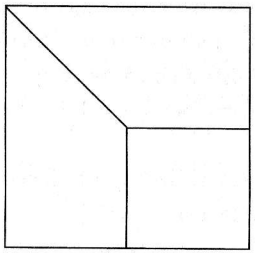
IDEA 55

SQUARE CUT

Despite the title of this idea it has nothing to do with cricket. It is an idea I first met on a course to learn about counselling techniques; I have adapted the idea as an active and fun problem for the mathematics classroom.

Take five square pieces of card and dissect each into three pieces. Each dissection has to be different, although this does not mean that every one of the 15 resulting shapes will be different. For example, a square might be dissected into two right-angled trapeziums and a square as in the diagram below.



Using double-sided sellotape stick each of the fifteen pieces onto the backs of fifteen students; they cannot see their own piece but they can see each other's. The challenge is for students to form themselves into groups of threes so everyone forms part of a square.

If one is feeling particularly brave, you might have each set of shapes duplicated in two different colours, so a class of 30 students can try to solve the problem . . . however, we all have our different tolerance and risk-taking levels . . . where were those textbooks?

IDEA 56

DIAGONAL DIVERSIONS 2

When two diagonals are cut from a regular pentagon, three isosceles triangles are formed; two of them are the congruent. One is a tall thin isosceles triangle (**T**) and another is a short squat isosceles triangle (**S**)

As a first task, students could be asked to work out the angles in each of these triangles. The next task is to make new shapes by joining together combinations of triangles **T** and **S**, full edge to full edge.

Fibonacci spotters may be able to use these shapes to make two alternating sets of isosceles triangles, generating the sequence 1, 1, 2, 3, 5, 8, . . . or using the symbols **T**, **S**, **TS**, **STS**, **TSSTS**, **STSTSSTS**, each of these combinations can be used to form enlargements of **T** and **S** type triangles.

The next idea is to explore diagonals in a hexagon. Here it is possible to cut off two different lengths of diagonals and there are three possible ways of dissecting a hexagon:

- One dissection produces a rectangle and two isosceles triangles.
- A second dissection produces an isosceles triangle, a scalene right-angled triangle and an isosceles trapezium.
- A third dissection produces two isosceles triangles and a kite.

For each dissection what different shapes can be formed by rearranging the pieces?

How many different dissections are there by slicing two diagonals from a heptagon, an octagon, a nonagon, etc?

What are the sizes of the angles in the shapes formed by the different solutions?

To answer this question students will need a strategy for calculating the size of the external and, therefore, the internal angles in a regular polygon.

If the diagonals cross each other there will be even more possibilities and even more shapes to be played around with and explored.