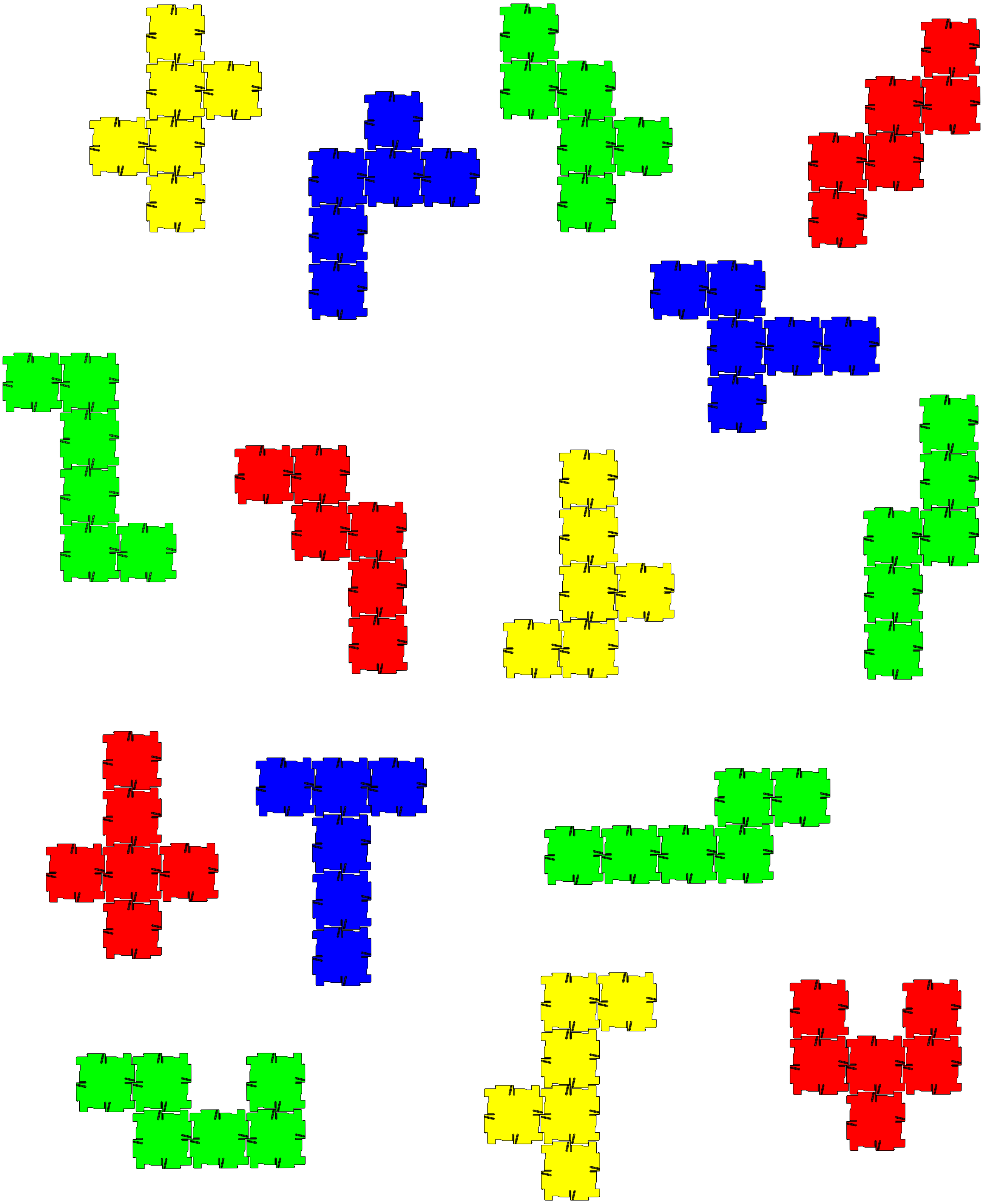
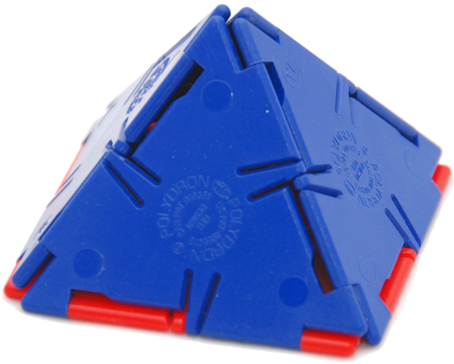
Set 3 – Nets of a cube puzzle

- Here are all eleven different nets for a cube, together with four that cannot be folded to make a cube.
- Can you find the four impostors?



