

**Global Teacher Empowerment Network GTEN**  
**TANGRAM GEOMETRY**  
 Saturday 23 July 2022 16:00 – 18:00 London Time

**Put your name, country and the age group you teach on the chat**

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**AIMS** African Institute for Mathematical Sciences SCHOOLS ENRICHMENT CENTRE  
**Global Teacher Empowerment Network (GTEN)**  
 PROGRAMME: TANGRAM GEOMETRY

**Learning Spiral**

IMPROVE SKILLS, KNOWLEDGE AND UNDERSTANDING OF:

- Properties of 2D shapes.
- Symmetry
- Fractions
- Similarity, Enlargement and Scale
- Accurate geometric construction using ruler and compasses

**UPPER SECONDARY**

**LOWER SECONDARY**

**UPPER PRIMARY**

**LOWER PRIMARY**

**EARLY YEARS**

**STARTER ACTIVITY**

1. Make your own tangram by paper folding
2. Very simple tangrams for small children
3. Interactive tangram puzzle solving
4. Symmetry
5. Tangram Fractions, area and perimeter
6. Tangram Fractions game
7. Five Tangram Polygon Puzzles.
8. Thirteen Tangram Polygon Puzzles
9. Folk tales: The Goose that Laid Golden Eggs and Jack and the Beanstalk
10. Golden Egg Tangram
11. Geometric construction to draw The Golden Egg Tangram
12. Birds made from the Golden Egg Tangram

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**DO TALK RECORD**  
 the basis of a good lesson  
 During this session you will need to wear 2 hats.

**DO** the activities pretending that you only know what your learners know.

**TALK** to other teachers by commenting on the chat about how your learners might discover new ideas doing this activity.

**RECORD** in whatever way that is meaningful to you as a teacher and also in a way that will be meaningful to your learners.

**Whole Class Activity**  
 Learners come one by one to put another domino in place.

The chain of dominoes is the record of this activity

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**MAKE YOUR OWN TANGRAM** [https://youtu.be/1l\\_U31PflQ](https://youtu.be/1l_U31PflQ)

**TALK ABOUT THE SHAPES AND WHAT FOLDS TO MAKE TO GET THE 7 PIECES**

Here is a simple way to make a tangram without measuring or ruling lines. You need a square of paper or card and some scissors to cut out the shapes. Follow the steps shown in the diagrams, folding on the red lines. Remember that every fold will find half a shape or half a line.

1. Fold D to B.
2. Fold A to C and just mark centre.
3. Fold D to centre and cut out piece 3.
4. Fold A to C and cut out pieces 1 and 2.
5. With the trapezium fold A to centre and cut out piece 4.
6. Fold edge to centre.
7. Cut out pieces 5, 6 and 7.

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**SOME VERY SIMPLE TANGRAM PUZZLES FOR YOUNG LEARNERS**

**MATHS TOYS**

2 big triangles  
2 small triangles  
1 medium sized triangle  
1 square  
1 parallelogram

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Visit the **WORLD OF TAN** <https://nrich.maths.org/14074>

You will find a series of stories about GranmaT and her grandchildren.

Join the Tan family on their adventures and enjoy creating different pictures from the 7 tangram pieces.

Solve the puzzles online by moving the pieces on the NRICH interactivities.

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**TANGRAM PATTERN**

<https://aiminghigh.aimssec.ac.za/tangram-pattern/>

Hands are symmetrical. What else can you see that is symmetrical?

**Make the grey shape.**

What do you notice about it?

Make your own symmetric pattern with the 7 tangram pieces?

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**TANGRAM FRACTIONS**

<https://aiminghigh.aimssec.ac.za/tangram-fractions/>

Take the edge length of the outer square as 1 unit and the area as 1 square unit. Find the areas of the 7 pieces. Some have the same area.

What fraction of the outer square does each piece make? Arrange the 7 pieces in order of their areas. Write order in chat.

What are the perimeters of the 7 pieces? Arrange the 7 pieces in order of their perimeters. Are these two orders the same?

