National Centre for Excellence in the Teaching of Mathematics

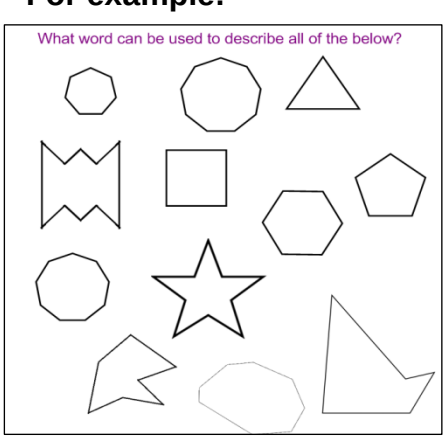
MathsHUBS

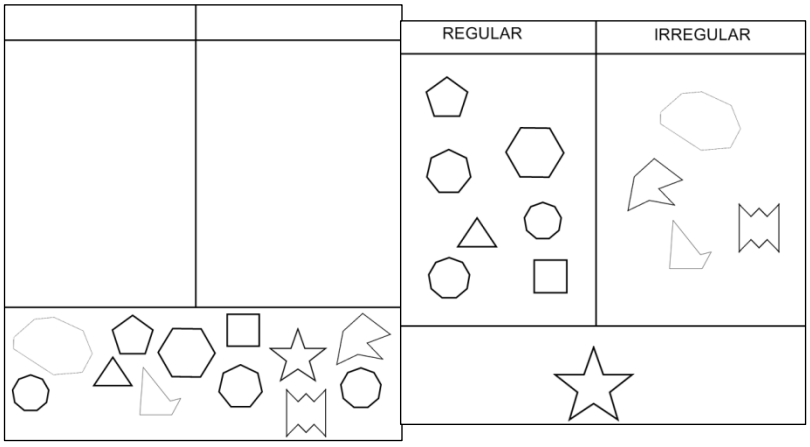
Big Ideas in Mastery: Mathematical Thinking

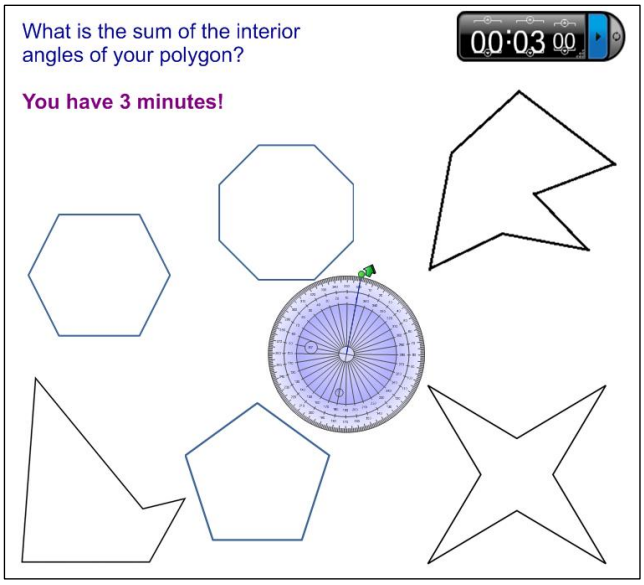
Messages

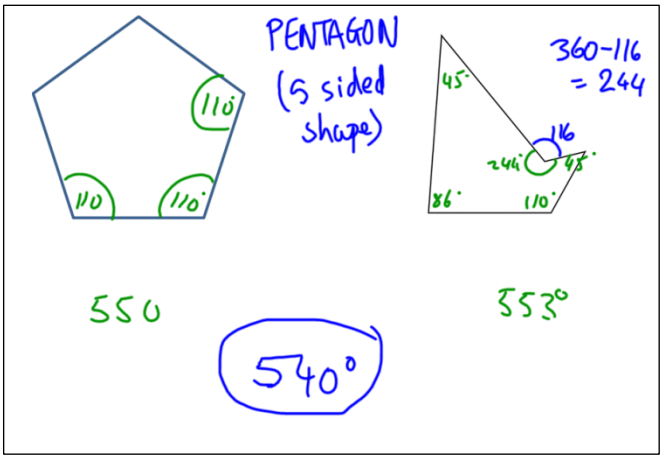
1. Mathematical thinking is central to deep and sustainable learning of mathematics.
2. Taught ideas that are understood deeply are not just 'received' passively but worked on by the learner. They need to be thought about, reasoned with and discussed.
3. Mathematical thinking involves:
   - looking for pattern in order to discern structure;
   - looking for relationships and connecting ideas;
   - reasoning logically, explaining, conjecturing and proving.

For example:









Rationale:

- To develop a deeper understanding of the meaning of polygon, regular and irregular by getting students to think for themselves about links/relationships/definitions.
- To provide visual aid for students to think conceptually about interior angles (spotting reflex angles as well as acute/obtuse angles)
- To give students a deeper understanding of the formula 180(n-2) in finding the sum of the interior angles

Delivery:

WWW

- Great for getting students to develop their mathematical language and thinking in having to justify their explanations.
- Getting students to spot what two categories the polygons could be placed in allowed them to define the meaning of 'regular' and 'irregular' on their own
    - Students seemed aware that regular shapes had all equal sides, but less aware that they also had all equal angles
- Very valuable discussion around the 'star' octagon. Students argued it was regular because all the sides are equal. When told it was in fact irregular, a valuable debate emerged about why. When a student noticed that not all the angles were equal, another student responded that they were, having only noticed the acute angles
- Investigative element – students measured the interior angles of a range of regular and irregular polygons, discovering that their answers matched for shapes with the same number of sides
- When measuring reflex angles, students applied knowledge of angles around a point adding up to 360degrees.
- Students noticed that the difference between each of the angle sums was 180degrees (180, 360, 540, 720 etc)
- Students spotted that the multiple of 180 was 2 less than the number of sides. This meant that their conceptual understanding of the formula was far better than past times I've taught this topic

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- Some students needed revision of how to use a protractor. It meant that when we went through the sum of the interior angles in their polygons, their total was a long way out, hence limiting the impact of the discovery that the totals will always be the same for certain polygons.

Investigate with triangles inside the polygons by asking students how they can show the relevance of 180degress and why it's always two less than the number of side