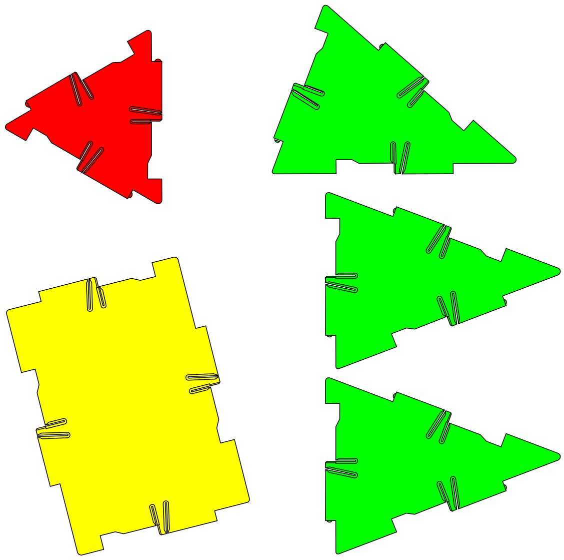
Set 3 – Pyramids



- Here is a square-based pyramid.
- A pyramid can have any polygon for the base and any triangles for the sloping faces.

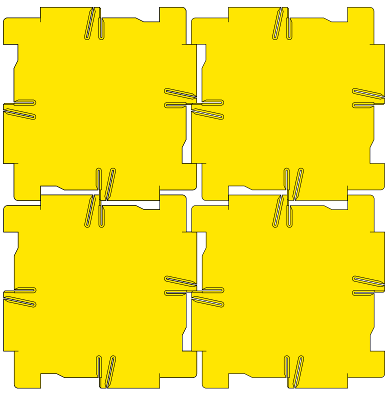
- Make a pentagonal-based pyramid.

- Make an unusual pyramid with the shapes on the right.



- Make a different pyramid with a rectangle for the base.

More Ideas

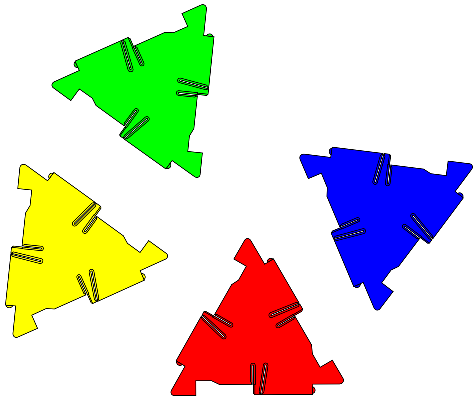


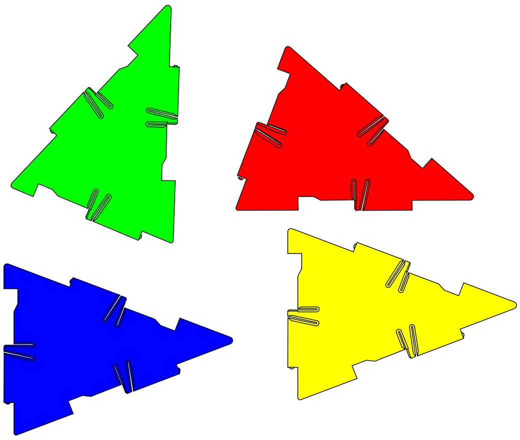
- Make an enlargement of the pyramid at the top of the page.
- You will need four squares for the base and lots of equilateral triangles.
- Try to work out how many triangles you need before you start.

- Make a very large pyramid with nine squares for the base.

Set 3 - The Tetrahedron

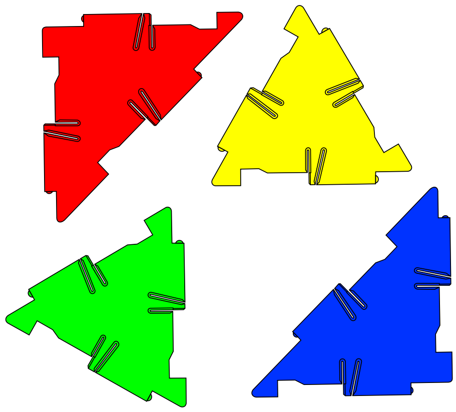
- A tetrahedron is a special pyramid made from four triangles.
- Make a tetrahedron with the four triangles on the right.
- Make a different tetrahedron with the four triangles below.