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### TANGRAM FRACTIONS SOLUTIONS

**Areas of 7 pieces in square units**

**Sum of areas (in increasing order):**  
 Area C + Area E + Area D + Area G + Area F + Area A + Area B  
 =  $\frac{1}{16} + \frac{1}{16} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{4} + \frac{1}{4}$   
 = 1 square unit

**Perimeters in increasing order:**  
 Perimeters of C & E each  $(1 + \sqrt{2})/2 = 1.21$  units to 3 s.f.  
 Perimeter of D is  $\sqrt{2} = 1.41$   
 Perimeters of G & F each  $1 + \sqrt{2}/2 = 1.71$   
 Perimeters of A & B each  $1 + \sqrt{2} = 2.41$

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### TANGRAM FRACTIONS

<https://aiminghigh.aimssec.ac.za/tangram-fractions/>

**Make a square from the pieces A, G, C and E.**

**What is its area?**  
**What is its edge length?**

Each of the people illustrated, and many other shapes, can be made with the 7 pieces.

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### TANGRAM FRACTIONS SOLUTIONS

**Areas of 7 pieces in square units**

The diagram shows a square made up from pieces A, G, C and E.  
 The area of the square is  $\frac{1}{2}$  square units.  
 The edge length is  $\frac{1}{\sqrt{2}}$  or  $\frac{\sqrt{2}}{2}$  units.

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### TANGRAM FRACTIONS GAME FOR 2 PLAYERS OR 2 TEAMS

You will need 7 tangram pieces.

Draw a square frame into which the pieces fit.

Make 8 identical fraction cards.  
 Write  $\frac{1}{4}, \frac{1}{4}, \frac{1}{8}, \frac{1}{8}, \frac{1}{8}, \frac{1}{16}, \frac{1}{16}$  on 7 cards and leave one card blank.

Put the cards in a bag or box and shake to mix them, or place the cards face down on the table and mix them.

Take the tangram pieces out of the frame. Each player (or team) picks a fraction card in turn, selects a tangram piece with area corresponding to the fraction on the card, notes the area, and places the piece in position in the frame.

The winner is the player with the greatest total area when all 8 cards have been taken.

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**5 POLYGONS WITH TO MAKE FROM THE 7 TANGRAM PIECES?**

<https://aiminghigh.aimssec.ac.za/tangram-2d-shapes/>

Now use the pieces of your Tangram to make

- A parallelogram
- An isosceles triangle
- A rectangle
- An isosceles trapezium
- A pentagon

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**ONLY 13 CONVEX POLYGONS CAN BE MADE WITH THE 7 TANGRAM PIECES**

Can you make them all?

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**ONLY 13 CONVEX POLYGONS CAN BE MADE WITH THE 7 TANGRAM PIECES**

Can you make them all?

This is a good class activity. Each polygon could be assigned to a pair of learners who should be asked to make the polygon and to describe its properties.

Then the class could make a poster for the classroom wall with their polygons and descriptions.

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**SOLUTIONS TO 13 CONVEX POLYGONS MADE FROM TANGRAM PIECES**

Match the polygons to the solutions

Make a systematic plan for doing this.

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**SOLUTIONS TO 13 CONVEX POLYGONS MADE FROM TANGRAM PIECES**

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**STORIES: THE GOOSE THAT LAYS GOLDEN EGGS  
JACK AND THE BEANSTALK**

**Aesop's Fables 620 BCE**  
**The Goose that lays the golden eggs**  
<https://www.youtube.com/watch?v=7dMBK6SIUPe>

**Traditional English Fairy Story**  
[https://en.wikipedia.org/wiki/Jack\\_and\\_the\\_Beanstalk](https://en.wikipedia.org/wiki/Jack_and_the_Beanstalk)  
 Jack climbs the beanstalk and steals the Goose that lays golden eggs, a bag of gold and a golden harp.

**The Giant is angry:**  
 "Fi-fi-fo-fum  
 I smell the blood of an Englishman.  
 Be he alive, or be he dead,  
 I'll grind his bones to make my bread."

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**MAGIC GOLDEN EGG**

Cut out the 9 Magic Egg Tangram pieces from the worksheet in <https://aiminghigh.aimssec.ac.za/magic-egg-tangram-puzzle/>  
 Make these birds using the 9 pieces.

