The Great 2D Shape Investigation

Objectives:

- To investigate classification and a wide range of properties of triangles and quadrilaterals.

Learning Outcomes:

I can identify acute, right, obtuse, straight and reflex angles.

I can distinguish and describe the properties of equilateral, isosceles, right-angled and scalene triangles.

I can distinguish and describe the properties of square, rectangle, rhombus, parallelogram, trapezium, kite and irregular quadrilateral.

I know the total interior angles of triangles and quadrilaterals.

I can construct shapes using a ruler and pair of compasses.

I can measure angles accurately using a protractor.

I can calculate perimeters and areas of measured triangles and quadrilaterals.

Method: A series of lessons using a combination of whole-class teaching, pair, group and individual work.

What you need: Sets of plastic 2D shapes, construction materials such as geostrips, rulers, protractors, compasses, pupil worksheets (see below)

Note: This umbrella investigation can be adapted to the needs and curriculum priorities for your class. Depending on your lines of enquiry, you can make use of additional material found in several of the other shape investigations.

Introductory Task

Share learning intentions for the investigation, vis:

- Draw 2D shapes
- Describe their properties
- Discuss describe and classify angles
- Accurately measure and draw angles
- Identify lines of symmetry
- Find perimeters and areas of 2D shapes

Agree with the pupils that it would be a good idea to find out what they already know and then agree what they are going to find out.

Have a series of key questions and statements (see pupil sheets), together with an assortment of construction material and plastic 2D shapes. Ask the pupils to work in pairs or small groups and discuss the statements and questions. Their task is to record what they have discovered and to be ready to share their findings with the class, either using drawings or using models made using the construction equipment.

As they work, ask to the pupils to note down any questions that spring to mind that they think it would be interesting to investigate. (The prompt sheet with part completed questions should help here.)

After a suitable period of time, call the pupils together round the board and put the statements and questions up with blu tac, sorting them according to whether there is agreement or not.

Discuss their responses. Ask a few pupils to explain their thinking, using the 2D shapes or construction materials to demonstrate.

As a class, agree things worthy of investigation and create some key questions: (Some question starters are given on the pupil sheet 'What will we investigate?'.)

Development

Depending on your curriculum objectives, the pupils' prior experience and the questions they come up with you can then use material from the following related investigations over subsequent lessons to develop the various lines of enquiry.

- How many different kinds of triangles are there?
- Properties of quadrilaterals
- Constructing polygons
- Angles in Polygons
- Perimeters and areas of triangles and quadrilaterals

From time to time, refer back to the original list of questions that the class has come up with and agree which questions have been answered and which ones have still to be solved. Encourage independent exploration of any areas that are not being covered in the main lines of enquiry, eg: the names of shapes with many different sides. (The internet will provide a good store of names!)

Assessment

The 'rich task' assessment activities below will give pupils either singly or in a group, an opportunity to demonstrate what they have learned across the whole investigation. The collected results will also form an attractive wall display!

True/False Statements for Discussion

You can't have a triangle with two obtuse angles.	The angles of any triangle add up to 180 degrees.
No quadrilateral has exactly three right angles.	A square is a special kind of rhombus.

An isosceles triangle has two lines of symmetry.	A kite can have one or two right angles.
A trapezium has one pair of parallel sides.	A polygon is any shape with straight edges.

A square has two lines of symmetry.	A scalene triangle has two obtuse angles.
The angles in a parallelogram always add up to 360 degrees.	A diamond is another name for a rhombus.

How many different kinds of triangle are there?	What kinds of angles can an isosceles triangle have?
How do you find the area of a parallelogram?	Do the angles in all quadrilaterals add to the same total?

Questions to Puzzle Over

What is the difference between a kite and a rhombus?	Which quadrilaterals can have exactly two right angles?
How do you find the perimeter of a trapezium?	How many lines of symmetry does a rectangle have?

Name: _____ Class: ____ Date: _____

What will we investigate?

What would it be interesting to investigate? Make up some of your own key questions. Use these ideas to get you started.

- How many different kinds of ……. are there?
- What kinds of angles can ……..have?
- How many lines of symmetry can ……. have?
- What do the angles in ……. add up to?
- How do you find the area of …….?
- How do you find the perimeter of …….?

What are the differences between a ..... and a ……?

Assessment Task - Your Own Shape

Take a sheet of A4 paper.

Select a triangle or quadrilateral of your choice.

In the upper half of the paper:

Construct your shape using only a straight edge and compasses.

Measure its angles and sides.

Record the measurements on the shape.

Mark any lines of symmetry on the shape using a dotted line.

In the lower half of the paper:

Calculate the perimeter and the total of the interior angles.

Record your calculations carefully, with explanations.

Write down as many properties of the shape as you can.

(eg It has two pairs of equal sides. Equal sides are opposite. It has one line of symmetry. It has two obtuse angles, one right angle and one acute angle etc.)

Write the name of the shape as a title at the top of the page and add your name at the bottom.

Use some colour to highlight the different features of your shape.

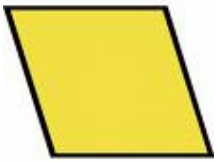
Assessment Task - Shape Booklet

Task:
To create a booklet or series of posters about polygons.

Stages in the investigation:

1. Triangles (equilateral, isosceles, right-angled, scalene, etc)
2. Quadrilaterals (square, rectangle, rhombus, kite, parallelogram, trapezium, etc)
3. Regular hexagon

Learning Intentions (WALT)

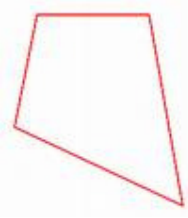


To revise names of triangles, quadrilaterals and other polygons:

- To construct shapes using compasses and a straight edge.
- To know their properties (angles, edges, diagonals).
- To know how to calculate their areas.

Success Criteria (WILF)

Jotters

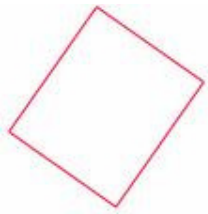


Your jotter will be your investigation log where you **record (neatly!) what you do**.
Each section of your work should have a **date and title**.
There should be regular **written explanations** of what you are doing.
All working is important. You don't rub anything out!

Team working

Each member of the group must **participate** fully.
If you work out how to **construct** a new shape, or **calculate the area** of a new shape, you must declare it to the class and let others listen while you explain your method!

The booklet



A description of **as many shapes as possible**, **logically presented**.

For each shape that you investigate there should be:

- One or more **accurate constructions using compasses** and a straight edge:
  - all sides carefully measured using a **ruler**.
  - all angles carefully measured using a **protractor**.
  - the shape(s) **named** correctly.
- A description of the properties:
  - How many **edges?**
    - Are any the same length? Which ones (adjacent, opposite)?
    - Are any parallel? How many pairs?
  - How many **angles?**
    - What kinds (acute, right, obtuse)?
    - What do they add up to?
  - How many **lines of symmetry?**
  - Properties of **diagonals?** (quadrilaterals only)
    - Are they the same length?
    - Are they at right angles?
- An explanation of how to calculate the **area**:
  - a worked example.
  - an explanation of WHY the method works.