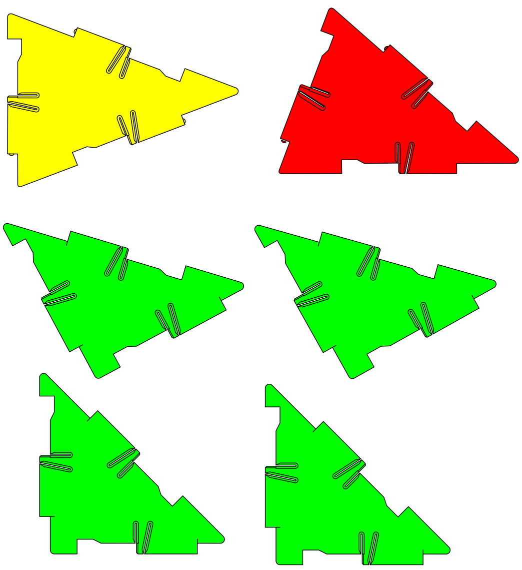


- Make a tetrahedron with three isosceles triangles and one equilateral triangle.
- Make a tetrahedron with two equilateral triangles and one right-angled triangle.

- Make a tetrahedron with three different triangles using the pieces on the right.

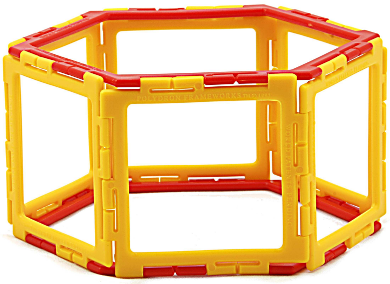


More Ideas

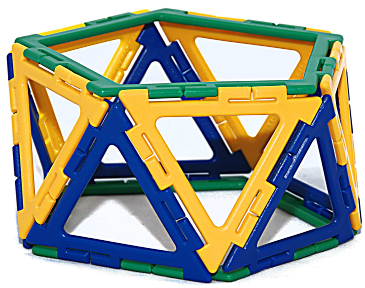


- It is possible to make a tetrahedron from more than four triangles, if you connect some of them together first to make larger triangles.
- Use all six triangles on the left to make a tetrahedron.

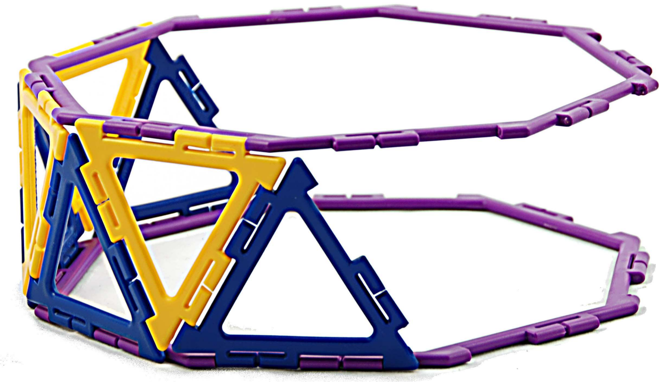
Set 3 – Prisms and Antiprisms



- A prism is made from two polygons with a belt of squares or rectangles between them. Here is a hexagonal prism.
- Make a pentagonal prism from two pentagons and five squares.
- Make an octagonal prism.
- Antiprisms are made from two polygons separated by a belt of equilateral triangles.
- This pentagonal antiprism has been made with different colours so that its structure can be seen clearly.



- Make an octagonal antiprism. Part of it is shown below.

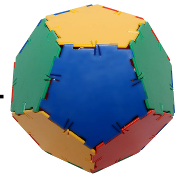


More Ideas

- The cross section of a prism is the same all the way along its length.
- Study the cross section of an antiprism carefully. What do you notice?

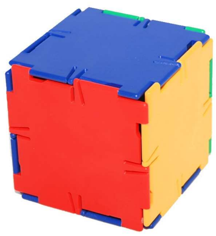
- Make a triangular antiprism. It has a triangle at each end and a belt of triangles. What do you notice about it?

Set 3 – Platonic Solids



- Platonic solids are special. To make them there are two rules that must be followed.