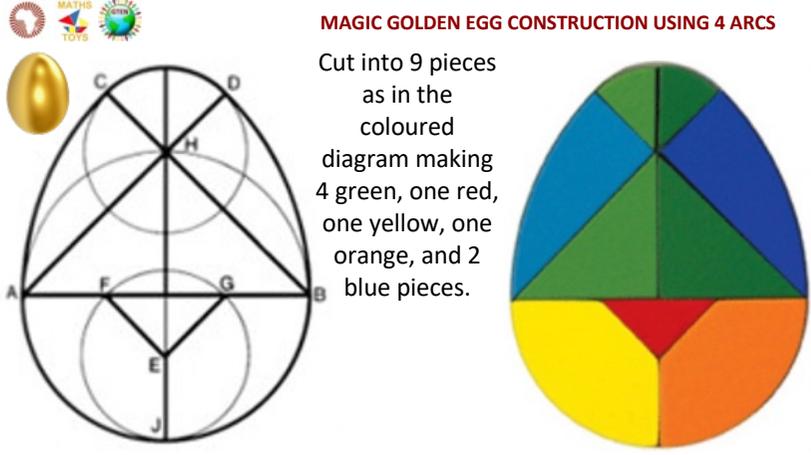
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**MAGIC GOLDEN EGG CONSTRUCTION USING 4 ARCS**

1. Draw a circle with radius 60 mm and mark diameters AB and HJ at right angles.
2. Draw the line from A to H and beyond.
3. Draw the line from B to H and beyond.
4. Draw a circle centre A, radius AB =120 mm, to find D on AH extended.
5. Draw a circle centre B, radius AB=120 mm, to find C on BH extended.
6. Draw the arc CD as part of the circle centre H radius 35 mm.
7. Mark E so that JE = 35mm and draw the circle centre E radius 35mm. Mark points F & G.

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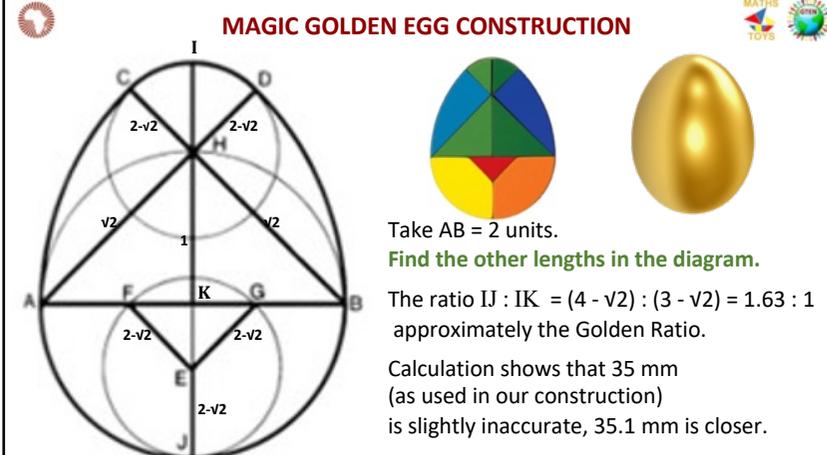
**MAGIC GOLDEN EGG CONSTRUCTION USING 4 ARCS**



Cut into 9 pieces as in the coloured diagram making 4 green, one red, one yellow, one orange, and 2 blue pieces.

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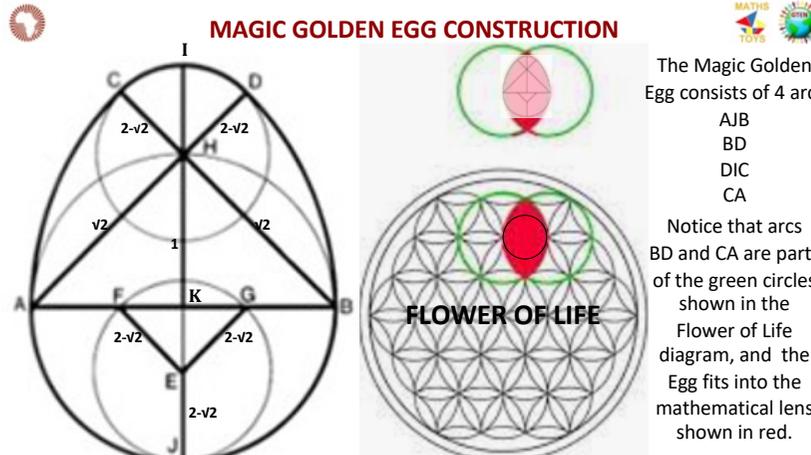
**MAGIC GOLDEN EGG CONSTRUCTION**



Take  $AB = 2$  units.  
 Find the other lengths in the diagram.  
 The ratio  $IJ : IK = (4 - \sqrt{2}) : (3 - \sqrt{2}) = 1.63 : 1$  approximately the Golden Ratio.  
 Calculation shows that 35 mm (as used in our construction) is slightly inaccurate, 35.1 mm is closer.

