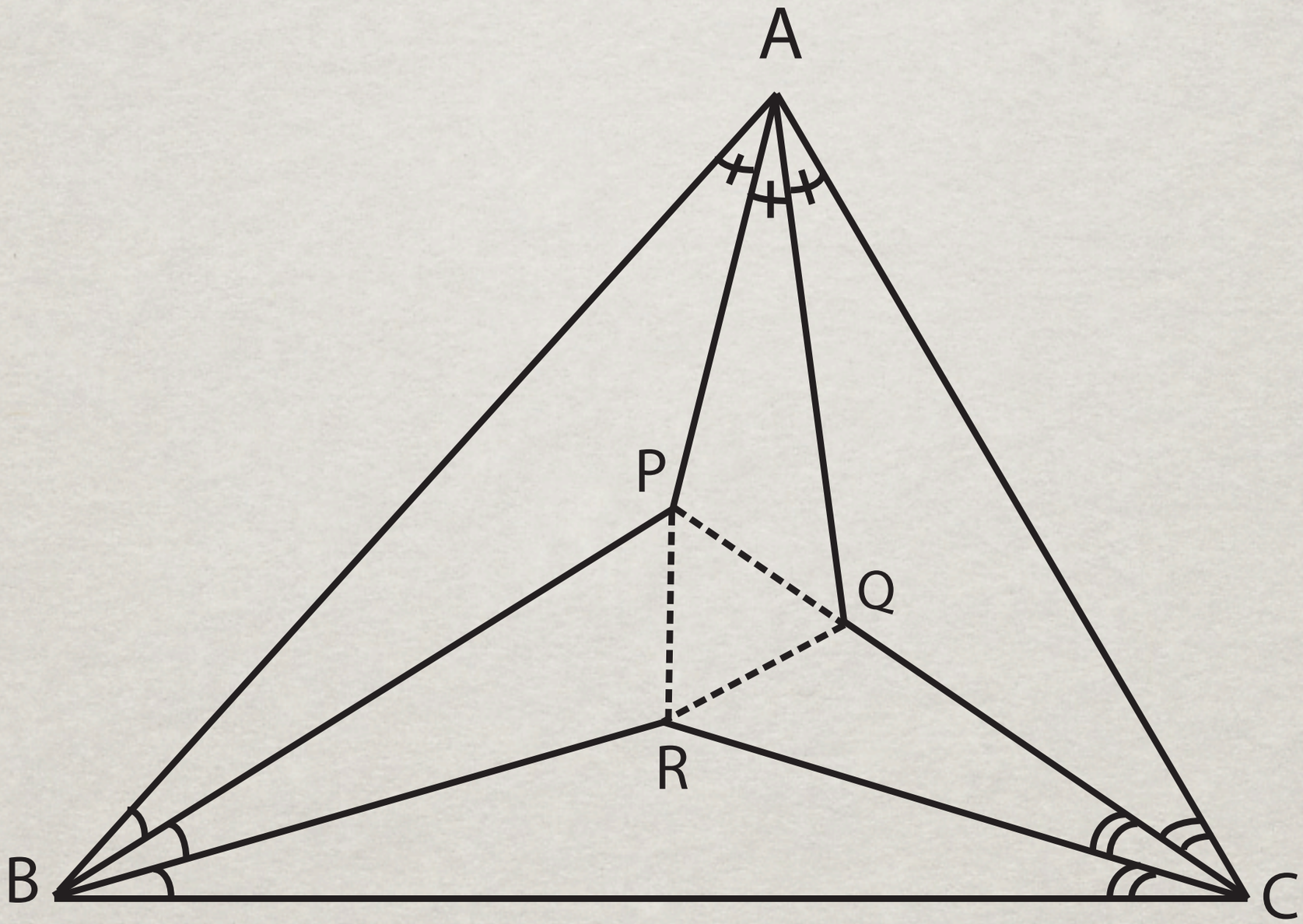
Curiosities

[Nine-points circle (1821)]



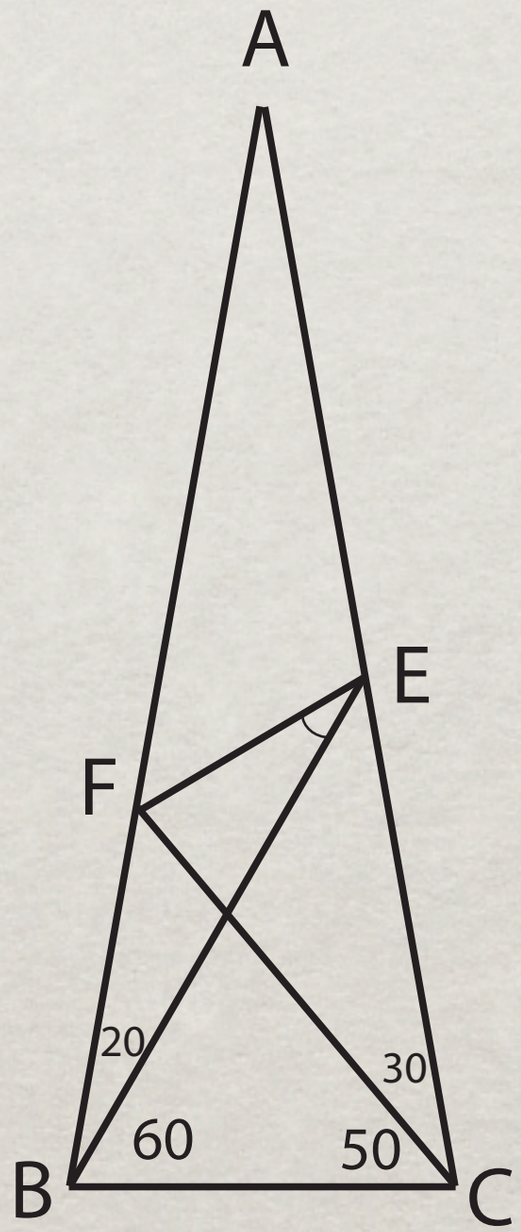
O : Orthocentre

[Morley's Miracle (1899), proof due to M.T. Naraniyengar (1909)**]**



Triangle PQR is equilateral !

CHALLENGE PROBLEM !



Prove ∠BEF= 30°

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Download: www.nclacademy.org/outreach

References:

- "A School Geometry" - H. Hall and F. Stevens, A.I.T.B.S Publishers, New Delhi. (Recommended textbook)
- www.cut-the-knot.org (Interactive geometry puzzles)
- www.mcescher.com (M.C. Escher's art gallery)