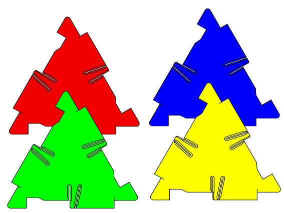
  1 Each one is made from only one sort of regular polygon.
  2 Each vertex of a Platonic Solid is the same.



- The only Platonic Solid that can be made from squares is the cube.

- Take twelve pentagons and make the solid on the right. It is called a dodecahedron.

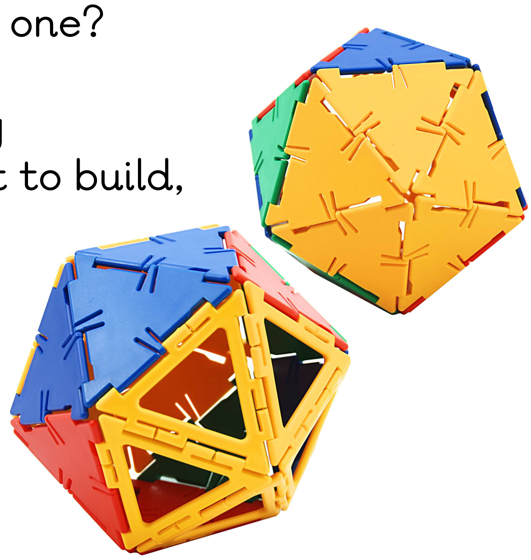
- There are three different Platonic Solids made from triangles.



- Make the simplest one from four equilateral triangles. It is called a regular tetrahedron.

- An octahedron is made from eight equilateral triangles. Can you make one?

- The final Platonic Solid needs twenty equilateral triangles. As it is difficult to build, here are two different views of it.

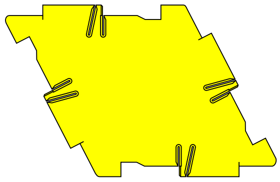


- Notice that some open triangles have been included to make it easier to build.

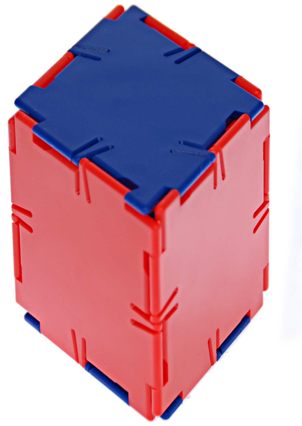
More Ideas

- Can you prove that there are only these five solids that fit the rules at the top of the page?

Set 3 - Rhombuses



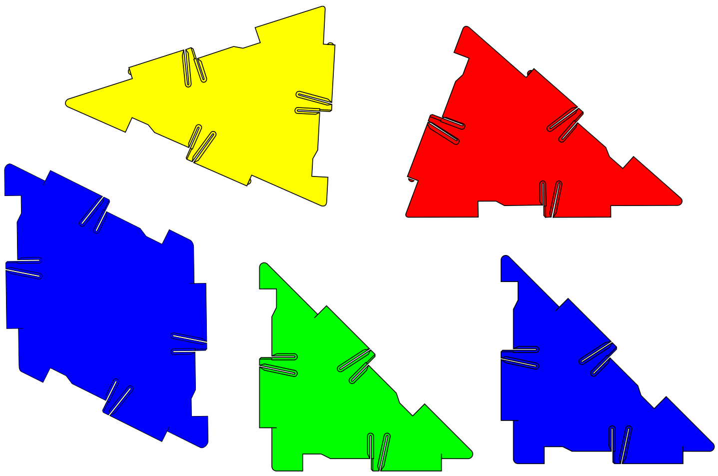
- A rhombus is a quadrilateral with four equal sides. This means that a square is a special quadrilateral.
- Make the prism on the right with two rhombuses and four squares.
- Take two identical triangles and use them to make a rhombus.
- Make three different rhombuses in this way, with pairs of triangles.



- Six rhombuses can be connected to make the solid on the left.
- This solid looks a little like a squashed cube. It is called a parallelopiped as each face is a parallelogram.

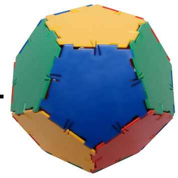
More Ideas

- It is possible to use the rhombus as the base for a pyramid.
- Use the pieces on the right to make a pyramid.