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**MAGIC GOLDEN EGG CONSTRUCTION**



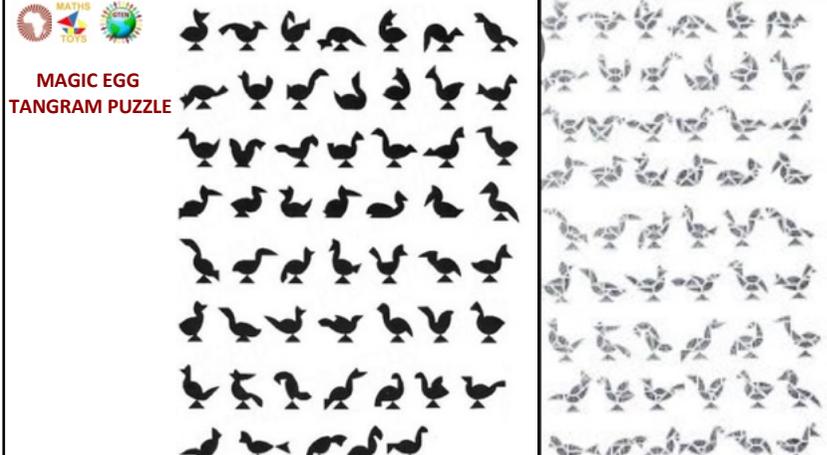
The Magic Golden Egg consists of 4 arcs  
 AIB  
 BD  
 DIC  
 CA

Notice that arcs BD and CA are parts of the green circles shown in the Flower of Life diagram, and the Egg fits into the mathematical lens shown in red.

**FLOWER OF LIFE**

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**MAGIC EGG TANGRAM PUZZLE**



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**SUMMARY**

**GOLDEN RATIO**  
IJ : IK

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**AIMINGHIGH TEACHER NETWORK**

**AIMSSEC** African Institute for Mathematical Sciences SCHOOLS ENRICHMENT CENTRE

On the AIMING HIGH website there are freely downloadable worksheets, Notes for Teachers with solutions, Key Questions and Diagnostic Quizzes for formative assessment, also Inclusion and Home Learning Guides with activities for learners of all ages and attainment levels.

Make your own Tangram video [https://youtu.be/1l\\_U31PifLQ](https://youtu.be/1l_U31PifLQ)  
 World Of Tan <https://nrich.maths.org/14074>  
 Tangram Pattern <https://aiminghigh.aimssec.ac.za/tangram-pattern/>  
 Tangram Fractions <https://aiminghigh.aimssec.ac.za/tangram-fractions/>  
 Tangram 2D Shapes <https://aiminghigh.aimssec.ac.za/tangram-2d-shapes/>  
 Aesops' Fables 'The Goose that lays The Golden Eggs' <https://www.youtube.com/watch?v=7dMBkgSIUPg>  
 Jack and The Beanstalk [https://en.wikipedia.org/wiki/Jack\\_and\\_the\\_Beanstalk](https://en.wikipedia.org/wiki/Jack_and_the_Beanstalk)  
 Magic Egg Tangram Puzzle <https://aiminghigh.aimssec.ac.za/magic-egg-tangram-puzzle/>

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**Global Teacher Empowerment Network (GTEN)**

For teachers in primary and secondary schools, colleges and universities

AIMSSEC GTEN YouTube Channel <https://www.youtube.com/c/MathsToys/video>

**AIMSSEC FACEBOOK** <https://www.facebook.com/aimssecsa/>

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Thanks for coming to this workshop.

Use the AIMSSEC ideas on AIMING HIGH and add comments.

Share what you have learned with other teachers.

Try to help all your learners to have a **'YES I CAN'** attitude to mathematics.

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