7-9: REMOTE MATHS

EDITION 17

GEOMETRY - INVESTIGATIONS

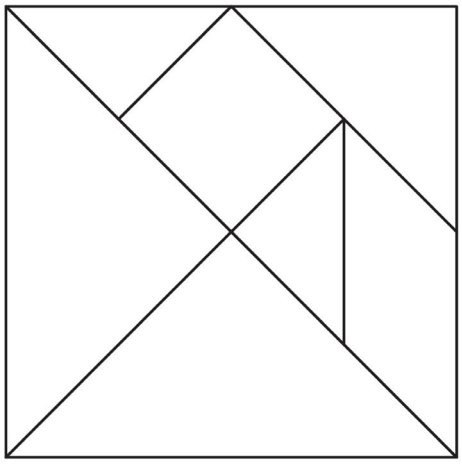
Mathematical language: Archimedes, inscribed, circumscribed, regular polygons, pentagon, hexagon, octagon, convex, translation, rotation, reflection, flip.

INVESTIGATION 1

CONVEX AND NON-CONVEX HEXAGONS

Adapted from AAMT Top Drawer

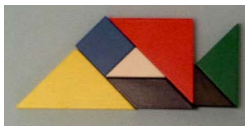
Materials: scissors and tangram



In this investigation you will be exploring convex and non-convex hexagons using tangram pieces

- In your own words, define convex and non-convex.
- Print and cut out the 7 pieces of the tangram
- Use all seven pieces to make **convex** hexagons. How many can you make? Draw or take a photo (example below).

- Use all seven pieces to make **non-convex** hexagons.
  How many can you make? Draw or take a photo (example below).



Explain

- Choose a hexagon, explain using geometrical language any movement (eg. reflection, rotation, etc.) required of tangram pieces to create your shape from the original square starting illustration.
- Test your instructions with a family member.

Enabling prompt: You are allowed to flip the parallelogram over. There is no need to turn the other pieces over. Hint: In total there are 27 possible (convex & non-convex) hexagons. How many can you find?
Extending prompt: How many possible convex hexagons are there? Can you find them all?

INVESTIGATION 2

WHAT IS π? METHOD OF EXHAUSTIONS

- Archimedes in c250BC used the method of "exhaustions" to determine the area of a circle. This was achieved by calculating the areas of inscribed and circumscribed regular polygons. As the number of sides of the polygons increase the area of the polygons become closer to the area of the circle. The two results (of the inscribed and circumscribed polygon) sandwich the area of a circle.
- In the diagram below, a circle has been (i) inscribed and circumscribed by a regular pentagon (Figure 1), (ii) inscribed and circumscribed by a regular hexagon (Figure 2) and (iii) inscribed and circumscribed by a regular octagon (Figure 3)

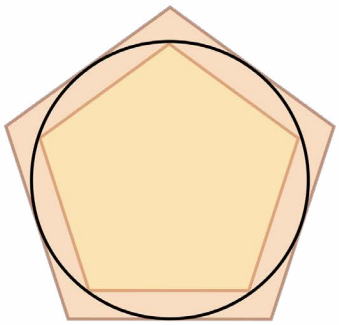


Figure 1

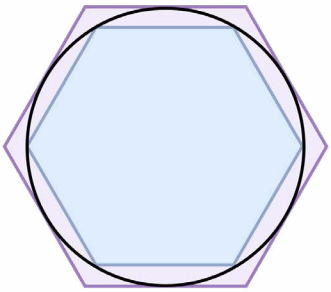


Figure 2

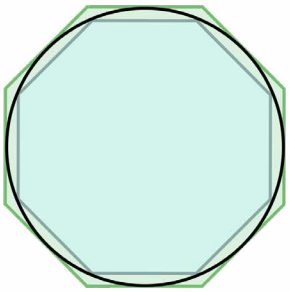


Figure 3

Use the method of exhaustions to find the area of a circle of radius 5cm. Any appropriate method may be used to find the area of the polygons but you must explain the method used.

Enabling prompt: You may need a compass and protractor.

- Draw you 5cm circle.
- Start with a polygon of the least number of sides eg. square (inscribe it and circumscribe it around your circle). Calculate the area of the inscribed square and circumscribed square.
- Record this in a table.
- Move to the next sized regular polygon, ie. pentagon and repeat.
- Move to a hexagon and repeat.
- Each time recording both your inscribed and circumscribed areas in a table.

Extending prompt: Show how your result may be used to approximate the value of π.

Look out for more tasks next week!