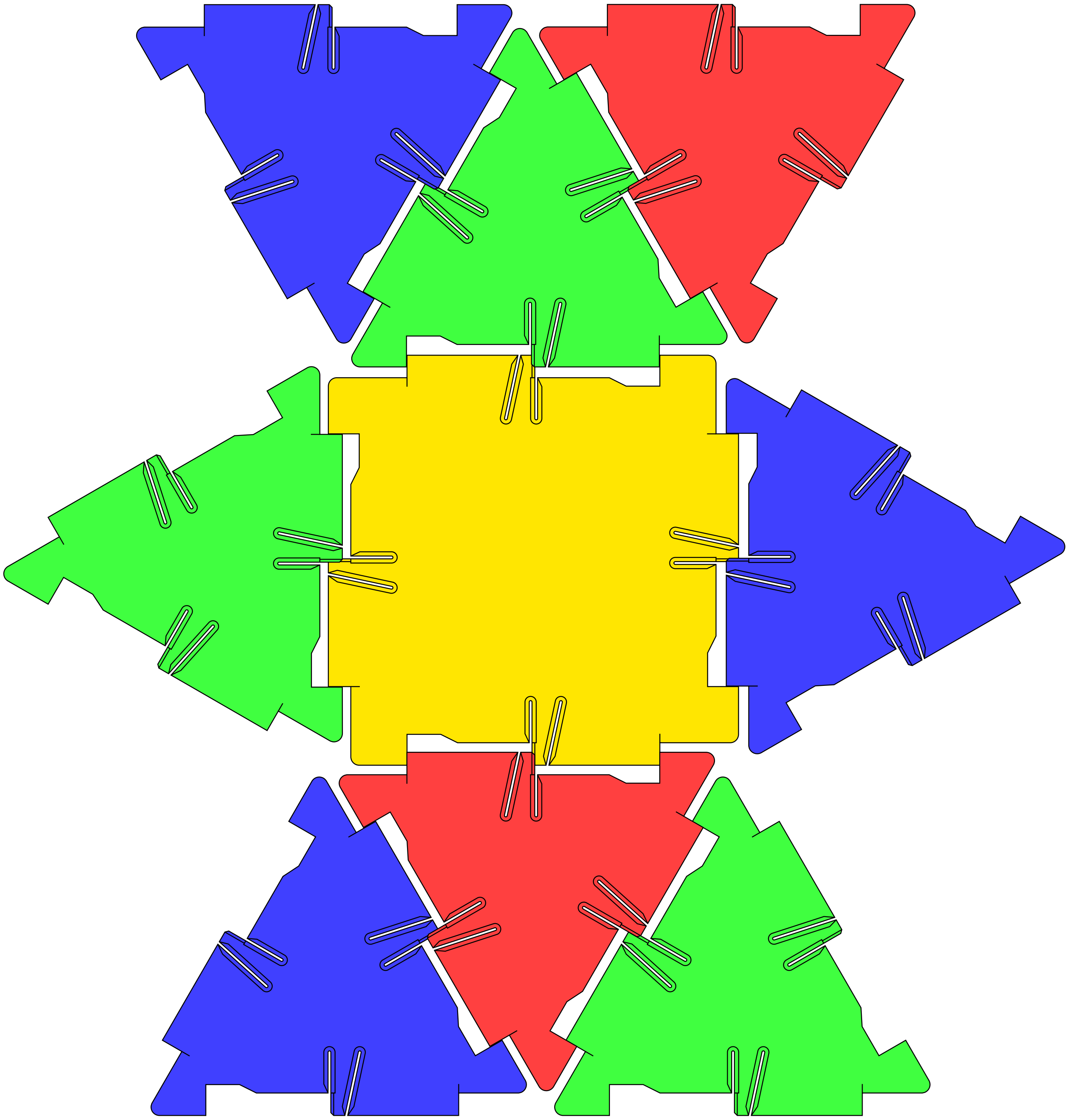


- Find a different way to use the rhombus as the base for a pyramid.

Set 3 - Tetrahedron Puzzle

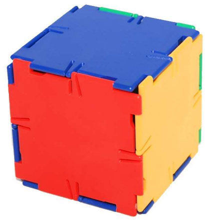


- Make two copies of this net using any colours.
- Fold up each of your nets to make a solid.

