October 2018

YBMA News

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The Newsletter of the Yorkshire Branch of the Mathematical Association

Our next meeting Saturday 20th October 2018 at 2.30pm

The Mall
School of Mathematics
University of Leeds

The Platonic Solids' Lesser Known Cousins

Dr Richard Elwes

"The Platonic solids need no introduction. But what makes these five shapes so special? They are the only polyhedra in which the faces are congruent regular polygons, with the same number meeting at each vertex, and which are convex – no holes or spikes. We investigate some of the less famous (but no less beautiful) shapes that arise when we relax or amend these restrictions.

"The session will also showcase three of the speaker's current favourite things: a child's construction toy (*Magformers*), a piece of software (Robert Webb's *Stella 4D*), and a rare book (*Adventures among the toroids* by Bonnie Stewart)."

Refreshments will be provided

Officers of the Yorkshire Branch of the Mathematical Association 2018-19

President: Lindsey Sharp
(lindseyelizab50@hotmail.com)

Secretary: Alan Slomson
(a.slomson@leeds.ac.uk)

Treasurer: Jane Turnbull
(da.turnbull@ntlworld.com)

See overleaf for *Mathematics in the Classroom*

Dates for your diary

Tuesday, 4th December 2018 at 7.30pm
Our famous Christmas Quiz, with seasonal refreshments and prizes for all!

Saturday, 9th March 2019
Enriching the teaching of A-level Statistics: a Study Day for Teachers
led by **Stella Dudzic** and **Darren Macey**

Wednesday, 3rd April 2019 at 2:30pm
W.P.Milne Lecture for sixthformers
To Infinity and Beyond
Dr Katie Chicot

In 2020 the Branch will celebrate its 100th anniversary.

We are keen to hear from anyone with past records of the YBMA and its activities, as we are short of archive material.

More than 30 Years of Masterclasses


Ri The Royal Institution
Science Lives Here

Royal Institution Masterclasses
Certificate of appreciation

We are pleased to award this certificate of appreciation to
The University of Leeds and Yorkshire Branch of the Mathematical Association

And hereby present them with this

Masterclass Long Service Award

For continuous contribution to the Masterclass programme for over 30 years

July 2018

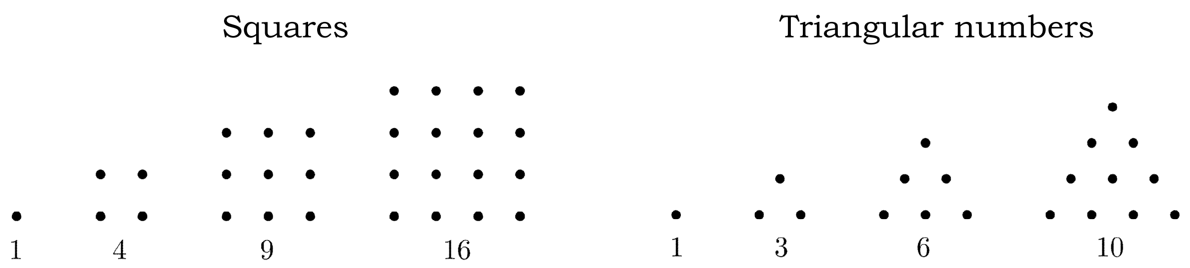
Professor Gail Cardew

The YBMA, together with the School of Mathematics, University of Leeds, has been presented by the Royal Institution with a certificate to commemorate more than 30 years support for Masterclasses, which began in Leeds in 1984. Currently these Masterclasses are organized by Professor Daniel Lesnic with the help of Priya Subramanian, Ruth Holland and Alan Slomson.

Mathematics in the Classroom

How many squares are triangular?

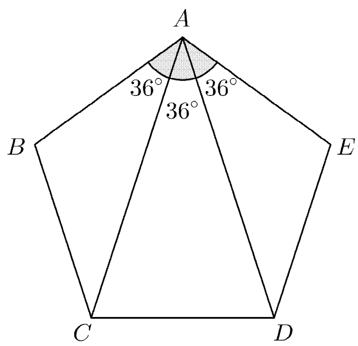
Of course, as shapes, squares are different from triangles. However, the Greeks thought of numbers geometrically. *Square numbers* are the numbers they associated with squares, which is how they get their name, and the *triangular numbers* are those associated with triangles, as shown in the diagrams.



We see that 1 counts as both a square and a triangular number.

This is not very interesting. However, it is interesting to ask whether there are any more squares that are also triangular numbers. A more difficult question is "How many squares are there which are also triangular numbers?"

A Regular Generalization



ABCDE is a regular pentagon.

In the last Newsletter we asked you to find the angles *EAD*, *DAC* and *CAB*.

We also asked how the answer could be generalized.

Solution

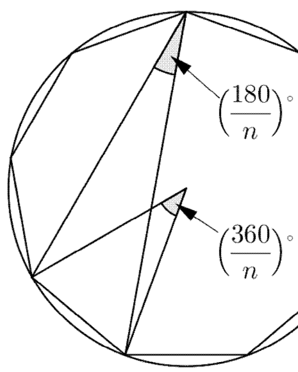
Each of the interior angles of a regular pentagon is 108°.

Now, in the triangle ABC, the sides BA and BC are equal because the pentagon is regular. Therefore, $\angle BAC = \angle BCA$, as they are base angles of an isosceles triangle. Hence, because $\angle ABC = 108^\circ$, and the sum of the angles in a triangle is 180°, it follows that $\angle BAC = \frac{1}{2}(180-108)^\circ = \frac{1}{2}(72)^\circ = 36^\circ$. Similarly, $\angle DAE = 36^\circ$.

It follows that $\angle CAD = \angle BAE - (\angle BAC + \angle DAE) = 108^\circ - (36^\circ + 36^\circ) = 108^\circ - 72^\circ = 36^\circ$.

Hence the diagonals AC and AD divide $\angle BAE$ into three equal angles, each of 36°.

It is not difficult to generalize this to any regular polygon.



Suppose we have a regular polygon with n vertices. These lie on a circle. (Can you prove this?) Each of the n edges of the polygon subtends an angle of $\left(\frac{360}{n}\right)^\circ$ at the centre of the circle.

Hence, using "the angle at the centre is twice the angle at the circumference", it follows that each edge subtends the same angle, $\left(\frac{180}{n}\right)^\circ$, at each other vertex. So the diagonals divide each interior angle of the polygon into $n-2$ equal angles.