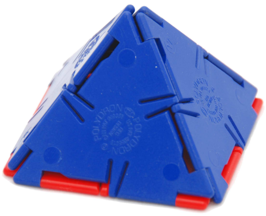


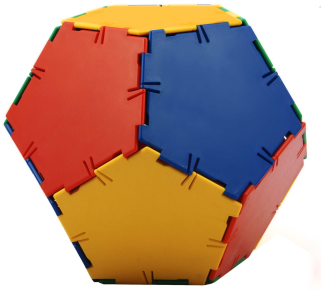
- Place the two solids together to make a large tetrahedron.
- When you have solved the puzzle give it to a friend to solve.

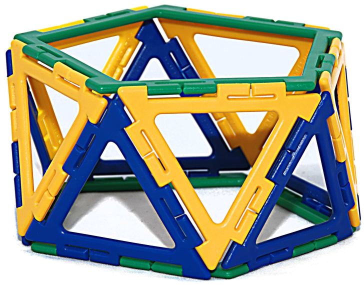
Set 3 – Faces, Vertices and Edges



- This cube has 6 faces, 8 vertices or corners and 12 edges. Make one and check.
- Make a collection of solids like the ones below.







- Make a larger copy of the table below.
- For each solid, record the the number of faces (F), the number of vertices (V) and the number of edges (E).

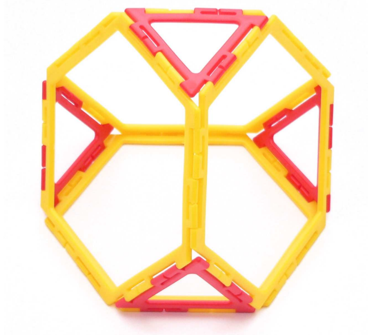
Name of Solid	Faces (F)	Vertices (V)	Edges (E)	F+V
Cube	6	8	12	14

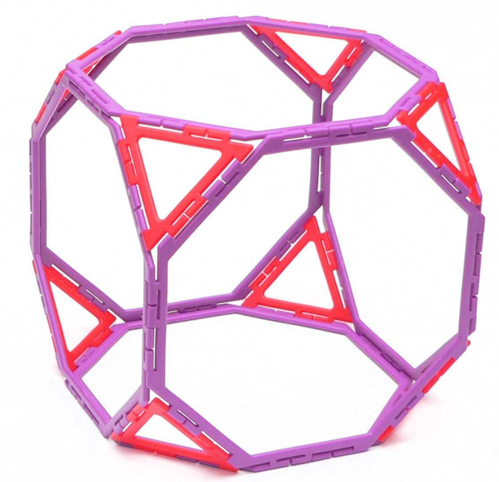
- In the final column record the sum F + V.
- Try to find a relationship between the number of faces (F), vertices (V) and edges (E), for each of your solids.
- This relationship is sometimes called Euler's formula, named after the 18th century Swiss mathematician, Leonhard Euler.

Set 3 – Corners

- In this activity we are going to concentrate on the corners or vertices of a solid. In each solid, every vertex must be the same arrangement of polygons.

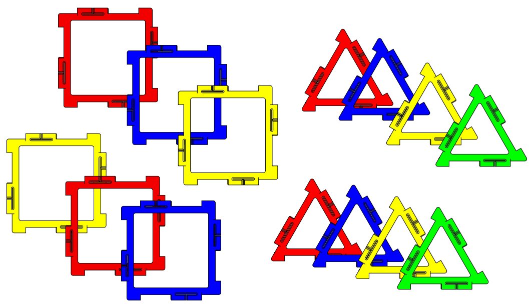
- This solid is made from four triangles and four hexagons. It is called a truncated tetrahedron. Two hexagons and a triangle meet at every vertex.





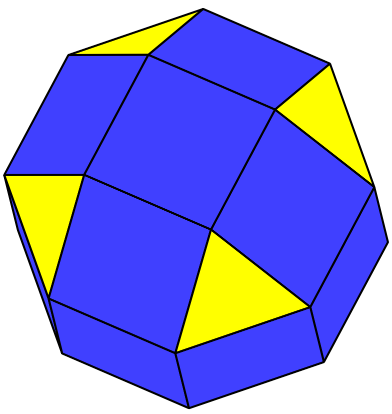
- Make this solid from octagons and triangles. Check that every vertex is the same.

- Make a solid from the pieces below. Every vertex must have the same arrangement of polygons.



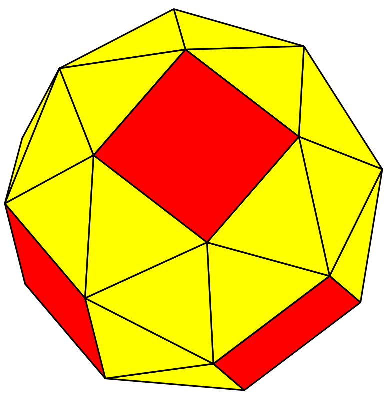
More Ideas

- Here are two fascinating solids.



- The solid on the left has three squares and an equilateral triangle meeting at each vertex.

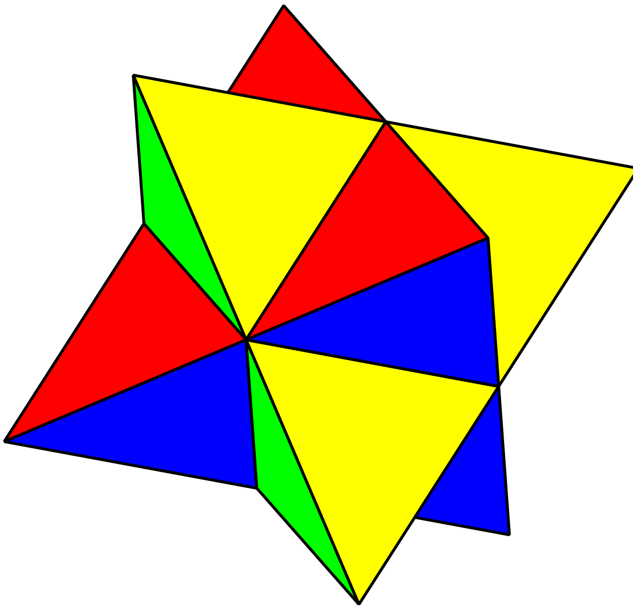
- This solid has four triangles and a square meeting at each vertex.

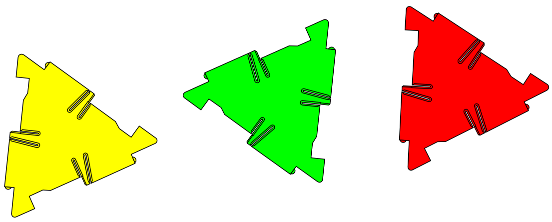


Set 3 – A Star Challenge

❍ We are going to make this amazing solid in the shape of a star. To make it you need 24 triangles, 6 of each colour.

❍ Each point is in the shape of a tetrahedron made from three triangles of different colours.

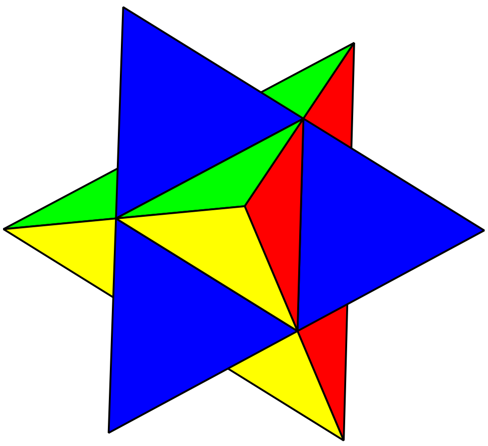


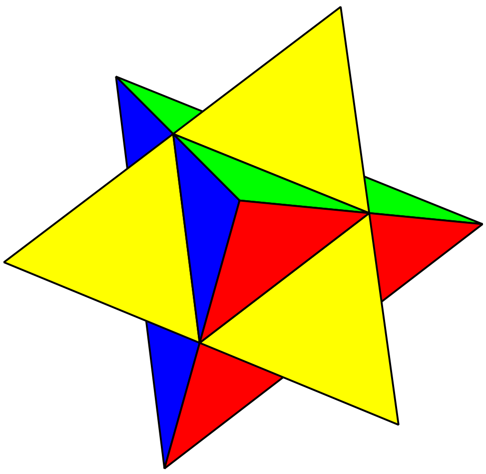


❍ The main solid is made of eight small tetrahedrons connected together.

❍ Notice how the pieces are arranged to create the illusion of two large tetrahedrons pushed together.

❍ Here are two more views to let you work out where the colours go.





❍ The solid you have built is called a stellated octahedron.